

DECEMBER 2023

Proposal for
the City of
Milwaukee
Energy Saving
Performance
Contract

The power behind your mission



SUBJECT: Proposal for the City of Milwaukee Energy Saving Performance Contract

Dear Members of the Selection Committee:

The project at the Department of Public Works Field Headquarters will open new doors for the City to expand its efficiency efforts in key facilities and infrastructure to drive energy and operational savings while addressing its climate goals. Identifying the right mix of upgrades and sustainability options will be crucial in advancing this critical program in a budget friendly manner. As a proven partner, Johnson Controls will develop and implement a full range of comprehensive energy services to provide holistic, turn-key energy and water savings and renewable energy improvements that further advance the City of Milwaukee's energy reduction and renewable energy goals. Specifically, Johnson Controls can:

- **Leverage our local Milwaukee roots:** We have been based in Wisconsin for more than 135 years, have a strong group of company service employees in the Milwaukee area, and have solid partnerships with many local contractors and supporting organizations. Johnson Controls takes pride in this community. Our devotion to Wisconsin and Milwaukee spans our entire organization; at our highest levels, Katie McGinty (VP & Chief Sustainability & External Relations Officer) is a member of the Governor's Task Force on Climate Change. Our employees live in Milwaukee, we work here and we volunteer here. In addition to our major corporate giving campaigns for the United Way and UPAF, our employees have donated more than \$14 million and volunteered nearly 4,000 hours of their time to 121 community organizations in the city over the past three years.
- **Build on our established, successful partnership with the City:** Recent successful efficiency projects at city libraries, as well as past projects at the Safety Academy, City Hall, and other facilities demonstrate our ability to deliver for the City.
Over many decades we have worked closely with your teams. We know and trust each other. This local partnership reduces the City's cost and risk. We are dedicating the same key personnel to this project who delivered multiple prior projects, including the Milwaukee Public Library effort to provide an unmatched level of knowledge and experience with the City. We also bring ongoing local maintenance and emergency repair services from factory-trained technicians based in our full-service local Milwaukee branch office. We chose to build our new Warren Johnson Engineering Lab in Milwaukee County and make it available to our clients and your benefits.
- **Develop an innovative suite of Energy Conservation Measures (ECMs) that address your operational efficiencies and climate goals:** We have a unique breadth of solution offerings with internal experts in renewable energy, electrification, water/wastewater treatment, street lighting, energy efficiency, resiliency, and smart city applications. After evaluating the DPW Field Headquarters we have developed a project that includes the ECMs listed in the Master Energy Plan to support your 25x25 Goal, as well as additional upgrades to achieve the targets included in your

We have developed a project that will enable you to meet your 25x25 Goal, as well as additional ECMs to achieve the targets included in your Climate and Equity Plan for both 2030 and 2050.

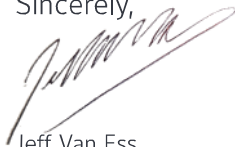
Climate and Equity Plan for both 2030 and 2050. We will help identify funding sources and use our in-house grants, rebates, and incentives team and Investment Tax Credit expert to put together an implementable plan going forward. In addition, all of our ECMs will be backed with our first party guarantee and City-specific measurement and verification services. The City will benefit from this roadmap of near-term and long-range planning approach to every project and strategic initiative.

- **Create Green Jobs in Milwaukee:** Through our past work with the City and numerous other clients in the Milwaukee metro area we have met and many times exceeded City SBE, apprentice, and RPP goals, and partnered with several local diverse subcontractors to help them grow their practice. This latest project is another opportunity for us to invest in the local workforce and continue developing Green Jobs in Milwaukee. Through our HVAC Lab at Barack Obama School of Career and Technical Education, our partnership with MATC, longstanding support of United Way, and other efforts in the area, we are helping to grow Milwaukee.

We will help identify funding sources and use our in-house grants, rebates, and incentives team and Investment Tax Credit expert to put together an implementable plan going forward.

The project we have outlined at the DPW Field Headquarters is just the beginning. We are eager to continue our work with the City of Milwaukee to help you achieve your energy and operational goals in this and additional facilities and infrastructure. If you have any questions about our proposal please contact me at (262) 505-0842 or jeff.vaness@jci.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeff Van Ess".

Jeff Van Ess
Account Executive

A handwritten signature in black ink, appearing to read "Robert Ricobene".

Robert Ricobene
Area Sales Manager

Building tomorrow *together*

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Executive Summary

The City of Milwaukee adopted the Climate and Equity Plan in June of this year with overwhelming support from City leaders and the broader Milwaukee community. According to the plan, by implementing 10 Big Ideas, “Milwaukee will support a new clean energy economy that provides new opportunities for people of color to more fully and equitably participate in the economic life of Milwaukee.” Johnson Controls stands with the City in support of this plan and offers to help in its implementation and funding. We have the local resources, experience and tools that are required to contribute to the City’s success. In our proposal we outlined ways in which we can support each of the 10 Big Ideas (see page v), as well as how we are meeting our own sustainability and equity objectives.

Building on Our 138-Year Partnership

To achieve these goals, the City will need a partner with local resources, innovative ideas, and financial solutions that are needed



NET ZERO GOAL

Johnson Controls is on track to become net zero by 2040. We share the journey you’re on and bring the expertise to help you achieve your goals. In 2021, we offset 100% of our GHG emissions from our U.S. manufacturing plants and our corporate headquarters through the purchase of 209,000 MWh of RECs. We also have solar arrays at some of our locations, including our headquarters in Milwaukee County.

We Are Milwaukee

to make additional investments in City facilities and infrastructure. Major upgrades need to take place to significantly save energy, lower maintenance, and increase reliability and facility comfort. This can only be achieved with creative and innovative deployment and funding initiatives. We are uniquely qualified to be your partner in this advancement. Johnson Controls is:

- Your existing trusted partner.
- Your Building Automation System (BAS), fire and security equipment system, and ongoing service provider.
- Your neighbor in Milwaukee since 1885 – we work, live and volunteer here.
- Your provider of unique funding programs such as contingent payment, as-a-service and more traditional tax-exempt lease purchasing.
- Your provider of Green Jobs, training programs, internships, and mentorship programs
- Your experienced, most qualified performance-based project provider for more than 35 years.

The City of Milwaukee and Johnson Controls have worked closely together for many decades. Johnson Controls was previously chosen by the City of Milwaukee to be the preferred, qualified ESCO to complete a performance contract at the Milwaukee Public Libraries in 2018. This was a successful energy saving project that upgraded the Central library and a neighborhood library. Several years earlier Johnson Controls was also chosen by the City to be the preferred, qualified ESCO to complete a successful energy saving project that upgraded City facilities and LED traffic signals. **Over the last several years, we have also worked with the Milwaukee Department of Public Works (DPW) to implement healthy facility solutions in City Hall and the municipal complex utilizing federal grants available from the pandemic.** Johnson Controls partnered with the DPW Infrastructure Services Division, serving as a consultant to prepare a comprehensive assessment report and implementation plan

for the City-wide street lighting infrastructure renovation and conversion to LED light fixtures. We also worked with the ECO office to evaluate the feasibility of facility renovations required to create a net zero fire station and neighborhood library. Additionally, we worked with Milwaukee as part of M-WERC to create a roadmap for smart city solutions within the City of Milwaukee. In all of these and many additional efforts over the years, Johnson Controls has continued to build on our knowledge and experience with City-specific goals and needs to become more and more your partner of choice. In addition to smart buildings technology, we have significant experience implementing innovative connected solutions within the communities, such as utility infrastructure upgrades, smart water metering, connected street lighting, and other smart city programs. Some other companies can claim to have some of the experience and expertise that Johnson Controls demonstrates. However no other company has this actual experience with the City of Milwaukee like we do.

Milwaukee Support Over the Past Three Years

\$14.4M

Donated

121

Community Groups

3,993

Volunteer Hours

795

Volunteers



Developing a Path to Your 2030 & 2050 Goals

This Request for Proposals focuses on the example DPW Field Headquarters. As with most other City facilities, Johnson Controls is already very familiar with the building and has existing BAS and service agreements already in place. A performance-based investment program would build on this firm foundation the City has already established with Johnson Controls.

“

Our ownership group committed to building an arena that is the gold standard for a sports and entertainment facility while also driving additional development and community growth throughout the region. We wouldn't be able to accomplish those goals without the partnership and support of Johnson Controls. Together we've built an incredible arena and an incredible future for our home city.

**- Peter Feigin,
Milwaukee Bucks President**

”

In our proposal, we have outlined a progression of alternatives to demonstrate a near-term and long-term roadmap for the DPW Field Headquarters, as well as the breadth of experience and resources that are available to the City in this proposed partnership. Our Technical Energy Assessment offers a holistic evaluation of the DPW Field Headquarters. We directly respond to the ECMs identified in the Master Energy Plan for this facility, which are designed to successfully contribute to the City's 25x25 Goal. Additionally, we identify an additional set of ECMs that will successfully achieve greenhouse gas emission reductions in compliance with the City's Climate and Equity Plan for 2030 and 2050. **Our holistic approach will provide an immediate and long-term roadmap for the City to achieve its energy and emission reductions goals.**



(Photo: Epstein Uhen Architects)

Our Commitment to Milwaukee Runs Deep

As part of our work with the Milwaukee Bucks and the Milwaukee Housing Authority, Johnson Controls helped develop a \$150,000 multi-sport recreational area at MPS' Browning Elementary School next to the Westlawn public housing complex. The Bucks and Johnson Controls are also donating \$600,000 toward community programs over the next 10 years. This fall, Johnson Controls announced four Smart and Healthy Neighborhood grants totaling \$1.2 million. The funds will support The Greater Milwaukee Urban League, the Milwaukee Parks Foundation, the Boys and Girls Clubs of Greater Milwaukee, and the Silver Spring Neighborhood Center. We have also continued our longstanding leadership role with the United Way, with our employees donating more than \$3.2 million last year.

We are eager to work with the City to walk through these alternatives and develop the best solution for Milwaukee. This same process would be applied to the other facilities and infrastructure as the program is expanded to additional locations. We will work with the City to collaboratively identify, evaluate, and prioritize projects, and then develop solutions and funding sources that will support the Climate and Equity Plan, deferred maintenance plan, and budgets.

These investments may only be possible with an alternative funding program such as the Johnson Controls Contingent Payment Program or Buildings-as-a-Service, which would complement these existing installed systems and service while further building out, integrating, and completing other critical infrastructure improvements. This continued partnership will maximize your existing investment and stretch your project dollars, all while eliminating the risk of switching to another provider.

Investing in the Local Workforce

Johnson Controls is also committed to the ongoing creation of Green Jobs. **We have a proven track record of meeting and exceeding SBE and RPP project goals on our projects, including efforts at the Milwaukee Public Library, Milwaukee Public Schools, Fiserv Forum, and Northwestern Mutual.** During this partnership with the City, we plan to collaborate with WRTM BIG STEP not only to meet project goals but also to team up on other new Green Job development, recruiting and training initiatives. We also have a partnership with MATC and Barack Obama School of Career and Technical Education to train Milwaukee high school students and community residents in HVAC and efficiency related jobs. In a partnership with the City, we could expand these programs to additional disciplines (renewable energy, street lighting maintenance, green infrastructure, etc.) and to the broader community.



MPS Prepares Students for the Future With Donated Johnson Controls Lab Equipment

Through a partnership with Milwaukee Public Schools, Johnson Controls installed an HVAC Learning Lab in the Barack Obama School of Career and Technical Education to help prepare Milwaukee students for high paying careers in the city. The four-year program provides curriculum and hands-on experience so they can be successful at MATC and in their careers.

How We Will Help Address Your 10 Big Ideas



Green Jobs Accelerator

- Johnson Controls projects to create renewable energy, energy efficiency and HVAC positions locally. We remain committed to SBE, apprenticeship and RPP programs, and have a proven track record of meeting or exceeding goals in previous projects with the City of Milwaukee, MPS, Fiserv Forum, and Northwestern Mutual Life.
- Continue to work with MATC and MPS on the HVAC training lab – replicate the Obama High School lab in which the instructor teaches students during the day and adults in the evenings to prepare community residents for family-supporting jobs in HVAC.
- Work toward establishing a City/County facility in a location such as Century City. Could add street lighting related electrical assembly and other skills to the training curriculum. Such a facility could also be used to upskill and retain DPW workers and to train community members to fill DPW jobs.
- Educate residents on HVAC related jobs and earnings potential.
- Continue to conduct student STEAM classes, student mentoring and internship programs.



Healthy Home Energy Upgrades

- Johnson Controls will help Milwaukee lead by example through its own facility improvements.
- Create programs and kiosks to educate the community on funding and implementation programs available to them.
- Work with local organizations such as Slipstream to assist in these educational efforts.



New Net-Zero Energy Homes

- Johnson Controls will help the City to lead by example with immediate investments to reach net zero at pilot locations: fire station, neighborhood library.
- Support community with alternative funding programs such as Johnson Controls (JC) Capital, PACE financing and grant support.
- Participate in community educational programs.



Commercial Building Benchmarking & Performance Standards

- Johnson Controls will help the City implement and fund facility demand reduction programs, electrification, renewable energy programs in energy, GHG and cost reduction. Continue participation in and support of Better Buildings Challenge.
- Leverage grants such as Focus on Energy, IRA, PSC Energy Innovation Grant, EV Infrastructure Grants, and EPA Climate Pollution Reduction Grants.
- Continue to support Building Performance Standard programs.
- Provide alternative funding for commercial property owners – JC Capital and expanded Milwaukee PACE programs.
- Community partner to support Milwaukee Housing Authority in similar goals.
- Continue to lead and influence policy change in US and state of Wisconsin – Johnson Controls supports White House CEO policies. Johnson Controls executive (Katy McGinty) on Wisconsin Governor's Task Force on Climate Change.
- Johnson Controls continues to lead by example in our own facilities.



Electrify Transportation

- Johnson Controls to support the development of partnerships to help implement P3 EV Infrastructure program with commercial properties throughout the City.
- Implement additional infrastructure at City municipal facilities to serve as examples to the community.
- Johnson Controls has installed EV charging stations at our offices locally and across the country, and has implemented stations as part of similar energy efficiency projects.



Nature in the City

- Johnson Controls to build Green Infrastructure solutions into energy saving performance contracts to stretch grants and funds available from MMSD and other programs.
- Support the City in grant writing for additional future success such as the \$12 million grant from the US Department of Agriculture that the City recently was awarded to plant additional trees.



Greening the Electric Grid

- Johnson Controls will help the City fund and implement City-owned renewable energy using our Wisconsin and nationwide experience. In Wisconsin, we have included nearly 1 MW of City-owned solar arrays in similar projects with similar efforts for MATC and other local clients. In all we have installed more than 500 renewable energy projects nationwide.
- Johnson Controls has identified significant opportunities for renewable energy and energy storage solutions in City municipal buildings and water treatment facilities. We will support the City with the purchase of RECs and implement solutions to transition to electrification such as Johnson Controls heat pump technology.



Waste Reduction & Sustainable Consumption

- Johnson Controls to support the City in providing community resources and education.
- Evaluate potential funding and implementation of waste-to-energy solutions within the community.



Resilience Ambassadors

- Johnson Controls to support the City and community in the development, funding and implementation of microgrids and other innovative technologies for community shelters and resiliency hubs.
- Support the City and community in grant writing.



People-Centered Transportation and Urban Design

- Johnson Controls to provide digital solutions (OpenBlue) to enable central data repository and reporting to reduce City facility staff and management travel requirements.
- Fund and implement Smart City solutions that automate processes and community services (transportation automation and wayfinding, water meter advanced metering infrastructure, other).

Evaluation Criteria Matrix

1. Proposals and Project Experience (25 points)

ESCO's experience on similar-sized guaranteed energy savings contracts with municipalities.	For more than 35 years, Johnson Controls has repeatedly provided guaranteed energy saving contracts with municipalities, many of similar-sized cities and many utilizing Wisconsin State Statute 66.0133, Energy Savings Performance Contracting. Johnson Controls has successfully completed two projects with the City of Milwaukee. See page 14 for references and the appendix for an overview of some of our recent work with large peer cities.
Proposals and experience of ESCO's personnel with guaranteed energy savings contracts on projects similar to the City of Milwaukee's project.	Johnson Controls has worked directly with the City of Milwaukee on two prior energy saving contracts similar to this project. In those prior projects, the City solicited proposals from other ESCO companies and in each case selected Johnson Controls to be the most qualified partner. See page 14.
Demonstrated experience designing, installing, and maintaining: <ul style="list-style-type: none"> ▪ Remote/Automated Control Systems and HVAC Systems ▪ Indoor/outdoor lighting and controls ▪ Renewable Energy Systems, including Rooftop Solar ▪ Energy Storage Systems ▪ Water metering technology 	Johnson Controls has the breadth of expertise and experience designing, installing, and maintaining remote/automated controls systems and HVAC systems, indoor/outdoor lighting and controls, renewable energy systems, energy storage systems, water metering technology and other solutions such as water treatment and pumping process, urban street lighting technology, smart city solutions, net-zero facilities, EV charging stations and green infrastructure. See page 24.
Reliability of equipment performance on past projects.	Johnson Controls has a solid track record with the City of Milwaukee and other clients in ensuring the reliability of equipment performance. We help our clients with service agreements and can work to negotiate extended warranties for clients when appropriate. See our references and page 48.
Documented energy savings on past projects similar to the City of Milwaukee's project.	The Milwaukee Public Library and the City of La Crosse are examples of successful Johnson Controls projects with documented energy savings similar to this project. Several other similar projects are included beginning on page 14.
Demonstrated completeness of past project documentation.	Johnson Controls provides complete project documentation including measurement and verification reports, installed equipment/system documentation, and training documents. See page 47.
Quality of client references.	Johnson Controls has implemented more than 3,500 performance contracts. We are currently managing more than 440 active contracts in North America with total outstanding guarantees exceeding \$7.2 billion. Among these, we have 10 active projects in Wisconsin that are guaranteed to save our clients \$75.3 million. See page 14.

2. Financial Approach (25 points)

Financial soundness and stability of ESCO.	Johnson Controls has been part of the state and this community for more than 135 years. Johnson Controls has the financial soundness and stability required of the right partner for Milwaukee. See page 13.
Capability to develop projects which qualify for attractive financing terms.	Supporting our clients in finding the right funding is unmatched in the industry. Johnson Controls has the experience to develop projects that qualify for the most attractive financing. Johnson Controls supports many funding alternatives including Contingent Payment program, As-a-service, and more traditional long-term leases. Our team also supports the pursuit of eligible rebates, grants, or external funding, including federal programs such as the Inflation Reduction Act. See page 11.
Reasonableness of Preliminary Project Costs and Cash Flow Analysis.	Our prior successful work with the City demonstrates our ability to create reasonable preliminary costs and cash flow. The cost and cash flow analysis in this proposal is based on the information that was available and will be verified with the Investment Grade Audit. See pages 39–41.
Achievable energy and cost savings, as shown in the DPW Field Headquarters ECM Worksheet.	Our prior successful work and existing guarantees with the City demonstrate our ability to achieve energy and cost savings. The energy and cost savings in this proposal are based on industry standards and the expertise of the Johnson Controls team. Actual costs and savings will be verified with the Investment Grade Audit. See page 40.
Reasonableness of investment grade audit costs and proposed compensation formula for ESCO.	The investment grade audit costs and other compensation formula are based on the Option 1 scope and are consistent with previously agreed to work with the City. See page 39.
Cost of annual fees for measurement and verification of savings, as well as for on-going system monitoring.	Annual fees for the Johnson Controls measurement and verification services are directly proportional to the time that our engineering team is working with you to ensure long-term project success. This investment is critical for the City to obtain the customized services that the City desires. See page 39.

3. Project Management (20 points)

Clear assignment of responsibility for various project tasks to specific individuals.	The Johnson Controls team has the local subject matter expertise and experience for all tasks throughout the design, installation, and M&V phases. See organizational chart and description of team. Many of these individuals have been working with the City for many years. See page 10.
Ability to effectively manage project construction and complete the project on schedule and within budget.	The Johnson Controls team has demonstrated its ability to successfully complete Milwaukee projects on schedule and within budget and while meeting SBE, Apprenticeship, and RPP goals. See page 28.
Approach to sub-contracting for labor in high demand, such as electricians.	Johnson Controls has partnerships with a network of many local and national contractors. Our vast number of local and national projects makes it possible to attract and retain the required resources. See page 34.

Clarity, organization, and level of detail in written response.	In this proposal, Johnson Controls provided not only a detailed solution for this example facility but also provided detailed examples of other improvement measures that could be effective at other City facilities and infrastructure in the future.
Communication skills of the ESCO's representatives at the oral interview.	Johnson Controls welcomes the opportunity to meet with the City team in an interview.
Quality of maintenance on past projects.	Johnson Controls has successful maintenance performance on past Milwaukee and other similar projects. See our references and page 48.

4. Approach to Energy Analysis and Guaranteed Savings (20 points)

Technical approach, including methods of analysis and understanding of existing building systems and conditions.	The Johnson Controls engineering and operations team completed a thorough analysis of the facility, following a walk-through and review of the provided information. Several alternative solutions were developed and presented. See page 21.
Approach to project commissioning.	A sample project commissioning plan was included. In a prior project with the City, Johnson Controls engaged Edison Energy for third-party commissioning support.
Sample investment grade audit for project similar to the City of Milwaukee's project.	See sample Investment Grade Audit (Milwaukee Public Library) in the appendix.
Baseline energy calculations and methodology for handling modifications/changes to the baseline.	Johnson Controls engineers have expertise and experience in baseline energy calculations and modifications. We follow industry standard protocols while working with your team to ensure that your situation is accounted for properly as we did together for the Milwaukee Public Library project.
Monitoring, measurement and verification services, and reporting on past projects.	Johnson Controls has been working with the City over the last three years on continual improvements and customization to the measurement and verification services and reporting. We have come a long way together to create a program that aligns with City goals and will continue to work toward the ideal final report. See existing Milwaukee Public Library report.
Comprehensiveness of understanding of all utility, state, and federal incentives, including Focus on Energy rebates, elective payments from the Inflation Reduction Act, & other incentives.	Johnson Controls has significant experience with all utility, state, and federal incentives. In 2023 we worked with another Wisconsin city to include elective payments from the Inflation Reduction Act for three solar arrays (>300 kW) as part of a performance contract. See page 12.
Proposed training for facility staff.	Johnson Controls will train facility staff on all implemented equipment and systems. See page 32.
Approach to savings measurement and verification.	Johnson Controls guarantees project results. We have an experienced team dedicated to monitoring, measuring, verifying, and reporting on projects. If savings are not realized, we make it right. We also work with City staff to support the realization of resource savings after implementation. We have a proven track record of this with the City of Milwaukee. See page 47.

Savings reports for clients similar to the City of Milwaukee.	See example reports in the appendix.
Feasibility of proposed preliminary technical measures.	Johnson Controls provided a suite of optional solutions in this proposal in our attempt to communicate the “art of the possible” for our partnership with the City. Some of these measures are feasible for this facility, and some are more applicable to another location, depending on the final goals and priorities of the City and that particular location. One option would be recommended based on project cash flow, another option would be recommended based on net-zero goals, etc. As your partner, Johnson Controls would work with the City to develop the right solution for each facility. See page 35.

5. Innovation (10 points)

Proposed innovative ECMs.	In our technical response Johnson Controls included a broad range of innovative ECMs to demonstrate our capabilities, experience and creativity. See page 24. Additionally, Johnson Controls has significant experience with many other infrastructure improvement initiatives that would apply to other facilities or infrastructure within the City including connected street lighting, water infrastructure, smart city technology, and others.
Benefits from innovative ECMs.	Benefits from innovative ECMs are included with each ECM description. Johnson Controls has not only implemented these ECMs for other similar clients, but we already have actually begun work together to analyze most of these solutions with the City of Milwaukee. We have completed an assessment with the street lighting, water works and smart city teams. See page 24.
Ability to implement innovative ECMs.	Johnson Controls has implemented innovative ECMs on a world-wide basis, most under an energy saving performance contract with guarantees. Because of our prior work with multiple departments within the City of Milwaukee we are best poised to begin implementation of these ECMs here too. No other contractor understands this opportunity or is capable of implementing and funding this breadth of innovation with the City of Milwaukee like Johnson Controls. See page 24.
Demonstrated knowledge and capability with emerging technologies and/or innovative solutions <ul style="list-style-type: none"> ▪ Electric Vehicle Charging Infrastructure, including EV Charging Infrastructure powered by solar energy. ▪ Net-Zero buildings or technologies that may lead to net-zero/ near net-zero emissions. 	Johnson Controls not only has knowledge about emerging and innovative technologies, we also have experience implementing them. As an example, we recently were awarded a grant from President Biden to ramp up heat pump research and manufacturing. See page 22.



ESCO Profile Form

1. Firm Name

Johnson Controls, Inc.
507 East Michigan Avenue
Milwaukee, WI 53202

a. Names & Titles of Two Contact Personnel

Jeff Van Ess
Account Executive
(262) 505-0842
jeff.vaness@jci.com

Bob Ricobene
Area Sales Manager
(331) 291-0034
bob.ricobene@jci.com

b. Submittal Is For:

Subsidiary

”

“Without the aid of your team, we would not have been able to capture \$13 million in funding for our expansive solar project on several city facilities, some with energy storage. The Johnson Controls local team also collaborated very well with other stakeholders and my financial team, including our bond counsel and Financial Advisor.”

- David Bilby, Director of Finance/Treasurer, City of Chula Vista, CA

2. Type of Firm

Corporation

3. Federal Employment Identification Number

39-0380010

4. Year Firm Established

1885

5. Name & Address of Parent Company

Johnson Controls International, plc
One Albert Quay, Cork, Ireland

6. Former Firm Names

Johnson Electric Service Company
Johnson Service Company

7. Five Year Summary of ESPC Contract Values

2023: ~\$406 million (Pending final FY23 numbers)

2022: \$679 million

2021: \$607 million

2020: \$423 million

2019: \$504 million

8. Corporate Background/ Historical Data

a. How many years has your firm been in business under its present business name?

49 years.

b. Indicate all other names by which your firm has been known and the length of time known by each name.

Johnson Electric Service Company (17 years)

Johnson Service Company (72 years)

c. How many years has your firm been involved in energy performance contracting?

40 years

d. Indicate the number of all energy performance contracting projects implemented by and currently under contract with your firm. Limit your response to ONLY those projects that have been managed directly by the specific branch, division, office or any individual in such branch, division or office that will be specifically assigned to this project. Attach additional sheets as necessary.

Johnson Controls has implemented more than 3,500 performance contracts. We currently are managing 441 active performance contracting projects in North America with total outstanding guarantees exceeding \$7.2 billion. Among these, we have 10 active projects in Wisconsin that are guaranteed to save our clients \$75.3 million.

9. Personnel Information

a. Please indicate the number of full-time personnel employed by your firm and the number available to work on this project.

100,000+ employees worldwide

2,493 employees in Wisconsin

324 in Milwaukee

Johnson Controls has been committed to Milwaukee for 138 years. It's where we call home, and 324 of our employees are proud to live in Milwaukee. We have a long history of contributing to the City's infrastructure initiatives, from improvements

to City of Milwaukee buildings to fueling efforts around the City's Better Buildings Challenge. We know the impact of our partnership is safer communities, more local jobs, and sustainable infrastructure – a more vibrant Milwaukee.



b. Project Team Members

JEFF VAN ESS

ACCOUNT EXECUTIVE

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Based in Milwaukee, Jeff will serve as your main point of contact. He will act as a liaison between our team and yours, providing close coordination to make sure your objectives are continually assessed and met. Jeff also manages the coordination of resources, procurement, the analysis of financing, grants and rebates, schedule development and ongoing support throughout the project. 12 years Milwaukee, WI																							
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	Corix Utilities, VP Operations, 10 years We Energies/Wisconsin Gas Company, Planning Engineer, 10 years																							
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> • BS, Mechanical Engineering, MSOE • American Water Works Association • National League of Cities • NAESCO • Wisconsin Rural Water Association • MWERC • The Water Council 																							
List all guaranteed energy performance contracting projects this individual has been involved with during past 5 years. Include project location, type of facilities, year implemented and dollar value of installed project costs.	<table border="1"> <thead> <tr> <th>Project & Location</th> <th>Type</th> <th>Year</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>City of La Crosse, WI Ph. 1-4</td> <td>Municipal</td> <td>2023</td> <td>\$11.4M</td> </tr> <tr> <td>Milwaukee Public Library</td> <td>Municipal</td> <td>2019</td> <td>\$2.4M</td> </tr> <tr> <td>Milwaukee Public Schools</td> <td>K-12</td> <td>2019</td> <td>\$5.9M</td> </tr> <tr> <td>Waukegan Schools, IL</td> <td>K-12</td> <td>2021</td> <td>\$13M</td> </tr> </tbody> </table>				Project & Location	Type	Year	Value	City of La Crosse, WI Ph. 1-4	Municipal	2023	\$11.4M	Milwaukee Public Library	Municipal	2019	\$2.4M	Milwaukee Public Schools	K-12	2019	\$5.9M	Waukegan Schools, IL	K-12	2021	\$13M
Project & Location	Type	Year	Value																					
City of La Crosse, WI Ph. 1-4	Municipal	2023	\$11.4M																					
Milwaukee Public Library	Municipal	2019	\$2.4M																					
Milwaukee Public Schools	K-12	2019	\$5.9M																					
Waukegan Schools, IL	K-12	2021	\$13M																					
Describe the specific role and responsibilities this individual had for each listed project.	Jeff served as the account executive, responsible for working closely with the client on continued support, including measurement and verification services.																							
Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Jeff's role for the City of Milwaukee project will be serving as the main point of contact for the City.																							
Describe any other relevant technical experience.	Not applicable																							
Indicate the total years of relevant energy-related experience for this individual.	32 Years																							

KEN CASCIO, PE, LEED AP

SENIOR ACCOUNT EXECUTIVE

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Ken is responsible for account management of owners, architects, engineers and contractors with respect to plan and construction projects. He also aids in facility management system design, specifications, budgeting, and final pricing and project implementation. 30 years Milwaukee, WI																															
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	Not applicable																															
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> • BS, Mechanical Engineering, University of Wisconsin Milwaukee • AS, Air Conditioning and Refrigeration Technology, MATC • Pi Tau Sigma, Honorary Mechanical Engineering Society • ASHRAE member • Professional Engineer, State of Wisconsin • LEED Accredited Professional 																															
List all guaranteed energy performance contracting projects this individual has been involved with during past 5 years. Include project location, type of facilities, year implemented and dollar value of installed project costs.	<table border="1"> <thead> <tr> <th>Project & Location</th> <th>Type</th> <th>Year</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Milwaukee Public Library</td> <td>Municipal</td> <td>2019</td> <td>\$2.4M</td> </tr> <tr> <td>BMO Campus</td> <td>Office</td> <td>2018/22</td> <td>\$1M</td> </tr> <tr> <td>MU COBA</td> <td>Education</td> <td>2021</td> <td>\$1M</td> </tr> <tr> <td>MU Nursing</td> <td>Education</td> <td>2022</td> <td>\$1M</td> </tr> <tr> <td>Associated Bank River Center Tower</td> <td>Commercial</td> <td>2022</td> <td>\$258K</td> </tr> <tr> <td>St. Catherine's SCA</td> <td>Healthcare</td> <td>2018</td> <td>\$1.3M</td> </tr> </tbody> </table>				Project & Location	Type	Year	Value	Milwaukee Public Library	Municipal	2019	\$2.4M	BMO Campus	Office	2018/22	\$1M	MU COBA	Education	2021	\$1M	MU Nursing	Education	2022	\$1M	Associated Bank River Center Tower	Commercial	2022	\$258K	St. Catherine's SCA	Healthcare	2018	\$1.3M
Project & Location	Type	Year	Value																													
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St. Catherine's SCA	Healthcare	2018	\$1.3M																													
Describe the specific role and responsibilities this individual had for each listed project.	Ken worked with the clients to develop the appropriate mix of ongoing service and maintenance services given the installed equipment and the capabilities and expertise of their in-house staff.																															
Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Ken's role for this project will be the same as described for previous projects.																															
Describe any other relevant technical experience.	Not applicable																															
Indicate the total years of relevant energy-related experience for this individual.	30 Years																															

WALT NOVASH

SOLAR PROGRAM MANAGER

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Walt has more than 20 years of industry experience and is responsible for the design of conceptual solutions for our advanced solutions and solar projects. He leads and manages the development of projects requiring additional engineering resources to efficiently and cost-effectively deliver projects from inception to close. 15 years Madison, WI																												
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	Full Spectrum Solar, Project Engineer, 2 years Seventh Generation Energy Systems, Project Engineer, 4 years																												
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> MS, Mechanical Engineering, Stanford University BA, Mechanical Engineering, Massachusetts Institute of Technology National Renewable Energy Laboratory 																												
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Project & Location	Type	Year	Value																										
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Cherry Creek Schools, CO	K-12	2022	\$69M																										
Honolulu, HI	Municipal	2021	\$26M																										
Describe the specific role and responsibilities this individual had for each listed project.	Photovoltaic system electrical design, array layout, output modeling, cost estimation, data monitoring, and commissioning.																												
Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Walt's role for this project will be the same as described for previous projects.																												
Describe any other relevant technical experience.	North American Board of Certified Energy Practitioners (NABCEP) Certified Solar PV Installer																												
Indicate the total years of relevant energy-related experience for this individual.	20 Years																												

JAMES BIESER

AREA OPERATIONS LEADER

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Jim will oversee the installation of all equipment and upgrades. He will work with the City and the subconsultants to coordinate schedules so your operations are not disrupted and the project is completed on time. 34 years Milwaukee, WI																																											
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	Not applicable																																											
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> BS, Mechanical Engineering, Marquette University ASHRAE member 																																											
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Project & Location	Type	Year	Value																																									
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Waukegan Schools, IL	K-12	2021	\$13M																																									
New Lisbon Schools, WI	K-12	2018	\$1M																																									
Describe the specific role and responsibilities this individual had for each listed project.	Jim served as the primary point of contact throughout the installation period, working with the client, our team and subcontractors to coordinate all construction activities to minimize disruptions to daily operations.																																											
Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Jim's role for the City of Milwaukee project will be the same as described for previous projects.																																											
Describe any other relevant technical experience.	Not applicable																																											
Indicate the total years of relevant energy-related experience for this individual.	34 Years																																											

ROBERT ZUMBAHLEN, PE, CEM

PRINCIPAL DEVELOPMENT ENGINEER

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Bob's responsibilities include the design, development and implementation of energy measures. He performs the initial feasibility studies, technical engineering audits, savings calculations, engineering designs, development of the scope of work, evaluation of subcontractor pricing and developing financial cashflow models. Bob also oversees the work of outside architects and consulting engineers. 28 years Chicago, IL																											
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	National Energy Management Institute, Project Energy Manager, 2 years R.L. Millies & Associates, Project Design Engineer, 4 years Beling Consultants, Project Design Engineer, 3 years																											
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> • BS, Engineering Mechanics and Materials, Southern Illinois University • Professional Engineer • Certified Energy Manager 																											
List all guaranteed energy performance contracting projects this individual has been involved with during past 5 years. Include project location, type of facilities, year implemented and dollar value of installed project costs.	<table border="1"> <thead> <tr> <th>Project & Location</th> <th>Type</th> <th>Year</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Village of Schaumburg, IL</td> <td>Municipal</td> <td>2019</td> <td>\$7.7M</td> </tr> <tr> <td>City of Decatur, IL Phase 2</td> <td>Municipal</td> <td>2018</td> <td>\$2.8M</td> </tr> <tr> <td>Rock Island County, IL</td> <td>Municipal</td> <td>2022</td> <td>\$5M</td> </tr> <tr> <td>Beloit College Ph. 1-2</td> <td>Higher Ed</td> <td>2022</td> <td>\$6.8M</td> </tr> <tr> <td>City of Rock Island, IL</td> <td>Municipal</td> <td>2020</td> <td>\$13.8M</td> </tr> </tbody> </table>				Project & Location	Type	Year	Value	Village of Schaumburg, IL	Municipal	2019	\$7.7M	City of Decatur, IL Phase 2	Municipal	2018	\$2.8M	Rock Island County, IL	Municipal	2022	\$5M	Beloit College Ph. 1-2	Higher Ed	2022	\$6.8M	City of Rock Island, IL	Municipal	2020	\$13.8M
Project & Location	Type	Year	Value																									
Village of Schaumburg, IL	Municipal	2019	\$7.7M																									
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City of Rock Island, IL	Municipal	2020	\$13.8M																									
Describe the specific role and responsibilities this individual had for each listed project.	Bob served as the development engineer, helping design the facility improvements for each client.																											
Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Bob's role for the City of Milwaukee project will be the same as described for previous projects.																											
Describe any other relevant technical experience.	Not applicable																											
Indicate the total years of relevant energy-related experience for this individual.	37 Years																											

HERMES POURELIAS

PRINCIPAL DEVELOPMENT ENGINEER

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Hermes is responsible for leading engineering, process and financial tasks during both preliminary and detailed development phases of projects. He performs high level analysis, promotes project quality and innovative scope to support closing bundled performance contracts. He supports engineering, process or financial tasks during preliminary assessment, solution design and during detailed development on large complex projects. <1 year Chicago, IL															
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	<ul style="list-style-type: none"> Johnson Controls, Principal Development Engineer, <1 year Trane Technologies, Energy Engineer, M&V Engineer, 14 years Siemens Industry, Product Development Applications Engineer, Energy Engineer, Engineering Specialist, Systems Engineer, 7 years Abbot Laboratories, Instrumentation & Controls Engineer, 3 years 															
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> BS, HVAC/R Engineering Technology, Ferris State University EPA Universal Refrigeration Technician Certification EPA 40 CFR Part 82 RETScreen Expert Clean Energy Management Software 															
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Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Hermes' role for the City of Milwaukee project will be the same as described for previous projects.															
Describe any other relevant technical experience.	<ul style="list-style-type: none"> Abraxas Metrix4 Utility Accounting System International Performance Measurement and Verification Protocol (IPMVP) 															
Indicate the total years of relevant energy-related experience for this individual.	25 Years															

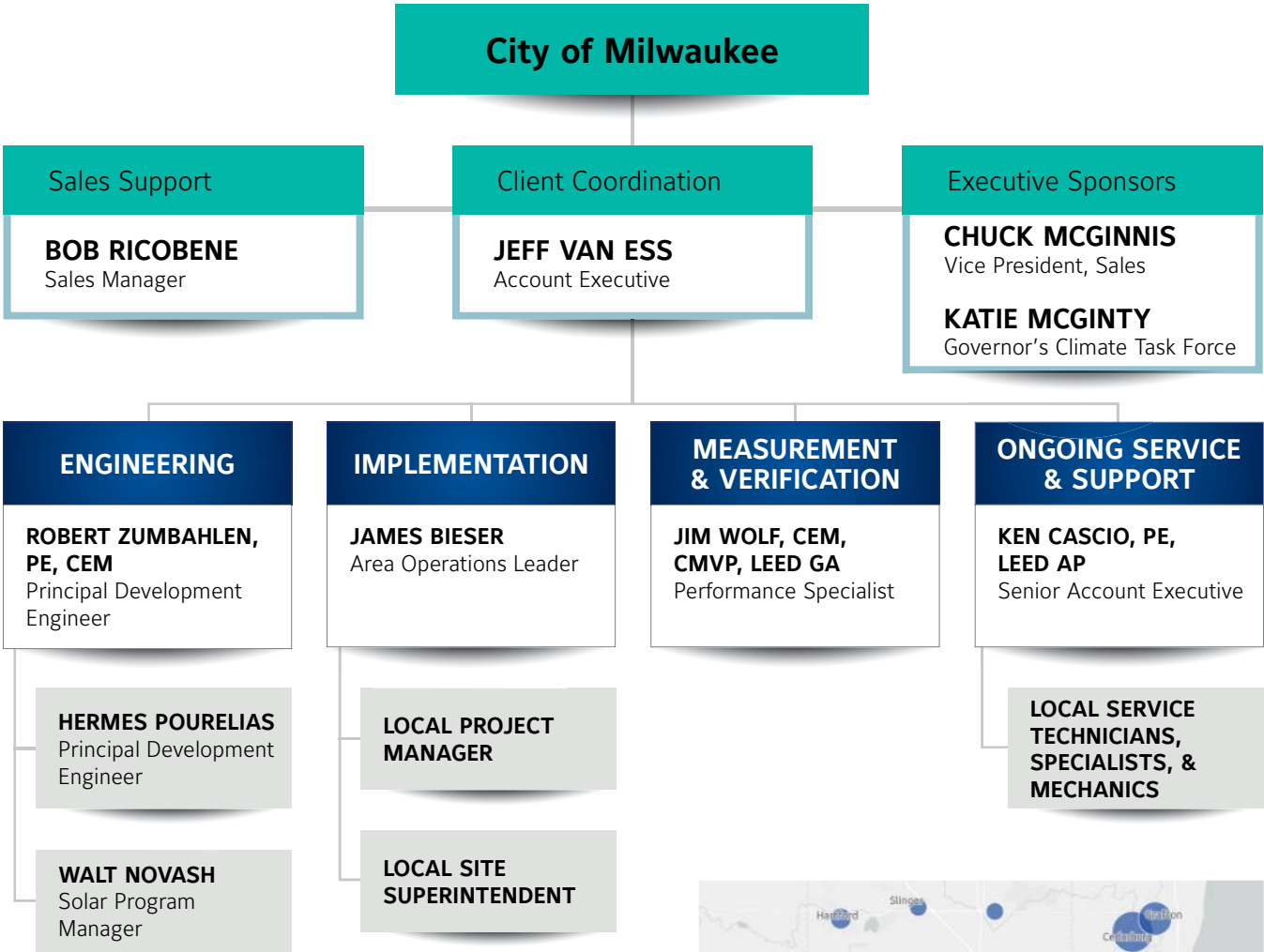
JIM WOLF, CEM, CMVP, LEED GA

PERFORMANCE SPECIALIST

Job Responsibilities: Number of Years with ESCO: Primary Office Location:	Jim works closely with clients throughout the performance period to ensure the energy conservation measures are performing as intended. He will prepare all reports, proactively identify client needs, and continually devise new strategies to deliver even greater savings. 22 years Chicago, IL																																
Employment History Company Name: Primary Job Responsibilities: Number of Years with Firm:	Not applicable																																
Educational Background List all academic degrees, certifications, professional affiliations, relevant publications and technical training.	<ul style="list-style-type: none"> • BA, Management, Aurora University • AS, Business Administration, Waubensee Community College • Certified Energy Manager • Certified Measurement & Verification Professional • LEED Green Associate • Association of Energy Engineers 																																
List all guaranteed energy performance contracting projects this individual has been involved with during past 5 years. Include project location, type of facilities, year implemented and dollar value of installed project costs.	<table border="1"> <thead> <tr> <th>Project & Location</th> <th>Type</th> <th>Year</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Rock Island County, IL</td> <td>Municipal</td> <td>2022</td> <td>\$5M</td> </tr> <tr> <td>Wyndham Springfield City Centre</td> <td>Commercial</td> <td>2023</td> <td>\$15M</td> </tr> <tr> <td>County of Oahu, HI Ph. 3</td> <td>Municipal</td> <td>2022</td> <td>\$10.3M</td> </tr> <tr> <td>County of Oahu, HI Ph. 2</td> <td>Municipal</td> <td>2021</td> <td>\$26.3M</td> </tr> <tr> <td>County of Oahu, HI Ph. 1</td> <td>Municipal</td> <td>2020</td> <td>\$24M</td> </tr> <tr> <td>City of Decatur, IL Phase 3</td> <td>Municipal</td> <td>2020</td> <td>\$600K</td> </tr> <tr> <td>Milwaukee Public Library</td> <td>Municipal</td> <td>2019</td> <td>\$2.4M</td> </tr> </tbody> </table>	Project & Location	Type	Year	Value	Rock Island County, IL	Municipal	2022	\$5M	Wyndham Springfield City Centre	Commercial	2023	\$15M	County of Oahu, HI Ph. 3	Municipal	2022	\$10.3M	County of Oahu, HI Ph. 2	Municipal	2021	\$26.3M	County of Oahu, HI Ph. 1	Municipal	2020	\$24M	City of Decatur, IL Phase 3	Municipal	2020	\$600K	Milwaukee Public Library	Municipal	2019	\$2.4M
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Describe the specific role and responsibilities this individual had for each listed project.	Jim developed and oversaw the implementation of the measurement and verification plan for the projects.																																
Provide a detailed description of the role and responsibilities this individual will have for the duration of this project.	Jim's role for the City of Milwaukee project will be the same as described for previous projects.																																
Describe any other relevant technical experience.	Not applicable																																
Indicate the total years of relevant energy-related experience for this individual.	30 Years																																

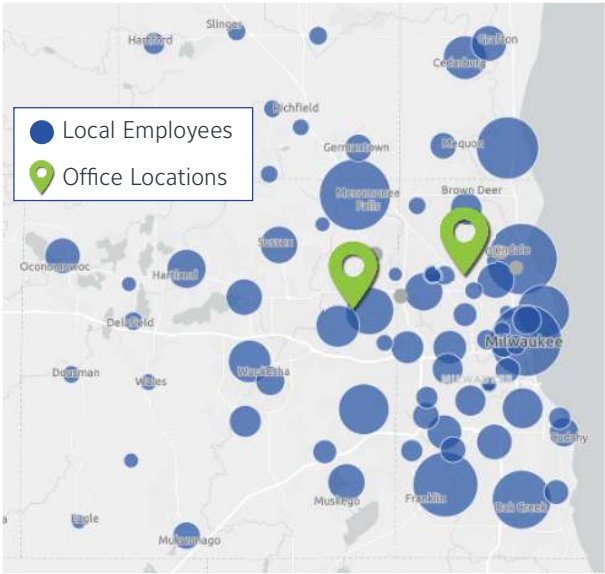
c. Submit an organizational chart that clearly identifies the roles and relationships of all key team members.

As an established partner with the City of Milwaukee, Johnson Controls has a large, experienced team based in the metro area to develop, implement, and monitor facility upgrades in any City building. **The Johnson Controls Milwaukee team will be available throughout all phases of the project to ensure that the City schedule will be met.** As the scope is not fully defined, we do not have specific commitment times for the assigned staff. Once the scope is defined, we will work with the City to optimize the correct number of staff needed and the time required to successfully execute the project.



*Johnson Controls
Employees & Offices
in the Metro Area*

Johnson Controls has more than 1,350 professionals based in the metro area, from senior leaders who will ensure this program is delivered successfully, to front line technicians who will provide close, responsive service whenever it is needed.



d. Certify that your firm will comply with all terms and conditions contained in the City of Milwaukee's Request for Proposals (RFP) and contract documents.

Johnson Controls requests further discussion and clarification on the terms and conditions contained in City of Milwaukee's Request for Proposals and contract documents.

e. Briefly describe the types of financing used by your firm for past energy performance contracts, including the source of funds and the potential dollar amounts currently available to your firm to finance these types of projects.

We have provided structured financing for thousands of clients, recently financing \$200 million in energy projects in one year alone. We work with more than 20 lenders, grant and rebate administrators, and finance experts every day. It is important to note that Johnson Controls does not make any money on financing. We arrange financing purely to assist our clients. Our Structured Finance Team matches the right financing structure to what is best for the City and most appropriate for the project. There are multiple ways to finance a performance contract project with Johnson Controls. The following information summarizes options.

1 **Contingent Payment Program**

Rather than borrow money from a third-party, Johnson Controls funds the project. The City then pays Johnson Controls over time, but where the obligation to pay is "contingent" upon savings delivered. If Johnson Controls does not perform and deliver the savings as expected, the City is able to withhold payment up to the shortfall amount. The City only pays for the savings it receives.

We have implemented the Contingent Payment program with several clients. They had strong credit ratings and could afford to traditionally finance the projects. However, they simply did not want to borrow money from a bank or bond issuance. Also, the clients wanted to make their savings payments to Johnson Controls out of their utility budget. From their perspective, they pay for energy savings the same way they pay for electricity, gas, and water from the utilities.

2 **Infrastructure as a Service**

Infrastructure as a Service (IaaS) is also a "pay for performance" program. Johnson Controls would pay for the cost to engineer and install the upgrades. The City would then pay for the benefits it receives over the contract term. A key difference from the Contingent Payment Program is that we will refurbish and repair all equipment throughout the agreement but will not ask the City for additional funds. You get the benefit of new infrastructure without the burden of ownership while we pay all O&M costs. At the end of the term, the City can either extend the service contract or purchase the upgrades for fair market value. The City also has contractual hand back provisions at the end of the agreement so that Johnson Controls honors our Facility Condition Index (FCI) at end of term. IaaS clients prefer the packaging of maintenance, life cycle and FCI on a per unit basis a set-it-and-forget-it model.

3 **Bond Financing**

Johnson Controls has worked on many projects in the past that were financed with various types of bonds. We have also worked on projects where referendums were needed for the public to approve the issuance. Johnson Controls has great relationships with municipal bond underwriters and will freely provide introductions for client. Johnson Controls cannot provide recommendations on a bond issuance. However, we can provide in-depth details on the project to enable the client and its underwriters/advisors to structure a bond issuance in a way that best serves the needs of the client.

4

Lease Financing

The most common form of financing for performance contract projects is a lease-purchase. In these arrangements, the City, as lessee, enters into a transaction with a financial institution, as lessor. A lease-purchase is popular because:

- It is not considered statutory debt.
- It does not require voter approval.
- The documentation and closing costs are relatively light.
- The time to close can be less than 30 days.

According to the Association for Government Leasing & Finance, one of the most valuable attributes of a lease-purchase is that it enables municipalities to finance projects without incurring a “debt” or an “indebtedness” that is subject to voter approval and debt limitations. For most government entities, laws dictate that transactions are considered “statutory debt” if the obligations exceed the revenues for the current fiscal period. They are therefore subject to voter approval and limitations. To address this, the lease-purchase contains certain covenants so that it is not considered debt.

Johnson Controls can work with lenders to design a payment schedule that corresponds to the construction period and savings generated from the project. The goal is to create a cash flow neutral transaction for the client. Johnson Controls can help to identify lenders that can offer lease-purchase terms that are as long as the law will allow. In most cases, this is 15 to 20 years. The longer amortization term enables a client to obtain more facility improvements with the same amount of savings. This reduces the amount of facility improvements that a client needs to purchase through its capital budget or other debt financing.

5

Grants, Rebates, & Incentives

Our Grant Services Team, along with the Rebate and Incentives Team, have one shared goal: find money for you. These teams identify alternative sources of funding so you can make more improvements to your facilities, reduce total cash outlay, and realize greater savings.

Countless clients have turned to our dedicated grant experts. With your permission, we are ready to help you. We can collaborate to identify qualified funding opportunities, facilitate, and develop grant applications, and provide support to help manage reporting and compliance requirements.

We work together throughout this process. The City will help by identifying subject matter experts, obtaining application review and approval from executive leadership, contributing key program and organizational information, and submitting a final application. This close collaboration strengthens the final application.

Our clients routinely secure the following types of rebates and incentives from utility companies with our assistance:

- Focus On Energy.
- Prescriptive efficiency equipment rebate programs (boilers, heat pumps, furnaces, water heaters, etc.).
- ENERGY STAR equipment and appliance rebates.
- Custom incentives for energy efficiency or energy resiliency projects outside of the utility company’s traditional prescriptive rebate program.
- Renewable rebates (solar, wind, geothermal, cogen, etc.).

“

What’s impressed me the most about Johnson Controls is what I’ve seen to be a desire of the company to develop a lasting relationship based on quality of products, installation and, even more important, long-term service.

- Steve Bedard, Chief Financial Officer, City of Charleston, SC

”

10. Financial References

a. Provide a company prospectus to include a Balance Sheet and Cash Flow Analysis not more than fifteen (15) months old.

Our latest audited financial statements from FY23 are included in the appendix.

b. Please provide the name, address, and the telephone number of the firm(s) that prepared the Financial Analysis.

Our financial statements are prepared in house by:

Olivier Leonetti

Executive Vice President and CFO
5757 North Green Bay Road
Glendale, WI 53209
(414) 524-1200

c. Please enclose banking references including financial institution, address, contact person, telephone number, and specific information on your firm's credit that may be used to fund construction for large-scale projects.

Michael Brunsman

Bank of America
231 S. LaSalle Street,
7th Floor
Chicago, IL 60604
(513) 929-5102
Michael.brunsmann@
bam.com

John Riddle

Sterling National Bank
500 Seventh Avenue,
3rd Floor
New York, NY 10018
(949) 370-2907
jriddle@snb.com

As of September 30, 2022, our parent company has more than \$42.1 billion in total reported assets. In addition, we continue to generate strong revenue and profitability. **For the fiscal year 2022, our company reported net revenue of nearly \$25.3 billion and net income of \$1.7 billion.** Our parent company has a long-term credit rating of BBB+/Stable/A-2 from Standard & Poor's Rating Service.

d. Maximum individual project and aggregate bonding limits.

\$200 million single; \$600 million aggregate

e. Please certify that your company does not owe the State of Wisconsin any taxes.

Johnson Controls does not owe the State of Wisconsin any taxes.

f. Please certify that your company is not currently under suspension or debarment by the State of Wisconsin, any other City, or the federal government.

Johnson Controls is not currently under suspension or debarment by the State of Wisconsin, any other City, or the federal government.

g. Please identify your firm's legal counsel for this project. Give the name and address of the primary individual responsible for contract negotiation.

Legal Counsel

Lincoln Loehrke
Executive Legal Director
(414) 524-2228
5757 N. Green Bay Rd.
Milwaukee, WI 53209

Contract Negotiations

Jeff Van Ess
Account Executive
(262) 505-0842
5757 N. Green Bay Rd.
Milwaukee, WI 53209

11. Project History & Client References

Using the following forms, list five (5) energy performance contracting projects currently in repayment and under contract with your firm which most resemble the scope of this project, including at least two projects that include adding solar generation to facilities. Please also list all energy performance contracting projects performed in the City of Milwaukee. Projects with installed costs of less than \$500,000 or single technology (e.g. lighting only, controls only, etc.) will not be considered. Attach additional sheets as necessary. Please put an asterisk by those project references involving buildings similar to the building(s) described in Appendix A. All information is required.

We have included five recent municipal projects involving similar facilities, as well as overviews of two projects completed in the City of Milwaukee. Solar generation systems were included in our work with Honolulu and La Crosse, with solar thermal arrays included in Louisville. In Hawaii, we helped

achieve six out of their 11 Climate Action goals. Aside from the MPS project, all efforts involved similar municipal facilities.



Johnson Controls is a NAESCO-accredited Energy Services Provider

Five Projects Currently in Repayment

MILWAUKEE PUBLIC LIBRARY*

MILWAUKEE, WISCONSIN

Project Dollar Amount (installed project costs)	\$2.4 million		
Primary ECMs Installed			
<ul style="list-style-type: none">Central Library replace and upgrade chilled water plant with mag-lev chillerCentral Library convert existing AC-7 from CAV to DOASCentral Library interior lighting retrofits		<ul style="list-style-type: none">Central Library exterior lighting retrofitsCentral Library lighting control panel upgradesBayview interior lighting retrofitsBayview exterior lighting retrofitsThird party commissioning	
Date Construction Started	3/2019		
Date Constructed Completed	2/2020		
Guarantee Period Start & End Dates	3/2020 – Present		
Dollar Value of Projected Annual Energy Savings	\$126,787		
Dollar Value of Guaranteed Annual Energy Savings	\$126,787		
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	\$35,564 PSA		
Method(s) of Savings M&V	Options A & C		
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	Name	Responsibilities	Included?
	Jeff Van Ess	Client Liaison	Y
	Jim Bieser	Implementation	Y
	Walt Novash	Solar	Y
	Jim Wolf	M&V	Y
Provide current and accurate telephone and email addresses of The City of Milwaukee’s representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Erick Shambarger Director of Environmental Sustainability eshamb@milwaukee.gov (414) 286-8556		

Summary of Energy Savings Performance Data

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	780,650	754,296	538305	480771	519434		
kW	443	425	320	351	372		
Steam (klbs)	587	558	871	1,212	2,344		
Other	\$105,494	\$123,526	\$112,851	\$120,671	\$132,123		

CITY OF LA CROSSE*

LA CROSSE, WISCONSIN

Project Dollar Amount (installed project costs)	\$9 million														
Primary ECMs Installed															
<ul style="list-style-type: none"> HVAC Controls LED lighting Street lighting conversion to LED 		<ul style="list-style-type: none"> 7 Solar Arrays (>0.5MW), 3 additional arrays in Phase 4 OpenBlue (Utility Bill, kiosk, energy management, asset management) 													
Date Construction Started	Phase 1: June 2019 Phase 2: November 2019 Phase 3: July 2021 Phase 4: October 2023														
Date Constructed Completed	Phase 1 & 2: June 2020 Phase 3: August 2022 Phase 4: Ongoing														
Guarantee Period Start & End Dates	June 2020 – Present														
Dollar Value of Projected Annual Energy Savings	\$358,000														
Dollar Value of Guaranteed Annual Energy Savings	\$358,000														
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	\$72,000														
Method(s) of Savings M&V	Option A														
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	<table border="1"> <thead> <tr> <th>Name</th> <th>Responsibilities</th> <th>Included?</th> </tr> </thead> <tbody> <tr> <td>Jeff Van Ess</td> <td>Client Liaison</td> <td>Y</td> </tr> <tr> <td>Jim Bieser</td> <td>Implementation</td> <td>Y</td> </tr> <tr> <td>Jim Wolf</td> <td>M&V</td> <td>Y</td> </tr> </tbody> </table>			Name	Responsibilities	Included?	Jeff Van Ess	Client Liaison	Y	Jim Bieser	Implementation	Y	Jim Wolf	M&V	Y
Name	Responsibilities	Included?													
Jeff Van Ess	Client Liaison	Y													
Jim Bieser	Implementation	Y													
Jim Wolf	M&V	Y													
Provide current and accurate telephone and email addresses of The City of Milwaukee's representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Lewis Kuhlman kuhlmanl@cityoflacrosse.org (608) 789-7361														

Summary of Energy Savings Performance Data - Phase 1

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	2,322,508	2,252,778	2,283,688	2,442,107			
kW	1,478	1,454	1,369	1,351			
Therms	14,657	12,924	17,547	17,547			
Other	\$284,702	\$269,070	\$296,527	\$298,261			

CITY & COUNTY OF HONOLULU*

HONOLULU, HAWAII

Project Dollar Amount (installed project costs)	Phase 1: \$36.3 million Phase 2: \$24 million		
Primary ECMs Installed			
Phase 1: Converted more than 53,000 streetlights to energy efficient LED fixtures and installed an island-wide lighting controls network. Phase 2: Johnson Controls implemented \$87 million of work involving 15 ECMs across 92 facilities and seven departments. The \$51 million in efficiency upgrades will generate \$73 million in guaranteed savings. The project involved 9.3MW of solar PV coupled with energy storage , as well as EVs and charging infrastructure. It enabled the Council to achieve six out of their 11 Climate Action goals.			
Date Construction Started	Phase 1: August 2019 Phase 2: December 2020		
Date Constructed Completed	Phase 1: February 2020 Phase 2: December 2022		
Guarantee Period Start & End Dates	Phase 1: March 2020 – February 2030 Phase 2: January 2023 – December 2042		
Dollar Value of Projected Annual Energy Savings	Phase 1: \$4,766,088 Phase 2: \$2,113,693		
Dollar Value of Guaranteed Annual Energy Savings	Phase 1: \$4,733,802 Phase 2: \$1,978,328		
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	Not applicable		
Method(s) of Savings M&V	IPMVP Options A and B		
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	Name	Responsibilities	Included?
	Jim Wolf	M&V	Y
	Walt Novash	Solar	Y
Provide current and accurate telephone and email addresses of The City of Milwaukee’s representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Allyn Lee Lead PM, Mechanical & Electrical Division Department of Design & Construction (808) 768-8428 alee2@honolulu.gov		

Summary of Energy Savings Performance Data - Phase 1 (Phase 2 Year 1 not yet complete)

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	15,779,342	15,779,342	15,779,342				
Other	\$4,733,802	\$4,733,802	\$4,733,802				

LOUISVILLE METRO*

LOUISVILLE, KENTUCKY

Project Dollar Amount (installed project costs)	Phase 1: \$9,294,516; Phase 2: \$26,664,487
Primary ECMs Installed	
<ul style="list-style-type: none"> • Building envelope • HVAC controls • HVAC upgrades • Solar thermal system 	<ul style="list-style-type: none"> • Pool improvements • Lighting retrofits • Site PC management • Steam traps • Water conservation • Kitchen hoods • Laundry upgrades • Pipe insulation
Date Construction Started	Phase 1: November 2010 Phase 2: August 2013
Date Constructed Completed	Phase 1: October 2012 Phase 2: December 2014
Guarantee Period Start & End Dates	Phase 1: November 2012 – October 2018 Phase 2: January 2015 – December 2037
Dollar Value of Projected Annual Energy Savings	Phase 1: \$693,998 Phase 2: \$1,577,328
Dollar Value of Guaranteed Annual Energy Savings	Phase 1: \$693,998 Phase 2: \$1,800,905
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	\$101,937 PSA
Method(s) of Savings M&V	Options A & B
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	Not applicable
Provide current and accurate telephone and email addresses of The City of Milwaukee's representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Mark Zoeller Director, Office of Facilities and Fleet (502) 574-0104 mark.zoeller@louisvilleky.gov

Summary of Energy Savings Performance Data - Phase 2

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	6,530,175	6,530,175	11,213,082	11,472,266	11,655,912	11,688,697	11,667,445
kW	3,731	3,731	11,534	14,994	12,108	12,431	12,917
Therms	407,054	407,054	306,311	370,378	328,677	348,923	362,096
Water kGallons	55,809	55,809	56,168	56,167	56,167	56,167	56,167
Other	\$1,577,328	\$1,800,905	\$1,867,320	\$1,762,831	\$1,871,310	\$1,923,054	\$1,970,860

CITY OF MARQUETTE*

MARQUETTE, MICHIGAN

Project Dollar Amount (installed project costs)	\$28 million		
Primary ECMs Installed			
<ul style="list-style-type: none"> Lighting retrofits & occupancy sensors Metasys controls upgrade AHU replacement Boiler replacements Chiller upgrade/replacement Cooling tower replacement Cogeneration Test pumps with generator Electric meter reduction 		<ul style="list-style-type: none"> Process/service pumps Domestic water heater Mechanical insulation Building envelope improvements Water conservation Meter replacements & AMI system Fire/security upgrades Vending machine controllers CCTV 	
Date Construction Started	10/2017		
Date Constructed Completed	8/2019		
Guarantee Period Start & End Dates	9/2019 – 8/2024		
Dollar Value of Projected Annual Energy Savings	\$2,842,699		
Dollar Value of Guaranteed Annual Energy Savings	\$2,842,699		
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	\$31,808 PSA		
Method(s) of Savings M&V	Options A & C		
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	Name	Responsibilities	Included?
	Walt Novash	Solar	Y
Provide current and accurate telephone and email addresses of The City of Milwaukee's representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Eric Stemen Operations Director estemen@mqcty.org (906) 225-8978		

Summary of Energy Savings Performance Data

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	3,363,338	3,363,338	3,403,189	3,403,189	3,304,900		
kW	1,934	1,934	3,107	3,107	2,663		
kGallons (Water)	1,186	1,186	1,325	1,325	1,325		
Meter Benefit	\$166,886	\$166,886	\$205,453	\$235,475	\$256,249		
Dollars (\$)	\$2,842,699	\$2,842,699	\$2,899,536	\$1,819,707	\$1,688,982		

Projects Completed in Milwaukee

SAFETY ACADEMY & SIGNALS*

MILWAUKEE, WISCONSIN

Project Dollar Amount (installed project costs)	\$2.3 million		
Primary ECMs Installed			
<ul style="list-style-type: none"> Boiler replacement Building controls upgrade Lighting upgrades Plumbing fixture upgrades 		<ul style="list-style-type: none"> Building envelope improvements Heating system upgrades LED traffic signals 	
Date Construction Started	October 2008		
Date Constructed Completed	June 2010		
Guarantee Period Start & End Dates	2009 - 2021		
Dollar Value of Projected Annual Energy Savings	\$338,861		
Dollar Value of Guaranteed Annual Energy Savings	\$338,861		
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	\$94,971		
Method(s) of Savings M&V	MSPG		
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	Name	Responsibilities	Included?
	Ken Cascio	Client Liaison	Y
	Jim Wolf	M&V	Y
Provide current and accurate telephone and email addresses of The City of Milwaukee's representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Thomas Tarkowski, PE DPW-ISD-Bridges & Buildings (414) 286-3295		

Summary of Energy Savings Performance Data

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	408,659	408,659	497,039				
Therms	22,930	22,930	26,863				
Water kGallons	1,118	1,118	1,118				
Other	\$338,861	\$338,861	\$338,861				

MILWAUKEE PUBLIC SCHOOLS

MILWAUKEE, WISCONSIN

Project Dollar Amount (installed project costs)	Phase 1: \$18.9 million Phase 2: \$5.6 million		
Primary ECMs Installed			
<ul style="list-style-type: none"> HVAC upgrades (chillers, boilers, air-handling units, VAV boxes, pumps, motors, kitchen hoods, domestic hot water, unit ventilators) Building automation system upgrades 		<ul style="list-style-type: none"> New roof, ceilings, doors and windows Re-designed connected lighting system with Smartcast technology 	
Date Construction Started	October 2016		
Date Constructed Completed	December 2019 (expected)		
Guarantee Period Start & End Dates	December 2019 through December 2020 (per customer request)		
Dollar Value of Projected Annual Energy Savings	\$322,000		
Dollar Value of Guaranteed Annual Energy Savings	\$322,000		
Dollar Value and Type of Annual Operational Cost Savings (if applicable) (e.g., outside maintenance contracts, material savings, etc.)	\$37,420		
Method(s) of Savings M&V	Option A		
Provide the names of the primary personnel involved in this project and their specific roles and responsibilities. Please indicate if the primary personnel on this project are also included in Section 10, Personnel Information.	Name	Responsibilities	Included?
	Jeff Van Ess	Client Liaison	Y
	Jim Bieser	Implementation	Y
	Walt Novash	Solar	Y
Provide current and accurate telephone and email addresses of The City of Milwaukee's representatives with whom your firm did business on this project. You should ensure that all representatives are familiar with this project.	Wendell Willis Chief Operating Officer (414) 475-8436 williswe@milwaukee.k12.wi.us		

Summary of Energy Savings Performance Data - Phase 2

	Projected Savings	Guaranteed Savings	Achieved Savings				
			Year 1	Year 2	Year 3	Year 4	Year 5
kWh	648,653	648,653	765,833				
Therms	11,884	11,884	11,884				
Other	\$75,787	\$75,787	\$88,396				

CITY OF MILWAUKEE DPW FIELD HEADQUARTERS

Infrastructure - Water Works - Operations
3850 North 35th Street

Technical Energy Assessment

1. Project Management

a. Project Summary

Summarize the scope of services (design, financial, operations, maintenance, training, etc.) offered by your firm for this project including the added value to the City of Milwaukee of your firm's services.

General Scope of Services

The matrix on the following page outlines the various services we bring to the City of Milwaukee, as well as our added values. Through similar projects at City Hall, the Central Library, and more, the City of Milwaukee has come to trust Johnson Controls to develop, install, and monitor energy efficiency measures in key facilities in the past. From experienced engineers and innovative financing structures, to our DBE partnerships and local service technicians, Johnson Controls brings expertise in each area to deliver yet another successful project.



UNMATCHED SUCCESS IN MEETING GUARANTEES

Johnson Controls is currently guaranteeing savings of \$7.2 billion for our clients, with more than \$300 million achieved annually. Our projects deliver the guaranteed savings 99.5% of the time.

We also have more Certified Measurement & Verification Professionals than any other firm, reflecting our commitment to providing results you can fully rely on.

Service	Summary
Auditing	Our audit consists of two distinct phases – the preliminary walk-through and the detailed audit (IGA), which will include utility and building surveys, and development of a baseline building simulation module. This in-depth level of analysis will ensure that the City's facilities will benefit from the most comprehensive conservation program possible.
Engineering Design	The engineering design of our projects will identify performance contracting energy-based opportunities, safety and regulation solutions, and a capital plan. The design will outline facility improvement measures and their potential cost savings.
Construction	The construction process integrates the City, subcontractors and our project personnel into a single team focused on successful implementation. Our process is built upon the four major functions of organizing, planning, installing, and completing the project. These functions provide a foundation for a cohesive, effective mechanism to manage the work – on time and with the quality we both demand while serving as an extension of the City's team. We bring a demonstrated ability to meet and exceed SBE, Apprenticeship and RPP goals.
Operations & Maintenance	Johnson Controls' approach to operation and maintenance is to help you determine those systems that are critical in the operation of your facilities, and to prioritize the tasks to be performed. Technologies have improved significantly over the past few years allowing a "predictive" approach to maintenance that allows diagnostic testing of certain equipment to predict impending equipment failure proactively. Through predictive diagnostics, equipment can be scheduled for repair and maintenance with minimal disruption to occupants, and at a lower cost than emergency repair.
Training	Johnson Controls will develop a comprehensive, directed and sustainable training program for the City. We will begin with brief interviews and simple testing to help determine your training needs and will use a variety of methods to train your staff, either on-site, or at one of our Johnson Controls Institute locations. Our training program will be completely customized for the City of Milwaukee and your facilities.
Financing	Financing is not a profit center for Johnson Controls. We will work with the client to assemble the most advantageous financing package. We have worked with large national financing companies and local banks to finance similar types of projects. We will explore traditional financing options like bonds or leases and investigate alternative financing options. We will present the advantages and disadvantage of each option to help the City make the best decision about financing.
Guarantees	Our M&V process uses IPMVP protocols and will guarantee the energy and GHG reductions while providing critical risk transfer to the City of Milwaukee.

8 Steps to Net Zero

Embarking on a project to decarbonize your facilities requires planning and commitment. Assurance that the measures and changes you're implementing achieve optimum performance and avoid unforeseen pitfalls that can jeopardize your sustainability goals will bolster confidence that you'll get where you're trying to go on time and on budget. You need a partner who has proven expertise to achieve the resiliency you seek, for your bottom line, for your community, and for the planet. Johnson Controls has developed

an eight-step process that can be applied to Milwaukee's building portfolio and infrastructure to move beyond ad hoc approaches to real results. Our process guarantees outcomes and provides risk management models to achieve emission reductions. Following our eight-step framework, Johnson Controls uniquely brings together a comprehensive solution that leverages these broader categories of technical solutions:

- Load reduction strategies.
- Building electrification.
- Advanced controls and digitalization.
- Distributed energy resources.
- And carbon-free energy supply.

Additional detailed information on each step is included in the appendix.



We're On the Same Journey

Forging a Path to Decarbonization for Our Flagship Plant

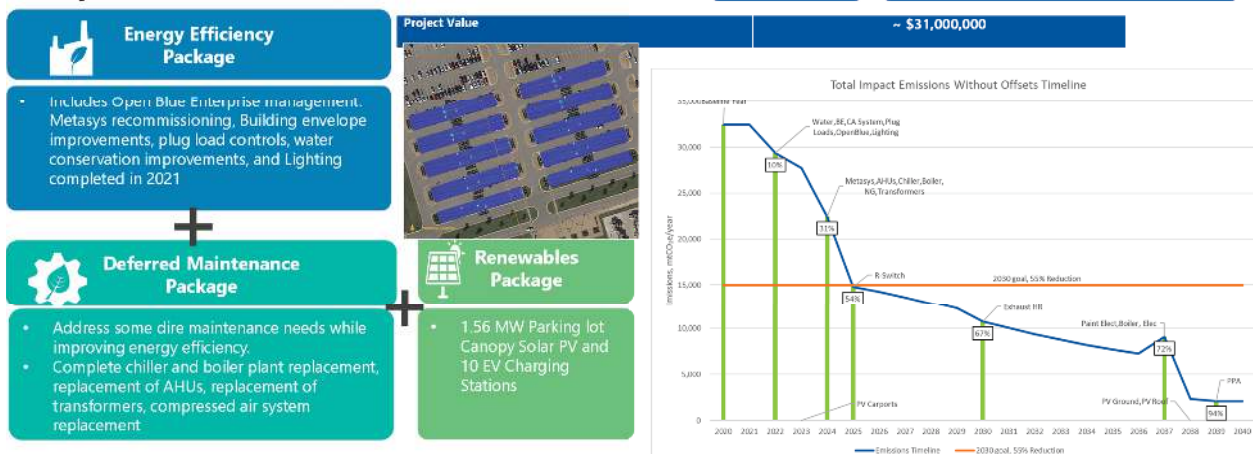
In 2020, our Norman, Oklahoma plant was one of our largest carbon emitters, making its decarbonization critical to meeting our overall emissions goals. The approach taken to slash energy consumption and emissions is the same one we bring to our clients, guided by our eight-step plan. We're deploying a central utility plant and redesigning and retrofitting a 1.56-megawatt carport solar solution with vehicle charging stations. Plans include electrification of process operations, water conservation upgrades, and more. The entire solution will be validated and supported using OpenBlue Enterprise Manager, the Net Zero Advisor application and the OpenBlue Central Utility Plant software, which enables central utility plant optimization, automated emissions reporting, and data-powered decision-making. Through these enhancements, the Norman plant will reduce its GHG emissions by 43% and reduce energy consumption by 26% (based on a 2017 baseline). In addition, we streamlined the plant's operations to deliver \$960,000 in annual energy, operations and maintenance savings while eliminating potential downtime in the facility.

Norman Decarbonization Plan

100% 2020 Site Emissions: 32,444 mtCO₂e, 196,742 MMBTU, 218 EUI
4th largest CO₂e emitter in JCI's Global Portfolio



- 25% reduction for energy and GHG intensity
- 10% reduction for water use at stressed locations
- 55% carbon reduction by 2030
- 100% carbon neutral by 2040



Innovative and Emerging Technologies

We are experienced in providing an unmatched breadth of innovation, including building efficiency equipment and controls, renewable energy and energy storage, electrification, water metering technology, water treatment and pumping process, street lighting, and other energy support services and digital solutions. Johnson Controls can provide these services and guarantee results.

BUILDING EFFICIENCY

Johnson Controls brings the most extensive experience in the smart building industry. We are experts in heating and cooling systems, building envelopes, energy management, and control, lighting systems, and water efficiency. We can implement our products and systems or implement other brands that may be preferred by Milwaukee. Building efficiency improvements in all municipal buildings can be thoroughly investigated in this program. We have worked with you on the City of Milwaukee municipal buildings for decades.

INDOOR AIR QUALITY

Johnson Controls brings the specialized expertise of several in-house Certified Indoor Air Quality Professionals to design and implement proven ways to improve air quality. One of the key strategies within energy conservation programs is optimizing the amount of outside air while limiting energy use during unoccupied periods. We often accomplish this by installing CO2 sensors on air handlers that control ventilation rates. By accurately measuring the amount of CO2 present and optimizing outside air ventilation, we can improve indoor air quality.

RENEWABLE ENERGY AND ENERGY STORAGE

We have the capability and experience to implement renewable energy sources in Milwaukee. Johnson Controls has been involved in more than 500 renewable energy projects to date, including solar/PV, geothermal, biogas-to-energy, biomethane recovery from landfills, and PPAs. These efforts have helped clients reduce carbon dioxide emissions by 17.4 million metric tons and generated savings of \$7.5 billion since 2000. We will work with you and other partners to create the best solution for the City. **Johnson Controls is thoroughly familiar with the specific applicable policies, requirements, tariffs, and interconnection agreements set by the Wisconsin Public Service Commission and/or We Energies.** We also



Johnson Controls was able to install seven City-owned solar arrays for the City of La Crosse totaling more than 0.5 MW.

recommend the further investigation of a resiliency solution, including energy storage to complement the renewable energy source and provide additional utility cost savings and energy resiliency. We have also helped communities implement wind turbines, cogeneration systems, biomass boilers, geothermal systems, and more to offset their energy costs and reduce their carbon footprints. These systems, even small ones, are also great instructional tools for the City.

VARIABLE REFRIGERANT FLOW

Variable refrigerant flow systems are capable of simultaneously heating and cooling different spaces. This is particularly attractive if there is a heat sink in the building, a warm room where heat is exhausted to the outside, or there are issues with limited space for ducting and mechanical equipment. In these instances, a VRF system may provide substantial benefits.

ELECTRIFICATION –**HEAT PUMPS**

We understand the City's sustainability goals and vision of electrification. We support this focus on sustainability and will work with the City to evaluate and implement cleaner alternatives when possible. As heat pumps can be used across a wide variety of residential, commercial, and industrial applications for heating, cooling, and hot water requirements, their demand has been gaining traction across the world as more companies look for a win-win cost-efficient solution that also meets their sustainability goals. Johnson Controls manufactures this technology and can bring this knowledge and expertise to the City.

Johnson Controls Awarded DOE Grant to Accelerate Heat Pump Manufacturing

Johnson Controls has been awarded a \$33 million grant from the U.S. Department of Energy to help increase domestic production of electric heat pumps by expanding three manufacturing sites. Combined, these facilities will be able to produce approximately 200,000 electric heat pumps per year, representing a nearly 200% production increase. This substantial volume will help drive energy affordability and energy security, while helping combat climate change and creating new jobs.

of the lighting infrastructure in the City. Our team partnered with the Milwaukee DPW Infrastructure team to complete a thorough assessment and action plan to upgrade the street lighting system.

CONNECTED CHILLERS

What if you could identify and address problems sooner? With our new Connected Chiller offering, your chillers are connected to our Remote Operations Center (ROC) in Wisconsin where we monitor them 24/7/365 for alarms, faults, and overall health. Currently, we have more than 30,000 chillers connected to our ROC. This is changing the way our customers do maintenance – through the use of technology and data.

SMART STREET LIGHTING

Johnson Controls has the expertise to collaborate with Milwaukee to create an intelligent, energy-efficient LED street lighting solution in the City. **We are one of the largest lighting design/implementation contractors in North America.** Smart street lighting would enhance the quality of life in Milwaukee to improve where citizens live, work and play. We have extensive experience not only in working with cities but also in working together with local utilities in the design and implementation of street lighting upgrades. We are very familiar with the current state and challenges

WATER UTILITY

Johnson Controls has ongoing projects in multiple water treatment plants and with water distribution systems across the United States which have reduced energy consumption, increased energy production, and recovered non-revenue water. The scope of these projects includes SCADA upgrades, upgrades to the HVAC system, building management, renewable energy, energy storage, water loss mitigation, water meter replacement and implementation of Advanced Metering Infrastructure (AMI). **Since 1999, we have implemented \$655 million in metering upgrades as part of 123 projects involving AMR and AMI systems, and 1.3 million meters.** These efforts have generated more than \$1 billion in benefits for our clients. The Johnson Controls team has on-staff water professionals that can help guide energy and water focused improvements, ranging from energy efficiency through net energy neutrality. Your water staff brings incredible knowledge and applied energy focus, and our team will complement it with the ability to find funding mechanisms to enable and strengthen those solutions.

OPENBLUE ENTERPRISE MANAGER

Johnson Controls has a comprehensive suite of application modules to monitor and improve energy efficiency, asset performance, maintenance operations, space performance, and ultimately the comfort and well-being of occupants. OpenBlue Enterprise Manager (OBEM) integrates with the Building Management System and other facility management systems to proactively analyze energy, asset, space, and occupant data. It provides a 'single pane of glass' enterprise-wide management platform, identifying issues and faults, and highlighting opportunities for improved performance, operational savings, and better building experience.

The Energy Management module of OBEM automatically collects analyses and displays information for all configured physical meters and virtual meters located in each building. The information for energy demand, consumption, and renewable energy can be aggregated and displayed on dashboards. Easy-to-understand summary reports can be generated from the dashboard data.

The top-level energy management dashboard contains KPI cards with energy consumption details for energy sources and other metered commodities such as electricity and water. KPI cards help users to monitor usage at the enterprise level, or for selected buildings, areas, or floors. Visual indicators highlight any KPIs which are significantly above or below the baseline. Users can also view energy savings against the baseline for each of the commodities, as well as the corresponding carbon footprint.

More detailed dashboards present energy usage statistics and analytics allowing the user to comprehend energy data intuitively. Through advanced global and configurable energy faults, meters trends from the master to submeters scan for unusual patterns to highlight excess consumption, high resting loads, and many other inefficient scenarios. The fault management displays identify potential corrections in building operations to help reduce energy costs. **The data on the dashboards are organized for clients to easily navigate through their portfolio and quickly prioritize which facilities need attention and create an immediate or automated work order.**

The Utility Bill Manager module adds the capability to add Utility Spend and Usage Data. With this

feature, OpenBlue can be used to receive your utility bills from your utility providers, analyze your utility bills for anomalies, and create reports on your utility consumption and cost of consumption, for the billing period.



OBEM Green Hub is a powerful, public-facing display of sustainability and conservation data. It creates engaging, interactive user experiences for building occupants, visitors, and the public on touch screen display. Multiple dashboards allow for interactive, or slideshow displays of several types of data in a fully configurable, easily maintainable format.

The Net Zero Advisor in OBEM allows users to monitor their GHG emissions for Scope 1 and 2 across their portfolio. By continuously gathering utility provider data (when available) or manual data uploads via templates, **OBEM will monitor the emission of each building, region/location, and portfolio. This can quickly highlight when excess emissions are being produced by a facility.**

“

JCI is currently performing a feasibility study to aid the City in identifying further savings through equipment, controls, and other efficiency measures throughout the city's building portfolio. This service is quite welcomed, as previous audits we have received from other vendors, proved to be less than impressive. We trust that this work will help crystallize our true needs and lay the foundation for future work in the near-term and beyond. I strongly believe that choosing the right partners on these projects will be the key to achieving our ambitious goals.

**- David Bilby, Director of Finance/
Treasurer, City of Chula Vista, CA**

”



OpenBlue provides dashboards with key performance indicators for selected buildings, areas, or floors. This enables you to easily navigate through your buildings and quickly prioritize which facilities need the most attention.

The sample dashboard above shows the total GHG emissions and trends for a location. It provides a comparison of GHG scopes 1 & 2, energy sources, reduction amounts, and emission patterns over time. Furthermore, it allows comparing current GHG emissions against selectable baseline years.

The Net Zero Advisor allows users to analyze emissions and energy consumption against a selectable baseline year. Trend graphs allow the sustainability or energy manager to analyze the performance over time and easily identify areas of drift. In situations where the GHG emissions are difficult to understand across your portfolio, OBEM's Net Zero Advisor will capture each building's emission footprint to help paint a clear picture of your portfolio's GHG status.

Total GHG emissions for the current year, including Scope 1 and Scope 2 emissions are summarized at each level of the operations. Total emissions reduction for the calendar year is captured manually through templates based on renewable energy credits and carbon offsets. Finally, Net emissions help you track progress toward sustainability objectives.

SMART CITY

If desired by the City, we will support the continued development of a Smart City plan by bringing department stakeholders together to share ideas, prioritize projects and create a comprehensive solution that will benefit the entire community. We have the expertise, resources, and partnerships to implement these technologies in Milwaukee – an innovation that improves City-wide efficiency, improves communication, provides economic development, and attracts new residents and businesses. As part of M-WERC we worked together on a high-level framework for what this innovation could look like in Milwaukee. As part of a project, we could add strategic demonstration sites to showcase these solutions and how they could positively impact the community.

ENERGY SUPPORT SERVICES

Johnson Controls can provide other complimentary advisory and consulting services such as:

- Utility Bill Analysis and support
- Energy Intensity Comparison
- Commodity Purchasing Consultation
- Fuel switching evaluation

- Utility rate evaluation
- Energy Awareness training
- Maintenance Staff energy education conferencing
- Consultation post-guarantee period
- Net Zero and Sustainability Advisor

EMERGING TECHNOLOGIES

The City will tap into the latest building system technology with Johnson Controls given our continual investments in research and development capabilities, as well as a network of laboratories and academic partnerships. These help us develop future technology and stay ahead of evolving industry needs. We've invested in 30 laboratories dedicated to development and testing. We complement our in-house capabilities with a network of the world's top scientists, engineers, professors, and students.

The City will see cutting-edge solutions when partnering with Johnson Controls due to the investment we have made in new technology.

b. Project Work Plan/Milestones

Describe your proposed management plan for accomplishing the work. Provide a proposed project schedule and a sample timeline of milestones necessary to implement all phases of the project.

Johnson Controls is eager to continue our working relationship with the City by implementing improvements that will address your current and future needs, reduce your energy costs, and make significant progress towards your sustainability goals. Through our team approach, we will provide all of the benefits of a performance-based partnership to Milwaukee, including:

- Delivering results and meeting your goals with our cohesive and responsive team.
- Reducing costs by streamlining processes.
- Enhancing the quality of programs and services.
- Minimizing your investment risk through guaranteed savings.
- Promoting local economic development opportunities, both directly and ancillary.

Our project management approach is based on more than a century of project management

Develop Project Participant List

We will develop a list of primary participants with their contact information to expedite communication throughout the project. We will also include a distribution list with all documents, and a list of attendees with meeting schedules.

Straightforward Deliverables

We will preface each deliverable with an overview of the information included, as well as any requested actions. We will also issue correspondence to the subcontractors to ensure the proper execution of their coordination items.

Regular Status Updates on Tasks

We will hold regular, ongoing meetings with our team and the City's personnel to review the schedule, provide an update of the status of all tasks, and develop work plans to mitigate any schedule changes to make sure the project stays on schedule.

Monthly Schedule Review

We will conduct a monthly detailed review of schedule performance based on the work breakdown structure and variance analysis. We will implement corrective action for elements that exceed established current period or cumulative thresholds.

expertise, as well as 40 years of implementing 3,500 performance contracts, including hundreds in similar municipal facilities. Our dedicated full-time project managers bring expertise in state and local codes and regulations because they are based in the area and undergo regular training to bring you the latest industry practices. And because they are all in-house employees, we provide you with single source accountability and greater assurance that the project will be delivered successfully. Our approach to effectively managing a performance contract is straightforward and consists of:

- Designing equipment and system upgrades based on the audit and financial payback.
- Understanding the specific needs of the City and assembling an experienced team to meet these needs.
- Conducting a thorough and accurate audit.
- Managing the project in accordance with our proven performance contract process.
- Coordinating and scheduling the installation to minimize interruption to your operations.
- Ensuring the project meets all performance requirements and complies with all state and local regulations.
- Commissioning the project.
- Administering custom owner training and providing for a smooth transition into planned service for each system.
- Providing guarantee monitoring in accordance with our PC monitoring process.

Key Responsibilities of Our Project Manager

Jim Bieser will be responsible for managing the entire project team. He will assign responsibilities, define expectations, measure performance, report on progress, and support the entire team's ability to achieve the goals in the construction plan. Jim also serves as the primary client liaison throughout the entire implementation process. In this capacity, he coordinates weekly construction team meetings with the City to ensure open lines of communication and expedient problem resolution. Jim will also conduct daily project status meetings with project foremen to discuss issues and maintain updated progress reports. Finally, he will ensure that all work is performed safely and in accordance with the design and contract documents.

Our project management plan is customized to each effort's size, complexity and unique challenges. It directly supports your goals by providing you with an experienced team with specific local government experience. Jim will coordinate the implementation phase from our office in Milwaukee. This office will serve as a center for the management, communications, planning, design review, field engineering, and technical support, as well as the center of coordination for the installation of the City's improvement measures.

Jim will create a specific, detailed plan for the implementation of the project. We plan and



Helping You Meet Your Diversity Participation Goals

We are a leader in supplier diversity. Since 1993, we have spent more than \$22 billion with certified women- and minority-owned suppliers. Globally, we have included more than 400 diverse and historically underutilized companies into more than 30 product and service categories to support our customer solutions. We have worked with numerous clients to meet and exceed their diverse participation goals using local subcontractors. **For major citywide efforts for the cities of Charleston, Louisville and Fort Worth we exceeded their goals and achieved 30%, 33%, and 40% participation rates respectively.**



schedule each task according to the critical path methodology, and execute each phase in line with the designated critical path schedule. Individual aspects are labeled with several key points, including the retrofit category, critical preceding tasks and linking tasks, construction milestones and necessary deadlines, management skills and tools required, follow-up responsibilities, special instructions, and changes from the original specifications.

Our ability to forecast various cost, labor and material aspects accurately will also benefit the City by eliminating wasted labor hours, minimizing material and labor costs, and streamlining implementation. An essential aspect of this is determining, correctly and precisely, the amount of specific labor type, man-hours and skill sets required to complete a task within a period of time. Because so many tasks are dependent upon the completion of a previous task, we use a detailed and accurate manpower loading system to ensure a timely installation. We have tremendous local government experience in forecasting PC projects and have developed large databases that will assist Jim in all facets of construction forecasting and planning.

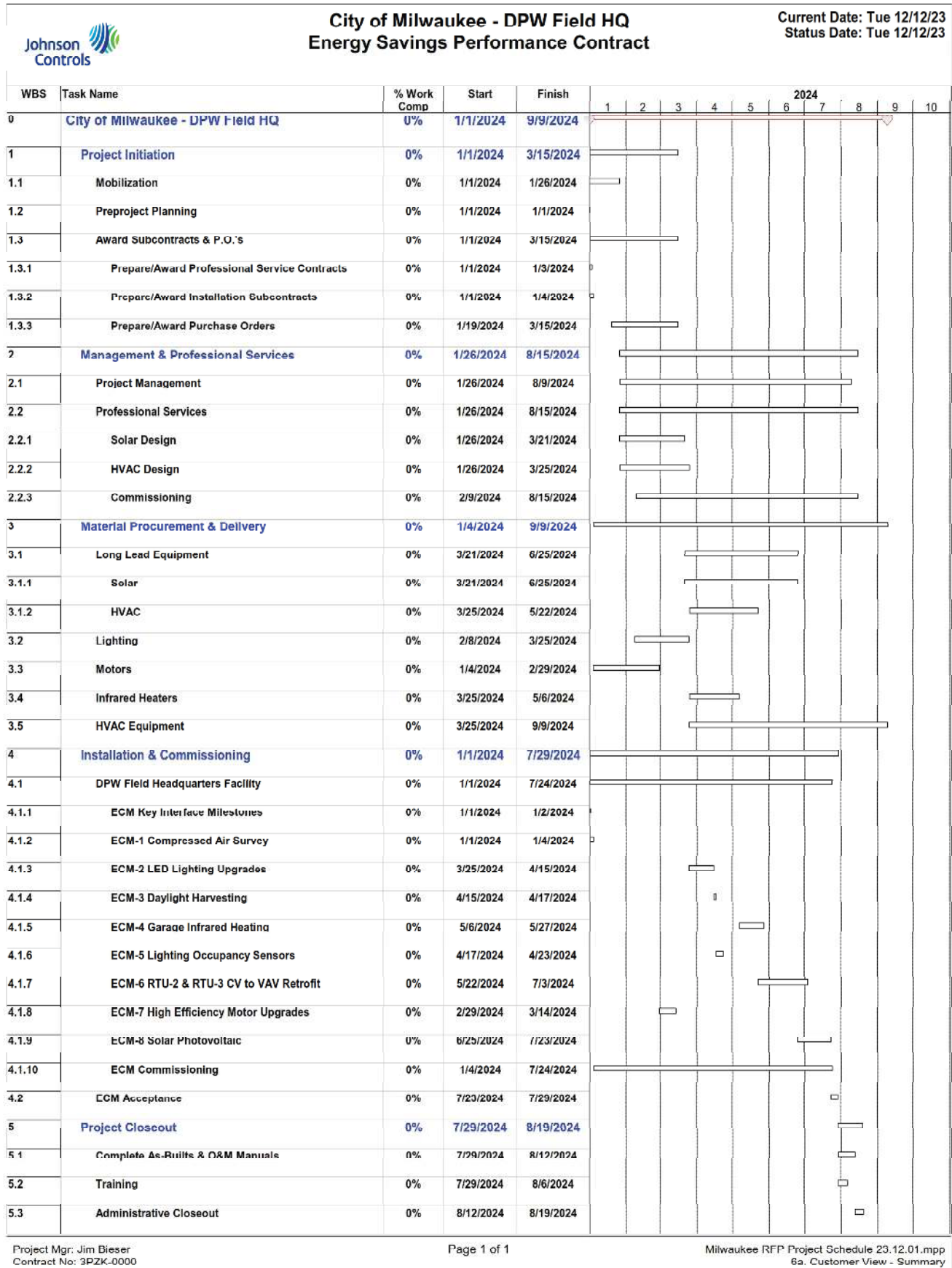
Jim Bieser, who implemented the Milwaukee Library project, will lead the installation from our office in Milwaukee.

Seamless Transitions Between Project Phases

We make a point to implement into our process smooth transitions from one phase to the next, as shown below. We involve our personnel and outside team members early to promote continuity, communication and coordination so nothing is missed. The project manager, for instance, will be involved early in the development process to help with the initial design and pricing, and to become acquainted with specific City needs and facilities for this project. This will ensure the project development work is completed with a seamless transition between the development team and the project management team.

Utility Audit	Engineering & Design	Construction & Commissioning	Measurement & Verification	Operations & Maintenance
Our core City of Milwaukee team will be involved throughout the process				
Jeff Van Ess - Account Management and Customer Satisfaction Lead				
Bob Zumbahlen - Project Development Engineer		Support Role		
Jim Bieser - Project Manager			Support Role	
Support Role	Jim Wolf - Measurement & Verification Engineer			Support Role
			Support Role	Service Technicians

Proposed Project Schedule and Sample Timeline



c. Training Provisions

Describe your firm's proposed approach to providing technical training for facility personnel. Indicate the proposed number of personnel to be trained and the type and frequency of training to be provided for the duration of the contract. Indicate how your firm will address any turnover of key facility personnel as it relates to project performance.

By partnering with Johnson Controls, the City will have the ability to customize training to increase the self-sufficiency of your staff or to develop competencies in specific areas. Training, in conjunction with our existing service offering, maximizes the efficiency of your operations and will help you continue to make the buildings more functional. Course content, location, schedule, and number of trainees will be determined once the final project scope has been identified. It is critical for training to occur at defined intervals throughout the course of this project, facilitating proper communication between Johnson Controls and your staff regarding how buildings will operate throughout the installation period and the entire term of our agreement. Refresher seminars will be available from year-to-year, as requested, to maintain the degree of training necessary for staff to perform at a high level of efficiency.

Project-Specific Training

As the leading technical service provider with 16,000 technicians and 12,500 global service delivery personnel, Johnson Controls has more in-house knowledge regarding efficiency than any other company. We have implemented similar energy and process improvements in countless municipal facilities. The program steps include:

- Defining current O&M procedures.
- Defining required maintenance and operating procedures required for new equipment.
- Reviewing training options with engineering and maintenance.
- Determining and organizing training programs, based on need and skill level, for functional groups within the facility (e.g., supervisors, maintenance staff, custodial, etc.).
- Recording each session for future use by staff.
- Performing training with each group using a mix of theory, hands-on practice, and maintenance manual application.
- Repeating and redesigning new needs on a regular basis and re-establishing competency on old ones.

Personnel to be Trained and the Type and Frequency of Training

Our project management personnel, manufacturer/equipment representatives, and specialized Johnson Controls trainers will provide training to appropriate personnel when needed. Training durations will be detailed after final engineering plans have been completed and submittals approved by the City.

Addressing Turnover of Key Facility Personnel

Our skills assessment will provide you with concrete data so you can make sound decisions and maximize the training dollars for the greatest impact. Through a series of interviews and surveys, we will develop a baseline skills assessment of your staff. We can then jointly determine the training, mentoring and support tools required for each employee, and provide targeted training so your personnel have the skills to operate and maintain the systems and equipment efficiently while providing you with a more in-depth overview of their expertise going forward.

Our gap analysis training report shows how skills are clearly illustrated so you can see at a glance where gaps exist. Our clients use this report not only to determine specific development needs, but to also determine which employee is best suited to respond to a specific work order. It becomes their dispatch resource guide and development planning guide.

Addressing the turnover of key facility personnel becomes easier since the City will have a firm understanding of the capabilities of its staff.

Johnson Controls will also record the initial and annual training sessions so the City can use them for new employees. This will enable you to readily transfer this training to new employees.

Designing an Optimal Training Program

Based on the identified training gaps – or to address other training issues – Johnson Controls will work with your staff to design the most suitable and cost-effective training program. We will use a variety of training methods to instruct your staff, including these three types of training methodologies:

- The Johnson Controls Institute
- Training Sessions at Our Local Branch Office
- On-Site Training at Your Facilities
- Packaged Training Programs
- Training Manuals

d. Project Financing

Describe your firm's preferred approach to providing or arranging financing for this project. Describe the structure of the financing arrangement including projected interest rate, financing term, repayment schedule, equipment ownership, security interest required, the responsibilities/liabilities of each party, and any special terms and conditions that may be associated with the financing of this project. Describe how construction will be financed. The City of Milwaukee reserves the right to provide its own financing.

Preferred Financing Arrangement

Our preferred financing arrangement is the arrangement that is best for the City. The amount of funding available for a performance contract is impacted by two main variables: the City's financial condition and the project size that the savings will support. Our Structured Finance Team will work with the City, including representatives from the Budget Office, to walk through the options.

Projected Interest Rate

Interest rates are market-determined at the time the lease is executed. We will work with the City and the lender to realize the best interest rate.

Financing Term

Most public entities take advantage of the full length of time allowed (typically 20 years) so they can leverage the maximum savings potential to address deferred maintenance needs.

Repayment Schedule

Frequency and timing of payments is the decision of the City. Often, we see governments choose annual payments, as opposed to quarterly or monthly, to simplify administrative aspects.

Equipment Ownership

The lessee technically owns the equipment during the term of the lease. The lessor files a UCC Financing Statement to protect its lien on the equipment during the lease term. At the conclusion of the lease term, or upon prepayment of the lease, lessee will have clear title to the equipment.

Security Interest Required

The lessee may grant the lessor a first lien security interest in the equipment being financed as part of the contract. The lessor shall file appropriate UCC Financing Statements to evidence its security interest in the equipment.

Responsibilities/Liabilities

All responsibilities and liabilities of the lessee and the lessor shall be set forth and mutually agreed upon in the financing documentation.



DRIVING DOWN THE COST OF YOUR PROJECT

Since 2009, Johnson Controls has helped win more than **\$433 million in grant funding**. Our team has an 80% win rate compared to an average industry win rate of 17% to 30%. We win funding from many sources, including the U.S. Department of Energy, the U.S. Department of Justice, and the U.S. Department of Homeland Security.

Special Terms and Conditions

If there are any special terms and conditions associated with a lease, they are determined on a case-by-case basis.

Financing Construction

If the City uses a tax-exempt municipal lease purchase agreement, at closing funds in an amount sufficient to capitalize the construction project cost are deposited into an interest-bearing escrow account established by a bank escrow agent and held for the benefit of the City. Any upfront equity cash outlays contributed by the City would also be deposited into this account. These funds are invested at the direction of the City, with maturities that match the agreed upon drawdown schedule associated with the project installation. Depending upon the pre-determined drawdown payment or Percentage of Completion payment schedule, we would invoice the City and the escrow agent.

The City is required to approve each payment and the amount before the escrow agent will release the funds. Interest for the lease would begin to accrue on the lease closing date, and is normally capitalized during the installation period. The payment structure is designed to match the program benefits such that there will be no negative cash flow in any of the repayment years.

The City of Milwaukee also has the right to provide its own financing.

e. Equipment and Installation Procurement

Describe your firm's preferred approach for selecting equipment and installation sub-contractors in an open and transparent way. Describe how you will seek to include small and local business enterprises in this process.

Selecting partners and equipment is conducted on a client-specific basis to ensure we choose the best match for the City. This approach gives us the flexibility to reach agreements that provide the greatest benefit to each specific client and site. And, recognizing that each client has a specific culture, we seek to find firms that will complement and align well with the client to ensure a strong working relationship.

Selection Process

Effective subcontractor management begins with screening through a competitive bid process, maximizing the use of local firms. We evaluate our partners for financial capability, technical excellence, past performance, personnel qualifications, ability to meet specifications and the realism of their cost. Our process also includes reference checks, a financial status review and a site visit to a comparable project where appropriate. We then work with you to select the partner that can provide the best value for the City in terms of quality, cost, and responsiveness. Johnson Controls will provide pricing transparency to the City and plans to bid major equipment and contracts competitively with results available to the City. We negotiate a contract with the terms and conditions that provide the best mechanism for managing services or materials while being fair to all parties. Our performance-based contracts with partners assure us of obtaining quality service. Our vendor management plans enable us to track and control costs and performance as closely as if we were doing the work ourselves. Most importantly, we retain full accountability for all work our subcontractors perform.

Including Small Business Enterprises

Being based in Milwaukee, we have established relationships with small businesses and have a strong track record of meeting or exceeding City goals in partnerships with Small Business Enterprises (SBE), Apprenticeships, and RPP programs. We strive to meet these goals because we know that this effort is not just an opportunity to enhance the efficiency and operations of the City facilities and infrastructure; it's an opportunity to improve the local economy as well. We will use our network of SBE subcontractors, as well as your list of preferred firms, to complete the project team. In prior projects in Milwaukee such as the Milwaukee Public Library, Milwaukee Public Schools, Fiserv Forum and Northwestern Mutual Life expansion, we met or exceeded these requirements. We also hope to collaborate with local firms like W RTP BIG STEP and MATC to create Green Job training and career opportunities.

2. Site Specific

a. Technical Site Assessment and Estimated Costs

Based upon the Utility Energy Data and Energy Conservation Measures (ECMs) identified for the DPW Field Headquarters (attachments 1-B and 2-D), please update the Cost Savings, Implementation Costs, Incentives, and Simple Payback period for each ECM recommended for the City of Milwaukee Department of Public Works Field Headquarters, located at 3850 N 35th St., Milwaukee, WI 53216. Feel free to go beyond the ECMs identified in the Master Energy Plan if proposing renewable energy and/or storage systems for this facility. Please provide the estimated costs and savings using the templates provided in Attachment 2-C. If innovative or exotic technologies are being proposed, please provide information on previous installations on similar projects, including cost and performance results, and your company's inhouse expertise or subcontractor relationship established to implement the technology.

Existing Building Description

The City of Milwaukee Department of Public Works Field Headquarter facility is a single-story mixed-use building complex comprised of an office building, a vehicle parking garage, and a maintenance shop facility. The office building is estimated at 30,000 square feet. The parking garage is approximately 116,000 square feet with the maintenance shop area estimated at 87,000 square feet for a total area of 233,000 square feet of usable interior space.

Lighting – The office building has a mix of both 32W T-8 2L florescent lamps with electronic ballast fixtures and sparsely retrofitted LED tubes. The four foot 4-lamp fixtures were found 50% de-lamped and observed to produce low-light level conditions with no occupancy sensors or lighting control system. The vehicle parking garage and maintenance shop area have been retrofitted with high bay LED light fixtures. Exterior lighting is a combination of 50W and 100W HID Metal Halide bulb fixtures.

HVAC – The office building is served by three packaged Rooftop Units (RTU) and an air-to-air Energy Recovery Unit (ERU). RTU-1 is a 50-ton Gas-Fired Variable Air Volume (VAV) system with electric reheat serving 23 zones in the main office area. RTU-2 is a 25-ton single zone gas-fired Constant Air Volume (CAV) unit serving the lunch/assembly room. RTU-3 is a 15-ton single zone gas-fired CAV unit serving the locker rooms together with an ERU. Two N+1 redundant mini-split units serve the computer server room located in the office building.

The parking garage is served by two gas-fired heating and ventilation makeup air units (MAU-1 and MAU-2). Both units are equipped with Variable Frequency Drives (VFD) and interlocked with their respective exhaust fans to control and maintain CO and NOx levels in the garage space. Eight gas-fired unit heaters provide heating in the parking garage maintained at a setpoint of 65°F.

The maintenance shop area facilities are served by several unit heaters of which some are supplied with makeup air. A third gas-fired heating and ventilation makeup air unit (MAU-3) serves the iron workers/metal shop. A horizontally mounted mixed air handling unit split-system is served by an air-cooled condensing unit (ACCU-3; Field-verify during IGA) serving the Flammable Storage Room and paint shop. Three gas-fired rooftop units (RTU-4, RTU-5 and RTU-6) serve the stock room/vehicle repair office, the SW conference room, and the south office area file/drawings corridor area, respectively. RTU-7 is a cooling only unit that serves the tool room. These rooftop units have standalone local thermostats and are also tied in the Metasys DDC system. A smaller cooling only Carrier RTU was located towards the southeast side of the roof that is yet to be identified for the area it serves. A pressure monitoring and control system serves a storage room believed to be located near the iron workers/metal shop maintenance area also supplied from MAU-3 that needs to be also field-verified.

Boilers – Two boilers; each serves the asphalt storage area and the vehicle repair bays radiant floor heating.

Domestic Hot Water Heater – A condensing hot water heater with storage tank in janitor’s closet serves the lavatories and showers located in the office building. Smaller electric hot water heaters serve the maintenance shop facilities.

Truck Wash – Equipped with two low temperature hot water heater/storage tanks located outside the building (to be field verified).

Computer Server Room – The server room load has outgrown its cooling capacity since also loading its backup N+1 condensing unit full-time.

Energy Conservation Measures

After reviewing the facility as described above, we developed a set of applicable ECMs. We started with a list of City-identified ECMs (ECM-1 through ECM-7) and then developed additional upgrades (ECM-8 through ECM-14) to deliver a more dramatic energy and emission reduction on the path toward meeting City Climate and Equity Plan goals. We created three options that demonstrate the expected result verses the level of required investment. **Option 1 – Savings Funded Solution** results in a positive cash flow over project term. **Option 2 – All City-identified ECMs plus Solar** provides additional project savings but requires some additional City investment. **Option 3 – Pathway toward Net-Zero** represents an “art of the possible” path to Net Zero with significantly more investment required. However, many grants and incentives are available, and our team will work with the City to leverage those funds to work toward these investments that generate deeper emissions cuts.

- **ECM-1 Compressed Air Leak Survey**
– **Existing:** The existing condition of the compressed air pneumatic system piping is believed to have air leaks. Compressed air leaks are commonly found in piping connection, joints and deteriorated hoses. **Proposed:** Johnson Controls will conduct a leak detection survey of the compressed air system and identify a list of improvements to implement with energy and cost savings. **Benefits:** This will reduce compressor run-time and reduce equipment cycling hence reducing energy consumption and cost. Additionally, this will prolong compressor equipment life and reduce associated O&M costs.

- **ECM-2 LED Lighting Retrofit – Existing:** The interior lighting system is comprised mostly of linear fluorescent fixtures using 32W T8 2L fluorescent lamps and electronic ballast together with some sparsely retrofitted T8 LED tube lights found in the open office area and assembly room 168. **Proposed:** This ECM will provide a detailed room-by-room lighting audit to identify a final scope of work. The preliminary scope of work includes upgrade of the office area fluorescent fixtures, primarily 2x4 lay-in fixture with two T8 lamps and ballast, with new LED fixture kits to provide energy reduction and increase current lighting levels. Our design would incorporate connected lighting in areas that could benefit from occupancy sensing and integrating daylight harvesting. Additionally, the use of controllable window shades will be evaluated where applicable. **Benefits:** The new lighting retrofit to LED technology would improve lighting levels and lower energy use and cost hence reduce the building’s carbon footprint in addition to minimizing the lighting stock by standardizing all locations with the same type of lamps. Controllable window shades will also help in controlling glare from daylight, UV fading of furniture and materials and help reduce HVAC demand due to higher temperatures from sunlight penetration.
- **ECM-3 Daylight Harvesting – Existing:** The lobby and office perimeter zones in the office building are currently not taking advantage of the available natural lighting to lower lighting levels and reduce energy use and cost. **Proposed:** Install daylight harvesting in select areas to automatically reduce electric lighting when daylight levels are high. This is accomplished using daylight sensors and lighting control systems with capability to dim or switch electric lighting in response to changing daylight availability using. **Benefits:** Daylight harvesting will lower the electric load on the lighting system by reducing lighting intensity and burn-hours hence saving energy use and cost.
- **ECM-4 Convert Garage Heating from Forced Air to Infrared Radiant Tube Heaters – Existing:** A total of eight gas-fired unit heaters serve the vehicle garage. **Proposed:** Existing unit heaters will be removed and replaced with indirect gas-fired infrared radiant tube heating

units. **Benefits:** This will eliminate fan energy from the unit heaters and increase thermal mass through conduction by directly heating surface areas and people hence slowing the rate of heat transfer and increasing occupancy comfort by eliminating convection air that can feel drafty and uncomfortable. **Note:** This ECM is not included in the cashflow under Option #1 due to significant capital contribution requirements.

- **ECM-5 Install Occupancy Sensors in Selected Areas – Existing:** There are currently no occupancy sensors in several areas of the facility including the shop area, carpentry breakroom, breakroom, restrooms, private offices, DPW office file storage area, conference rooms, small shop areas, or waterworks file/scanner room. The lack of occupancy sensors and lighting controls is not allowing to automatically switch off lights in unoccupied spaces. **Proposed:** Install occupancy sensors in transient areas with centralized lighting controls. **Benefits:** This will help reduce burn-hours hence lower energy use and cost.
- **ECM-6 Retrofit Air Handling System to VAV – Existing:** Packaged rooftop units RTU-2, and RTU-3 are constant volume air distribution systems. RTU-2 serves assembly room 168 and RTU-3 serves the locker rooms. These units cycle on/off to meet space temperature setpoint with no modulation. **Proposed:** Convert RTU-2 and RTU-3 to VAV systems with consideration to occupancy sensors and CO2 based Demand Control Ventilation (DCV) in these high occupancy spaces. **Benefits:** Converting these units to high efficiency VAV systems will increase energy efficiency and improve occupancy comfort. **Note:** This ECM is not included in the cashflow under Option #1 due to significant capital contribution requirements.
- **ECM-7 Upgrade Motors to Premium Efficiency on As-Fails Basis – Existing:** Fan and pump motors are believed to be of standard and low efficiency equipment. **Proposed:** Replace motors with premium efficiency units. **Benefits:** New and more efficient motors will operate at lower temperatures hence saving energy, and potentially reducing additional utility cost by also lowering power factor.

- **ECM-8 Solar Photovoltaic – Existing:** There are currently no solar PV systems installed at the facility. All electricity is being purchased from the electric utility. **Proposed:** This ECM involves a solar PV system with the PV array located on the roof. The entire system would consist of the PV array on the building roof, PV inverters to convert the DC electricity coming out the PV modules to grid-quality AC electricity, and the necessary switches, fuses, conduit, conductors etc. required to provide a complete, code-compliant system and satisfy the local utility interconnection requirements.

In Wisconsin, within WE Energies service territory, the currently applicable net metering regulation specifies that any solar PV production over and above the facility usage in a given billing period will be credited at the "Customer's Buy-Back Energy Rate" rate, which is currently \$0.04642/kWh. This is considerably lower than the retail electricity rate. To account for this, the solar PV system has been sized so that it does not generate significantly more in any given month/billing period than the expected future electrical usage of the facility. Another consideration in the PV system sizing was the WE Energies 300 kWac size limit for PV net metering. The preliminary system size is 160kWdc (120 kWac), well below the net metering limit.

The preliminary system modeling was performed with a tool called Helioscope, which is an online tool used widely across the PV industry to generate preliminary layouts and output estimates for PV systems. The tool allows all expected loss factors to be taken into account, including electrical wiring losses, inverter and module efficiency losses, dirt and snow soiling, etc. The tool also includes a sophisticated geometric modeling and shade modeling function, which allows shading from nearby obstacles such as trees, buildings, rooftop equipment, parts of the same building the PV array is on, etc. to be modeled and the associated shading losses to be quantified in the model result.

ROOF-MOUNTED PV ARRAY

The image on the right shows a preliminary layout for a PV array located on the roof of the Milwaukee DPW Shop. The array was preliminarily located in the southwestern part of the roof, because the transformer serving the building is located near that corner of the roof, which should lead to the most straightforward interconnection for the PV system. The rooftop has a large amount of area available, so the final array location may be adjusted based on roof structural or roof condition considerations.

Rooftop PV racking may be attached to the roof using fasteners/penetrations that are flashed and sealed, or may be “ballasted”, that is, held down by weight. Typically, the weight consists of concrete blocks placed into ballast trays built into the racking specifically for this purpose. Normally the first choice is to use the ballasted approach, as this avoids the need to make roof penetrations and seal/flash them. In some cases, the roof structure is not adequate to hold the additional weight of the ballast blocks, which can add several pounds per square foot of weight to the PV system. The roof structure will need to be analyzed by a professional structural engineer to determine whether the roof in question can support the additional weight of the PV system. This work would be performed as part of a more detailed development phase of the project.

Roof condition is also an important consideration when installing a PV array on the roof of a building. During the detailed development project phase, a roof survey would be performed to establish the condition of the roofing material. In general the goal when installing solar PV on a roof is to avoid having to move the PV array for reroofing or roof repair over the expected 25- to 30-year lifetime of the PV system. In some cases, if the roof is not new but is still in good condition, a roof coating or minor roof repairs can be performed to bring the roof to a near-new condition before installing the PV array.

Benefits: Solar PV is an emissions-free renewable technology with low maintenance requirements, no moving parts\The PV system



would be interconnected on the customer side of the existing utility metering, and the electricity produced would be used in the facility in place of electricity that would have previously been purchased from the electric utility. Some of the facility electricity usage will still be purchased from the electric utility, but the solar PV will generate savings in the form of lower electric bills. Thus, the benefits from the PV system consist of the “green” emissions free electricity, and savings on electric bills.

- **ECM-9 OpenBlue Enterprise Manager – Existing:** OBEM is a comprehensive building management platform to power a new class of smart commercial buildings that are secure, healthy, and sustainable. Benefits: The suite of OBEM applications focus on different outcomes such as energy efficiency and sustainability, equipment reliability for occupant comfort, smart facilities management (staff productivity), utility bill management, real estate utilization, building occupant wellness and productivity, and customer facing kiosks. OBEM uses an open digital platform to connect to data both in the building and to other technology applications in the cloud.

OPTION 1 - Savings Funded Solution

This option includes all ECM-1 through ECM-3, ECM-5 and ECM-7 through ECM-9, as described above, and provides a project that could be funded with savings generated. ECM-4 and ECM-6 were excluded because of the longer payback. The estimated cost for Option 1 is \$449,037 with an annual utility cost avoidance of \$36,128 per year **and no capital contribution requirements**. We have elected to present this scenario as Option #1 because it is a more economically viable option. Note: The solar PV cost includes the expected 30% ITC direct pay.

Attachment 2-C: ESCO's Proposed Project Costs and Cash Flow Analysis	
Project Site: DPW Field Headquarters	
Fee Category	Fees⁽¹⁾ Dollar (\$) Value
Engineering and Project Management	
Investment Grade Energy Audit	\$ 15,000
Design Engineering Fees	\$ 9,703
Construction Management	\$ 26,684
System Commissioning	\$ 5,625
Initial Training Fees	\$ 3,900
Project Service Fees Sub Total	\$ 60,912
Energy Conservation Measures - Equipment and Installation	
ECM-1 Compressed Air Leak Survey	\$ 2,500
ECM-2 LED Lighting Retrofit	\$ 43,750
ECM-3 Install Daylight Harvesting Controls in Selected Areas	\$ 3,125
ECM-4 Convert Garage Heating from Forced Air to Radiant	\$ -
ECM-5 Install Occupancy Sensors in Selected Areas	\$ 12,500
ECM-6 Retrofit Air Handling System to VAV	\$ -
ECM-7 Upgrade Motors to Premium Efficiency on As-Fails Basis	\$ 15,000
ECM-8 Solar PV	\$ 288,750
ECM-9 Open Blue Enterprise Manager	\$ 22,500
Fees for ESCO-Arranged Financing	\$ -
Other Financing Costs (defined)	\$ -
TOTAL FINANCED PROJECT COSTS:	\$ 449,037

First Year Annual Service Fees	Fees⁽¹⁾ Dollar (\$) Value
Measurement and Verification (Traditional Annual Report)	\$ 5,800
On-going System Monitoring (ESCO has Access to Building Automation System and will alert City Staff of Energy Performance Issues Throughout the Year)	Included In Above
Staff Training Services	Included In Above
TOTAL FIRST YEAR ANNUAL SERVICES	\$ 5,800

NOTES:

1. Fees include all mark-ups, overhead, and profit.

ECM SAVINGS

DPW Field HQ Baseline Energy Use and Estimated Savings Calculator

Portfolio Manager Property ID	Annual Energy Use	
Year Ending	12/31/2009	12/31/2022
Electricity Use - Grid Purchase (kWh)	1,053,053	1,328,559
Electricity Use - Grid Purchase (kBtu)	3,593,017	4,533,045
Electricity Use – Generated from Onsite Renewable Systems and Used Onsite (kWh)	0	0
Electricity Use – Generated from Onsite Renewable Systems and Used Onsite (kBtu)	0	0
Natural Gas Use (therms)	124,814	126,637
Natural Gas Use (kBtu)	12,481,372	12,663,742
Total kBtu (Site Energy)	16,074,389	17,196,787

ECM	ECM-1	ECM-2	ECM-3	ECM-4	ECM-5	ECM-6	ECM-7	ECM-8	ECM-9	Total
Electricity Savings - Grid Purchase (kWh) On Peak	3,382	22,584	11,019	-	5,006	-	895	-	9,747	42,886
Electricity Savings - Grid Purchase (kWh) Off Peak	2,767	16,354	7,346	-	3,338	-	732	-	9,747	30,537
Electricity Savings - Grid Purchase (kWh)	6,149	38,938	18,365	-	8,344	-	1,627	-	19,493	73,423
Electricity Savings - Grid Purchase (kBtu)	20,984	132,880	62,672	-	28,475	-	5,552	-	66,522	250,563
Electricity Savings – Generated from Onsite Renewable Systems and Used Onsite (kWh)	-	-	-	-	-	-	-	205,847		205,847
Electricity Savings – Generated from Onsite Renewable Systems and Used Onsite (kBtu)	-	-	-	-	-	-	-	702,473		702,473
Natural Gas Savings (therms)	-	-	-	-	-	-	-	-	2,326	-
Natural Gas Savings (kBtu)	-	-	-	-	-	-	-	-	232,600	-
Total kBtu Savings (Site Energy)	20,984	132,880	62,672	-	28,475	-	5,552	-	299,122	250,563
Electric Cost per KWH On Peak	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866
Electric Cost per KWH Off Peak	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542
Electric cost of kW On Peak Demand	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10
Gas Cost per Therm	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100
Electric Savings On Peak	\$ 293	\$ 1,956	\$ 954	\$ -	\$ 434	\$ -	\$ 77	\$ 10,696	\$ 844	\$ 15,254
Electric Savings Off Peak	\$ 150	\$ 886	\$ 398	\$ -	\$ 181	\$ -	\$ 40	\$ 4,459	\$ 528	\$ 6,641
Demand Charge Savings	\$ 3,986	\$ 1,450	\$ 2,174	\$ -	\$ -	\$ -	\$ -	\$ 5,436	\$ -	\$ 13,046
Gas Savings	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,186	\$ 1,186
Total Dollar Savings	\$ 4,429	\$ 4,291	\$ 3,527	\$ -	\$ 614	\$ -	\$ 117	\$ 20,591	\$ 2,558	\$ 36,128

Estimated Site kBtu after project	68,799
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CASHFLOW

Project Cost = \$ 449,037

Capital Contribution Up-Front = \$ 0

Principle = \$ 449,037

Attachment 2-C
ESCO's Proposed Annual Cash Flow Analysis

Escalation Rate by Utility:			Principal:	\$ 449,037	Financed Project Costs:	\$ 890,104	Annual Payment:	\$ 42,386	
Electric:	3.00%	Natural Gas:	3.00%	Water:	3.00%	Finance Term:	20 years	Interest:	\$ 441,067
Construction Months:		6	Escalation Rate for Annual Fees:		3.00%	Annual Interest Rate:	7.00%	Other (specify):	na

Year	Electric Cost Savings	Natural Gas Cost Savings	Water Savings	Operational Cost Savings	Total Cost Savings	Maintenance, Monitoring, EM&V, and Training Fees	Guaranteed Cost Savings	Financing Payment	Net Savings
1	\$ 34,941	\$ 1,186	\$ -	\$ 5,000	\$ 41,128	\$ (5,800)	\$ 35,328	\$ (42,386)	\$ (7,058)
2	\$ 35,990	\$ 1,222	\$ -	\$ 5,150	\$ 42,362	\$ (5,974)	\$ 36,388	\$ (42,386)	\$ (5,998)
3	\$ 37,069	\$ 1,259	\$ -	\$ 5,305	\$ 43,632	\$ (6,153)	\$ 37,479	\$ (42,386)	\$ (4,907)
4	\$ 38,181	\$ 1,296	\$ -	\$ 5,464	\$ 44,941	\$ -	\$ 44,941	\$ (42,386)	\$ 2,555
5	\$ 39,327	\$ 1,335	\$ -	\$ 5,628	\$ 46,290	\$ -	\$ 46,290	\$ (42,386)	\$ 3,904
6	\$ 40,507	\$ 1,375	\$ -	\$ 5,796	\$ 47,678	\$ -	\$ 47,678	\$ (42,386)	\$ 5,292
7	\$ 41,722	\$ 1,416	\$ -	\$ 5,970	\$ 49,109	\$ -	\$ 49,109	\$ (42,386)	\$ 6,723
8	\$ 42,974	\$ 1,459	\$ -	\$ 6,149	\$ 50,582	\$ -	\$ 50,582	\$ (42,386)	\$ 8,196
9	\$ 44,263	\$ 1,503	\$ -	\$ 6,334	\$ 52,099	\$ -	\$ 52,099	\$ (42,386)	\$ 9,713
10	\$ 45,591	\$ 1,548	\$ -	\$ 6,524	\$ 53,662	\$ -	\$ 53,662	\$ (42,386)	\$ 11,276
11	\$ 46,958	\$ 1,594	\$ -	\$ 6,720	\$ 55,272	\$ -	\$ 55,272	\$ (42,386)	\$ 12,886
11	\$ 48,367	\$ 1,642	\$ -	\$ 6,921	\$ 56,930	\$ -	\$ 56,930	\$ (42,386)	\$ 14,544
12	\$ 49,818	\$ 1,691	\$ -	\$ 7,129	\$ 58,638	\$ -	\$ 58,638	\$ (42,386)	\$ 16,252
13	\$ 51,313	\$ 1,742	\$ -	\$ 7,343	\$ 60,397	\$ -	\$ 60,397	\$ (42,386)	\$ 18,011
14	\$ 52,852	\$ 1,794	\$ -	\$ 7,563	\$ 62,209	\$ -	\$ 62,209	\$ (42,386)	\$ 19,823
15	\$ 54,438	\$ 1,848	\$ -	\$ 7,790	\$ 64,076	\$ -	\$ 64,076	\$ (42,386)	\$ 21,690
16	\$ 56,071	\$ 1,904	\$ -	\$ 8,024	\$ 65,998	\$ -	\$ 65,998	\$ (42,386)	\$ 23,612
17	\$ 57,753	\$ 1,961	\$ -	\$ 8,264	\$ 67,978	\$ -	\$ 67,978	\$ (42,386)	\$ 25,592
18	\$ 59,485	\$ 2,020	\$ -	\$ 8,512	\$ 70,017	\$ -	\$ 70,017	\$ (42,386)	\$ 27,631
19	\$ 61,270	\$ 2,080	\$ -	\$ 8,768	\$ 72,118	\$ -	\$ 72,118	\$ (42,386)	\$ 29,732
20	\$ 63,108	\$ 2,143	\$ -	\$ 9,031	\$ 74,281	\$ -	\$ 74,281	\$ (42,386)	\$ 31,895
Total	\$ 1,001,997	\$ 34,018	\$ -	\$ 143,382	\$ 1,179,397	\$ (8,964)	\$ 1,161,470	\$ (890,104)	\$ 271,366

OPTION 2 - All City-identified ECMs plus Solar

This option includes all ECM-1 through ECM-9 as described above. The estimated cost for Option 2 is \$1,310,786 with an annual utility savings of \$49,180 per year and will require a capital contribution of \$589,854. The project costs, savings and cashflow are included in the appendix. Note: The solar PV cost includes the expected 30% ITC direct pay. This option is not recommended because of its capital contribution requirement unless additional funding is available.

OPTION 3 – Pathway Toward Net Zero

To achieve the goal of 45% reduction in Emissions the following ECMs are included in this option. We have evaluated these enhanced ECMs in addition to ECMs in Option #1.

- **ECM-1 See in the above Option #1.**
- **ECM-2 See in the above Option #1.**
- **ECM-3 See in the above Option #1.**
- **ECM-4 See in the above Option #1.**
- **ECM-4a Upgrade three heating and ventilation MAUs and add Heat Recovery – Existing:** MAUs are inefficient for today's standards and are also nearing their end-of-life expectancy with no heat recovery system and aging speed drives and degraded CO and NOx sensors accuracy. **Proposed:** Explore and provide analysis of several solution technologies best suited to upgrade and even electrify the heating and ventilation MAU equipped with a heat recovery system. Consideration will be given to a run-around coil glycol loop, a fixed plate heat exchanger, or a heat pump system. **Benefits:** Modernizing the ventilation air system will provide more energy efficient and lower noise levels including low maintenance and operation. This together with upgrading the existing sensors to infrared detection technology with higher sensitivity, accuracy and better response time will improve indoor air quality conditions for field personnels' comfort, health, safety and wellbeing.
- **ECM-4b Upgrade Exhaust Fan Motors to Premium Efficiency – Existing:** Standard and low efficiency exhaust fan motors with no modulation (field-verify) serving their respective heating and ventilation MAU. **Proposed:** Replace exhaust fans with Premium efficiency direct-drive motors equipped with new speed drives and building pressure sensors. **Benefits:** More energy efficient exhaust fan motors tracking supply fans and controlling to building pressure will provide more precision ventilation controls improving indoor conditions and also help reduce noise levels for a quieter indoor garage space.
- **ECM-5 See in the above Option #1.**
- **ECM-6 HVAC Electrification – Existing:** The office building is conditioned with traditional HVAC packaged rooftop units of both CAV and VAV system types with electric reheat VAV box terminal units and perimeter zone baseboard electric resistance radiant heating. **Proposed:** Explore and provide analysis using a select number of solutions best suited to modernize and electrify the office building HVAC system. Consideration will be given to technologies such as geothermal heat pump coupled with air-cooled VRF systems with heat recovery providing simultaneous heating and cooling for applications with interior and exterior thermal loads. VRF systems are enhanced direct-expansion (DX) ductless multi-split heat pump systems. Rooftop units will be replaced with an ERV type Dedicated Outside Air System (DOAS) providing de-humidification, heat recovery, building pressure control and supplying pretreated outside air for meeting the ASHRAE 62.1 minimum ventilation requirements. The existing duct system will be reused where possible to deliver ventilation air from the new DOAS unit. **Benefits:** Eliminate perimeter zones and terminal unit electric resistance heating

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The team of industry experts and engineering professionals made the entire process as "turn-key" as possible, while keeping the City involved every step of the way. Johnson Controls staff created a comprehensive and phased plan from concept to savings management; they collaborated with City staff and vendors during planning and technical design; and they continue to manage the implementation of energy cost savings initiatives. The team has always responded promptly and appropriately to any issues and concerns, and they are able to provide whatever resources the project has required.

**- Project Manager Robin Smith,
City of Jacksonville Beach, FL**

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hence lowering electric utility cost with an increase in heating efficiency of up to 200% from electric resistance heating with a COP of 3. Better performance and controls at part-load conditions. The system efficiency together with low maintenance expenses can, over time, offset the initial cost of the system in energy savings. Other benefits include flexible installation of the two-pipe system line-set taking less room in both new construction and retrofit projects in tight spaces. A suspended ceiling system at the FHQ DPW office is an advantage for installing a VRF system supply cassette making it a suitable candidate for this type of application. VRF systems are designed to provide for a better zone temperature and humidity control hence maximizing occupancy health and comfort. VRF systems have low maintenance therefore provide higher O&M cost-avoidance than a traditional HVAC system. This advanced and progressive technology solution satisfies both electrification and green renewables energy initiative to transition to clean energy and help the City get closer to meeting both its 25X25 and Net Zero goals by 2050.

- **ECM-7 See in the above Option #1.**
- **ECM-8 See in the above Option #1 but this is 404kWdc (300 kWac) to match the utility limit.**

Table 2: Solar PV System Preliminary Design Overview

LOCATION - TYPE	SIZE (kWDC)	OUTPUT YEAR 1 (kWh)	ANNUAL BUILDING USAGE, HISTORICAL 12 MONTHS (KWH)	PERCENT OF BUILDING HISTORICAL USAGE FROM PV (%)
Shop Building - Rooftop	404.8	518,394	1,328,559	39%

- **ECM-8a Battery Energy Storage System (BESS) – Existing:** There are currently no battery storage systems installed at the facility. **Proposed:** This ECM proposes to install a battery energy storage system (BESS) which would serve the primary purpose of generating savings on the demand charge portion of the electric bills. In addition, the battery system could be configured to provide limited facility backup power in the event of an extended utility outage, with the understanding that this “microgrid” functionality would require more technical due diligence and design work to ensure that the batteries can be integrated correctly with the facility electrical infrastructure. For the purposes of this preliminary analysis the primary function of the battery was assumed to be demand reduction and demand charge savings.

The location of the battery system would need to be determined within a more detailed project development phase, but preliminarily the assumption is that the battery would be located outdoors in a climate-controlled enclosure. Due to NFPA fire codes, it is often difficult to locate a battery system indoors unless it is a very small residential-sized battery system.

Johnson Controls and Milwaukee Public Schools STEAM Camp

Johnson Controls sponsored a 2 ½ day Science Technology, Engineering, Arts, and Math Camp where students received hands on experiential learning and learned the ability for them to translate learning to their school, home and life. They worked in teams and presented their learning to MPS leadership.



The battery demand savings were modeled using an online tool called Energy Toolbase, which is an industry-standard tool used for the purpose of modeling savings from PV and energy storage systems. This tool runs a one-year 15-minute interval simulation based on the facility electrical usage, the PV system output, the battery power (kW) and capacity (kWh), and the utility rate structure taking on-peak and off-peak billing periods into account. The tool essentially calculates the modeled electric bill before PV and energy storage, and after PV and energy storage.

Since the modeling for the battery savings was based on monthly usage data, it was necessary to create a synthetic load profile to match this usage data, which was done by fitting the monthly values to the US DOE Standard Load Profile for a Medium-Sized Office located in Milwaukee. A more accurate analysis would need to be performed in the detailed development project phase, using actual electrical usage interval data obtained from WE Energies.

Table 3: Battery Energy Storage System Preliminary Design Overview

LOCATION - TYPE	POWER (kWAC)	NOMINAL CAPACITY (KWHDC)
Outdoor enclosure	150	372

Benefits: The primary benefit of the battery energy storage system would be the savings achieved on the demand portion of the electric bills. A secondary benefit would be the ability to provide limited backup power during an extended utility outage. This secondary benefit was not investigated in detail for this preliminary response and would require further work to ensure the battery could function successfully within the existing facility electrical infrastructure.

- **ECM-9 See in the above Option #1.**
- **ECM-10 Electrify Condensing Domestic HW Heater – Existing:** Condensing domestic hot water heater with storage tank. **Proposed:** Electrify the condensing domestic hot water heater by replacing it with a heat pump hot water heater. **Benefits:** This heat pump system will improve the efficiency by up to 200% by recovering the heat from the surrounding space while dehumidifying and lowering the load on HVAC system.
- **ECM-11 Convert Gas-Fired Rooftop Units (RTU) to Heat Pumps – Existing:** Three gas-fired rooftop units: RTU-4, RTU-5, RTU-6. **Proposed:** Electrify by replacing these units with heat pumps. **Benefits:** Electrification of aging HVAC equipment supports and contributes the City’s initiative of reducing greenhouse gas emissions with more energy efficient units of higher SEER rating for better performance, reliability and a sustainable solution.
- **ECM-12 Water Conservation – Water efficiency and storm water management. Proposed:** Rainwater harvesting or reusing gray water for truck washing. **Benefits:** Conserve water and reduce cost in accordance with the Milwaukee Green Infrastructure Plan.
- **ECM-13 Building Envelope Ceiling Insulation – Existing:** No insulation underneath the metal roof deck ceiling in both the parking garage and maintenance shop areas. This will increase the rate of conductive heat transfer, which would be accelerated by using the proposed indirect gas radiant

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The experience with Johnson Controls has been very positive for the City of Fort Worth. We have completed or currently have underway projects totaling in excess of \$30 million, over 100 locations and up to 15 years duration.

These projects have been implemented in several phases, which allow the City to track and verify the savings.

**- Greg Simmons,
Facilities Manager,
City of Fort Worth, TX**

”

infrared heaters in ECM-4 since they would directly heat the building envelope surfaces. **Proposed:** Apply foam spray insulation underneath the metal roof decking to increase R-value and help reduce the rate of conductive heat transfer. **Benefits:** This building envelope energy conservation measure will save energy use and cost and prolong the life of heating equipment with less cycling hence minimizing O&M associated costs.

- **ECM-14 Computer Server Room Mini-Split System Upgrade – Existing:** The server room load has outgrown its cooling capacity since it's also loading its N+1 backup condensing unit full-time. **Proposed:** Upgrade and resize these units to more energy efficient units while restoring true N+1 redundancy for meeting the increase in higher cooling load. **Benefits:** New split-system units with higher IEER efficiency rating and restored N+1 redundancy will provide a higher degree of performance and reliability while proactively mitigating potentially critical system failure and downtime of the City's IT systems infrastructure.

The estimated cost for Option 3 is \$4,800,000 with an annual utility savings of \$98,000 per year. This will require a capital input of \$3,400,000. This option will provide a 54% reduction in emissions by 2030.

ECMs FOR ACHIEVING CITY'S NET ZERO GOAL BY 2050:

In addition to the proposed geothermal solution in the above ECM-6, Johnson Controls is considering to further explore other renewable type power generating technologies and mechanism for achieving the 25X25 goal of 25% of power generation from renewable resources by 2025. These include:

- Inline-Hydroelectric Waterwheel generation technology. A perfect fit to supplement Solar PV power generation using the same inverter. It is ideal in facilities with high water usage coupled with Solar/Renewable Energy Credit (S/ RECs) certificates purchasing.
- Other emerging technologies include renewable fuel cell energy storage for non-dispatchable power sources such as solar PV and wind turbines, which would be another option to evaluate for building properties with real estate that can support installation.
- Including EV charging stations to support, promote and encourage electric vehicle transportation.
- Distributed Energy Storage (DES) would be another option for mission critical sites needing power conditioning and control management for delivering stable and uninterrupted power.
- Conducting a feasibility study with life-cycle analysis and cost for installing a Combined Heat-Cool and Power (CCHP) tri-gen microturbine to provide on-site power generation and use waste heat recovery to provide both heating and cooling using an absorber chiller together with heat exchangers. This provides the added benefits of eliminating both mechanical vapor compression and synthetic refrigerants hence deliver stability, reliability, and resiliency while at the same time reducing global warming potential and the City's carbon footprint.



ATTENTION TO SAVINGS

The New Buildings Institute found that best practices in building maintenance and operations reduce energy use 10% to 20%. In contrast, poor maintenance can increase energy use by 30% to 60%.

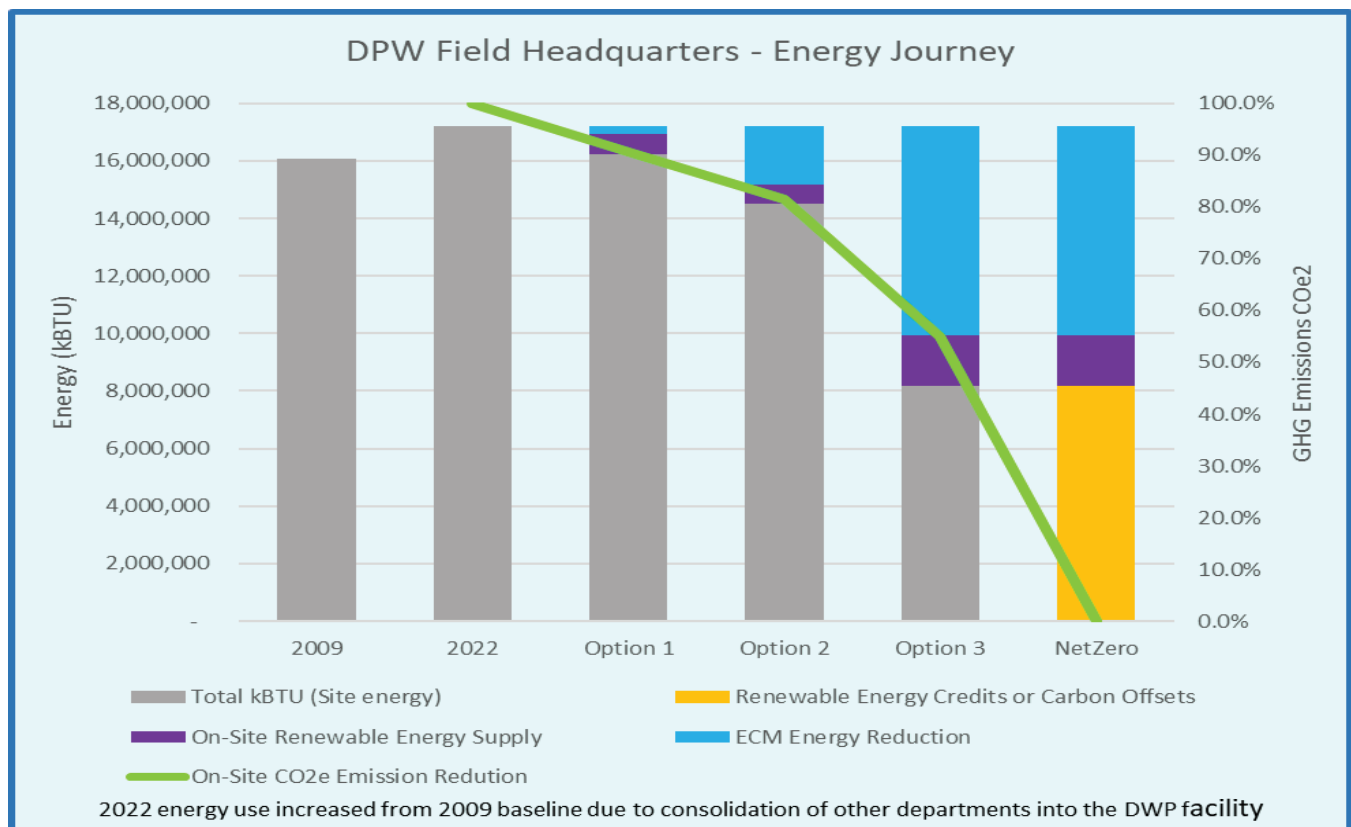
When selected as your partner, Johnson Controls will also provide additional analysis of more cutting-edge solutions at the forefront of technology as further advancements are made in science and engineering over the next 27 years. This also includes additional improvements to the building envelope to reach the remaining balance of achieving the City of Milwaukee's Net Zero greenhouse gas goal emissions by 2050.

Summary of Energy Savings and Emissions Reduction

DPW Field Headquarters - Energy Summary Table

Portfolio Manager Property ID	Annual Energy Use		Estimated Energy Usage		
Year Ending	12/31/2009	12/31/2022	Option 1	Option 2	Option 3
Electricity Use - Grid Purchase (kWh)	1,053,053	1,328,559	1,255,136	1,178,340	501,559
Electricity Use - Grid Purchase (kBtu)	3,593,017	4,533,045	4,282,524	4,020,496	1,711,319
Electricity Use – Generated from Onsite Renewable Systems and Used Onsite (kWh)	0	0	205,847	205,847	518,394
Electricity Use – Generated from Onsite Renewable Systems and Used Onsite (kBtu)	0	0	702,350	702,350	1,768,760
Natural Gas Use (therms)	124,814	126,637	126,637	111,737	64,637
Natural Gas Use (kBtu)	12,481,372	12,663,742	12,663,700	11,173,700	6,463,700
Total kBtu (Site Energy)	16,074,389	17,196,787	16,243,874	14,491,846	6,406,259
Percent Reduction of Energy versus 2009 Baseline			-1.1%	9.8%	60.1%
Percent Reduction of Energy versus 2022 Baseline			5.5%	15.7%	62.7%
Percent Reduction of Emissions CO2e versus 2022 Baseline			2.5%	11.6%	54.9%

Baseline adjustment: As can be noted via the table above, the DPW Field HQ facility has realized an increase in Annual Energy Use between 2009 and 2022. During the RFP walk-through Johnson Controls was made aware that, during that time period, the City of Milwaukee consolidated several departments to this site which has resulted in greater occupancy and increased energy consumption to accommodate occupant comfort. To ensure cross-reference to the ENERGY STAR baseline, Johnson Controls recommends a Baseline Adjustment to the 2022 energy usage to reflect the additional energy consumption and more closely correlate the two baseline years.



b. Energy Baseline Calculation Methodology and Measurement & Verification Plan

Describe the methods used to compute baseline energy use. Describe any computerized modeling programs used by your firm to establish baseline consumption. Please summarize procedures, formulas and methodologies including any special metering or equipment your firm will use to measure and calculate energy savings for this project. Describe the methods used to adjust the guaranteed level of savings from any material changes that occur due to such factors as weather, occupancy, facility use changes, etc. Indicate any operational cost savings opportunities and how such savings are to be identified, documented and measured.

Project savings will be measured and verified in accordance with the guidance provided by the International Performance Measurement and Verification Protocol (IPMVP). The City of Milwaukee and Johnson Controls will collaborate to determine which M&V Option (A, B, C, or D) is appropriate for each project under the Master Energy Service Agreement. We expect that lighting-only projects will use Option A, and whole building retrofits will follow Option C. M&V activities begin with a review of the existing energy consumption patterns and historical usage which will serve as the baseline for projecting and confirming future energy reduction. To ensure the accuracy of energy flows, there may be a need for data validation through the installation and calibration of additional meters. To ensure transparency in reporting results, we use a third-party verification tool entitled Option C Energy Management Measurement & Verification System available via Abraxas Energy Consulting. Option C capitalizes on the strength of its predecessor, Metrix 4, to normalize energy usage for variations in weather and other variables, where applicable while allowing for modifications associated with changes in facility use. Benefits will be calculated on an annual basis with the period beginning the first month after the project has been accepted.

O&M savings will be derived from a collaborative effort with the City of Milwaukee during which we will identify labor and use material costs as the basis for projecting O&M savings. We will calculate benefits based upon reduced labor costs and foregone replacement material costs derived from the installation of new equipment.

Describe your firm's proposed approach to treatment of savings achieved during construction and how those savings will be documented and verified.

Construction savings are measured and documented using IPMVP and Option C, where applicable. Total construction period savings are calculated by tying each ECM and its completed installation date to its capability to generate the savings. Construction period savings may be aggregated into a single dollar amount for the construction period and carried forward as project benefits for the duration of the contract reporting. Construction period savings stop at the signature date of the substantial completion document.

Describe how your Measurement & Verification Plan will utilize EPA Energy Star Portfolio Manager as a starting point for measuring energy savings. Describe any specific factors for calculating energy savings that will deviate from Portfolio Manager and how those factors can be mutually accounted for by both The City of Milwaukee and Company.

As an additional reporting metric, **Johnson Controls will cross-reference the annual savings, as calculated above, against the results detailed in ENERGY STAR Portfolio Manager.**

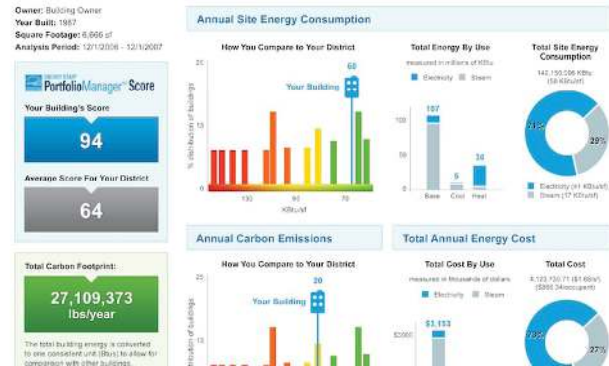
We will conduct further analysis to identify the extent to which Abraxas Energy Consulting Option C Energy Management Measurement & Verification System and ENERGY STAR Portfolio Manager are based in the same weather data. Where differences exist, we will include an explanation in the annual report so as to allow for correlation between the traditional M&V reporting (baseline: calendar year 2022) versus the ENERGY STAR Portfolio Manager "Weather-Adjusted Source EUI (kBtu/ft²)" results (baseline: 2009).

Therefore, we will work with the City of Milwaukee Environmental Collaboration Office (ECO) as necessary to register the ESPC project and input required information and data in the EPA's eProjectBuilder database platform both at the initial project concept stage and throughout the duration of the project repayment term, and provide the City of Milwaukee ECO with ENERGY STAR Portfolio Manager baseline and use adjustments as necessary and that may be in addition to any agreed upon baseline and savings adjustments and savings calculations associated with our guarantee.



We understand that the City is looking to use the ENERGY STAR Portfolio Manager to track energy use. Developed by the EPA and Department of Energy, Portfolio Manager is an innovative online energy management tool to help organizations track and assess energy and water consumption of facilities.

The system helps set investment priorities, identify under-performing buildings, verify efficiency improvements, and receive EPA recognition for superior energy performance. Johnson Controls, previously recognized as an ENERGY STAR Partner of the Year, brings significant experience with Portfolio Manager. In one year we benchmarked 907 buildings through Portfolio Manager. Of these, 21 ranked in the top 25% and received the ENERGY STAR label, and 12 had an energy performance rating that improved 10 points or more in the previous year. We will use our expertise to enable the City to track your energy use and performance so you see the data you need how you need to see it.



c. Equipment Maintenance Approach

Please describe any major changes in operations or maintenance for this project that your company anticipates. Include a description of the types of maintenance services projected for this project. Please discuss the role of the City's personnel in performing maintenance on the new and existing equipment. Discuss the relationship of maintenance services to the savings guarantee, any required duration of the maintenance agreement and what impact termination of maintenance prior to the end of the contract term would have on the savings guarantee.

Operations/Maintenance Changes

We will identify any major O&M changes through our assessment of current maintenance and training activities following the newly installed facility improvement measures.

Types of Maintenance Services Available

A Planned Service Agreement provides you with a customized service strategy designed around the needs of the City's buildings. The options include:

- **Basic Coverage:** scheduled service visits for covered equipment. No parts or equipment are provided.

- **Premium Coverage:** basic coverage as well as repair labor, plus repair material for covered equipment. This option places the majority of the risk on us.
- **Extended Service:** service for repairs performed outside of business hours (available either 24/5 or 24/7).

Maintenance Services and the Savings Guarantee

We do not require that our staff perform service as part of a performance contract. If the City wishes to perform maintenance on the equipment (per manufacturers' recommended specifications), there will be no impact on the guarantee as long as the separate M&V agreement is in place.

OpenBlue Net Zero Steps

8 Steps to Net Zero



Step 1: Goal setting and advisory services.

This step of the decarbonization process encompasses organizational-level planning where we work with your organization

to determine an optimized path forward based on the City of Milwaukee Climate and Equity Plan and defined Key Performance Indicators (KPIs), flowing organizational-level goals down to asset-level goals and tactics. We will run a process to enable prioritization of assets that have the greatest ROI and highest carbon reduction opportunities and develop strategies to implement the transformation, the scale and speed of which may be unlike other initiatives employed by organizations to date. These advisory services may include:

- Cultural and organization-wide alignment.
- GHG Inventory (Scope 1, 2, 3) baselines and scenarios.
- Discovery of the largest value drivers.
- Peer and market benchmarking.
- Decarbonization roadmap and strategy.
- Financial assessment and solutions.
- Master planning.

The outcome of this step is a clear plan, or an implementation pathway, and the financial strategies to fund the effort, quickly, efficiently, and, if beneficial, with the risk shifted to us. We meet with the organization to review and align specific goals, we review each of the major levers to determine what solutions will be considered as part of the decarbonization strategy, and we develop a strategy and roadmap to move from planning to action.



Step 2: Safe, secure, and healthy environments.

People are our most important assets, so a focus on indoor air quality and ventilation, daylighting, and building safety and security is critical

to round out any buildings assessment. We can implement practices proven to improve occupant health and safety, boosting productivity, and

meeting and exceeding code requirements and health recommendations. This may include:

- Building code compliance for occupant safety
- Indoor air quality and ventilation.
- Fire safety, building and cyber security strategies and technologies.
- Industry-leading certification of health and safety (e.g., BOMA/WELL).



Step 3: Digitally enabled environments.

We believe having the right technology backbone is necessary to establish, implement and track your goals. Our digital solutions gather site-level energy data, automating that collection where possible,

to set and track goals, and drive decision-making. Our Net Zero Advisor application streamlines energy data consolidation, allowing building-level baselines and goal setting, progress tracking, and ongoing reporting of Scope 1 and 2 GHG emissions.

Automation also helps reduce energy use and provides tools for planning and monitoring. Johnson Controls' OpenBlue suite of connected solutions for building systems includes tailored, artificial intelligence-infused service solutions, such as fault detection and remote diagnostics, predictive maintenance, compliance monitoring, advanced risk assessments, digital twin (a digital replica of your assets, processes and systems, enabling immersive analysis of your physical building) and more, all designed to make buildings function more efficiently and to provide building data in an easy-to-access dashboard. Solutions can include:

- Data-driven building decision-making using predictive, automated, responsive capabilities.
- Energy management information systems.
- Transparent, traceable decarbonization dashboard and compliance with local and state disclosures.
- Tenant or sub-metered spaces data management solutions.

Step 4: Efficient infrastructure. We use the criteria established in Step 1 to identify facilities and the right solutions for energy conservation, electrification, operational improvements, and



energy infrastructure to meet your goals. We leverage our deep knowledge bolstered by more than 135 years of experience as building experts to deliver a program that moves our clients with speed and scale. Some of the services Johnson Controls

provides include:

- Savings and performance-based energy efficiency programs.
- Deferred maintenance resolution.
- Infrastructure resiliency.
- Electrification solutions.
- Portfolio energy management.
- Water conservation and reuse solutions.



Step 5: Sustainable operations. This step focuses on continued optimal performance through best practices in operations and maintenance to ensure efficient infrastructure continues to perform as

designed. Digitally enabled management of building assets helps us deliver sustained lower emissions operations more efficiently. Areas of focus may include:

- Continuous operations management plans.
- Training or staffing future-ready infrastructure experts.
- Sustainable lifecycle management and technology obsolescence planning.
- Condition-based, predictive maintenance.



Step 6: Distributed energy resources. In this step, we evaluate approaches to maximize on-site renewable energy generation, energy storage and grid interactive optimization.

Our goal is to optimize the cost/benefit for facilities and reduce emissions from demand-side and “behind the meter” energy. This includes a review of energy and demand charges to capture potential cost savings while addressing site resiliency needs. Services may include:

- Distributed energy strategy.
- On-site energy storage.
- Grid interactive services.
- Advanced asset optimization.
- Demand response services.
- Electric vehicle (EV) charging.



Step 7: Renewable energy supply services.

For any building portfolio buying energy from the grid, purchasing green energy is a critical part of an emissions reduction strategy. RECs, PPAs, VPPAs are all contracts

that can help achieve carbon neutrality through off-site solutions. Renewable energy supply solutions should be considered in the context of an organization’s goals and plan for their buildings and the complexities of timing and expiration of existing contracts. Johnson Controls partners with world class expert organizations to execute, and can even bundle these contracts into services, to create a holistic solution. Services include:

- Renewable energy advisory.
- Renewable energy procurement (PPAs, VPPAs, RECS, RNG).
- Carbon offsets.
- Energy supply budget and billing management.
- Renewable finance, development and trading.



Step 8: Certify and recognize impact.

Johnson Controls has decades of experience monitoring solutions’ performance (actual vs. projected) throughout the calendar year to validate performance and inform

future recommendations. Enabled by building digitalization through our OpenBlue platform, an organization receives regular reports for internal and external constituents as well as governmental and regulatory agencies. Support can be delivered in the following areas:

- Transparent, traceable decarbonization dashboards for accounting and reporting.
- Brand, public relations and communications.
- Industry-leading certifications facilitation.

Option 2 Costs, Savings and Cashflow

OPTION 2 - All City-identified ECMs plus Solar

This option includes all ECM-1 through ECM-9 as described above. The estimated cost for Option 2 is \$1,310,786 with an annual utility savings of \$49,180 per year and will require a capital contribution of \$589,854. Note: The solar PV cost includes the expected 30% ITC direct pay. This option is not recommended because of its capital contribution requirement unless additional funding is available.

Attachment 2-C: ESCO's Proposed Project Costs and Cash Flow Analysis	
Project Site: DPW Field Headquarters	
Fee Category	Fees⁽¹⁾ Dollar (\$) Value
Engineering and Project Management	
Investment Grade Energy Audit	\$ 15,000
Design Engineering Fees	\$ 29,453
Construction Management	\$ 73,633
System Commissioning	\$ 9,375
Initial Training Fees	\$ 5,200
Project Service Fees Sub Total	\$ 132,661
Energy Conservation Measures - Equipment and Installation	
ECM-1 Compressed Air Leak Survey	\$ 2,500
ECM-2 LED Lighting Retrofit	\$ 43,750
ECM-3 Install Daylight Harvesting Controls in Selected Areas	\$ 3,125
ECM-4 Convert Garage Heating from Forced Air to Radiant	\$ 637,500
ECM-5 Install Occupancy Sensors in Selected Areas	\$ 12,500
ECM-6 Retrofit Air Handling System to VAV	\$ 150,000
ECM-7 Upgrade Motors to Premium Efficiency on As-Fails Basis	\$ 15,000
ECM-8 Solar PV	\$ 288,750
ECM-9 Open Blue Enterprise Manager	\$ 25,000
Fees for ESCO-Arranged Financing	\$ -
Other Financing Costs (defined)	\$ -
TOTAL FINANCED PROJECT COSTS:	\$ 1,310,786

First Year Annual Service Fees	Fees⁽¹⁾ Dollar (\$) Value
Measurement and Verification (Traditional Annual Report)	\$ 9,800
On-going System Monitoring (ESCO has Access to Building Automation System and will alert City Staff of Energy Performance Issues Throughout the Year)	Included In Above
Staff Training Services	Included In Above
TOTAL FIRST YEAR ANNUAL SERVICES	\$ 9,800

NOTES:

1. Fees include all mark-ups, overhead, and profit.

ECM SAVINGS

DPW Field HQ Baseline Energy Use and Estimated Savings Calculator

Portfolio Manager Property ID	Annual Energy Use	
Year Ending	12/31/2009	12/31/2022
Electricity Use - Grid Purchase (kWh)	1,053,053	1,328,559
Electricity Use - Grid Purchase (kBtu)	3,593,017	4,533,045
Electricity Use – Generated from Onsite Renewable Systems and Used Onsite (kWh)	0	0
Electricity Use – Generated from Onsite Renewable Systems and Used Onsite (kBtu)	0	0
Natural Gas Use (therms)	124,814	126,637
Natural Gas Use (kBtu)	12,481,372	12,663,742
Total kBtu (Site Energy)	16,074,389	17,196,787

ECM	ECM-1	ECM-2	ECM-3	ECM-4	ECM-5	ECM-6	ECM-7	ECM-8	ECM-9	Total
Electricity Savings - Grid Purchase (kWh) On Peak	3,382	22,584	11,019	12,400	5,006	27,478	895	-	9,747	82,764
Electricity Savings - Grid Purchase (kWh) Off Peak	2,767	16,354	7,346	18,600	3,338	18,318	732	-	9,747	67,455
Electricity Savings - Grid Purchase (kWh)	6,149	38,938	18,365	31,000	8,344	45,796	1,627	-	19,493	150,219
Electricity Savings - Grid Purchase (kBtu)	20,984	132,880	62,672	105,791	28,475	156,283	5,552	-	66,522	512,637
Electricity Savings – Generated from Onsite Renewable Systems and Used Onsite (kWh)	-	-	-	-	-	-	-	205,847		205,847
Electricity Savings – Generated from Onsite Renewable Systems and Used Onsite (kBtu)	-	-	-	-	-	-	-	702,473		702,473
Natural Gas Savings (therms)	-	-	-	11,600	-	3,300	-	-	2,326	14,900
Natural Gas Savings (kBtu)	-	-	-	1,160,000	-	330,000	-	-	232,600	1,490,000
Total kBtu Savings (Site Energy)	20,984	132,880	62,672	1,265,791	28,475	486,283	5,552	-	299,122	2,002,637
Electric Cost per KWH On Peak	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866	\$0.0866
Electric Cost per KWH Off Peak	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542	\$0.0542
Electric cost of kW On Peak Demand	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10	\$15.10
Gas Cost per Therm	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100	\$0.5100
Electric Savings On Peak	\$ 293	\$ 1,956	\$ 954	\$ 1,074	\$ 434	\$ 2,380	\$ 77	\$ 10,696	\$ 844	\$ 18,707
Electric Savings Off Peak	\$ 150	\$ 886	\$ 398	\$ 1,007	\$ 181	\$ 992	\$ 40	\$ 4,459	\$ 528	\$ 8,641
Demand Charge Savings	\$ 3,986	\$ 1,450	\$ 2,174	\$ -	\$ -	\$ -	\$ -	\$ 5,436	\$ -	\$ 13,046
Gas Savings	\$ -	\$ -	\$ -	\$ 5,916	\$ -	\$ 1,683	\$ -	\$ -	\$ 1,186	\$ 8,785
Total Dollar Savings	\$ 4,429	\$ 4,291	\$ 3,527	\$ 7,997	\$ 614	\$ 5,055	\$ 117	\$ 20,591	\$ 2,558	\$ 49,180

Estimated Site KBtu after project	61,182
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CASHFLOW

Project Cost = \$1,310,786

Capital Contribution Up-Front = \$ 589,854

Principle = \$ 720,932

Attachment 2-C ESCO's Proposed Annual Cash Flow Analysis									
Escalation Rate by Utility:				Principal:	\$ 720,932	Financed Project Costs:	\$ 1,429,069	Annual Payment:	\$ 68,051
Electric:	3.00%	Natural Gas:	3.00%	Water:	3.00%	Finance Term:	20 years	Interest:	\$ 708,137
Construction Months: 6		Escalation Rate for Annual Fees:		3.00%	Annual Interest Rate:		7.00%	Other (specify):	na
Year	Electric Cost Savings	Natural Gas Cost Savings	Water Savings	Operational Cost Savings	Total Cost Savings	Maintenance, Monitoring, EM&V, and Training Fees	Guaranteed Cost Savings	Financing Payment	Net Savings
1	\$ 40,394	\$ 8,785	\$ -	\$ 5,000	\$ 54,180	\$ (9,800)	\$ 44,380	\$ (68,051)	\$ (23,671)
2	\$ 41,606	\$ 9,049	\$ -	\$ 5,150	\$ 55,805	\$ (10,094)	\$ 45,711	\$ (68,051)	\$ (22,340)
3	\$ 42,854	\$ 9,320	\$ -	\$ 5,305	\$ 57,479	\$ (10,397)	\$ 47,082	\$ (68,051)	\$ (20,969)
4	\$ 44,140	\$ 9,600	\$ -	\$ 5,464	\$ 59,203	\$ -	\$ 59,203	\$ (68,051)	\$ (8,847)
5	\$ 45,464	\$ 9,888	\$ -	\$ 5,628	\$ 60,980	\$ -	\$ 60,980	\$ (68,051)	\$ (7,071)
6	\$ 46,828	\$ 10,185	\$ -	\$ 5,796	\$ 62,809	\$ -	\$ 62,809	\$ (68,051)	\$ (5,242)
7	\$ 48,233	\$ 10,490	\$ -	\$ 5,970	\$ 64,693	\$ -	\$ 64,693	\$ (68,051)	\$ (3,358)
8	\$ 49,680	\$ 10,805	\$ -	\$ 6,149	\$ 66,634	\$ -	\$ 66,634	\$ (68,051)	\$ (1,417)
9	\$ 51,170	\$ 11,129	\$ -	\$ 6,334	\$ 68,633	\$ -	\$ 68,633	\$ (68,051)	\$ 582
10	\$ 52,705	\$ 11,463	\$ -	\$ 6,524	\$ 70,692	\$ -	\$ 70,692	\$ (68,051)	\$ 2,641
11	\$ 54,287	\$ 11,807	\$ -	\$ 6,720	\$ 72,813	\$ -	\$ 72,813	\$ (68,051)	\$ 4,762
11	\$ 55,915	\$ 12,161	\$ -	\$ 6,921	\$ 74,997	\$ -	\$ 74,997	\$ (68,051)	\$ 6,946
12	\$ 57,593	\$ 12,526	\$ -	\$ 7,129	\$ 77,247	\$ -	\$ 77,247	\$ (68,051)	\$ 9,196
13	\$ 59,320	\$ 12,901	\$ -	\$ 7,343	\$ 79,565	\$ -	\$ 79,565	\$ (68,051)	\$ 11,514
14	\$ 61,100	\$ 13,288	\$ -	\$ 7,563	\$ 81,951	\$ -	\$ 81,951	\$ (68,051)	\$ 13,901
15	\$ 62,933	\$ 13,687	\$ -	\$ 7,790	\$ 84,410	\$ -	\$ 84,410	\$ (68,051)	\$ 16,359
16	\$ 64,821	\$ 14,098	\$ -	\$ 8,024	\$ 86,942	\$ -	\$ 86,942	\$ (68,051)	\$ 18,891
17	\$ 66,766	\$ 14,521	\$ -	\$ 8,264	\$ 89,551	\$ -	\$ 89,551	\$ (68,051)	\$ 21,500
18	\$ 68,769	\$ 14,956	\$ -	\$ 8,512	\$ 92,237	\$ -	\$ 92,237	\$ (68,051)	\$ 24,186
19	\$ 70,832	\$ 15,405	\$ -	\$ 8,768	\$ 95,004	\$ -	\$ 95,004	\$ (68,051)	\$ 26,953
20	\$ 72,957	\$ 15,867	\$ -	\$ 9,031	\$ 97,854	\$ -	\$ 97,854	\$ (68,051)	\$ 29,803
Total	\$ 1,158,367	\$ 251,930	\$ -	\$ 143,382	\$ 1,553,680	\$ (15,145)	\$ 1,523,389	\$ (1,429,069)	\$ 94,320

Sustainability Recognition

We are honored to be recognized

We don't just talk about sustainability at Johnson Controls. As the following prestigious awards show, we do what we say we will do – year after year.

CLIMATE



Recognized for our commitment to transparency and social responsibility. Honored annually since 2006.



Corporate Knights 100 Most Sustainable Corporations in the World. Ranked number one in our industry and number 12 overall.



Awarded to companies with ESG performance above sector-specific Prime threshold, fulfilling ambitious requirements.



Identifies companies across Europe that have shown the highest reduction in their emissions intensity.



CDP Climate score A- for comprehensiveness of disclosure and best practices associated with environmental leadership.



Top 1% of companies assessed across environment, labor and human rights, ethics, and sustainable procurement.



Leading global companies in ESG criteria.



Recognizes global corporations demonstrating commitment to and momentum toward sustainable markets.

GOVERNANCE



Sixteen-time honoree for unwavering commitment to business integrity.



For strong ESG management.



For strong ESG practices.



Selected as a company leading its industry in managing the most significant ESG risks and opportunities.



Top 15 percent of our industry in sustainability performance.



Leading global companies in ESG, based on ESG indicators provided by Sustainalytics.



Based on recommendations from employees asked to rate their willingness to recommend their employers to others.



Recognizes companies that address society's unmet needs, evaluated on social impact, business results and innovation.

List of Municipal Clients

Sample Sustainable Infrastructure Projects with Large Local Governments



City of Fort Worth, TX

The City of Fort Worth worked with Johnson Controls on a seven-phase program to reduce energy consumption throughout 107 municipal facilities by 36%. We are guaranteeing \$93 million in savings and have exceeded the guarantee by more than 22%.



City of El Paso, TX

El Paso partnered with Johnson Controls on a four-phase effort to upgrade the city's street lights to LED, which reduced energy and maintenance costs by 65%. We helped secure \$200,000 in utility rebates to fund the project, and we are guaranteeing \$19.4 million in savings, which we have exceeded by 34%.



City of Galveston, TX

The Galveston Park Board partnered with Johnson Controls to implement \$2.2 million in equipment and system upgrades. The project involved a new facility management system, fire suppression system, building envelope improvements and more. The effort also included an allowance to gain LEED points.



Jefferson County, TX

Johnson Controls is installing \$16 million in facility upgrades in 24 buildings, including the courthouse, correctional facility, juvenile justice center, sheriff's office, four police precincts, the visitor's center, the arena and exhibit hall, and the airport. The improvements will save the County more than \$25 million.



City of Atlanta, GA

Johnson Controls installed \$11.6 million in new systems and equipment in the City Hall, City Hall Annex, Municipal Court, and Detention Center. The improvements include chiller replacements, new controls and cooling towers, lighting retrofits, and more. This will ultimately save Atlanta \$15.7 million.



Louisville Metro Government, KY

Louisville selected Johnson Controls to implement a major energy efficiency project in 24 municipal facilities that will save the City more than \$56 million. In addition to a variety of building upgrades, the two-phase \$36 million project included ENERGY STAR ratings and LEED certifications.



City of Charleston, SC

The City of Charleston has worked with Johnson Controls for 40 years on many projects to reduce energy and operating costs. The most recent effort involved upgrading a diverse array of 35 municipal facilities that will save Charleston more than \$20 million while cutting the City's energy use at the facilities by 16%.

Sample Investment Grade Audit

Milwaukee Public Library

Investment Grade Audit Report, Volume 1

#MPL-18-006



2019



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Disclaimer

The information contained with this Investment Grade Audit report has been prepared in accordance with the requirements of Contract #MPL-18-006 Investment Grade Energy Audit of Milwaukee Public Library Facilities and Systems. All content within this report is current as of the date of revision noted on the report; however, for the purposes of a Guaranteed Energy Savings contract based on the results of this report, the terms, conditions, and content of the GES contract shall supersede this report.

Schedule A: Equipment installed by Johnson Controls (and their subcontractors)

The following information provides a description of the scope of work.

ECM-1-MCL – Central Library Replace and Upgrade Chilled Water Plant with Mag - Lev Chiller

This ECM proposes installing a new water-cooled York YMC2 magnetic bearing, variable speed, centrifugal chiller with a new primary pump and condenser water pump to serve the new chiller. The new YMC2 chiller would then be run as the primary chiller. The existing Trane chiller would be peak-load back-up, and the existing Air-Cooled York chiller would be used as a back-up shoulder season chiller.

Removal of the abandoned water-cooled McQuay chiller in room SB-0006 is **not included** in the scope of work for this ECM.

Subcontracted Engineering Scope:

- Engineer to visit each site and document existing equipment and conditions.
- Review of existing mechanical floor plans.
- Heating and cooling final load calculations are to be performed by Engineer. Building minimum outside air ventilation amounts, to calculate the ventilation load, will be taken from the existing plans.
- Engineer to provide demolition and new work HVAC drawings in CAD.
- Engineer to provide HVAC specification for associated equipment.
- Temperature Control specification or control sequence by JCI.
- Engineer will not be doing any Plumbing Engineering, Fire Protection, Electrical Engineering, or Structural Engineering work.
- Professional Engineering stamping of plans and specifications for items submitted to Department of Safety and Professional Services.
- Submit plans and specifications to the Department of Safety and Professional Services as required.
- Review of submittals for HVAC equipment.
- Provide sign-off for Department of Safety & Professional Services occupancy requirements as necessary.
- Engineer to provide electronic copies of all final documents for printing and distribution for contractor and owner use. Engineer to print plans and specification for Department of Safety & Professional Services.

Direct Materials and Equipment (JCI/YORK Furnished Equipment):

JCI/YORK HIGH-EFFICIENCY MAGNETIC BEARING CENTRIFUGAL WATER CHILLERS:

- Water Cooled, Magnetic Bearing Centrifugal Compressor
- Electrical Requirements:
 - 460/3/60 Single Point Power Connection
 - Unit Mounted Variable Speed Drive
 - IEEE 519 Harmonic Filter
- Optiview Control Center with OptiSound Control
- Form 7 Shipment
 - Compressor, Condenser, Evaporator, and Drive all ship separately
 - Field Assembled
- Evaporator:
 - Marine Water Boxes w/ Hinges, 150psi, 2-Pass
 - 0.025" Enhanced Copper Tubes
 - Grooved Water Connections
- Condenser:
 - Marine Water Boxes w/ Hinges, 150psi, 2-Pass
 - 0.025" Enhanced Copper Tubes

- Grooved Water Connections
- Service Isolation Valves
- Factory Mounted BACnet (MS/TP) Communications Module
- 1" Thick Neoprene Isolation Pads
- One Year Parts and Labor Warranty on Entire Unit
- Five Year Compressor Parts Warranty
- Factory Start-up and Training by JCI Chiller Technicians
- Reassembly and Pressure Testing by JCI Chiller Technicians

Subcontracted Installation Scope:

JCI Controls Scope (JCI and electrical controls labor and material listed below)

- Demo existing controls at chiller and for two pumps.
- Connect new controls to existing Metasys network.
 - BACnet trunk to new chiller.
 - Furnish and install DDC for new chilled water and condenser water pumps.
 - Wire to existing control panel.
 - Flow switch interlock.
 - Graphics.
- Control drawings and commissioning.
- Controls per JCI/MPL Standards.
- One Year parts and labor warranty.

Mechanical Contractor Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Demolish and remove the existing York water cooled chiller in room B9, Existing pad will remain for reuse.
- Demolish and remove one existing primary pump (CP-10) in room B9 serving the evaporator of the York water cooled chiller in room B9. Existing pad will remain for reuse.
- Demolish and remove all existing piping and accessories serving the existing water-cooled chiller enough to facilitate installation of the new chiller.
- Demolish and remove one existing condenser water pump (CP-7) in room SB-0005 serving the existing water-cooled York Chiller in room B9. Existing pad will remain for reuse.
- Demolish the existing wiring serving the existing water-cooled York chiller.
- Disconnect one existing chilled water pump motor for CP-10. Remove existing motor starter for pump.
- Disconnect one existing condenser water pump motor for CP-7. Remove existing motor starter for pump.
- Install one new 350 ton water-cooled chiller in room B9 on the existing chiller pad saved for reuse.
- Furnish and Install all piping and accessories as required to provide piping connections and service to the new water-cooled chiller.
- Furnish and Install one new primary chiller pump to serve the new chiller on the existing pump pad in room B9 saved for reuse.
- Furnish and Install one new condenser water pump to serve the new chiller on the existing pump pad in room SB-0005 saved for reuse.
- Provide labeling and pipe tags for all newly installed piping.
- Provide pipe jacketing for newly insulated pipe within mechanical room.
- Insulate all newly installed pipes, ducts and any pipe or duct where insulation was removed to tie in the new work. Piping or duct not previously insulated or where insulation was removed solely for hazardous material abatement is not included.
- Provide new electrical connection to new chiller and new feeder, conduit, electrical wire, breakers, and components required for operation.
- Provide new electrical connection to new primary pump. Provide new HOA motor starter with pilot lights for new pump.
- Provide new electrical connection to new condenser pump. Provide new motor starter for new pump.

- Contractor shall field verify electrical service and provide updates to electrical service as required by the new equipment and all applicable codes.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.

ECM-3-MCL – Central Library Convert Existing AC-7 from CAV to DOAS

This ECM proposes removal and replacement of AC-7 with a new built-up dedicated outdoor air (DOAS) air handling unit with energy recovery. In addition to the new unit, this ECM proposes installed a booster cooling coil and a reheat coil in the duct that serves the book-drop area and a new dedicated thermostat for that section of floor 3T. The cooling coil shall be chilled water and the reheat coil shall be steam.

Subcontracted Engineering Scope:

- Engineer to visit each site and document existing equipment and conditions.
- Review of existing mechanical floor plans.
- Heating and cooling final load calculations are to be performed by Engineer. Building minimum outside air ventilation amounts, to calculate the ventilation load, will be taken from the existing plans.
- Engineer to provide demolition and new work HVAC drawings in CAD.
- Engineer to provide HVAC specification for associated equipment.
- Temperature Control specification or control sequence by JCI.
- Engineer will not be doing any Plumbing Engineering, Fire Protection, Electrical Engineering, or Structural Engineering work.
- Professional Engineering stamping of plans and specifications for items submitted to Department of Safety and Professional Services.
- Submit plans and specifications to the Department of Safety and Professional Services as required.
- Review of submittals for HVAC equipment.
- Provide sign-off for Department of Safety & Professional Services occupancy requirements as necessary.
- Engineer to provide electronic copies of all final documents for printing and distribution for contractor and owner use. Engineer to print plans and specification for Department of Safety & Professional Services.

Direct Materials and Equipment (JCI Furnished Equipment):

JCI / YORK SOLUTION XTI AIR HANDLING UNITS COMPLETE WITH THE FOLLOWING:

- 2" Double Wall Construction with Spray Injected Foam Panels
- L/240 Panel Deflection
- Shipping Splits
- Formed Steel Baserail
- Inlet Plenum (Top Tier)
- Flat Filter Section (Top Tier)
 - 2" MERV 8
 - Filter Gauge Provided (0-2")
- Discharge Plenum (Top Tier)
- Inlet Plenum
- Flat Filter Section
 - 2" MERV 8
 - Filter Gauge Provided (0-2")
- Heat Wheel Section
 - Synthetic, 4A Molecular Sieve Total Enthalpy Wheel
 - Inverter Rated Motor
- Integral Face & Bypass Coil
 - 2 Row Steam Coil

- CW Cooling Coil Segment with Drain Pan
 - Surface Decontamination UV Lights
- Steam Reheat Coil Section
- Supply Fan Section
 - Direct-Drive Plenum Fan w/ VFD
 - Premium Efficiency (460/3/60 VAC)
 - 1" Spring Isolation
 - Shaft Grounding Ring
 - Fan Inlet Screen
- Exhaust Fan Section (separate)
 - Direct-Drive Plenum Fan w/ VFD
 - Premium Efficiency (460/3/60 VAC)
 - 1" Spring Isolation
 - Shaft Grounding Ring
 - Fan Inlet Screen
- Humidifier Section
 - Steam Humidifier w/ Wye Strainer and Steam Trap
- Discharge Plenum Section
- Access Sections as Specified
- 1 Year Parts and labor Warranty

JOHNSON CONTROLS TWO LOOSE COILS COMPLETE WITH THE FOLLOWING:

- Cooling/Heating Coils
- 5/8" Tube Diameter
- Galvanized Casing, Copper Header
- 0.035" Tube Thickness

Subcontracted Installation Scope:

JCI Controls Scope (JCI and electrical controls labor and material listed below)

- Demo existing AC-7 controls.
- Connect new controls to existing Metasys network.
 - Furnish and install DDC for new replacement AHU. Includes all sensors, transducers, valves, actuators, dampers, and control panel.
 - Furnish and install DDC for new steam and chilled water booster coils in mechanical room. Controls for booster coil wire to new panel serving AC-7. Mount and wire 4 total zone sensor back to mechanical room: One on 1T, one 2T, one 3T and one in book drop area.
 - Graphics.
- Control drawings and commissioning.
- Controls per JCI/MPL Standards.
- One Year parts and labor warranty.

Mechanical Contractor Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Open the existing 10' by 7' openings that separate the floors 1T, 3T, and 4T in the north-east corner to provide direct access to the mechanical room. Save all wood framing and materials for reuse.
- Remove 10' by 7' section of 4T roof located at the north-east veranda immediately above the existing opening located in the floors of 3T and 4T.
- Remove existing AC-7; including chilled water coils, steam coils, humidifier, fan, and AHU casing.
- Remove existing return fan for AC-7.
- Remove existing pipe as required for removal of AC-7.
- Remove three existing dampers associated with AC-7 (outside air, return air, and relief air dampers).

- Remove three existing “VAV” dampers in the supply ducts for AC-7.
- Remove existing supply and return ducts as required to remove AC-7 and the existing return fan.
- Existing intake and exhaust duct and louvers shall remain for reuse.
- Disconnect and remove two VFDs, one for AC-7 supply fan and one for AC-7 return fan.
- Reinstall wood framing and opening covering for 10’ by 7’ openings located on 3T and 4T with materials saved during removal.
- Restore 10’ by 7’ section of 4T veranda immediately above 3T and 4T opening, patch and seal to match the surrounding construction.
- Patch and paint area immediately surrounding new stats to match the existing finish immediately adjacent to the new thermostat.
- Install one new 100% OA DOAS AHU.
- Install one new exhaust fan.
- For duct serving the Book-drop area (approximately 600 cfm):
 - Install one new duct mounted chilled water coil.
 - Install one new duct mounted steam reheat coil.
- Insulate all newly installed pipes, ducts and any pipe or duct where insulation was removed to tie in the new work. Piping or duct not previously insulated or where insulation was removed solely for hazardous material abatement is not included.
- Provide wiring and connection for two new VFDs, one for AC-7 supply fan and one for AC-7 return fan.
- Electrical contractor shall field verify and modify existing electrical service as required to accommodate newly installed equipment.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.

ECM-12a-MCL – Central Library Interior Lighting Retrofits

This measure proposes upgrading the existing interior lighting to LED sources. Retrofits will be completed only where identified in Attachment 5 and only for fixtures that are currently in-use and have lamps installed.

This lighting scope includes the retrofit of existing fixtures as described in Attachment 5; complete new lighting fixtures are not included for any area of the library, except for within the third floor hallways adjacent to the rotunda, where nine (9) existing fluorescent strip fixtures are to be replaced with a new LED strip fixture, final fixture to be approved by the Customer. This scope of work excludes all areas identified for new ceilings (listed in Attachment 5 as “NR” for no retrofit), where neither retrofits nor new fixtures are anticipated (areas outlined in red on the floor plans included in Attachment 5). Additionally, occupancy sensors will only be installed where indicated, in the quantity indicated, in Attachment 5, as listed under “Sensor Description”, “Sensor Type”, and “Qty of Sensors/(C)ontrolled”.

Emergency and egress lighting at the Central Library is not included in this ECM due to a separately contracted egress study currently in progress by MPL and their consultants.

Subcontracted Installation Scope:

Lighting Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Mock-up of the following fixtures for approval:
 - Rotunda Area Wall Sconce – One (1) 6-lamp decorative wall sconce to be relamped with LED screw-in lamps.
 - Hallway Area Décor Pendant – One (1) 5-lamp decorative chandelier fixture to be relamped with LED screw-in lamps.

- Grand Staircase Décor fixture – One (1) 6-lamp pedestal decor fixture to be relamped with LED screw-in lamps. This scope included mock-up of only one (1) side of the staircase to allow a side-by-side review of pre- and post-retrofit lighting.
- Décor Pendant Metal Halide fixture – One (1) 1-lamp décor fixture location with the proposed relamp scope of work.
- Recessed can fixture – Two (2) to Four (4) 1-lamp recessed can retrofit utilizing the proposed Green Creative Recessed Can Retrofit product.
- Trustee Conference Room – Two (2) fixtures to be relamped utilizing the proposed lamp and driver retrofit.
- Retrofits of the interior lighting fixtures identified in Attachment 5 including:
 - Re-lamp of Historic Décor Lighting Fixtures with LED comparable lamps.
 - Incandescent and Compact Fluorescent screw in lamps to be re-lamped with LED comparable lamps.
 - Linear fluorescent lighting fixtures to be retrofitted with LED tube and external driver.
 - Recess Can fixtures to be replaced with LED replacement kits.
- Hardwired Occupancy Sensor controls installed in select areas identified in Attachment 5.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.
- Removal or relocation of owner shelving, furniture, or other owner property identified as necessary to facilitate installation of lighting retrofits.

ECM-12b-MCL – Central Library Exterior Lighting Retrofits

This measure proposes upgrading the existing non-LED exterior lighting to LED sources. Retrofits will be completed only where identified in Attachment 5 and only for fixtures that are currently in-use and have lamps installed. Fixtures converted to LED sources as part of prior retrofit project(s) are **excluded** from the scope of work.

Subcontracted Installation Scope:

Lighting Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Retrofits of the exterior lighting fixtures identified in Attachment 5.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.
- Removal or relocation of owner shelving, furniture, or other owner property identified as necessary to facilitate installation of lighting retrofits.

ECM-12c-MCL – Central Library Lighting Control Panel Upgrades

This measure proposes installation of twelve (12) new lighting control panels serving areas where lighting is currently controlled solely by electric panel circuit breakers.

Lighting control panel upgrades will be provided only for areas where lighting is undergoing retrofit as described in ECM-12a-MCL. This scope of work **excludes** the nine (9) lighting control panels estimated to replace electric panel circuit breaker control for lighting in all areas identified for new ceilings (areas outlined in red on the floor plans included in Attachment 5).

Subcontracted Installation Scope:

Lighting Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Installation of twelve (12) lighting control panels.
- Rewiring from existing electric power to new lighting control panels.
- Drywall patching and painting around new lighting control panels to match existing conditions.

JCI Controls Scope (JCI and electrical controls labor and material listed below)

- Connect twelve (12) lighting control panels to existing Metasys network (trunk tie-in).
- Programming of all lighting points and graphics of lighting zones.
- Software override for “all on” and “all off” commands to lighting in public spaces.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.
- Removal or relocation of owner shelving, furniture, or other owner property identified as necessary to facilitate installation of new lighting control panels.

ECM-4a-BVL – Bayview Library Interior Lighting Retrofits

This measure proposes upgrading the existing interior lighting to LED sources. Retrofits will be completed only where identified below and only for fixtures that are currently in-use and have lamps installed.

All emergency and egress lighting will remain on the current emergency power source; an inverter has **not** been included in the scope of work for this ECM.

Subcontracted Installation Scope:

Lighting Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Mock-up of the following fixtures for approval:
 - Main Library Space HID Uplighting Flood Lights – Two (2) 1-lamp HID flood lights to be replaced with LED flood lights.
- Retrofits of the interior lighting fixtures identified in Attachment 5 including:
 - Replacement of Metal Halide uplighting floods with LED uplighting with integral controls for daylight and occupancy.
 - Incandescent and Compact Fluorescent screw in lamps to be re-lamped with LED comparable lamps.
 - Linear fluorescent lighting fixtures to be retrofitted with LED tube and external driver.
 - Recess Can fixtures to be replaced with LED replacement kits.
- Hardwired Occupancy Sensor controls installed in select areas identified in Attachment 5.

JCI Controls Scope (JCI and electrical controls labor and material listed below)

- Connect existing panel controls for interior and exterior lighting above to existing Metasys network (trunk tie-in).
- Programming of all lighting points and graphics of lighting zones.
- Software override for “all on” and “all off” commands to lighting in public spaces.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.

- Removal or relocation of owner shelving, furniture, or other owner property identified as necessary to facilitate installation of lighting retrofits.

ECM-4b-BVL – Bayview Library Exterior Lighting Retrofits

This measure proposes upgrading the existing non-LED exterior lighting to LED sources. Retrofits will be completed only where identified below and only for fixtures that are currently in-use and have lamps installed. Fixtures converted to LED sources as part of prior retrofit project(s) are excluded from the scope of work.

Subcontracted Installation Scope:

Lighting Scope (labor and all materials listed below include all electrical power wiring and any general contracting work required for a complete scope of work)

- Retrofits of the exterior lighting fixtures identified in Attachment 5.

Owner shall be responsible for:

- Any and all hazardous materials abatement prior to installation of any components as required.
- Removal or relocation of owner shelving, furniture, or other owner property identified as necessary to facilitate installation of lighting retrofits.

Schedule B: Energy Savings Guarantee

Project Benefits

Certain Definitions.

For purposes of this IGA, the following terms have the meanings set forth below:

Annual Project Benefits are the portion of the projected Total Project Benefits to be achieved in any one year of the Guarantee Term.

Annual Project Benefits Realized are the Project Benefits actually realized for any one year of the Guarantee Term.

Annual Project Benefits Shortfall is the amount by which the Annual Project Benefits exceed the Annual Project Benefits Realized in any one year of the Guarantee Term.

Annual Project Benefits Surplus is the amount by which the Annual Project Benefits Realized exceed the Annual Project Benefits in any one year of the Guarantee Term.

Baseline is the mutually agreed upon data and/or usage amounts that reflect conditions prior to the installation of the Improvement Measures as set forth in Section IV below.

Guarantee Term will commence on the first day of the month next following the Substantial Completion date and will continue through the duration of the M&V Services, subject to earlier termination as provided in the Agreement.

Installation Period is the period beginning on JCI's receipt of Customer's Notice to Proceed and ending on the commencement of the Guarantee Term.

Measured Project Benefits are the utility savings and cost avoidance calculated in accordance with the methodologies set forth in Section III below.

Non-Measured Project Benefits are identified in Section II below. The Non-Measured Project Benefits have been agreed to by Customer and will be deemed achieved in accordance with the schedule set forth in the Total Project Benefits table below. Customer and JCI agree that: (i) the Non-Measured Project Benefits may include, but are not limited to, future capital and operational costs avoided as a result of the Work and implementation of the Improvement Measures, (ii) achievement of the Non-Measured Project Benefits is outside of JCI's control, and (iii) Customer has evaluated sufficient information to conclude that the Non-Measured Project Benefits will occur and bears sole responsibility for ensuring that the Non-Measured Project Benefits will be realized. Accordingly, the Non-Measured Project Benefits shall not be measured or monitored by JCI at any time during the Guarantee Term, but rather shall be deemed achieved in accordance with the schedule set forth in the Total Project Benefits table below.

Project Benefits are the Measured Project Benefits plus the Non-Measured Project Benefits to be achieved for a particular period during the term of the Agreement.

Total Project Benefits are the projected Project Benefits to be achieved during the entire term of the Agreement.

Project Benefits Summary

Subject to the terms and conditions of the Agreement, JCI and Customer agree that Customer will be deemed to achieve a total of \$995,195 in Non-Measured Project Benefits and JCI guarantees that Customer will achieve a total of \$2,662,516 in Measured Project Benefits during the term of the Agreement, for Total Project Benefits of \$3,657,711, as set forth in the Total Project Benefits table below.

Total Project Benefits

Year	Utility Cost Avoidance*	Operations & Maintenance Cost Avoidance**	Focus on Energy Incentive Benefit***	Future Capital Cost Avoidance**	Annual Project Benefits
1	\$ 101,633	\$ 21,893	\$ 33,253	\$ 430,000	\$ 586,779
2	\$ 104,428	\$ 22,331	\$ -	\$ -	\$ 126,759
3	\$ 107,299	\$ 22,777	\$ -	\$ -	\$ 130,077
4	\$ 110,250	\$ 23,233	\$ -	\$ -	\$ 133,483
5	\$ 113,282	\$ 23,698	\$ -	\$ -	\$ 136,980
6	\$ 116,397	\$ 24,172	\$ -	\$ -	\$ 140,569
7	\$ 119,598	\$ 24,655	\$ -	\$ -	\$ 144,253
8	\$ 122,887	\$ 25,148	\$ -	\$ -	\$ 148,035
9	\$ 126,267	\$ 25,651	\$ -	\$ -	\$ 151,918
10	\$ 129,739	\$ 26,164	\$ -	\$ -	\$ 155,903
11	\$ 133,307	\$ 26,687	\$ -	\$ -	\$ 159,994
12	\$ 136,973	\$ 27,221	\$ -	\$ -	\$ 164,194
13	\$ 140,739	\$ 27,766	\$ -	\$ -	\$ 168,505
14	\$ 144,610	\$ 28,321	\$ -	\$ -	\$ 172,931
15	\$ 148,587	\$ 28,887	\$ -	\$ -	\$ 177,474
16	\$ 152,673	\$ 29,465	\$ -	\$ -	\$ 182,138
17	\$ 156,871	\$ 30,054	\$ -	\$ -	\$ 186,926
18	\$ 161,185	\$ 30,655	\$ -	\$ -	\$ 191,841
19	\$ 165,618	\$ 31,269	\$ -	\$ -	\$ 196,886
20	\$ 170,172	\$ 31,894	\$ -	\$ -	\$ 202,066
Total	\$ 2,662,516	\$ 531,942	\$ 33,253	\$ 430,000	\$ 3,657,711

*Utility Cost Avoidance is a Measured Project Benefit. Utility Cost Avoidance figures in the table above are based on anticipated increases in unit energy costs as set forth in the table in Section IV below.

** Operations & Maintenance Cost Avoidance and Future Capital Cost Avoidance are Non-Measured Project Benefits. Operations & Maintenance Cost Avoidance and Future Capital Cost Avoidance figures in the table above are based on a mutually agreed fixed annual escalation rate of two percent (2.0%).

*** Focus on Energy Incentive Benefits are estimated based on funding formulas current at the time of development but are not part of the financial guarantee. Focus on Energy Incentive Benefits are a one-time rebate anticipated to occur during Year 1 of the Project Benefits Term.

Revision Date: 1/16/2019

Within sixty (60) days of the commencement of the Guarantee Term, JCI will calculate the Measured Project Benefits achieved during the Installation Period plus any Non-Measured Project Benefits applicable to such period and advise Customer of same. Any Project Benefits achieved during the Installation Period may, at JCI's discretion, be allocated to the Annual Project Benefits for the first year of the Guarantee Term. Within sixty (60) days of each anniversary of the commencement of the Guarantee Term, JCI will calculate the Measured Project Benefits achieved for the applicable year plus any Non-Measured Project Benefits applicable to such period and advise Customer of same.

Customer acknowledges and agrees that if, for any reason, it (i) cancels or terminates receipt of M&V Services, (ii) fails to pay for M&V Services in accordance with the agreement, (iii) fails to fulfill any of its responsibilities necessary to enable JCI to complete the Work and provide the M&V Services, or (iv) otherwise cancels, terminates or materially breaches the Agreement, the Assured Performance Guarantee shall automatically terminate and JCI shall have no liability hereunder.

Project Benefits Shortfalls or Surpluses.

- (i) Project Benefits Shortfalls. If an Annual Project Benefits Shortfall occurs for any one year of the Guarantee Term, JCI shall, at its discretion and in any combination, (a) set off the amount of such shortfall against any unpaid balance Customer then owes to JCI, (b) pay to Customer the amount of such shortfall, or (c) subject to Customer's agreement, provide to Customer additional products or services, in the value of such shortfall, at no additional cost to Customer.
- (ii) Project Benefits Surpluses. If an Annual Project Benefits Surplus occurs for any one year of the Guarantee Term, JCI may, at its discretion and in any combination, bill Customer for the amount of payments made pursuant to Section C(i)(b) above and/or the value of the products or services provided pursuant to clause C(i)(c) above, in an amount not to exceed the amount of such surplus.
- (iii) Additional Improvements. Where an Annual Project Benefits Shortfall has occurred, JCI may, subject to Customer's approval (which approval shall not be unreasonably withheld, conditioned, or delayed), implement additional Improvement Measures, at no cost to Customer, which may generate additional Project Benefits in future years of the Guarantee Term.

NON-MEASURED PROJECT BENEFITS

The Project Benefits identified below were derived using engineering calculations based on industry standards and data provided by the Customer. These Project Benefits shall be Non-Measured Project Benefits (as defined above).

The parties acknowledge that Customer's capital contribution of \$430,000, to be paid in full to JCI during the construction period, shall result in the receipt by Customer of certain "Capital Cost Avoidance" benefits, which benefits are Non-Measured Project Benefits, as set forth below. It is understood between the Parties that (a) any equipment included in the Work for which capital outlay funds have been allocated for replacement are included in such Capital Cost Avoidance benefits; (b) equipment to be replaced pursuant to this Project that is at or near the end of its useful life is included in Capital Cost Avoidance benefits even if not budgeted, and Owner stipulates that for such equipment, failure and replacement is imminent within the Guaranty Term; and (c) Project Benefits allocable to Capital Cost Avoidance shall be the amortized cost of the equipment being replaced over the desired period, which must be no longer than the useful life of the equipment or the Guaranty Term (calculated as total installed cost / number of years).

The information in this section summarizes the Non-Measured Project Benefits. The details on the calculations and other supporting material are provided in the Investment Grade Audit report.

Non-Measured Project Benefits

Year	Non-Measured Utility Benefits	Non-Measured Operational Benefits	Focus on Energy Incentive Benefits	Future Capital Cost Avoidance	Annual Non-Measured Project Benefits
1	\$ -	\$ 21,893	\$ 33,253	\$ 430,000	\$ 485,146
2	\$ -	\$ 22,331	\$ -	\$ -	\$ 22,331
3	\$ -	\$ 22,777	\$ -	\$ -	\$ 22,777
4	\$ -	\$ 23,233	\$ -	\$ -	\$ 23,233
5	\$ -	\$ 23,698	\$ -	\$ -	\$ 23,698
6	\$ -	\$ 24,172	\$ -	\$ -	\$ 24,172
7	\$ -	\$ 24,655	\$ -	\$ -	\$ 24,655
8	\$ -	\$ 25,148	\$ -	\$ -	\$ 25,148
9	\$ -	\$ 25,651	\$ -	\$ -	\$ 25,651
10	\$ -	\$ 26,164	\$ -	\$ -	\$ 26,164
11	\$ -	\$ 26,687	\$ -	\$ -	\$ 26,687
12	\$ -	\$ 27,221	\$ -	\$ -	\$ 27,221
13	\$ -	\$ 27,766	\$ -	\$ -	\$ 27,766
14	\$ -	\$ 28,321	\$ -	\$ -	\$ 28,321
15	\$ -	\$ 28,887	\$ -	\$ -	\$ 28,887
16	\$ -	\$ 29,465	\$ -	\$ -	\$ 29,465

Year	Non-Measured Utility Benefits	Non-Measured Operational Benefits	Focus on Energy Incentive Benefits	Future Capital Cost Avoidance	Annual Non-Measured Project Benefits
17	\$ -	\$ 30,054	\$ -	\$ -	\$ 30,054
18	\$ -	\$ 30,655	\$ -	\$ -	\$ 30,655
19	\$ -	\$ 31,269	\$ -	\$ -	\$ 31,269
20	\$ -	\$ 31,894	\$ -	\$ -	\$ 31,894

In the table above, each column before Annual Non-Measured Project Benefits contains rounded amounts.

Non-Measured Utility Benefits	ECM	Year 1 Benefits	Escalation
None	None	\$ -	0%
Total Non-Measured Utility Benefits =		\$ -	

Non-Measured Operational Benefits	ECM	Year 1 Benefits	Escalation
The Non-Measured Operational Benefits of ECM-1-MCL are a result of Operational Subcontracted Maintenance Costs avoided due to the new chiller	ECM-1-MCL	\$ 15,000	2.00%
The Non-Measured Operational Benefits of ECM-12a-MCL are the result of Operational Material Savings due to Lighting Replacement	ECM-12a-MCL	\$ 6,259	2.00%
The Non-Measured Operational Benefits of ECM-12b-MCL are the result of Operational Material Savings due to Lighting Replacement	ECM-12b-MCL	\$ 6	2.00%
The Non-Measured Operational Benefits of ECM-4a-BVL are the result of Operational Material Savings due to Lighting Replacement	ECM-4a-BVL	\$ 611	2.00%
The Non-Measured Operational Benefits of ECM-4b-BVL are the result of Operational Material Savings due to Lighting Replacement	ECM-4b-BVL	\$ 17	2.00%
Total Non-Measured Operational Benefits =		\$ 21,893	

Focus on Energy Incentive Benefits	ECM	Year 1 Benefits	Escalation
The Focus on Energy Incentive Benefit is the result of lighting energy savings	ECM-12a-MCL	\$ 29,537	0%
The Focus on Energy Incentive Benefit is the result of lighting energy savings	ECM-4a-BVL	\$ 3,716	0%
Total Non-Measured Incentive Benefits =		\$ 33,253	

The Non-measured Project Benefits described in the table above run for the entire performance period. Details on data and associated calculations are presented in the final audit report used to develop the project. Focus on Energy Incentive Benefits are estimated based on funding formulas current at the time of development but are not part of the financial guarantee. Focus on Energy Incentive Benefits are a one-time rebate anticipated to occur during Year 1 of the Project Benefits Term.

Post-installation, the proposed efficiency rating in scope of work will be compared with the ECMs As-built documentation to confirm actual units installed. The achieved non-measured benefits will be adjusted one-time only and documented in the Post-Installation Report if proposed unit efficiency does not meet or exceed efficiency listed in scope of work.

Customer agrees that the Non-Measured Project Benefits are reasonable and that the installation of the Improvement Measures will enable Customer to take actions that will result in the achievement of such Non-Measured Project Benefits.

Schedule C: Compensation to ESCO

Total Price of the Work

The price to be paid by Customer for the Work shall be \$2,441,402. This includes \$430,000 capital cost avoidance, provided by the Customer as a portion of the down payment. The remaining \$2,011,402 will be provided through Project Financing, secured by the Customer under separate contract. The Down Payment and Construction Progress Payments (including payment for materials delivered to JCI and work performed on and off-site) shall be made to JCI as follows:

Payment	Percent of Contract Value	Estimated Percent Construction Completion*	Approximate Invoice Date
First payment due:	17.6%	17.6%	January 31, 2019, initial Down Payment
Second payment due:	32.4%	50.0%	February 15, 2019, remaining Down Payment
Third payment due:	7.5%	57.5%	April 15, 2019
Fourth payment due:	7.5%	65.0%	May 15, 2019
Fifth payment due:	7.5%	72.5%	June 15, 2019
Sixth payment due:	7.5%	80.0%	July 15, 2019
Seventh payment due:	7.5%	87.5%	August 15, 2019
Eighth payment due:	7.5%	95.0%	September 15, 2019
Final payment due:	5.0%	100.0%	Construction Retainer, Due Upon Completion

*Percent of construction completion has been estimated as the actual construction schedule is dependent on final engineered design of the ECMs, field conditions during implementation, and other factors not yet known. Invoicing will occur approximately monthly based on the schedule noted above.

M&V Services

The total price for JCI's M&V Services, as detailed on Schedule 2 of this Agreement, is \$108,839. This amount will be paid to JCI in annual installments, beginning with the first annual payment of \$35,564 and escalating annually at two percent (2.0%). These payments will be due and payable when Customer receives JCI's invoice and in advance of the services JCI is to provide, and shall be made throughout the Guarantee Term.

First Annual amount due: \$35,564

Due Date: Annually on September 15

First payment due: September 15, 2019

At the end of Project Benefits Year 3, as described in Schedule 2, the M&V will transition from Option C to stipulated benefits for the remainder of the Guarantee Term. During Year 3, the Customer may elect to continue Option C at the current pricing and escalation rate.

Schedule D: Description of the Premises

Milwaukee Central Public Library

The MPL Central Library opened on Oct. 3, 1898. The building originally shared space with the Milwaukee Public Museum until the museum completed its move to its own building on West Wells Street in the mid-1960s. In 1957, an addition to the Central Library building was opened on the Wells Street side. The building has four fireproof levels of shelving books below ground level. The facility has a 33,000 sq. ft. green roof above the Business and Periodicals Room. The green roof has moisture barriers and insulating features to reduce heating and cooling costs. The Library also has solar electric panels that generate approximately 36,000 kilowatt hours per year.

Bay View Public Library

The Bay View Library is the newer facility built in 1993. The facility has a single VAV AHU air handler that uses Metasys digital controls. Because of water leaks and other issues in the boiler room the fan housing is rusting out. The DX chiller is original and uses Refrigerant 22. The facility has two atmospheric original cast sectional boilers that are rusting out on the shell. The facility has T8 fluorescent lamps for lighting. The front foyer is an open bright environment with high ceilings and large windows, but has metal halide wall packs for lighting which does not use daylight harvesting.

Center Street Public Library

The Center Street Library was built in 1989. The facility has a single AHU VAV fan systems for the space. There is an atmospheric cast sectional boilers for heating the building. The DX cooling unit refrigeration is R22 and is original.

Atkinson Public Library

The Atkinson Library was built in the 1960 and renovated in 1994. The facility has a VAV AHU multi-zone air handling unit that has been converted from constant volume, and a relatively new Thermal Solutions high efficiency modular boiler. The VAV multi-zone AHU have been retrofitted with digital zone dampers and Ebtron airflow measuring stations to produce the correct air flow. The outside DX condensing unit is original and uses R22, potentially needs to be relocated on the roof.

Schedule E: Calculation of Baseline; Methodology to Adjust Baselines

The unit utility costs for the Baseline period are set forth below as “Base Utility Cost” and shall be used for all calculations made under this Schedule. The Base Utility Cost shall be escalated annually by the actual utility cost escalation but such escalation shall be no less than the mutually agreed “floor” escalation rate of two and three quarters percent (2.75%).

The calculations for baseline utility costs are further explained below. Baseline Source EUI information has been retrieved from ENERGY STAR Portfolio Manager and is presented for information only. Determination of the conversion factor from kBtu (site) to kBtu (source) are by the U.S. Environmental Protection Agency and are not within JCI’s guarantee. Additionally, no baseline natural gas usage has been included for facilities where natural gas consumption will be unaffected by the implemented ECMs. Center Street and Atkinson Libraries are included for informational purposes only at this time, but are not included in the scope of work for any ECM and are not included in the M&V scope of work.

Baseline (July 2016 to June 2017)		Energy			Total Annual Utility Spend
		Electric Consumption	Natural Gas	Steam	
		kWh	therm	klbs	
Milw Central Public Library (MCL)	Dollars	\$297,681		\$119,812	\$417,493
	Units	2,904,947		9,335	
Bay View Public Library (BVL)	Dollars	\$24,340	\$5,866		\$24,340
	Units	204,320	7,485		
Center Street Public Library (CSL)	Dollars	\$24,779	\$6,000		\$24,779
	Units	206,040	7,656		
Atkinson Public Library (AL)	Dollars	\$19,608	\$5,025		\$19,608
	Units	155,600	6,412		
Sites Total	Dollars	\$366,408	\$16,891	\$119,812	\$486,220
	Units	3,470,907	21,553	9,335	

For the Central Library facility, the following additional baseline information has been retrieved from ENERGY STAR Portfolio Manager and is presented for information relative to the M&V responsibilities outlined in this Schedule 2.

2009 Better Buildings Challenge Baseline Year Source kBtu	40,597,443 kBtu
2017 Benefit Term Baseline Year Source kBtu	38,198,387 kBtu
Projected Savings Source kBtu due to all MCL ECMs	7,325,605 kBtu
Projected 2019 Source kBtu	30,192,633 kBtu
Estimated Percent Reduction from 2017 Baseline due to all ECMs	19.2%

The unit utility costs for the Baseline period are set forth below as “Base Utility Cost” and shall be used for all calculations made under this Schedule. The Base Utility Cost for electric, natural gas, and fuel represents the 12 or 24 month average utility costs between June 2017 and June 2018 as described in detail in the following tables.

Rate Summary

Building	Account	Rate Code	Tariff	Unit	Rate
Milwaukee Central Public Library (MCL) 818 W WISCONSIN AVE	8026753497	AG1	Milwaukee	Steam Used (mlbs)	\$11.197480
	6606872777	FG-1	WGC	Gas Used (therms)	\$0.855000
	6276451235	FG-1	WGC	Gas Used (therms)	\$0.855000
	4296319834	CP1, CP1PV	Wisconsin	Standard/ On-Peak Usage Charge	\$0.074150
				Off-Peak Usage Charge	\$0.052810
				On-Peak Demand Charge	\$13.519000
				Customer Demand Charge	\$1.380000
Bay View Public Library (BVL) 2566 S KINNICKINNIC AVE	6840261981	FG-2	WGC	Gas Used (therms)	\$0.783700
		CG2	Wisconsin	Standard/ On-Peak Usage Charge	\$0.121010
				Off-Peak Usage Charge	\$0.091700
				On-Peak Demand Charge	\$6.860000
Center Street Public Library (CSL) 2728 W FOND DU LAC AVE	7418869938	FG-2	WGC	Gas Used (therms)	\$0.783700
	7418869938	CG2	Wisconsin	Standard/ On-Peak Usage Charge	\$0.121010
				Off-Peak Usage Charge	\$0.091700
				On-Peak Demand Charge	\$6.860000
Atkinson Public Library (AL) 1960 W ATKINSON AVE	6822231038	FG-2	WGC	Gas Used (therms)	\$0.783700
		CG2	Wisconsin	Standard/ On-Peak Usage Charge	\$0.121010
				Off-Peak Usage Charge	\$0.091700

Building	Account	Rate Code	Tariff	Unit	Rate
				On-Peak Demand Charge	\$6.860000

Effective Electric Rates used in Calculations

The following is the expected baseline and may be updated for anything found during construction.

MPL 814 West Wisconsin					
Energy					
	Usage from 6/13/17-6/13/18				
on peak	1,413,807	48.7%	\$ 0.0742	\$ 0.0742	\$ 0.0742
off peak	1,491,140	51.3%	\$ 0.0528	\$ 0.0528	\$ 0.0528
	2,904,947			Effective kWh rate	\$ 0.06320
Demand					
	Elect Service	Distribution			
	On-Peak Demand Charge				\$ 13.52
	Customer Demand Charge				\$ 1.38
2566 S KINNICKINNIC AVE					
Energy					
	Usage from 6/28/17-6/27/18				
on peak	115,680	56.6%	\$ 0.0742	\$ 0.1210	\$ 0.1054
off peak	88,640	43.4%	\$ 0.0528	\$ 0.0917	\$ 0.0787
	204,320			Effective kWh rate	\$ 0.09383
Demand					
	Elect Service	Distribution			
	On-Peak Demand Charge				\$6.860000
	Customer Demand Charge				\$ -

2728 W FOND DU LAC AVE						
Energy						
	Usage from 6/12/17-6/11/18					
on peak	120,000	58.2%	\$ 0.0742	\$ 0.1210	\$	0.1054
off peak	86,040	41.8%	\$ 0.0528	\$ 0.0917	\$	0.0787
	206,040			Effective kWh rate	\$	0.09426
Demand						
	Elect Service	Distribution				
	On-Peak Demand Charge					\$6.860000
	Customer Demand Charge				\$	-

1960 W ATKINSON AVE						
Energy						
	Usage from 6/26/17-6/25/18					
on peak	94,000	60.4%	\$ 0.0742	\$ 0.1210	\$	0.1054
off peak	61,600	39.6%	\$ 0.0528	\$ 0.0917	\$	0.0787
	155,600			Effective kWh rate	\$	0.09484
Demand						
	Elect Service	Distribution				
	On-Peak Demand Charge					\$6.860000
	Customer Demand Charge				\$	-

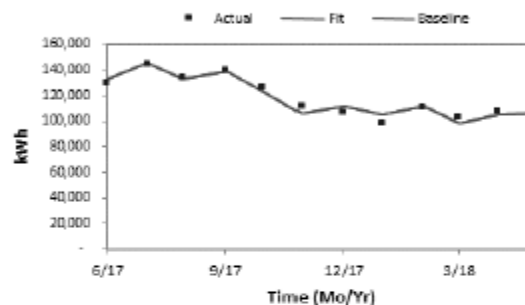
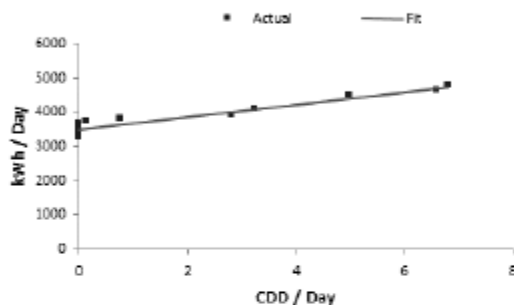
Methodology to Adjust Baselines



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kWh(Qty OnPk)



From	To	# Days	Reading	Incl?	HDD	CDD	Offset	Baseline	Deviation
05/12/17	06/13/17	33	129,055	<input checked="" type="checkbox"/>	0.0	93.0	-	132,474	2.6%
06/14/17	07/14/17	31	143,932	<input checked="" type="checkbox"/>	0.0	204.5	-	145,919	1.4%
07/15/17	08/11/17	28	133,729	<input checked="" type="checkbox"/>	0.0	190.5	-	132,859	-0.7%
08/12/17	09/14/17	34	139,507	<input checked="" type="checkbox"/>	0.0	110.5	-	139,180	-0.2%
09/15/17	10/12/17	28	125,908	<input checked="" type="checkbox"/>	0.0	140.0	-	123,601	-1.8%
10/13/17	11/11/17	30	111,538	<input checked="" type="checkbox"/>	0.0	4.5	-	105,757	-5.2%
11/12/17	12/13/17	32	105,869	<input checked="" type="checkbox"/>	0.0	0.0	-	111,928	5.7%
12/14/17	01/12/18	30	97,660	<input checked="" type="checkbox"/>	0.0	0.0	-	104,933	7.4%
01/13/18	02/13/18	32	109,749	<input checked="" type="checkbox"/>	0.0	0.0	-	111,928	2.0%
02/14/18	03/13/18	28	102,122	<input checked="" type="checkbox"/>	0.0	0.0	-	97,937	-4.1%
03/14/18	04/12/18	30	107,098	<input checked="" type="checkbox"/>	0.0	0.0	-	104,933	-2.0%
04/13/18	05/11/18	29	110,841	<input checked="" type="checkbox"/>	0.0	22.5	-	105,559	-4.8%
Sum/Average/Max		365	1,417,008		0.0	765.5	-	1,417,008	0% +/- 3.6%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kWh)} = 3497.749 \times \text{\#Days} + 183.3175 \times \text{CDD}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-3.6082%. The underlying regression has a $R^2=0.9247$

Baseline Costs are calculated using Average Cost/Consumption.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

CDD = Cooling Degree-Days calculated for MILWAUKEEWI for a 65.0 F° balance point.

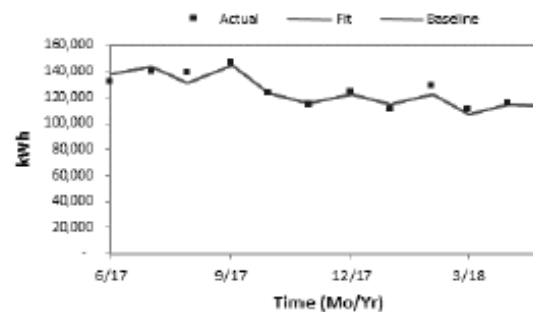
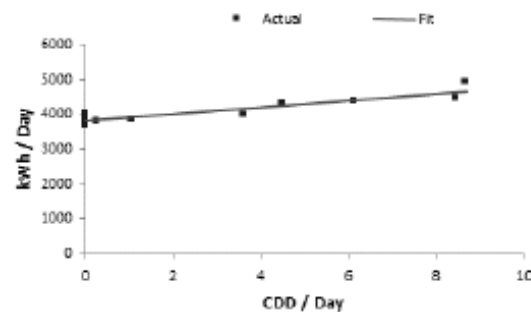
Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kWh(Qty OffPk)



From	To	# Days	Reading	Incl?	HDD	CDD	Offset	Baseline	Deviation
05/12/17	06/13/17	33	131,352	<input checked="" type="checkbox"/>	0.0	119.5	-	137,612	4.8%
06/14/17	07/14/17	31	138,732	<input checked="" type="checkbox"/>	0.0	262.5	-	143,938	3.8%
07/15/17	08/11/17	28	138,040	<input checked="" type="checkbox"/>	0.0	243.5	0	130,633	-5.4%
08/12/17	09/14/17	34	146,167	<input checked="" type="checkbox"/>	0.0	153.5	-	144,748	-1.0%
09/15/17	10/12/17	28	122,674	<input checked="" type="checkbox"/>	0.0	172.5	-	123,703	0.8%
10/13/17	11/11/17	30	114,378	<input checked="" type="checkbox"/>	0.0	8.5	-	115,327	0.8%
11/12/17	12/13/17	32	123,580	<input checked="" type="checkbox"/>	0.0	0.0	-	122,131	-1.2%
12/14/17	01/12/18	30	110,399	<input checked="" type="checkbox"/>	0.0	0.0	-	114,497	3.7%
01/13/18	02/13/18	32	128,424	<input checked="" type="checkbox"/>	0.0	0.0	-	122,131	-4.9%
02/14/18	03/13/18	28	109,993	<input checked="" type="checkbox"/>	0.0	0.0	-	106,864	-2.8%
03/14/18	04/12/18	30	114,605	<input checked="" type="checkbox"/>	0.0	0.0	-	114,497	-0.1%
04/13/18	05/11/18	29	111,394	<input checked="" type="checkbox"/>	0.0	30.5	-	113,658	2.0%
Sum/Average/Max		365	1,489,738		0.0	990.5	0	1,489,738	0% +/- 3.4%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kWh)} = 3816.577 \times \text{\#Days} + 97.6148 \times \text{CDD} + \text{Offset}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-3.4223%. The underlying regression has a $R^2=0.8517$

Baseline Costs are calculated using Average Cost/Consumption.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

CDD = Cooling Degree-Days calculated for MILWAUKEEWI for a 63.0 F° balance point.

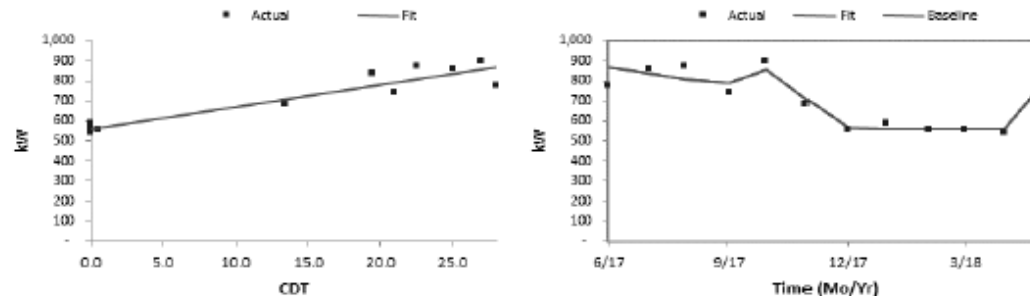
Multiplier and Offset are derived from Modification(s) in effect during the tuning period and are replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kW(Dmd OnPk)



From	To	# Days	Reading	Incl?	HDT	CDT	Offset	Baseline	Deviation
05/12/17	06/13/17	33	776	<input checked="" type="checkbox"/>	0.0	28.0	-	868	11.9%
06/14/17	07/14/17	31	856	<input checked="" type="checkbox"/>	0.0	25.0	-	835	-2.5%
07/15/17	08/11/17	28	868	<input checked="" type="checkbox"/>	0.0	22.5	-	807	-6.9%
08/12/17	09/14/17	34	738	<input checked="" type="checkbox"/>	0.0	21.0	-	791	7.2%
09/15/17	10/12/17	28	895	<input checked="" type="checkbox"/>	0.0	27.0	-	857	-4.2%
10/13/17	11/11/17	30	684	<input checked="" type="checkbox"/>	0.0	13.5	-	708	3.5%
11/12/17	12/13/17	32	556	<input checked="" type="checkbox"/>	0.0	0.5	-	564	1.5%
12/14/17	01/12/18	30	587	<input checked="" type="checkbox"/>	0.0	0.0	-	559	-4.9%
01/13/18	02/13/18	32	557	<input checked="" type="checkbox"/>	0.0	0.0	-	559	0.4%
02/14/18	03/13/18	28	554	<input checked="" type="checkbox"/>	0.0	0.0	-	559	0.9%
03/14/18	04/12/18	30	538	<input checked="" type="checkbox"/>	0.0	0.0	-	559	3.8%
04/13/18	05/11/18	29	832	<input checked="" type="checkbox"/>	0.0	19.5	-	774	-7.0%
Sum/Average/Max		365	8,440		0.0	157.0	-	8,440	0% +/- 6.4%

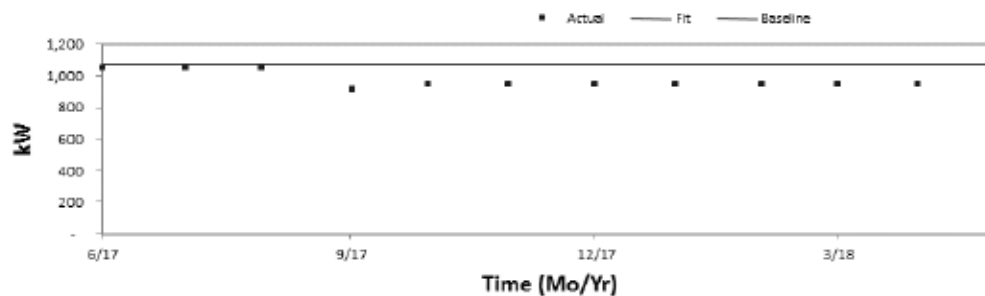
Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.
Below is the equation used to calculate the Baseline values for the tuning period and all future periods:
Baseline (kW) = 558.8385 + 11.0467 x CDT
The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-6.379%. The underlying regression has a R²=0
Baseline Costs are calculated using Average Cost/Demand, but no less than \$0/ kW.
Explanations and Assumptions:
☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.
CDT = Cooling Delta T calculated for MILWAUKEEWI for a 55.0 F° balance point.
CDT was calculated using Maximum Temperatures.
Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kW(Dmd OffPk)



From	To	# Days	Reading	Incl?	HDT	CDT	Offset	Baseline	Deviation
05/12/17	06/13/17	33	1,042	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	3.1%
06/14/17	07/14/17	31	1,042	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	3.1%
07/15/17	08/11/17	28	1,042	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	3.1%
08/12/17	09/14/17	34	909	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	18.3%
09/15/17	10/12/17	28	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
10/13/17	11/11/17	30	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
11/12/17	12/13/17	32	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
12/14/17	01/12/18	30	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
01/13/18	02/13/18	32	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
02/14/18	03/13/18	28	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
03/14/18	04/12/18	30	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
04/13/18	05/11/18	29	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
Sum/Average/Max		365	11,535		0.0	0.0	-	12,900	10.6% +/- 13.4%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kW)} = 1075$$

The Baseline Equation has a Net Mean Bias of 10.5798% and a Monthly Mean Error of +/-13.3915%. The underlying regression has a $R^2=0$

Baseline Costs are calculated using Average Cost/Demand, but no less than \$0/ kW.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

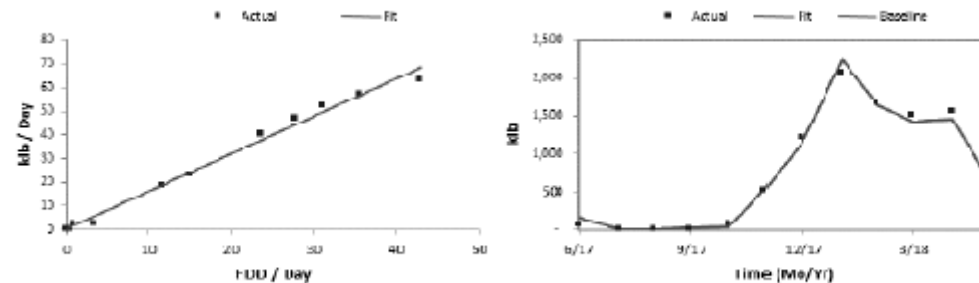
Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 8026753497

Site: Site1
Meter: Main-Steam
Unit: klb(Qty OnPk)



From	To	# Days	Reading	Incl?	HDD	CDD	Offset	Baseline	Deviation
05/11/17	06/09/17	30	67	<input checked="" type="checkbox"/>	97.0	0.0	-	156	132.6%
06/10/17	07/12/17	33	-	<input checked="" type="checkbox"/>	0.5	0.0	-	3	0.0%
07/13/17	08/09/17	28	-	<input checked="" type="checkbox"/>	0.0	0.0	-	2	0.0%
08/10/17	09/08/17	30	-	<input checked="" type="checkbox"/>	12.5	0.0	-	22	0.0%
09/09/17	10/01/17	32	77	<input checked="" type="checkbox"/>	26.5	0.0	-	44	-42.4%
10/11/17	11/07/17	28	521	<input checked="" type="checkbox"/>	325.0	0.0	-	517	-0.8%
11/08/17	12/07/17	30	1,209	<input checked="" type="checkbox"/>	708.5	0.0	-	1,124	-7.0%
12/08/17	01/09/18	33	2,069	<input checked="" type="checkbox"/>	1419.0	0.0	-	2,250	8.7%
01/10/18	02/07/18	29	1,655	<input checked="" type="checkbox"/>	1031.5	0.0	-	1,636	-1.2%
02/08/18	03/08/18	29	1,512	<input checked="" type="checkbox"/>	901.0	0.0	-	1,429	-5.5%
03/09/18	04/01/18	33	1,554	<input checked="" type="checkbox"/>	921.0	0.0	-	1,461	-6.0%
04/11/18	05/09/18	29	671	<input checked="" type="checkbox"/>	435.0	0.0	-	691	3.0%
Sum/Average/Max		354	9,335		5877.5	0.0	-	9,335	0% +/- 9.9%

Main-Steam (Account # 8026753497): Tuning Period is 364 days from 5/11/2017 until 5/9/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (klb)} = 0.0746 \times \# \text{Days} + 1.5836 \times \text{HDD}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-0.8275%. The underlying regression has a $R^2=0.9905$

Baseline Costs are calculated using Average Total Cost/Consumption.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

HDD = Heating Degree-Days calculated for MILWAUKEEWI for a 62.0 F° balance point.

Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.

Schedule F: Financing Agreement

The Customer intends to enter into a Tax-Exempt Lease-Purchase financing agreement with a third-party lender. Refer to the negotiated Financing Agreement for details.

Schedule G: Johnson Controls Maintenance Responsibilities

JCI will provide the M&V Services set forth below in connection with the Assured Performance Guarantee. The following responsibilities refer specifically to the proposed Assured Performance Guarantee and do not represent a Service Agreement for the equipment proposed in any individual ECM. These responsibilities are separate and distinct from any existing equipment and performance service agreements between Johnson Controls and the Customer.

1. During the Installation Period, a JCI Performance Assurance Specialist will track Measured Project Benefits. JCI will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 60 days of the commencement of the Guarantee Term.
2. Within 60 days of each anniversary of the commencement of the Guarantee Term, JCI will provide Customer with an annual report containing:
 - A. an executive overview of the project's performance and Project Benefits achieved to date;
 - B. a summary analysis of the Measured Project Benefits accounting; and
 - C. depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.
3. During the Guarantee Term, a JCI Performance Assurance Specialist will monitor the on-going performance of the Improvement Measures, as specified in the Agreement, to determine whether anticipated Measured Project Benefits are being achieved. For the duration of the Option C portion of the M&V scope, monitoring will occur at a minimum through two (2) on-site reviews per year, twelve (12) monthly conference calls per year, and several remote checks of monitoring data per month per year. For the duration of the Option A portion of the M&V scope, monitoring will occur through one (1) on-site review and periodic remote checks of monitoring data as necessary. In this regard, the Performance Assurance Specialist will periodically assist Customer, on-site or remotely, with respect to the following activities:
 - A. review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
 - B. advise Customer's designated personnel of any performance deficiencies based on such information;
 - C. coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
 - D. inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
 - E. provide the Customer with ENERGY STAR Portfolio Manager baseline and use adjustments as necessary as they relate to work done under the Contract and that may be in addition to any agreed upon baseline and savings adjustments and savings calculations associated with the provisions of the Contractor's energy savings guarantee.
4. For specified Improvement Measures utilizing an "Option A" M&V protocol, JCI will:
 - A. conduct pre and post installation measurements required under the Agreement;
 - B. confirm the building management system employs the control strategies and set points specified in the Agreement; and

- F. analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting and water benefits calculations will be determined from the as-built information to reflect the actual mix of retrofits encountered during installation).

Schedule H: Customer Maintenance Responsibilities

In order for JCI to perform its obligations under the Agreement with respect to the Work, the Assured Performance Guarantee, and the M&V Services, Customer shall be responsible for:

5. Providing JCI, its subcontractors, and its agents reasonable and safe access to all facilities and properties that are subject to the Work and/or M&V Services;
6. Providing for removal or relocation of owner shelving, furniture, or other owner property identified as necessary to facilitate installation of the Work.
7. In coordination with JCI, providing for shut down and scheduling of affected locations during installation, including timely shutdowns of chilled water and hot water systems as needed to accomplish the Work and/or M&V Services;
8. Providing timely reviews and approvals of design submissions, proposed change orders, and other project documents. Project submittals to include:
 - Product cut sheets for major equipment, lighting, and lighting controls;
 - Schematic design drawings during review meeting (20% complete drawings including equipment outlines, boundary of work, and major duct, pipe, or conduit routings as necessary);
 - Construction drawings during review meeting (95% complete drawings);
 - Control drawings and sequences of operation;
 - Project specifications;
9. Providing the following information with respect to the project and project site as soon as practicable following JCI's request:
 - a. surveys describing the property, boundaries, topography and reference points for use during construction, including existing service and utility lines;
 - b. geotechnical studies describing subsurface conditions, and other surveys describing other latent or concealed physical conditions at the project site;
 - c. temporary and permanent easements, zoning and other requirements and encumbrances affecting land use, or necessary to permit the proper design and construction of the project and enable JCI to perform the Work;
 - d. a legal description of the project site;
 - e. as-built and record drawings of any existing structures at the project site; and
 - f. environmental studies, reports and impact statement describing the environmental conditions, including hazardous conditions or materials, in existence at the project site.
10. Following the receipt of any environmental studies, reports, or impact statements describing the environmental conditions, JCI will identify all work areas impacted by known environmental hazards identified in the documentation, and will identify any work areas where construction activities may disturb suspected hazardous materials. The Customer will provide timely testing and abatement of known or suspected ACMs and Non-JCI Hazardous Materials encountered during project implementation;
11. Securing and executing all necessary agreements with adjacent land or property owners that are necessary to enable JCI to perform the Work;

12. Providing assistance to JCI in obtaining any permits, approvals, and licenses that are JCI's responsibility to obtain as set forth in Schedule 1;
13. Obtaining any permits, approvals, and licenses that are necessary for the performance of the Work and are not JCI's responsibility to obtain as set forth in Schedule 1;
14. Except for tasks that JCI is responsible for, properly maintaining, and performing appropriate preventative maintenance on, all equipment and building systems affecting the Assured Performance Guarantee in accordance with manufacturers' standards and specifications;
15. Except for tasks that JCI is responsible for, promptly repairing or replacing any item of equipment or the building systems affecting the achievement of Project Benefits, including without limitation pursuing claims under any applicable manufacturer's warranties then in affect;
16. Providing the utility bills, reports, and similar information reasonably necessary for administering JCI's obligations under the Assured Performance Guarantee within five (5) days of Customer receipt and/or generation or JCI's request therefor;
17. Providing all records relating to energy and/or water usage and related maintenance of the premises and relevant equipment requested by JCI;
18. Providing and installing utility sub-meters on all new construction and/or additions built during the Guarantee Term as recommended by JCI or, alternatively, paying JCI's applicable fees for calculating necessary adjustments to the Assured Performance Guarantee as a result of the new construction;
19. Providing and maintaining a dedicated telephone line and/or TCP/IP remote connection to facilitate remote monitoring of relevant equipment; including DDC Controls systems or existing Energy Management Controls systems for trended data collection, remote data files downloads and/or remote monitoring tasks;
20. Promptly notifying JCI of any change in use or condition described in Section III of Schedule 2 or any other matter that may impact the Assured Performance Guarantee;
21. Taking all actions reasonably necessary to achieve the Non-Measured Project Benefits;

Schedule I: ECM Operation Parameters; Standards of Comfort and Service

Building system operating parameters and the standards of comfort and service for the systems at the Milwaukee Central Public Library are as follows.

Model Snapshot

The images below represent the actual configuration of the simulated building.

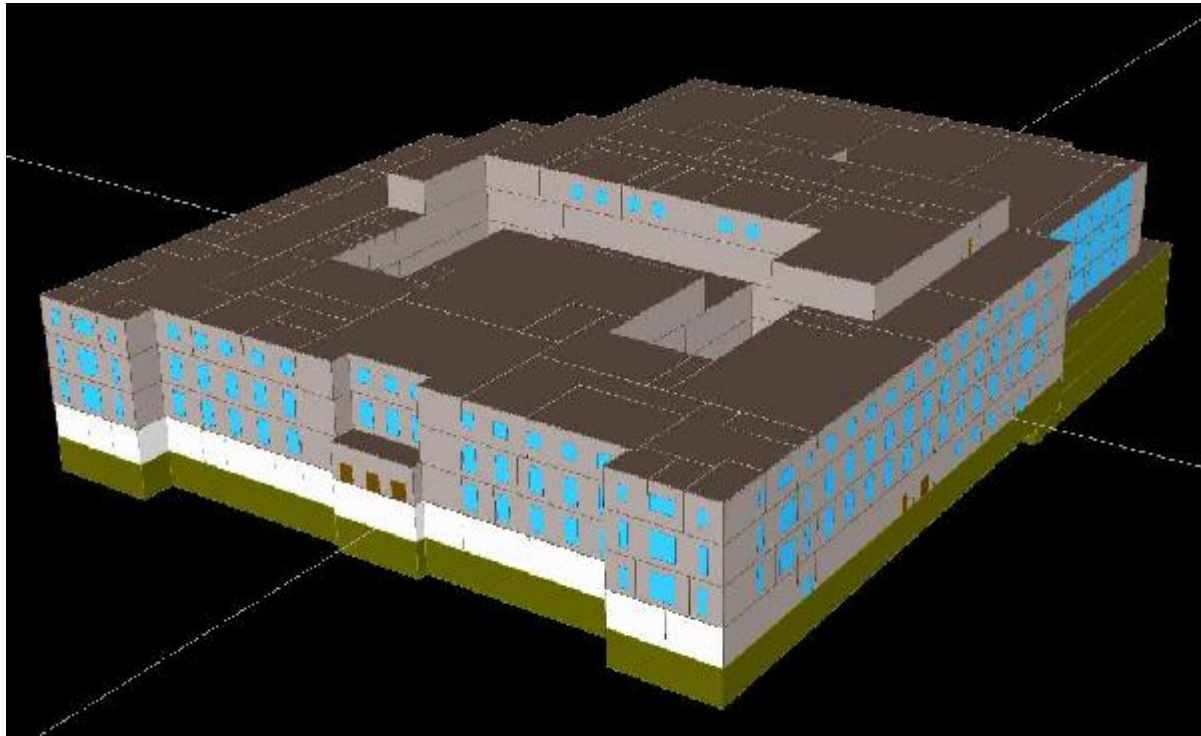


Figure 1: Milwaukee Central Public Library as viewed from the Southeast

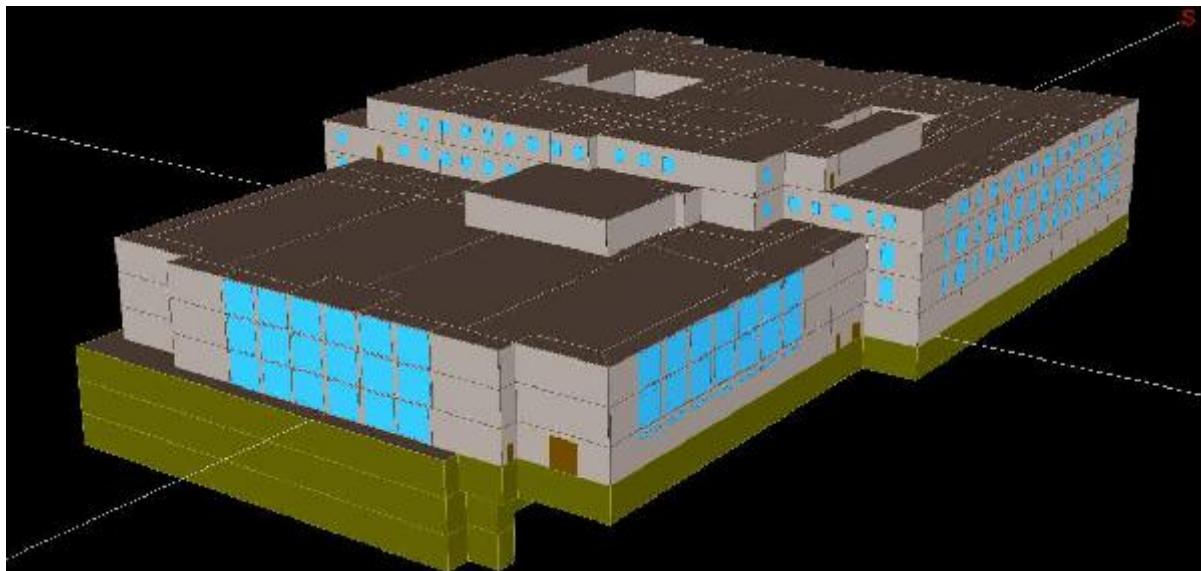


Figure 2: Milwaukee Central Public Library as viewed from the Northwest

Base Energy Model Conditions

Utility Rates

The following utility rates were used in calculating building energy costs, consistent with the baseline calculations in Schedule E.

Utility	Rate
Electricity	\$0.0632 / kwh (average rate)
Steam	\$11.1975 / 1,000,000 BTU
Peak Electricity	\$13.519 / Monthly kW

Building Construction

Information on building material properties used in the construction of Central Library was researched and reviewed for use in both the construction of the energy model and calculation of building peak heating/cooling loads.

Building construction remained static from model to model.

Building Infiltration

Infiltration was simulated using 0.5 air changes/hour for perimeter zones in both the “base” and all “proposed” simulations.

Building infiltration remained static from model to model.

Internal Building Conditions

The following represents base model internal building equipment loads that have been kept static from the existing building conditions, to the proposed simulations:

Internal Load Description	Value
Lighting	1.0 W/sq. ft.
Misc. Equipment	0.2 W/sq. ft.

Internal Space Temperatures

The building contains mixture of pneumatic and electric thermostats. The following represents base model internal building zone temperatures:

System	Thermostat Set-points	Occupied Cooling Value	Unoccupied Cooling Value	Occupied Heating Value	Unoccupied Heating Value
AC-1	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-2	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-3	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F

System	Thermostat Set-points	Occupied Cooling Value	Unoccupied Cooling Value	Occupied Heating Value	Unoccupied Heating Value
AC-4	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-5	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-6	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-7	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-8	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-10	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-11	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-12	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-13	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-14	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-15	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-16	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-17	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-19	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-22	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-23	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-24	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-25	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-27	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
AC-28	All Seasons	74.0 F	78.0 F	68.0 F	62.0 F
Rare Books	All Seasons	63.0 F	NA	62.0 F	NA

Schedules (Occupancy, Equipment, etc.)

Schedules for occupancy, office equipment, miscellaneous equipment and lighting were approximated and kept static from the base model to the proposed simulations.

Based on the hours of operation posted online for the library in the table below the building was assumed to be occupied most heavily during those times.

Schedules (Air Handling Units)

Based on information provided, the following table represents an understanding on how the existing building air handling systems are currently scheduled.

No AHU schedules were modified or altered by any ECM. This table indicates when each air handler system is in the “on” mode:

System	MON	TUE	WED	THU	FRI	SAT	SUN
AC-1	4a – 8p	4a – 8p	4a – 6p	4a – 6p	4a – 6p	4a – 5p	9a – 5p
AC-2	4a – 8p	4a – 8p	4a – 6p	4a – 6p	4a – 6p	4a – 5p	9a – 5p
AC-3	5a – 5p	5a – 5p	5a – 5p	5a – 5p	5a – 5p	OFF	OFF
AC-4	4a – 5p	4a – 5p	4a – 5p	4a – 5p	6a – 6p	6a – 5p	9a – 5p
AC-5	4a – 5p	4a – 5p	4a – 5p	4a – 5p	4a – 4p	OFF	OFF
AC-6	5a – 10p	5a – 5p	5a – 6p	5a – 10p	5a – 6p	5a – 5p	9a – 5p
AC-7	5a – 5p	6a – 5p	6a – 5p	6a – 5p	6a – 5p	9a – 5p	9a – 5p
AC-8	5a – 8p	6a – 8p	6a – 6p	6a – 6p	6a – 6p	6a – 5p	9a – 5p
AC-10	4a – 8p	6a – 6p	6a – 6p	6a – 9p	6a – 6p	6a – 6p	9a – 5p
AC-11	7a – 10a 4p – 8p	7a – 10a	7a – 2p	7a – 5p	7a – 10a	9a – 4p	9a – 5p
AC-12	6a – 8p	6a – 8p	6a – 9p	6a – 6p	6a – 6p	6a – 5p	12p – 5p
AC-13	6a – 8p	6a – 8p	6a – 6p	6a – 6p	6a – 6p	6a – 5p	1p – 5p
AC-14	4a – 4p	4a – 4p	4a – 4p	4a – 4p	4a – 4p	OFF	OFF
AC-15	6a – 6p	6a – 6p	6a – 5p	6a – 5p	6a – 5p	OFF	OFF
AC-16	5a – 5p	6a – 5p	6a – 5p	6a – 5p	6a – 5p	OFF	OFF
AC-17	8a – 8p	8a – 8p	7a – 6p	7a – 6p	7a – 6p	8a – 5p	12p – 5p
AC-19	8a – 8p	8a – 8p	7a – 6p	7a – 6p	7a – 6p	8a – 5p	9a – 5p
AC-22	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR
AC-23	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR
AC-24	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR
AC-25	6a – 8p	6a – 8p	6a – 8p	6a – 6p	6a – 6p	6a – 6p	9a – 5p
AC-27	7a – 8p	7a – 8p	7a – 6p	7a – 6p	7a – 6p	7a – 6p	9a – 5p
AC-28	7a – 8p	7a – 8p	7a – 6p	7a – 6p	7a – 6p	7a – 6p	9a – 5p
Rare Books	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR	24 HR

Lighting Hours of Operation

The lighting system annual run hours by space type are agreed to be as shown in the table below. These run hours are based on schedules and sample loggers used during the audit phase. These values are considered non-measured and agreed upon by the Customer.

Include (Yes/No)	All Areas Usage Group Code	Description	Existing Burn Hours Assigned	Proposed Controlled Burn Hours
Yes	E	Exterior	4380	4380
Yes	X	Exit Signs	8760	8760
No	VEND	Vending Machines	8760	6132
Yes	AU	Auditorium/Stage	4038	2827
Yes	BR	Break room	1205	603
No	CL	Classroom	4038	2827
Yes	CR	Conference Room	1000	500
No	CT	Court Room/Trial Areas	4038	2827
Yes	GA	Garage/Parking Decks	4038	2827
No	GYM	Gymnasium	4038	2827
Yes	HW	Hallway	3432	1716
Yes	KT	Kitchen	1385	693
No	LAB	Laboratory	4038	2827
Yes	LO	Lobby/Entry Vestibule	4038	2827
No	LI	Library	4038	2827
No	LQ	Living Quarters/Bunk Rooms	4038	2827
No	LR	Locker Room	4038	2827
Yes	ME	Mechanical/Electrical Rooms	2493	1745
Yes	MP	Multipurpose	4038	2827
Yes	OO	Open Office	2850	2280
No	OS	Office Support (copy room, coffee room, etc.)	4038	2827
Yes	PO	Private Office	2493	1745
No	PR	Patient Room	4038	2827
Yes	RR	Restroom	1500	375
Yes	RT	Retail	4038	2827
Yes	ST	Storage	2493	1745
No	WH	Warehouse	4038	2827

Include (Yes/No)	All Areas Usage Group Code	Description	Existing Burn Hours Assigned	Proposed Controlled Burn Hours
Yes	UT	Utility/Janitor Closets	2493	1246
Yes	WS	Workshop	4038	2827
Yes	SW	Stairwell	4038	2827
Yes	CF	Cafeteria	4038	2827
Yes	LIB	Library Public Space	3071	2150
Yes	EMG	Emergency Lighting	8760	6132
Yes	24/7	Night Light	8760	6132
Yes	LOL	Lobby - Low Use	2493	1745
No	DW		4038	2827
Yes	LIBL	Library Space - low use	2493	1745
Yes	LABL	Lab Space - low use	2493	1745
Yes	STH	Stairwell - High Use	4038	2827
Yes	LOAS	Lobby - Already Sensored	4038	4038
Yes	HWAS	Hallway - Already Sensored	3432	3432
Yes	OOAS	Open Office - Already Sensored	2850	2850
Yes	CRAS	Conference Room - Already Sensored	1000	1000
Yes	LIBAS	Library - Already Sensored	4038	4038
Yes	STAS	Storage - Already Sensored	4038	4038
Yes	RRAS	Restroom - Already Sensored	1500	1500
Yes	POAS	Private Office - Already Sensored	4038	4038
Yes	SWAS	Stairwell - Already Sensored	4038	4038
Yes	UTAS	Utility/Janitor Closets - Already Sensored	2493	2493
Yes	EMG EGRESS	Emergency Egress Lighting	299	299

Simulation Descriptions

A brief description of the “base” model and each “ECO” model is reviewed below:

“Base” Model:

The base model simulates how the building is currently functioning. The building was researched, with results being entered into the simulation. Where information was unknown, assumptions were made, based on similar type buildings.

Energy Conservation Measure 1 (ECM-1):

This ECM simulation implements a replacement and upgrade of the existing York water- cooled chiller with a larger Mag-Lev Chiller.

The new Mag-Lev Chiller is more efficient and able to run at more varied conditions than the existing Trane screw chiller which was assumed to be shut off during late spring and early fall due to cooling tower and chiller reliability issues. During the late spring and early fall the existing York Air Cooled chiller is operated as the primary chiller in lieu of the existing Trane water cooled screw chiller.

The chiller replacement simulation assumes the following:

- Increase the chiller efficiency:
 - Baseline:
 - York Air cooled chiller: 1.12 kW-per-ton
 - Trane Water cooled Screw chiller: 0.9 kW-per-ton
 - Proposed
 - York Mag-Lev water cooled centrifugal chiller: 0.55 kW-per-ton
- The new Mag-Lev chiller has improved turn-down because of the integral VSD drive, allowing the chiller to back down further when full capacity is unnecessary. This ECM assumes a new chiller curve to simulate this improved turn-down and VSD control.
- Chiller operation schedule changes:
 - Increasing the of chiller capacity enables the new York Mag-Lev chiller to operate as the sole primary chiller until very late in the fall and early in the spring when the potential for freezing weather requires the cooling tower to be drained.
 - The simulation assumes that the new York chiller will run at the edges of the season that the air-cooled machine covered in the past due to the improved efficiency at lower temperatures.
 - In the simulation, the lockout schedule for the water-cooled chiller was updated:
 - Baseline: June 1st – September 30th
 - Proposed: March 30th – October 31st

Energy Conservation Measure 3 (ECM-3):

This ECM simulation implements a conversion of AC-7 from CAV to a DOAS.

The conversion enables a reduction of airflow by converting to a 100% outdoor air system. Additionally, the unit will have a heat recovery wheel with a 78% efficiency.

This simulation assumes the following:

- In the simulation the airflow was dropped from 30,000 CFM to 12,000 CFM to match the existing thermal loads.
- The outside air was increased from 20% to 100% to improve the indoor air quality of the space.
- The simulation assumes a 78% efficient enthalpy wheel installed on the new system.

Schedule J: Johnson Controls Training Responsibilities

Johnson Controls will provide training to the Customer's designated operating personnel following the installation, startup, and commissioning of the proposed equipment. Training will include:

1. Review of equipment startup and commissioning documentation.
2. Overview of installed equipment.
3. Training on maintenance procedures as specified in the equipment's Installation, Operations & Maintenance (IOM) documentation.
4. Review of basic troubleshooting procedures indicated in the equipment's IOMs.

Schedule K: Construction and Installation Schedule

All ECMs proposed on the Premises have been designed to a preliminary design level, with final design documents to be developed during the implementation schedule. The anticipated construction and installation schedule is as follows:

Payment	Percent of Contract Value	Estimated Percent Construction Completion*	Approximate Invoice Date
First payment due:	17.6%	17.6%	January 31, 2019, initial Down Payment
Second payment due:	32.4%	50.0%	February 15, 2019, remaining Down Payment
Third payment due:	7.5%	57.5%	April 15, 2019
Fourth payment due:	7.5%	65.0%	May 15, 2019
Fifth payment due:	7.5%	72.5%	June 15, 2019
Sixth payment due:	7.5%	80.0%	July 15, 2019
Seventh payment due:	7.5%	87.5%	August 15, 2019
Eighth payment due:	7.5%	95.0%	September 15, 2019
Final payment due:	5.0%	100.0%	Construction Retainer, Due Upon Completion

*Percent of construction completion has been estimated as the actual construction schedule is dependent on final engineered design of the ECMs, field conditions during implementation, and other factors not yet known. Invoicing will occur approximately monthly based on the schedule noted above.

Schedule L: Current and Known Future Capital Projects at the Premises

At the time of publication of this report, there are no known current or future capital projects at the premises.

Schedule M: Pre-Installation Equipment Inventory

HVAC Equipment

Following is a high level summary of the existing Library systems, controls and lighting.

Building Fan Systems

There are approximately 23 air handling units (AHUs) that serve the Library. A few select fans have already been replaced due to remodeling needs. The fan type are a combination of large built-up air handlers and smaller modular fans distributed throughout the building. Many of the AHU are going through a controls network upgrade to the latest revision of the Johnson Controls Metasys extended architecture. Some of the fan systems have been converted to partial variable air volume (VAV), some are constant volume and a few are dual duct. Some of the dual duct systems have had been retrofitted to a homegrown VAV system. The fan that serves the administration area has a steam to hot water system used for ducted reheat. Some of the fans systems in the building have had variable speed drives (VSDs) installed for system balancing or ramp loading. In many applications the perimeter steam radiant heat is running on a separate pneumatic thermostat, which causes the overhead fan system to buck room temperature set points. Fan SC 10 has some VAV boxes and electric duct reheat. Many of the fan systems are original vintage (older than 40 years) and considered to be at the end of their ASHRAE life cycle.

Currently the AHU systems are running continually through the day even if the spaces are not occupied. The spaces currently do not have demand controlled ventilation controls such as occupancy sensors or CO2 sensors.

The following is a list of AHU systems and approximate age:

System	Area(s) Served	Approximate Age
AC-1	2 nd Floor, North Section	>10 years
AC-2	1 st Floor, North Section	>10 years
AC-3	4 Tier, North Section	>10 years
AC-4	Humanities Area	3 years
AC-5	3 rd Floor Binary	5 years
AC-6	1 st Floor CD/Tape/Music Collections	5 years
AC-7	1 Tier – 4 Tier Stacks	>10 years
AC-8	4 Tier Maintenance Shop	5 years
AC-10	3 rd Floor Lobby, 2 nd Floor Offices	10 years
AC-11	1 st Floor Meeting Room	5 years
AC-12	2 nd Floor Business Office	>10 years
AC-13	1 st Floor Fine Arts Area	>10 years
AC-14	4 th Floor Catalog Area	>10 years
AC-15	Administrative Offices	>10 years
AC-16	Administrative Offices	>10 years
AC-17	2 nd Floor Music/Art	10 years

Revision Date: 1/16/2019

System	Area(s) Served	Approximate Age
AC-19	2 nd Floor Music/Art	10 years
AC-23	Centennial Hall	>10 years
AC-25	Portions of 4 Tier, 1 st Floor, 2 nd Floor, and 3 rd Floor	>10 years
AC-26	1 st Floor Children's Area	10 years
AC-27	1 st Floor Children's Area	10 years
AC-28	1 st Floor Children's Area	10 years
Rare Books	Rare Books Room	>10 years
Admin Fan Coils	Administrative Offices	>10 years

Heating Systems

The building is currently heated with steam purchased from We Energies. Steam serves preheat coils on fans and room radiation throughout the building. In many cases the steam radiation is controlled by a separate pneumatic thermostat, and it was described that the perimeter radiation and the overhead air system will buck each other. It was mentioned that there was a steam trap survey done for the entire building over the past year, and the staff has been repairing steam traps in house that have been problematic. The steam condensate returned from the heating system to the basement is typically between 140°F or hotter, and is dumped into the sewer. There is a possibility that some of this heat could be recovered for heating domestic water or room radiant heating.

Cooling Systems

The building is served by a water-cooled Trane and York chiller and an air-cooled rooftop York chiller. Currently, the Trane chiller is considered the best chiller in house and is used most of the time. The York chiller is approximately 25 years old and has had maintenance problems with leaks.

Controls

The control system is a Johnson Controls Metasys system. Most of the controls on the fans are still pneumatic with a DDC interface. Many of the fan systems have the original pneumatic actuation for dampers and valves. The controls hardware in the chiller room and other select areas are currently being converted to the latest Metasys extended architecture. The Libraries have service agreements in place with Johnson Controls for controls, fire and security.

Lighting Equipment

The majority of the lighting throughout the building is a combination of T8 or T12 fluorescent lamps. There are a few select areas that have LED upgrades. There are no occupancy controls or light level sensors. Lights are primarily controlled by Library employees switching circuits on and off within breaker panel.

The following table describes the existing lighting equipment within the Milwaukee Central Public Library and Bayview Public Library premises.

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	FT8 - T8 Linear Fluorescent	20	112
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	FT8 - T8 Linear Fluorescent	8	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	CF - Compact Fluorescent	20	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	FT8 - T8 Linear Fluorescent	4	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	FT8 - T8 Linear Fluorescent	105	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	CF - Compact Fluorescent	693	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T101	ECF - Exit Sign	3	3
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T-105	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T-103	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T-104	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	T-102	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	c310	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	c310	CF - Compact Fluorescent	14	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	c310	ECF - Exit Sign	1	12
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	SR 3	CF - Compact Fluorescent	2	23
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	SR 3	CF - Compact Fluorescent	4	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	SR 3	CF - Compact Fluorescent	7	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	SR 3	FT8 - T8 Linear Fluorescent	2	58

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	SR 3	CF - Compact Fluorescent	2	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	95-ELEV	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	S7	CF - Compact Fluorescent	14	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	S5	CF - Compact Fluorescent	14	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	S3	CF - Compact Fluorescent	14	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T1	S4	CF - Compact Fluorescent	14	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	FT8 - T8 Linear Fluorescent	43	112
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	FT8 - T8 Linear Fluorescent	14	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	FT8 - T8 Linear Fluorescent	105	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	CF - Compact Fluorescent	1253	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	CF - Compact Fluorescent	17	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-201	ECF - Exit Sign	3	3
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-202	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-203	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T2	T-204	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	25	112
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	9	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	CF - Compact Fluorescent	11	13

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	CF - Compact Fluorescent	970	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	I Standard Incandescent	10	60
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	100	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	6	112
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	10	112
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	5	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	40	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	ECF - Exit Sign	3	3
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	20	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T301	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	ELEV MACHINE M	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T304	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T303	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T306	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	T302	I Standard Incandescent	1	60

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SBC 301	CF - Compact Fluorescent	5	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SBC 301	CF - Compact Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-C1	FT8 - T8 Linear Fluorescent	13	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-C1	FT8 - T8 Linear Fluorescent	11	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-C1	CF - Compact Fluorescent	1	31
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-C1	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-1	LED	1	6
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-1	CF - Compact Fluorescent	5	42
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-1 IN UNIT	I Standard Incandescent	4	60
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB1 T2	CF - Compact Fluorescent	3	42
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-0005	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-0005	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-0005	CF - Compact Fluorescent	14	42
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-0005	CF - Compact Fluorescent	2	85
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-0006	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-0006	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-70	CF - Compact Fluorescent	5	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-70	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-8-tunnel	LED	1	6

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-8-tunnel	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-8-tunnel	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-9	I Standard Incandescent	2	150
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-7A	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	SB-11	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	B-T3	V4	I Standard Incandescent	2	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	ELEV-E5	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	T4	ELEV-E5	FT8 - T8 Linear Fluorescent	2	24
ECM-12a-MCL	Central Library-Interior Lighting	T4	T408	FT8 - T8 Linear Fluorescent	4	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	T408	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	T408	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	T4	T48A	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	T408B	LED	1	22
ECM-12a-MCL	Central Library-Interior Lighting	T4	T408B	LED	1	22
ECM-12a-MCL	Central Library-Interior Lighting	T4	GARAGE	LED	18	24
ECM-12a-MCL	Central Library-Interior Lighting	T4	GARAGE	FT8 - T8 Linear Fluorescent	3	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	GARAGE	FT8 - T8 Linear Fluorescent	4	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	T425	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	T411	FT8 - T8 Linear Fluorescent	3	112

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	MENS	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	T403	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	T403	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	T404	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	T405	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	T402	LED	13	22
ECM-12a-MCL	Central Library-Interior Lighting	T4	T402	LED	1	15
ECM-12a-MCL	Central Library-Interior Lighting	T4	T402	V Vending Machine	2	400
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC3	CF - Compact Fluorescent	4	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	T402	CF - Compact Fluorescent	1	31
ECM-12a-MCL	Central Library-New Ceiling Construction	T4	SOUND RM	LED	11	6
ECM-12a-MCL	Central Library-New Ceiling Construction	T4	LIBRARY BRAILLE RM	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-New Ceiling Construction	T4	LIBRARY BRAILLE RM	FT8 - T8 Linear Fluorescent	112	31
ECM-12a-MCL	Central Library-New Ceiling Construction	T4	LIBRARY BRAILLE RM	FT8 - T8 Linear Fluorescent	110	31
ECM-12a-MCL	Central Library-New Ceiling Construction	T4	LIBRARY BRAILLE RM	CF - Compact Fluorescent	10	35
ECM-12a-MCL	Central Library-New Ceiling Construction	T4	LIBRARY BRAILLE RM	FT8 - T8 Linear Fluorescent	3	170
ECM-12a-MCL	Central Library-Interior Lighting	T4	LIBRARY BRAILLE RM	ECF - Exit Sign	1	12

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	LIBRARY BRAILLE RM	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB3	FT8 - T8 Linear Fluorescent	7	61
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB3	FT8 - T8 Linear Fluorescent	4	61
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB3	FU - U-Tube Fluorescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB3	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB3	CF - Compact Fluorescent	1	32
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB3	CF - Compact Fluorescent	1	32
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB4	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB4	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB4	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	B44	CF - Compact Fluorescent	22	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B44	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	B59	CF - Compact Fluorescent	7	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B59	CF - Compact Fluorescent	4	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B59	CF - Compact Fluorescent	18	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B59	ECF - Exit Sign	3	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	V2	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB7	CF - Compact Fluorescent	4	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB7	CF - Compact Fluorescent	12	17

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB7	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	B57B	FT8 - T8 Linear Fluorescent	19	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B57	FT8 - T8 Linear Fluorescent	55	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B57	FT8 - T8 Linear Fluorescent	4	31
ECM-12a-MCL	Central Library-Interior Lighting	T4	B57	CF - Compact Fluorescent	4	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	LOCKED-IT	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B57A-LOCKED	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B56	FT12 - T12 and other Linear Fluorescent	1	144
ECM-12a-MCL	Central Library-Interior Lighting	T4	B73	FT8 - T8 Linear Fluorescent	3	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B73	CF - Compact Fluorescent	13	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B9	FT8 - T8 Linear Fluorescent	6	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B9	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B01	CF - Compact Fluorescent	3	42
ECM-12a-MCL	Central Library-Interior Lighting	T4	B8-LOCKED	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B7	FT8 - T8 Linear Fluorescent	17	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B7	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B6	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B19	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B28	CF - Compact Fluorescent	1	26

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	B15	FT8 - T8 Linear Fluorescent	19	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B15	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B15	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B15	LED	1	22
ECM-12a-MCL	Central Library-Interior Lighting	T4	B17	FT12 - T12 and other Linear Fluorescent	8	145
ECM-12a-MCL	Central Library-Interior Lighting	T4	B17	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B17	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B21	LED	5	9
ECM-12a-MCL	Central Library-Interior Lighting	T4	B21	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B36	FT12 - T12 and other Linear Fluorescent	6	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B23	FT12 - T12 and other Linear Fluorescent	82	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B13A	FT8 - T8 Linear Fluorescent	3	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B13	FU - U-Tube Fluorescent	15	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB5	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB5	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB5	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	B60A	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC2	CF - Compact Fluorescent	1	31

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC2	ECF - Exit Sign	1	12
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC2	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B60C	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC3	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC3	ECF - Exit Sign	1	12
ECM-12a-MCL	Central Library-Interior Lighting	T4	SC3	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	B60R	CF - Compact Fluorescent	2	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B60E	CF - Compact Fluorescent	2	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	STAGE	H - Halogen Incandescent	2	500
ECM-12a-MCL	Central Library-Interior Lighting	T4	AUD-B60	H - Halogen Incandescent	20	65
ECM-12a-MCL	Central Library-Interior Lighting	T4	AUD-B60	CF - Compact Fluorescent	6	104
ECM-12a-MCL	Central Library-Interior Lighting	T4	AUD-B60	H - Halogen Incandescent	14	150
ECM-12a-MCL	Central Library-Interior Lighting	T4	AUD-B60	0	5	0
ECM-12a-MCL	Central Library-Interior Lighting	T4	UNDER AUD	I Standard Incandescent	7	100
ECM-12a-MCL	Central Library-Interior Lighting	T4	B61	CF - Compact Fluorescent	4	39
ECM-12a-MCL	Central Library-Interior Lighting	T4	B61	LED	1	9
ECM-12a-MCL	Central Library-Interior Lighting	T4	B61	H - Halogen Incandescent	1	75
ECM-12a-MCL	Central Library-Interior Lighting	T4	B61	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B61 AT ELEV.	CF - Compact Fluorescent	1	17

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	B66	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B41 LOOS RM	CF - Compact Fluorescent	10	186
ECM-12a-MCL	Central Library-Interior Lighting	T4	B41 LOOS RM	LED	3	9
ECM-12a-MCL	Central Library-Interior Lighting	T4	B41 LOOS RM	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	T4	B41A	CF - Compact Fluorescent	1	27
ECM-12a-MCL	Central Library-Interior Lighting	T4	B48	CF - Compact Fluorescent	1	27
ECM-12a-MCL	Central Library-Interior Lighting	T4	B64	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B64	FT8 - T8 Linear Fluorescent	6	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	MEZZANINE LADIES	CF - Compact Fluorescent	1	27
ECM-12a-MCL	Central Library-Interior Lighting	T4	B62	FT12 - T12 and other Linear Fluorescent	10	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B62	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B78	FU - U-Tube Fluorescent	3	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B65	CF - Compact Fluorescent	4	52
ECM-12a-MCL	Central Library-Interior Lighting	T4	B65B	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	B5A	CF - Compact Fluorescent	1	27
ECM-12a-MCL	Central Library-Interior Lighting	T4	B42	I Standard Incandescent	2	100
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB2	CF - Compact Fluorescent	8	29
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB2	CF - Compact Fluorescent	5	32
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB2	ECF - Exit Sign	1	12

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB2	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58	FT8 - T8 Linear Fluorescent	16	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58	CF - Compact Fluorescent	3	29
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B56A	FT8 - T8 Linear Fluorescent	4	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B55	FT8 - T8 Linear Fluorescent	15	90
ECM-12a-MCL	Central Library-Interior Lighting	T4	B55	CF - Compact Fluorescent	2	51
ECM-12a-MCL	Central Library-Interior Lighting	T4	B55	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	T4	B55A	FT8 - T8 Linear Fluorescent	1	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58F	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58E	FT8 - T8 Linear Fluorescent	6	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58D	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58C	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58B	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B58A	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B53	FT8 - T8 Linear Fluorescent	3	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B54	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	T4	B52	CF - Compact Fluorescent	2	27

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	B52	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B52	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B49	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B49	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	B49A	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB 1-B	I Standard Incandescent	1	150
ECM-12a-MCL	Central Library-Interior Lighting	T4	B40	FU - U-Tube Fluorescent	16	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B40	FT8 - T8 Linear Fluorescent	3	33
ECM-12a-MCL	Central Library-Interior Lighting	T4	B40B	FU - U-Tube Fluorescent	1	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B40C	I Standard Incandescent	2	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	PIPE CHASE	I Standard Incandescent	2	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	B40A	FU - U-Tube Fluorescent	1	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B39	FT8 - T8 Linear Fluorescent	11	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB 1-A	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	B32	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B33B	FU - U-Tube Fluorescent	7	72
ECM-12a-MCL	Central Library-Interior Lighting	T4	B33B	FT8 - T8 Linear Fluorescent	10	33
ECM-12a-MCL	Central Library-Interior Lighting	T4	B33A	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	T4	B33B	CF - Compact Fluorescent	2	26

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	T4	BOOK STORAGE	FT8 - T8 Linear Fluorescent	18	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	BOOK STORAGE	FT8 - T8 Linear Fluorescent	3	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B29	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B29	FT8 - T8 Linear Fluorescent	3	170
ECM-12a-MCL	Central Library-Interior Lighting	T4	B38	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	T4	B26	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	T4	B24	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	T4	B24	FT12 - T12 and other Linear Fluorescent	1	115
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB1	CF - Compact Fluorescent	13	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB1	CF - Compact Fluorescent	2	17
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB1	CF - Compact Fluorescent	4	13
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB1	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	T4	CB1	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	1	LIBRAIN OFFICE	FT8 - T8 Linear Fluorescent	2	112
ECM-12a-MCL	Central Library-Interior Lighting	1	OPEN OFFICE	FT8 - T8 Linear Fluorescent	2	112
ECM-12a-MCL	Central Library-Interior Lighting	1	PRIVATE OFFICE	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	1	LIBRAIN OFFICE	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	1	102B	H - Halogen Incandescent	1	65
ECM-12a-MCL	Central Library-Interior Lighting	1	102A	CF - Compact Fluorescent	1	13

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	LOBBY-100	MH Metal Halide Fixtures	5	295
ECM-12a-MCL	Central Library-Interior Lighting	1	LOBBY-100	CF - Compact Fluorescent	4	93
ECM-12a-MCL	Central Library-Interior Lighting	1	LOBBY-100	0	3	0
ECM-12a-MCL	Central Library-Interior Lighting	1	102	MH Metal Halide Fixtures	18	295
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	4	65
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	1	130
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	6	51
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	2	87
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	14	51
ECM-12a-MCL	Central Library-Interior Lighting	1	102	MH Metal Halide Fixtures	5	95
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	6	51
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	3	32
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	1	32
ECM-12a-MCL	Central Library-Interior Lighting	1	102	FT8 - T8 Linear Fluorescent	15	31
ECM-12a-MCL	Central Library-Interior Lighting	1	102	MH Metal Halide Fixtures	10	183
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	4	35
ECM-12a-MCL	Central Library-Interior Lighting	1	102	CF - Compact Fluorescent	4	93
ECM-12a-MCL	Central Library-Interior Lighting	1	103	CF - Compact Fluorescent	27	51
ECM-12a-MCL	Central Library-Interior Lighting	1	103	FT8 - T8 Linear Fluorescent	8	112

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	103	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	103	LED	4	9
ECM-12a-MCL	Central Library-Interior Lighting	1	103	LED	6	6
ECM-12a-MCL	Central Library-Interior Lighting	1	103	CF - Compact Fluorescent	2	38
ECM-12a-MCL	Central Library-Interior Lighting	1	103	CF - Compact Fluorescent	1	38
ECM-12a-MCL	Central Library-Interior Lighting	1	103	LED	4	6
ECM-12a-MCL	Central Library-Interior Lighting	1	C103	FT8 - T8 Linear Fluorescent	26	58
ECM-12a-MCL	Central Library-Interior Lighting	1	C103	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	MEDIA 160	FT8 - T8 Linear Fluorescent	22	112
ECM-12a-MCL	Central Library-Interior Lighting	1	MEDIA 160	CF - Compact Fluorescent	6	38
ECM-12a-MCL	Central Library-Interior Lighting	1	161	FT8 - T8 Linear Fluorescent	18	112
ECM-12a-MCL	Central Library-Interior Lighting	1	161	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	167	CF - Compact Fluorescent	5	13
ECM-12a-MCL	Central Library-New Ceiling Construction	1	162	FT8 - T8 Linear Fluorescent	16	58
ECM-12a-MCL	Central Library-New Ceiling Construction	1	168	FT8 - T8 Linear Fluorescent	12	112
ECM-12a-MCL	Central Library-New Ceiling Construction	1	164	FT8 - T8 Linear Fluorescent	28	58
ECM-12a-MCL	Central Library-Interior Lighting	1	161	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-New Ceiling Construction	1	166	FT8 - T8 Linear Fluorescent	42	58

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	161	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-New Ceiling Construction	1	166B	FT8 - T8 Linear Fluorescent	2	90
ECM-12a-MCL	Central Library-New Ceiling Construction	1	166C	FT8 - T8 Linear Fluorescent	2	90
ECM-12a-MCL	Central Library-New Ceiling Construction	1	165	FT8 - T8 Linear Fluorescent	12	112
ECM-12a-MCL	Central Library-Interior Lighting	1	111	FT8 - T8 Linear Fluorescent	9	112
ECM-12a-MCL	Central Library-Interior Lighting	1	111	CF - Compact Fluorescent	11	38
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	FT8 - T8 Linear Fluorescent	291	58
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	FT8 - T8 Linear Fluorescent	16	58
ECM-12a-MCL	Central Library-Interior Lighting	1	101	LED	1	85
ECM-12a-MCL	Central Library-Interior Lighting	1	101	MH Metal Halide Fixtures	9	295
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	6	87
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	5	32
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	19	38
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	FT8 - T8 Linear Fluorescent	311	31
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	FT8 - T8 Linear Fluorescent	10	31

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	2	13
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	4	13
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	FT8 - T8 Linear Fluorescent	6	170
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	32	13
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	FT8 - T8 Linear Fluorescent	206	58
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	7	13
ECM-12a-MCL	Central Library-New Ceiling Construction	1	101	CF - Compact Fluorescent	4	38
ECM-12a-MCL	Central Library-Interior Lighting	1	101	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	1	101	ECF - Exit Sign	4	20
ECM-12a-MCL	Central Library-Interior Lighting	1	109	FT8 - T8 Linear Fluorescent	15	58
ECM-12a-MCL	Central Library-Interior Lighting	1	104	FT8 - T8 Linear Fluorescent	8	89
ECM-12a-MCL	Central Library-Interior Lighting	1	104	H - Halogen Incandescent	8	75
ECM-12a-MCL	Central Library-Interior Lighting	1	105	FT8 - T8 Linear Fluorescent	4	58
ECM-12a-MCL	Central Library-Interior Lighting	1	106	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	1	117	FT8 - T8 Linear Fluorescent	16	112
ECM-12a-MCL	Central Library-Interior Lighting	1	117	FT8 - T8 Linear Fluorescent	45	58

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	117	FT8 - T8 Linear Fluorescent	9	89
ECM-12a-MCL	Central Library-Interior Lighting	1	117	ECF - Exit Sign	1	12
ECM-12a-MCL	Central Library-Interior Lighting	1	124	FT8 - T8 Linear Fluorescent	12	89
ECM-12a-MCL	Central Library-Interior Lighting	1	118	FT8 - T8 Linear Fluorescent	9	58
ECM-12a-MCL	Central Library-Interior Lighting	1	118	LED	1	22
ECM-12a-MCL	Central Library-Interior Lighting	1	118	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	121	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	1	120	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	1	119	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	1	181	FT8 - T8 Linear Fluorescent	120	31
ECM-12a-MCL	Central Library-Interior Lighting	1	181	FT8 - T8 Linear Fluorescent	48	31
ECM-12a-MCL	Central Library-Interior Lighting	1	181	FT8 - T8 Linear Fluorescent	53	31
ECM-12a-MCL	Central Library-Interior Lighting	1	181	CF - Compact Fluorescent	9	29
ECM-12a-MCL	Central Library-Interior Lighting	1	181	H - Halogen Incandescent	8	50
ECM-12a-MCL	Central Library-Interior Lighting	1	181	LED	48	6
ECM-12a-MCL	Central Library-Interior Lighting	1	181	CF - Compact Fluorescent	25	46
ECM-12a-MCL	Central Library-Interior Lighting	1	181	CF - Compact Fluorescent	10	46
ECM-12a-MCL	Central Library-Interior Lighting	1	181	LED	6	6
ECM-12a-MCL	Central Library-Interior Lighting	1	181	LED	2	6

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	181	CF - Compact Fluorescent	16	558
ECM-12a-MCL	Central Library-Interior Lighting	1	181	CF - Compact Fluorescent	5	93
ECM-12a-MCL	Central Library-Interior Lighting	1	181	H - Halogen Incandescent	38	50
ECM-12a-MCL	Central Library-Interior Lighting	1	181	CF - Compact Fluorescent	10	26
ECM-12a-MCL	Central Library-Interior Lighting	1	181	FT8 - T8 Linear Fluorescent	16	112
ECM-12a-MCL	Central Library-Interior Lighting	1	181	LED	13	9
ECM-12a-MCL	Central Library-Interior Lighting	1	181	H - Halogen Incandescent	4	50
ECM-12a-MCL	Central Library-Interior Lighting	1	181	H - Halogen Incandescent	6	50
ECM-12a-MCL	Central Library-Interior Lighting	1	181	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	1	181	H - Halogen Incandescent	4	50
ECM-12a-MCL	Central Library-Interior Lighting	1	184	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	1	185	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	1	170	CF - Compact Fluorescent	4	35
ECM-12a-MCL	Central Library-Interior Lighting	1	170	LED	1	96
ECM-12a-MCL	Central Library-Interior Lighting	1	170	H - Halogen Incandescent	12	50
ECM-12a-MCL	Central Library-Interior Lighting	1	170	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	RESTROOM HALL	LED	2	6
ECM-12a-MCL	Central Library-Interior Lighting	1	RESTROOM HALL	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	1	181M	FT8 - T8 Linear Fluorescent	4	58

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	181W	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	1	182	H - Halogen Incandescent	8	75
ECM-12a-MCL	Central Library-Interior Lighting	1	182	LED	7	6
ECM-12a-MCL	Central Library-Interior Lighting	1	182A	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	1	134B	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	1	134B	FT12 - T12 and other Linear Fluorescent	4	72
ECM-12a-MCL	Central Library-Interior Lighting	1	100B	CF - Compact Fluorescent	3	32
ECM-12a-MCL	Central Library-Interior Lighting	1	100N	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	1	100N	CF - Compact Fluorescent	1	32
ECM-12a-MCL	Central Library-Interior Lighting	1	100N	LED	1	22
ECM-12a-MCL	Central Library-Interior Lighting	1	100W	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	1	100W	CF - Compact Fluorescent	1	32
ECM-12a-MCL	Central Library-Interior Lighting	1	100W	LED	1	22
ECM-12a-MCL	Central Library-Interior Lighting	1	135	FT8 - T8 Linear Fluorescent	15	116
ECM-12a-MCL	Central Library-Interior Lighting	1	100A	FT12 - T12 and other Linear Fluorescent	2	72
ECM-12a-MCL	Central Library-Interior Lighting	1	100B	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	1	C138	CF - Compact Fluorescent	4	65
ECM-12a-MCL	Central Library-Interior Lighting	1	C138	ECF - Exit Sign	1	20

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	C138	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	1	C138-DISPLAY	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	1	C138	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	1	137	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	1	137	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	1	137C	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	1	137A	CF - Compact Fluorescent	2	27
ECM-12a-MCL	Central Library-Interior Lighting	1	138-BOOK STORE	CF - Compact Fluorescent	9	13
ECM-12a-MCL	Central Library-Interior Lighting	1	138-BOOK STORE	FT8 - T8 Linear Fluorescent	30	58
ECM-12a-MCL	Central Library-Interior Lighting	1	138-BOOK STORE	H - Halogen Incandescent	15	75
ECM-12a-MCL	Central Library-Interior Lighting	1	138-BOOK STORE	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	1	141	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	1	141	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	141	FT12 - T12 and other Linear Fluorescent	1	144
ECM-12a-MCL	Central Library-Interior Lighting	1	144	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	1	143	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	1	140A	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	1	145	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	1	140	FT8 - T8 Linear Fluorescent	2	112

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	141	CF - Compact Fluorescent	7	13
ECM-12a-MCL	Central Library-Interior Lighting	1		CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	1	142	FT12 - T12 and other Linear Fluorescent	2	144
ECM-12a-MCL	Central Library-Interior Lighting	1	142	CF - Compact Fluorescent	3	13
ECM-12a-MCL	Central Library-Interior Lighting	1	142A	CF - Compact Fluorescent	2	13
ECM-12a-MCL	Central Library-Interior Lighting	1	149	I Standard Incandescent	1	100
ECM-12a-MCL	Central Library-Interior Lighting	1	149	I Standard Incandescent	2	120
ECM-12a-MCL	Central Library-Interior Lighting	1	149A	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-New Ceiling Construction	1	153	I Standard Incandescent	7	150
ECM-12a-MCL	Central Library-New Ceiling Construction	1	153	FT8 - T8 Linear Fluorescent	36	58
ECM-12a-MCL	Central Library-New Ceiling Construction	1	153	I Standard Incandescent	169	60
ECM-12a-MCL	Central Library-New Ceiling Construction	1	153	FT12 - T12 and other Linear Fluorescent	98	85
ECM-12a-MCL	Central Library-Interior Lighting	1	C100	CF - Compact Fluorescent	4	130
ECM-12a-MCL	Central Library-Interior Lighting	1	V1	CF - Compact Fluorescent	3	26
ECM-12a-MCL	Central Library-Interior Lighting	1	134A	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	1	134A	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	1	134A	FT8 - T8 Linear Fluorescent	2	112

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	134B	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	1	134	FT8 - T8 Linear Fluorescent	15	89
ECM-12a-MCL	Central Library-Interior Lighting	1	134	FT8 - T8 Linear Fluorescent	2	112
ECM-12a-MCL	Central Library-Interior Lighting	1	134	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	1	133A	FT12 - T12 and other Linear Fluorescent	1	72
ECM-12a-MCL	Central Library-Interior Lighting	1	132A-PIPE CHASE	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	1	C180	CF - Compact Fluorescent	1	78
ECM-12a-MCL	Central Library-Interior Lighting	1	C180	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	1	C180	I Standard Incandescent	2	120
ECM-12a-MCL	Central Library-Interior Lighting	1	180	H - Halogen Incandescent	19	75
ECM-12a-MCL	Central Library-Interior Lighting	1	180	H - Halogen Incandescent	12	50
ECM-12a-MCL	Central Library-Interior Lighting	1	180	H - Halogen Incandescent	5	75
ECM-12a-MCL	Central Library-Interior Lighting	1	180	LED	1	9
ECM-12a-MCL	Central Library-Interior Lighting	1	180	CF - Compact Fluorescent	3	26
ECM-12a-MCL	Central Library-Interior Lighting	1	180	H - Halogen Incandescent	6	50
ECM-12a-MCL	Central Library-Interior Lighting	1	180	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	1	180A	FT8 - T8 Linear Fluorescent	1	89
ECM-12a-MCL	Central Library-Interior Lighting	1	C101	CF - Compact Fluorescent	3	170
ECM-12a-MCL	Central Library-Interior Lighting	1	C101	LED	9	9

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	1	C101	CF - Compact Fluorescent	3	170
ECM-12a-MCL	Central Library-Interior Lighting	1	C101	CF - Compact Fluorescent	3	26
ECM-12a-MCL	Central Library-Interior Lighting	1	C101	CF - Compact Fluorescent	5	29
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	8	26
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	ECF - Exit Sign	4	12
ECM-12a-MCL	Central Library-Interior Lighting	2	WOMENS	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	2	WOMENS	FT8 - T8 Linear Fluorescent	4	31
ECM-12a-MCL	Central Library-Interior Lighting	2	MENS	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	2	MENS	FT8 - T8 Linear Fluorescent	3	31
ECM-12a-MCL	Central Library-Interior Lighting	2	UTILITY CLOSET	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	2	BREAK RM	FT8 - T8 Linear Fluorescent	24	112
ECM-12a-MCL	Central Library-Interior Lighting	2	BREAK RM	V Vending Machine	1	400
ECM-12a-MCL	Central Library-Interior Lighting	2	BREAK RM	V Vending Machine	1	180
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE RM	FT8 - T8 Linear Fluorescent	34	58
ECM-12a-MCL	Central Library-New Ceiling Construction	2	FILE RM	FT8 - T8 Linear Fluorescent	128	89
ECM-12a-MCL	Central Library-New Ceiling Construction	2	FILE RM	FC Circline Fluorescent	2	25
ECM-12a-MCL	Central Library-New Ceiling Construction	2	FILE RM	FT8 - T8 Linear Fluorescent	1	31
ECM-12a-MCL	Central Library-Interior Lighting	2	STORAGE	CF - Compact Fluorescent	2	26

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE RM	FT8 - T8 Linear Fluorescent	20	112
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE RM	FT12 - T12 and other Linear Fluorescent	15	144
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE RM	FT12 - T12 and other Linear Fluorescent	35	43
ECM-12a-MCL	Central Library-Interior Lighting	2	ROTONDA	CF - Compact Fluorescent	3	91
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	3	13
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	2	65
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	I Standard Incandescent	1	100
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	1	78
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	1	91
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	3	13
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	2	65
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	2	78
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	1	91
ECM-12a-MCL	Central Library-Interior Lighting	2	ROHTONDIA	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	2	Elev. at stairs in main lib.	FT8 - T8 Linear Fluorescent	4	31
ECM-12a-MCL	Central Library-Interior Lighting	2	Elev. at stairs in main lib.	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	H - Halogen Incandescent	6	260

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	10	35
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL DISPLAY	LED	10	9
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	LED	8	6
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	ECF - Exit Sign	2	20
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	LED	6	9
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	LED	4	6
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	LED	8	6
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	LED	3	9
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	H - Halogen Incandescent	7	260
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	CF - Compact Fluorescent	4	156
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	AT STAIRS	FT8 - T8 Linear Fluorescent	48	58
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	FT8 - T8 Linear Fluorescent	40	58
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	2	51
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL DISPLAY	LED	5	9
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	15	13
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	7	35
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	ECF - Exit Sign	1	20

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	FT8 - T8 Linear Fluorescent	12	58
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	LED	6	9
ECM-12a-MCL	Central Library-Interior Lighting	2	MENS HALL	CF - Compact Fluorescent	1	35
ECM-12a-MCL	Central Library-Interior Lighting	2	MENS	CF - Compact Fluorescent	2	51
ECM-12a-MCL	Central Library-Interior Lighting	2	MENS	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	2	WOMENS HALL	CF - Compact Fluorescent	1	35
ECM-12a-MCL	Central Library-Interior Lighting	2	WOMENS	CF - Compact Fluorescent	2	51
ECM-12a-MCL	Central Library-Interior Lighting	2	WOMENS	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	2	LIB	CF - Compact Fluorescent	10	255
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	FT8 - T8 Linear Fluorescent	48	58
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	FT8 - T8 Linear Fluorescent	307	58
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	CF - Compact Fluorescent	8	26
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	CF - Compact Fluorescent	12	13
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	FT8 - T8 Linear Fluorescent	430	31
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	FT8 - T8 Linear Fluorescent	3	31

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	CF - Compact Fluorescent	52	46
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	LIB	ECF - Exit Sign	6	20
ECM-12a-MCL	Central Library-New Ceiling Construction	2	LIB	CF - Compact Fluorescent	2	42
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	CF - Compact Fluorescent	10	186
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	FT8 - T8 Linear Fluorescent	21	170
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	FT8 - T8 Linear Fluorescent	12	112
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	CF - Compact Fluorescent	6	31
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	CF - Compact Fluorescent	30	17
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	CF - Compact Fluorescent	10	186
ECM-12a-MCL	Central Library-Interior Lighting	2	RECP area	CF - Compact Fluorescent	23	51
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	CF - Compact Fluorescent	9	51
ECM-12a-MCL	Central Library-Interior Lighting	2	humanities rm	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	ME CLOSET	CF - Compact Fluorescent	1	51
ECM-12a-MCL	Central Library-Interior Lighting	2	ARCHIVE READING RM	FT8 - T8 Linear Fluorescent	10	89
ECM-12a-MCL	Central Library-Interior Lighting	2	ARCHIVE READING RM	FT8 - T8 Linear Fluorescent	2	89

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	TECH CONFERENCE RM-KIRKELAS RM	FT8 - T8 Linear Fluorescent	6	58
ECM-12a-MCL	Central Library-Interior Lighting	2	TECH CONFERENCE RM-KIRKELAS RM	CF - Compact Fluorescent	4	35
ECM-12a-MCL	Central Library-Interior Lighting	2	ELEC RM	FT12 - T12 and other Linear Fluorescent	2	72
ECM-12a-MCL	Central Library-Interior Lighting	2	OPEN OFFICE-	FT8 - T8 Linear Fluorescent	19	89
ECM-12a-MCL	Central Library-Interior Lighting	2	OPEN OFFICE-	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	2	OPEN OFFICE-	CF - Compact Fluorescent	1	35
ECM-12a-MCL	Central Library-Interior Lighting	2	OPEN OFFICE-	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	STAF RESTROOM	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	STAF RESTROOM	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	STAF RESTROOM	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	STAF RESTROOM	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	UTLITY RM	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE AND RECP. AREA	FT8 - T8 Linear Fluorescent	18	89
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE AND RECP. AREA	FT8 - T8 Linear Fluorescent	3	89
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE AND RECP. AREA	FT8 - T8 Linear Fluorescent	1	33
ECM-12a-MCL	Central Library-Interior Lighting	2	FILE AND RECP. AREA	CF - Compact Fluorescent	7	35
ECM-12a-MCL	Central Library-Interior Lighting	2	IT RM	CF - Compact Fluorescent	1	26

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	COMPUTER RM	FT8 - T8 Linear Fluorescent	10	170
ECM-12a-MCL	Central Library-Interior Lighting	2	BREAK RM	FT8 - T8 Linear Fluorescent	6	58
ECM-12a-MCL	Central Library-Interior Lighting	2	STORAGE	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	STORAGE	FT8 - T8 Linear Fluorescent	2	90
ECM-12a-MCL	Central Library-Interior Lighting	2	ELEC RM	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	LIBRAIN OFFICE	FT8 - T8 Linear Fluorescent	1	89
ECM-12a-MCL	Central Library-Interior Lighting	2	LIBRAIN OFFICE	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2	LIBRAIN OFFICE	FT8 - T8 Linear Fluorescent	6	89
ECM-12a-MCL	Central Library-Interior Lighting	2	LIBRAIN OFFICE	FT8 - T8 Linear Fluorescent	7	58
ECM-12a-MCL	Central Library-Interior Lighting	2	MEETING RM	FT8 - T8 Linear Fluorescent	4	89
ECM-12a-MCL	Central Library-Interior Lighting	2	MEETING RM	FT8 - T8 Linear Fluorescent	1	170
ECM-12a-MCL	Central Library-Interior Lighting	2	MIRCOFORMS	FT8 - T8 Linear Fluorescent	12	170
ECM-12a-MCL	Central Library-Interior Lighting	2	ELEV LOBBY	CF - Compact Fluorescent	1	186
ECM-12a-MCL	Central Library-Interior Lighting	2	ELEV LOBBY	CF - Compact Fluorescent	4	46
ECM-12a-MCL	Central Library-Interior Lighting	2	UTLITY	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	H - Halogen Incandescent	10	50
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	LED	12	9
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	4	13

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	CF - Compact Fluorescent	42	17
ECM-12a-MCL	Central Library-Interior Lighting	2	ART REC. RM.	CF - Compact Fluorescent	10	156
ECM-12a-MCL	Central Library-Interior Lighting	2	ART REC. RM.	CF - Compact Fluorescent	5	26
ECM-12a-MCL	Central Library-Interior Lighting	2	ART REC. RM.	FT8 - T8 Linear Fluorescent	104	31
ECM-12a-MCL	Central Library-Interior Lighting	2	ART REC. RM.	LED	26	6
ECM-12a-MCL	Central Library-Interior Lighting	2	ART REC. RM.	CF - Compact Fluorescent	12	51
ECM-12a-MCL	Central Library-Interior Lighting	2	ART REC. RM.	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	OPEN OFFICE	FT8 - T8 Linear Fluorescent	6	89
ECM-12a-MCL	Central Library-Interior Lighting	2	PRIVATE OFFICE	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	2	211	CF - Compact Fluorescent	8	156
ECM-12a-MCL	Central Library-Interior Lighting	2	211	CF - Compact Fluorescent	5	26
ECM-12a-MCL	Central Library-Interior Lighting	2	211	FT8 - T8 Linear Fluorescent	78	31
ECM-12a-MCL	Central Library-Interior Lighting	2	211	LED	20	6
ECM-12a-MCL	Central Library-Interior Lighting	2	211	FT8 - T8 Linear Fluorescent	16	254
ECM-12a-MCL	Central Library-Interior Lighting	2	211	FT8 - T8 Linear Fluorescent	2	254
ECM-12a-MCL	Central Library-Interior Lighting	2	211	FT8 - T8 Linear Fluorescent	4	254
ECM-12a-MCL	Central Library-Interior Lighting	2	211	FT8 - T8 Linear Fluorescent	1	170
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	FT8 - T8 Linear Fluorescent	4	58
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	FT8 - T8 Linear Fluorescent	2	58

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	STORAGE	FT8 - T8 Linear Fluorescent	8	254
ECM-12a-MCL	Central Library-Interior Lighting	2	TEL RM	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	CF - Compact Fluorescent	32	46
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	LED	6	44
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	CF - Compact Fluorescent	187	13
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	LED	18	9
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	CF - Compact Fluorescent	8	46
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	FC Circline Fluorescent	11	25
ECM-12a-MCL	Central Library-Interior Lighting	2	Rare books	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	2	HALL	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	2	SC1	CF - Compact Fluorescent	1	52
ECM-12a-MCL	Central Library-Interior Lighting	2	SC1	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	2.5	MECH RM	FT12 - T12 and other Linear Fluorescent	6	72
ECM-12a-MCL	Central Library-Interior Lighting	2.5	MECH RM	FT12 - T12 and other Linear Fluorescent	1	72
ECM-12a-MCL	Central Library-Interior Lighting	2.5	storage	FT12 - T12 and other Linear Fluorescent	6	144
ECM-12a-MCL	Central Library-Interior Lighting	2.5	DUMB Waiter mech. rm	I Standard Incandescent	1	100

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	3	370B	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	3	370	CF - Compact Fluorescent	5	26
ECM-12a-MCL	Central Library-Interior Lighting	3	C 380	LED	13	22
ECM-12a-MCL	Central Library-Interior Lighting	3	C 380	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	3	380	CF - Compact Fluorescent	3	13
ECM-12a-MCL	Central Library-Interior Lighting	3	380	LED	9	66
ECM-12a-MCL	Central Library-Interior Lighting	3	380	LED	9	22
ECM-12a-MCL	Central Library-Interior Lighting	3	380	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	3	386	FT8 - T8 Linear Fluorescent	14	116
ECM-12a-MCL	Central Library-Interior Lighting	3	DIRECTOR	FT8 - T8 Linear Fluorescent	8	116
ECM-12a-MCL	Central Library-Interior Lighting	3	PROJECT MANGER	FT8 - T8 Linear Fluorescent	4	112
ECM-12a-MCL	Central Library-Interior Lighting	3	379	FT8 - T8 Linear Fluorescent	2	112
ECM-12a-MCL	Central Library-Interior Lighting	3	378	FT8 - T8 Linear Fluorescent	4	116
ECM-12a-MCL	Central Library-Interior Lighting	3	377	FT8 - T8 Linear Fluorescent	4	116
ECM-12a-MCL	Central Library-Interior Lighting	3	376	FT8 - T8 Linear Fluorescent	4	116
ECM-12a-MCL	Central Library-Interior Lighting	3	375	FT8 - T8 Linear Fluorescent	2	112
ECM-12a-MCL	Central Library-Interior Lighting	3	380R	FT8 - T8 Linear Fluorescent	4	112
ECM-12a-MCL	Central Library-Interior Lighting	3	PATRICIA SWANSON	FT8 - T8 Linear Fluorescent	2	112
ECM-12a-MCL	Central Library-Interior Lighting	3	CAHILL	FT8 - T8 Linear Fluorescent	4	112

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	3	MURPHY	FT8 - T8 Linear Fluorescent	4	112
ECM-12a-MCL	Central Library-Interior Lighting	3	CONFERENCE RM 383	LED	4	22
ECM-12a-MCL	Central Library-Interior Lighting	3	IT RM-locked	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	3	381 W	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	3	381 W	FT8 - T8 Linear Fluorescent	4	58
ECM-12a-MCL	Central Library-Interior Lighting	3	380PC	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	3	381-M	FT8 - T8 Linear Fluorescent	6	58
ECM-12a-MCL	Central Library-Interior Lighting	3	381 B	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	3	Elev big	FT8 - T8 Linear Fluorescent	10	31
ECM-12a-MCL	Central Library-Interior Lighting	3	Small elev	FT8 - T8 Linear Fluorescent	4	31
ECM-12a-MCL	Central Library-Interior Lighting	3	380 T	CF - Compact Fluorescent	3	13
ECM-12a-MCL	Central Library-Interior Lighting	3	380 T	CF - Compact Fluorescent	2	26
ECM-12a-MCL	Central Library-Interior Lighting	3	380 T	LED	14	42
ECM-12a-MCL	Central Library-Interior Lighting	3	SCHACHERER	LED	1	42
ECM-12a-MCL	Central Library-Interior Lighting	3	MEYER	LED	4	22
ECM-12a-MCL	Central Library-Interior Lighting	3	380X	LED	1	42
ECM-12a-MCL	Central Library-Interior Lighting	3	373	LED	2	66
ECM-12a-MCL	Central Library-Interior Lighting	3	373	LED	4	42
ECM-12a-MCL	Central Library-Interior Lighting	3	373	ECF - Exit Sign	1	3

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	3	371	LED	2	22
ECM-12a-MCL	Central Library-Interior Lighting	3	372	LED	4	22
ECM-12a-MCL	Central Library-Interior Lighting	3	C 322	CF - Compact Fluorescent	6	13
ECM-12a-MCL	Central Library-Interior Lighting	3		ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	3	C300	CF - Compact Fluorescent	5	52
ECM-12a-MCL	Central Library-Interior Lighting	3	C300	FT12 - T12 and other Linear Fluorescent	4	145
ECM-12a-MCL	Central Library-Interior Lighting	3	C300	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	3	C300	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	3	300-ROTONDA	LED	120	6
ECM-12a-MCL	Central Library-Interior Lighting	3	300-ROTONDA	MH Metal Halide Fixtures	1	458
ECM-12a-MCL	Central Library-Interior Lighting	3	300SR	CF - Compact Fluorescent	6	27
ECM-12a-MCL	Central Library-Interior Lighting	3	300SR	I Standard Incandescent	5	60
ECM-12a-MCL	Central Library-Interior Lighting	3	ELEV RM	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	3	ELEV RM	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	3	AC RM 318	CF - Compact Fluorescent	9	42
ECM-12a-MCL	Central Library-Interior Lighting	3	AC RM 318	FT12 - T12 and other Linear Fluorescent	1	145
ECM-12a-MCL	Central Library-Interior Lighting	3	AC RM 318	I Standard Incandescent	1	150
ECM-12a-MCL	Central Library-Interior Lighting	3	AIR HANDLER	CF - Compact Fluorescent	6	42

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	3	HALL	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	3	HALL	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	3	HALL	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	3	HALL	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	3	HALL	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-New Ceiling Construction	3	324	FT8 - T8 Linear Fluorescent	7	58
ECM-12a-MCL	Central Library-New Ceiling Construction	3	324	FT8 - T8 Linear Fluorescent	125	58
ECM-12a-MCL	Central Library-New Ceiling Construction	3	324	FT8 - T8 Linear Fluorescent	5	33
ECM-12a-MCL	Central Library-Interior Lighting	3	324	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	3	325 W	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	3	325 M	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	3	AC RM	FT8 - T8 Linear Fluorescent	5	58
ECM-12a-MCL	Central Library-Interior Lighting	3	AC RM IN UNITS	I Standard Incandescent	2	75
ECM-12a-MCL	Central Library-Interior Lighting	3	328	FT8 - T8 Linear Fluorescent	5	89
ECM-12a-MCL	Central Library-Interior Lighting	3	328-IN UNITS	CF - Compact Fluorescent	2	13
ECM-12a-MCL	Central Library-Interior Lighting	3	325	FT8 - T8 Linear Fluorescent	11	89
ECM-12a-MCL	Central Library-Interior Lighting	3	325	FT8 - T8 Linear Fluorescent	1	89
ECM-12a-MCL	Central Library-Interior Lighting	3	325	ECF - Exit Sign	1	20

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-New Ceiling Construction	3	329	FT8 - T8 Linear Fluorescent	7	58
ECM-12a-MCL	Central Library-New Ceiling Construction	3	329	FT8 - T8 Linear Fluorescent	101	58
ECM-12a-MCL	Central Library-Interior Lighting	3	329	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	3	330	FT8 - T8 Linear Fluorescent	24	89
ECM-12a-MCL	Central Library-Interior Lighting	3	330	FT8 - T8 Linear Fluorescent	2	89
ECM-12a-MCL	Central Library-Interior Lighting	3	330	FT8 - T8 Linear Fluorescent	1	33
ECM-12a-MCL	Central Library-Interior Lighting	3	330	ECF - Exit Sign	2	12
ECM-12a-MCL	Central Library-Interior Lighting	3	330A	FT8 - T8 Linear Fluorescent	3	89
ECM-12a-MCL	Central Library-Interior Lighting	3	312	LED	57	24
ECM-12a-MCL	Central Library-Interior Lighting	3	312	LED	3	24
ECM-12a-MCL	Central Library-Interior Lighting	3	312	ECF - Exit Sign	2	3
ECM-12a-MCL	Central Library-Interior Lighting	3	312 A	I Standard Incandescent	3	60
ECM-12a-MCL	Central Library-Interior Lighting	3	312 C	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	3	C 312	FT8 - T8 Linear Fluorescent	2	58
ECM-12a-MCL	Central Library-Interior Lighting	3	301	FT8 - T8 Linear Fluorescent	21	112
ECM-12a-MCL	Central Library-Interior Lighting	3	301	ECF - Exit Sign	4	3
ECM-12a-MCL	Central Library-Interior Lighting	3	301	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	3	301	LED	2	18

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	3	301	LED	12	6
ECM-12a-MCL	Central Library-Interior Lighting	3	301	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	3	301	LED	1	18
ECM-12a-MCL	Central Library-Interior Lighting	3	303	FT8 - T8 Linear Fluorescent	4	58
ECM-12a-MCL	Central Library-Interior Lighting	3	OFFICE	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	3	E4 ELEV	FT12 - T12 and other Linear Fluorescent	4	46
ECM-12a-MCL	Central Library-Interior Lighting	3	E4 ELEV	FT12 - T12 and other Linear Fluorescent	2	50
ECM-12a-MCL	Central Library-Interior Lighting	3	OPEN OFFICE	FT8 - T8 Linear Fluorescent	12	58
ECM-12a-MCL	Central Library-Interior Lighting	3	OPEN OFFICE	ECF - Exit Sign	1	3
ECM-12a-MCL	Central Library-Interior Lighting	3	322-PC	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	3	C 302	FT12 - T12 and other Linear Fluorescent	5	145
ECM-12a-MCL	Central Library-Interior Lighting	3	C 302	ECF - Exit Sign	1	12
ECM-12a-MCL	Central Library-Interior Lighting	3	316	FT8 - T8 Linear Fluorescent	7	33
ECM-12a-MCL	Central Library-Interior Lighting	3	316	FU - U-Tube Fluorescent	3	72
ECM-12a-MCL	Central Library-Interior Lighting	3	316 B	FT8 - T8 Linear Fluorescent	1	33
ECM-12a-MCL	Central Library-Interior Lighting	3	316 A	I Standard Incandescent	1	60
ECM-12a-MCL	Central Library-Interior Lighting	3	315 A	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	3	315 B	CF - Compact Fluorescent	1	42

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	3	315	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	3	308	FT8 - T8 Linear Fluorescent	23	58
ECM-12a-MCL	Central Library-Interior Lighting	3	308	FT8 - T8 Linear Fluorescent	1	58
ECM-12a-MCL	Central Library-Interior Lighting	3	308	V Vending Machine	1	400
ECM-12a-MCL	Central Library-Interior Lighting	3	308	V Vending Machine	1	180
ECM-12a-MCL	Central Library-Interior Lighting	3	308A	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	3	311	FT8 - T8 Linear Fluorescent	23	89
ECM-12a-MCL	Central Library-Interior Lighting	3	311B	FT8 - T8 Linear Fluorescent	3	89
ECM-12a-MCL	Central Library-Interior Lighting	3	311 A	FT8 - T8 Linear Fluorescent	3	89
ECM-12a-MCL	Central Library-Interior Lighting	3	302	FT8 - T8 Linear Fluorescent	15	112
ECM-12a-MCL	Central Library-Interior Lighting	3	302A	FT8 - T8 Linear Fluorescent	1	112
ECM-12a-MCL	Central Library-Interior Lighting	3	S1	CF - Compact Fluorescent	7	13
ECM-12a-MCL	Central Library-Interior Lighting	3	S1 - Stairs	CF - Compact Fluorescent	4	17
ECM-12a-MCL	Central Library-Interior Lighting	3.5	AIR HAndler	FT12 - T12 and other Linear Fluorescent	5	72
ECM-12a-MCL	Central Library-Interior Lighting	4	400 D	FT12 - T12 and other Linear Fluorescent	2	72
ECM-12a-MCL	Central Library-Interior Lighting	4	400	FT12 - T12 and other Linear Fluorescent	12	145
ECM-12a-MCL	Central Library-Interior Lighting	4	400 A ROOM AT ELEV	FT8 - T8 Linear Fluorescent	3	58
ECM-12a-MCL	Central Library-Interior Lighting	4	400 A ROOM AT ELEV	FT8 - T8 Linear Fluorescent	1	58

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	4	400 A ROOM AT ELEV	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	4	405 TAXIDERMY	CF - Compact Fluorescent	5	42
ECM-12a-MCL	Central Library-Interior Lighting	4	405 TAXIDERMY	CF - Compact Fluorescent	2	42
ECM-12a-MCL	Central Library-Interior Lighting	4	500 ELEV MACHINE RM	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	4	500 ELEV MACHINE RM	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	4	HALL	FT8 - T8 Linear Fluorescent	12	58
ECM-12a-MCL	Central Library-Interior Lighting	4	HALL	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	4	406	CF - Compact Fluorescent	4	42
ECM-12a-MCL	Central Library-Interior Lighting	4	407	CF - Compact Fluorescent	4	26
ECM-12a-MCL	Central Library-Interior Lighting	4	409	CF - Compact Fluorescent	5	42
ECM-12a-MCL	Central Library-Interior Lighting	4	420 MEN	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	4	OLD UT	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	4	422 MEN	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	4	422 MEN	ECF - Exit Sign	1	20
ECM-12a-MCL	Central Library-Interior Lighting	4	416	FT12 - T12 and other Linear Fluorescent	21	145
ECM-12a-MCL	Central Library-Interior Lighting	4	416	CF - Compact Fluorescent	1	18
ECM-12a-MCL	Central Library-Interior Lighting	4	415	FT12 - T12 and other Linear Fluorescent	2	72
ECM-12a-MCL	Central Library-Interior Lighting	4	415	ECF - Exit Sign	1	20

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	4	414	FT12 - T12 and other Linear Fluorescent	12	145
ECM-12a-MCL	Central Library-Interior Lighting	4	411	FT12 - T12 and other Linear Fluorescent	6	72
ECM-12a-MCL	Central Library-Interior Lighting	4	408-locked	FT12 - T12 and other Linear Fluorescent	12	145
ECM-12a-MCL	Central Library-Interior Lighting	4	404	FT12 - T12 and other Linear Fluorescent	6	72
ECM-12a-MCL	Central Library-Interior Lighting	4	404A	FT12 - T12 and other Linear Fluorescent	1	72
ECM-12a-MCL	Central Library-Interior Lighting	4	404B	FT12 - T12 and other Linear Fluorescent	4	72
ECM-12a-MCL	Central Library-Interior Lighting	4	404D	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	4	402	CF - Compact Fluorescent	1	26
ECM-12a-MCL	Central Library-Interior Lighting	4	403	I Standard Incandescent	4	60
ECM-12a-MCL	Central Library-Interior Lighting	4	403 A RESTROOM HALL	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	4	403 B RESTROOM	CF - Compact Fluorescent	1	42
ECM-12a-MCL	Central Library-Interior Lighting	4	403 B RESTROOM	CF - Compact Fluorescent	1	13
ECM-12a-MCL	Central Library-Interior Lighting	4	401 STORAGE	CF - Compact Fluorescent	4	26
ECM-12a-MCL	Central Library-Interior Lighting	4	2ND ELEV MACHINE RM	FT12 - T12 and other Linear Fluorescent	2	72
ECM-12a-MCL	Central Library-Interior Lighting	5	500 ELEV MACHINE RM	FT8 - T8 Linear Fluorescent	7	58
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E3	FT8 - T8 Linear Fluorescent	2	31

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E3	FT8 - T8 Linear Fluorescent	2	24
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E5	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E5	FT8 - T8 Linear Fluorescent	2	24
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E7	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E7	FT8 - T8 Linear Fluorescent	2	24
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV-E8	FT8 - T8 Linear Fluorescent	2	31
ECM-12a-MCL	Central Library-Interior Lighting	ELEV	ELEV	FT8 - T8 Linear Fluorescent	2	24
ECM-12b-MCL	Central Library-Exterior Lighting	3	EXTERIOR DOOR	MV Mercury Vapor	1	205
ECM-12b-MCL	Central Library-Exterior Lighting	E	Front	CF - Compact Fluorescent	2	104
ECM-12b-MCL	Central Library-Exterior Lighting	E	Left	LED	2	24
ECM-12b-MCL	Central Library-Exterior Lighting	E	Left	LED	27	26
ECM-12b-MCL	Central Library-Exterior Lighting	E	Back	LED	16	26
ECM-12b-MCL	Central Library-Exterior Lighting	E	Back	CF - Compact Fluorescent	3	13
ECM-12b-MCL	Central Library-Exterior Lighting	E	Back	CF - Compact Fluorescent	2	13
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	LED	8	24
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	LED	27	26

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	LED	2	24
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	CF - Compact Fluorescent	2	26
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	H - Halogen Incandescent	1	150
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	LED	2	24
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	CF - Compact Fluorescent	2	13
ECM-12b-MCL	Central Library-Exterior Lighting	E	right	LED	1	24
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	B	Boiler Room	FT8 - T8 Linear Fluorescent	3	112
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Storage	FT8 - T8 Linear Fluorescent	1	112
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Hallway	FT8 - T8 Linear Fluorescent	2	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Meeting Room	CF - Compact Fluorescent	11	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Meeting Room	I Standard Incandescent	13	150
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Storage	FT8 - T8 Linear Fluorescent	1	112
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Kitchen	FT8 - T8 Linear Fluorescent	2	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Break Room	CF - Compact Fluorescent	4	85

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Custodian	FT8 - T8 Linear Fluorescent	2	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Storage	FT8 - T8 Linear Fluorescent	1	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Custodian	I Standard Incandescent	1	150
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Restroom	FT8 - T8 Linear Fluorescent	1	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Hallway	FT8 - T8 Linear Fluorescent	2	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	STORAGE	FT8 - T8 Linear Fluorescent	1	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	OFFICE	CF - Compact Fluorescent	9	85
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	OFFICE	CF - Compact Fluorescent	3	31
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	JOB CENTER	CF - Compact Fluorescent	4	85
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	JOB CENTER	CF - Compact Fluorescent	4	85
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Manager Office	CF - Compact Fluorescent	2	85
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	DVD	CF - Compact Fluorescent	9	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	DVD	MH Metal Halide Fixtures	3	916
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	FT8 - T8 Linear Fluorescent	3	89

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	FT8 - T8 Linear Fluorescent	6	89
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	FT8 - T8 Linear Fluorescent	8	89
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	CF - Compact Fluorescent	2	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	CF - Compact Fluorescent	8	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	CF - Compact Fluorescent	7	31
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	FU - U-Tube Fluorescent	3	81
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	FT8 - T8 Linear Fluorescent	4	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Children's Area	FT8 - T8 Linear Fluorescent	2	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Fiction	FT8 - T8 Linear Fluorescent	36	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Fiction	FT8 - T8 Linear Fluorescent	12	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Fiction	CF - Compact Fluorescent	4	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Fiction	CF - Compact Fluorescent	1	31
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Library Main Space	MH Metal Halide Fixtures	9	916
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Library Main Space	MH Metal Halide Fixtures	9	916

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Library Main Space	LED	1	168
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Library Cards	CF - Compact Fluorescent	5	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Library Cards	ECF - Exit Sign	1	4
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Entry	MH Metal Halide Fixtures	1	916
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Entry	MH Metal Halide Fixtures	1	916
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Entry	CF - Compact Fluorescent	2	51
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Entry Showcase	H - Halogen Incandescent	2	50
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Women's	CF - Compact Fluorescent	3	31
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Women's	FT8 - T8 Linear Fluorescent	3	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Men's	CF - Compact Fluorescent	3	31
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Men's	FT8 - T8 Linear Fluorescent	3	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Stairwell	FT12 - T12 and other Linear Fluorescent	2	72
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Mech. Room	FT12 - T12 and other Linear Fluorescent	6	72
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Electrical Room	FT12 - T12 and other Linear Fluorescent	1	72

ECM	Facility Name	Floor	Room #	Existing Technology	Existing Fix Qty	Exist System Wattage
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Electrical Room	FT8 - T8 Linear Fluorescent	1	58
ECM-4a-BVL	Bay View Branch Library-Interior Lighting	1	Lawn Storage	FT12 - T12 and other Linear Fluorescent	2	72
ECM-4a-BVL	Bay View Branch Library-Interior Lighting		Programming Tool		2	0
ECM-4b-BVL	Bay View Branch Library-Exterior Lighting	E	Rear entry door	LED	2	44
ECM-4b-BVL	Bay View Branch Library-Exterior Lighting	E	North Side	LED	3	44
ECM-4b-BVL	Bay View Branch Library-Exterior Lighting	E	East Side	LED	3	44
ECM-4b-BVL	Bay View Branch Library-Exterior Lighting	E	Front Entrance	MH Metal Halide Fixtures	1	916
ECM-4b-BVL	Bay View Branch Library-Exterior Lighting	E	Parking Lot	LED	2	155

Schedule N: Methods of Savings Measurement and Verification

The following is a brief overview of the measurement and verification methodologies applicable to the Improvement Measures set forth below. JCI shall apply these methodologies, as more fully detailed in the guidelines and standards of the International Measurement and Verification Protocol (IPMVP) and/or the Federal Energy Management Program (FEMP), in connection with the provision of M&V Services hereunder.

Measured Project Benefits Summary

The information in this section summarizes the estimated Measured Project Benefits. The calculation of the Measured Project Benefits is based on the energy consumption and demand savings projected for each measure individually, but are not individually guaranteed and are not individually severable. All values reported below are estimated for Year 1 of the Project Benefits Term.

		Energy						Total Annual Utility Savings	
		Electric Consumption		Natural Gas		Steam			
		kWh	kBtu	therm	kBtu	klbs	kBtu	kBtu (site)	kBtu (source)
ECM-1-MCL	Dollars	\$ 21,817		\$ -		\$ -		\$ 21,817	
	Units	108,110.00	368,871.32	-	-	-	-	368,871.32	1,032,839.70
ECM-3-MCL	Dollars	\$ 5,014		\$ -		\$ 6,245		\$ 11,259	
	Units	31,255.00	106,642.06	-	-	558.00	666,252.00	772,894.06	1,098,100.17
ECM-12a-MCL	Dollars	\$ 60,895		\$ -		\$ -		\$ 60,895	
	Units	541,972.00	1,849,208.46	-	-	-	-	1,849,208.46	5,177,783.70
ECM-12b-MCL	Dollars	\$ 109		\$ -		\$ -		\$ 109	
	Units	1,767.00	6,029.00	-	-	-	-	6,029.00	16,881.21
ECM-12c-MCL	Dollars	\$ -		\$ -		\$ -		\$ -	
	Units	-	-	-	-	-	-	-	-
ECM-4a-BVL	Dollars	\$ 7,312		\$ -		\$ -		\$ 7,312	
	Units	68,656.00	234,254.27	-	-	-	-	234,254.27	655,911.96
ECM-4b-BVL	Dollars	\$ 238		\$ -		\$ -		\$ 238	
	Units	2,537.00	8,656.24	-	-	-	-	8,656.24	24,237.48
Total All ECMs	Dollars	\$ 90,371		\$ -		\$ 6,245		\$ 101,630	
	Units	754,297.00	2,573,661.36	-	-	558.00	666,252.00	3,239,913.36	8,005,754.22

The calculated benefits are based on the following conversion factors as well as the agreed upon utility rates described in this Schedule 2. This table is provided for information only and is not guaranteed. Note that the conversion from kBtu (site) to kBtu (source) is subject to update by the U.S. Environmental Protection Agency on an annual basis.

Fuel	Base Units	Conversion factor to kBtu	Conversion from kBtu (site) to kBtu (source)
Electricity (Grid)	kWh	3.412	2.80
Electricity (On-site Renewable)	kWh	3.412	1.00
Natural Gas	Therm	100	1.05
District Steam	kLbs	1,194	1.20

General M&V Methods

The following is a brief overview of the measurement and verification methodologies applicable to the Improvement Measures set forth below. JCI shall apply these methodologies, as more fully detailed in the guidelines and standards of the International Measurement and Verification Protocol (IPMVP) and/or the Federal Energy Management Program (FEMP), in connection with the provision of M&V Services hereunder.

The following table summarizes the M&V method applied by ECM.

Facility	ECM Number	ECM Name	M&V Method	
			Year 1-3	Year 4+
Central Library	ECM-1-MCL	Central Library Replace and Upgrade Chilled Water Plant with Mag-Lev Chiller	Option C	None
	ECM-3-MCL	Central Library Convert Existing AC-7 from CAV to DOAS	Option C	None
	ECM-12a-MCL	Central Library Interior Lighting Retrofits	Option C	None
	ECM-12b-MCL	Central Library Exterior Lighting Retrofits	Option C	None
	ECM-12c-MCL	Central Library Lighting Control Panel Upgrades	Option C	None
Bayview Library	ECM-4a-BVL	Bayview Library Interior Lighting Retrofits	Option A	None
	ECM-4b-BVL	Bayview Library Exterior Lighting Retrofits	Option A	None

Option A: Partially Measured Retrofit Isolation

Measured Project Benefits are determined by partial field measurement of the energy use of the system(s) to which an Improvement Measure was applied separate from the energy use of the rest of the facility. Measurements will be short-term with only one-time measurements before and after the Installation Period.

Partial measurement means that some but not all parameters will be measured. Careful review of the design and installation of Improvement Measures is intended to demonstrate that the stipulated values fairly represent the probable actual values. Agreed-upon values will be shown in the measurement and verification plan, along with analysis of the significance of the error they may introduce. Engineering

calculations using short-term pre and post-retrofit measurements and stipulations are used to calculate Measured Project Benefits for the duration of the Guarantee Term.

Measured Project Benefits from the following Improvement Measures will be calculated using Option A:

ECM Number	ECM Name
ECM-4a-BVL	Bayview Library Interior Lighting Retrofits
ECM-4b-BVL	Bayview Library Exterior Lighting Retrofits

Lighting Improvements – ECM 4a-BVL, & 4b-BVL

The savings for this ECM are generated through a reduction in energy used by the lighting system; therefore the measurement boundary is the lighting system itself.

The existing power draw will be measured using a true RMS meter. The pre and post sample plan will adhere to the 80/20 guidelines. Fixtures with similar lamps and ballasts, counts and types, will be grouped together with a lamp/ballast code. Measured wattages will be used where collected. In some situations, such as when a certain type of lighting fixture is not available by itself on a switch, typical wattages as published by ANSI (American National Standards Institute) will be used. These values will be measured only once prior to retrofit.

Expected Pre Retrofit Sample Plan

Pre-Construction Component Code	Pre-Construction Population	Existing System kW	Projected kWh Savings	Percentage of Connected Load	Percentage of Saving Contribution	Population Sample Size for Coefficient of Variation: 0.5	Minimum Required Fixture Samples
2X32T8EBN	2290	132.82	98,165.6	24%	15%	11	11
4X32T8EBN	397	44.46	69,082.0	8%	11%	11	11
3X32T8EBN	563	50.11	65,345.0	9%	10%	11	11
1X13CFLSI	3453	44.89	61,349.2	8%	9%	11	11
2X400MH	24	21.98	45,937.9	4%	7%	8	8
1X32T8EBN	1752	54.31	39,606.1	10%	6%	11	11
1X250MH	42	12.39	21,908.1	2%	3%	9	9
12X42CFL4P	16	8.93	21,226.8	2%	3%	7	7
2X34T12MB	160	11.52	18,579.3	2%	3%	11	11
2X60T12HOMB	75	10.88	18,173.7	2%	3%	10	10
1X50HAL	106	5.30	12,391.4	1%	2%	10	10
9X32T8EBN3	30	7.62	10,877.1	1%	2%	9	9
4X42CFL4P	31	5.77	10,778.7	1%	2%	9	9
6X32T8EBN2	57	9.69	10,340.7	2%	2%	10	10
1X75HAL	56	4.20	10,193.0	1%	2%	10	10
4X65HAL	13	3.38	10,060.6	1%	2%	6	6
4X32T8EBN2	60	6.96	8,595.2	1%	1%	10	10
1X26CFLSI	131	3.41	7,591.8	1%	1%	11	11

Pre-Construction Component Code	Pre-Construction Population	Existing System kW	Projected kWh Savings	Percentage of Connected Load	Percentage of Saving Contribution	Population Sample Size for Coefficient of Variation: 0.5	Minimum Required Fixture Samples
1X150HAL	22	3.30	7,549.4	1%	1%	8	8
4X34T12MB2	25	3.60	6,312.8	1%	1%	8	8
1X60INCA	211	12.66	6,243.3	2%	1%	11	11

Expected Post Retrofit Sample Plan

Post-Construction Component Code	Post-Construction Population	Proposed System kW	Projected kWh Savings	Percentage of Connected Load	Percentage of Savings Contribution	Population Sample Size for Coefficient of Variation: 0.5	Minimum Required Fixture Samples
4XLEDT4FT-DR-STD	522	27.14	98,615.4	8%	15%	11	11
2XLEDT4FT-DR-STD	871	22.65	87,682.4	7%	13%	11	11
1X6LEDSI	3502	21.01	76,100.0	6%	12%	11	11
1X319LEDF-UP	25	7.98	45,474.1	2%	7%	8	8
3XLEDT4FT-DR-STD	312	12.17	45,387.4	4%	7%	11	11
2XLEDT4FT-HO-DR-STD	320	10.56	25,249.6	3%	4%	11	11
1X37LEDF-RETRO	155	5.74	25,179.7	2%	4%	11	11
1XLEDT4FT-DR-STD	381	4.95	23,985.4	2%	4%	11	11
12X8.5LED4P	16	2.02	21,226.8	1%	3%	7	7
1XLEDT4FT-HO-DR-STD	434	7.38	19,784.5	2%	3%	11	11
1X9LEDSI	200	1.80	19,362.8	1%	3%	11	11
1X45LED HID	23	1.04	18,867.5	0%	3%	8	8
1X6 LED-MR16	96	0.58	12,391.4	0%	2%	10	10
9XLEDT4FT-DR-STD	30	4.32	10,877.1	1%	2%	9	9
1X25LEDF-6RC	176	4.58	10,876.8	1%	2%	11	11
4X8.5LED4P	31	1.30	10,778.7	0%	2%	9	9
1X17LED PAR38	49	0.83	10,711.9	0%	2%	9	9

The lighting system annual run hours by space type are agreed to be as shown in Schedule I.

Equations for Calculating Lighting Retrofit Savings (Option A)

Demand (kW)

$$\text{Connected kW Saving} = \sum_u [(\text{kW/Fixture}_{\text{baseline}} \times \text{Quantity}_{\text{baseline}} - \text{kW/Fixture}_{\text{post}} \times \text{Quantity}_{\text{post}})]_{t,u}$$

where:

$\text{kW/fixture}_{\text{baseline}}$ = lighting baseline demand per fixture for usage group u

$\text{kW/fixture}_{\text{post}}$ = lighting demand per fixture during post-installation period for usage group

$\text{Quantity}_{\text{baseline}}$ = quantity of affected fixtures before the lighting retrofit for usage group u

$\text{Quantity}_{\text{post}}$ = quantity of affected fixtures after the lighting retrofit for usage group u

Examples of usage groups include hallways and offices.

Energy (kWh)

$$\text{kWh Savings}_{\text{Lighting}} = \sum_u [\text{Connected kW Savings}_u \times \text{Hours of Operation}]_{t,u}$$

where:

kW Savings_u = kilowatt savings realized during the post-installation time for usage group u

$\text{Hours of Operation}$ = number of operating hours during the time period t for the usage group u

Option B: Retrofit Isolation

Measured Project Benefits are determined by field measurement of the energy use of the systems to which an Improvement Measure was applied separate from the energy use of the rest of the facility. Short-term, long-term or continuous measurements are taken throughout the pre and post-retrofit periods. Engineering calculations using short term, long-term or continuous pre and post-retrofit measurements are used to calculate the Measured Project Benefits for the duration of the Guarantee Term.

Measured Project Benefits from the following Improvement Measures will be calculated using Option B:

ECM Number	ECM Name
None	None

Option C: Whole Facility

Option C involves use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of Improvement Measure, but not individually if more than one is applied to an energy meter. This option determines the collective Measured Project Benefits of all Improvement Measures applied to the part of the facility monitored by the energy meter. Also, since whole building meters are used, Measured Project Benefits reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Measured Project Benefits from the following Improvement Measures will be calculated using Option C:

ECM Number	ECM Name
ECM-1-MCL	Central Library Replace and Upgrade Chilled Water Plant with Mag-Lev Chiller
ECM-3-MCL	Central Library Convert Existing AC-7 from CAV to DOAS
ECM-12a-MCL	Central Library Interior Lighting Retrofits
ECM-12b-MCL	Central Library Exterior Lighting Retrofits
ECM-12c-MCL	Central Library Lighting Control Panel Upgrades

Savings will be proved by using Metrix Utility Accounting System. An example M&V report demonstrating how Metrix Utility Accounting System is used to determine savings is included as Attachment 7. This example report is provided for information purposes only. All M&V reports for this project will reflect the scope of work and performance of the project and facilities described in Schedule 1 and this Schedule 2. Additionally, the results will be inputted into Energy Star Portfolio Manager.

Option D: Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use. Such simulation model must be “calibrated” so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year.

Option D may be used to assess the performance of all Improvement Measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation tool in Option D allow estimates of the Measured Project Benefits attributable to each Improvement Measure within a multiple Improvement Measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Options A and B. In this case, the system’s energy use must be isolated from that of the rest of the facility by appropriate meters.

Measured Project Benefits from the following Improvement Measures will be calculated using Option D:

ECM Number	ECM Name
None	None

Schedule O: Systems Startup and Commissioning of ECM

The proposed ECMs will undergo third-party commissioning through a provider identified and contracted by JCI from a list of customer-approved providers. The Customer representative(s) may participate in any or all scope identified below. Commissioning will include the following:

Third-party Commissioning Agent Scope

- Attend one (1) pre-construction meeting to review commissioning requirements with all involved subcontractors.
- Provide commissioning specifications for HVAC equipment, lighting, and controls to be commissioned.
- Attend two (2) commissioning meetings during the project duration.
- Verify installation of all ECMs was complete as per scope
 - Check approved HVAC equipment, lighting, and controls were installed
 - Confirm completion of HVAC equipment start-up and confirm burn-in of lighting (lamps and ballasts) for 100 hours; identify any problems
 - Verify lighting luminaire aiming and complete a visual inspection for lighting operating problems
- Complete on-site Functional Performance Testing for HVAC equipment, lighting, and controls being commissioned. Sampling rates, if applied, will be consistent with industry standard statistical sampling approaches.
 - Functional Performance Testing for HVAC equipment and HVAC controls will include exercising the equipment through the sequence of operation and verifying correct response and performance.
 - Functional Performance Testing for lighting and lighting controls will include:
 - Measuring light levels
 - Operational tie in check with new BAS controls or local switching and system on/off scheduling
 - Operation check related to occupancy sensors, daylight harvesting, dimming sequence
- Provide functional performance testing documentation and a Final Commissioning Report.

Schedule P: Alternative Dispute Resolution Procedures

JCI and Customer will attempt to settle any controversy, dispute, difference, or claim between them concerning the performance, enforcement, or interpretation of the Agreement (collectively, "Dispute") through direct discussion in good faith, but if unsuccessful, will submit any Dispute to non-binding mediation in the nearest major metropolitan area of the state where the project is performed. If the parties are unable to agree on a mediator or a date for mediation, either party may request JAMS, Inc. to appoint a mediator and designate the time and procedure for mediation. Such mediator shall be knowledgeable, to each party's reasonable satisfaction, with respect to matters concerning construction law. Neither JCI nor Customer will file a lawsuit against the other until not less than sixty (60) days after the mediation referred to herein has occurred, unless one or both parties is genuinely and reasonably concerned that any applicable statute of limitations is on the verge of expiring. JCI AND CUSTOMER HEREBY WAIVE THEIR RESPECTIVE RIGHTS TO A JURY TRIAL AS TO ANY CLAIM OR CAUSE OF ACTION BASED UPON, ARISING OUT OF OR DIRECTLY OR INDIRECTLY RELATED TO THIS AGREEMENT, INCLUDING CONTRACT, TORT AND STATUTORY CLAIMS, AND EACH OF THE PARTIES HERETO ACKNOWLEDGES THAT THIS WAIVER IS A MATERIAL INDUCEMENT TO ENTER INTO A BUSINESS RELATIONSHIP, THAT EACH HAS RELIED ON THIS WAIVER IN ENTERING INTO THIS AGREEMENT, AND THAT EACH WILL CONTINUE TO RELY ON THIS WAIVER IN THEIR RELATED FUTURE DEALINGS UNDER THIS AGREEMENT.

Schedule Q: Insurance and Bonds

JCI shall maintain insurance in amounts no less than those set forth below in full force and effect at all times until the Work has been completed, and shall provide a certificate evidencing such coverage promptly following Customer's request therefor.

COVERAGES	LIMITS OF LIABILITY
Workmen's Compensation Insurance or self-insurance, including Employer's Liability	Statutory
Commercial General Liability Insurance	\$5,000,000 Per Occurrence \$5,000,000 Aggregate
Comprehensive Automobile Liability Insurance	\$5,000,000 Combined Single Limit

The above limits may be obtained through primary and excess policies, and may be subject to self-insured retentions.

Customer shall be responsible for obtaining builder's risk insurance coverage for the Improvement Measures and shall at all times be responsible for any loss or casualty to the Improvement Measures. Customer shall also maintain insurance coverage, of the types and in the amounts customary for the conduct of its business, throughout the term of the Agreement.

Schedule R: Warranties

JCI will perform the Work in a professional, workman-like manner. JCI will promptly re-perform any non-conforming Work for no charge, as long as Customer provides written notice to JCI within one (1) year following Substantial Completion or such other period identified in the Agreement. If JCI installs or furnishes goods or equipment under the Agreement, and such goods or equipment are covered by an end-user warranty from their manufacturer, JCI will transfer the benefits of such warranty to Customer. The foregoing remedy with respect to the Work, together with any remedy provided by goods or equipment manufacturers, shall be Customer's sole and exclusive remedies for warranty claims. Customer agrees that the one (1) year period following Substantial Completion, or such other period identified in the Agreement, shall be a reasonable time for purposes of submitting valid warranty claims with respect to the Work. These exclusive remedies shall not have failed of their essential purpose so long as JCI transfers the benefits of any goods or equipment end-user warranty to Customer and remains willing to re-perform any non-conforming Work for no charge within the one (1) year period described above or such other period identified in the Agreement. NO OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE PROVIDED BY JCI. This warranty does not extend to any Work that has been abused, altered, or misused, or repaired by Customer or third parties without the supervision or prior written approval of JCI. Except with respect to goods or equipment manufactured by JCI and furnished to Customer hereunder, for which JCI shall provide its express written manufacturer's warranty, JCI shall not be considered a merchant or vendor of goods or equipment.

Schedule S: Proposed Final Project Costs and Final Project Cash Flow Analysis

		Measured Savings		Non-Measured (Agreed Upon)			Total Savings	Loan Payment	Performance Management	Balance
		Utility Savings	Total	Operational Savings	Rebate (Not Guaranteed)	Total				
Construction Years	Year 0	\$ 4,059	\$ 4,059	\$ -	\$ -	\$ -	\$ 4,059	\$ -	\$ -	\$ 4,059
	Year 1	\$ 101,633	\$ 101,633	\$ 21,893	\$ 33,253	\$ 55,146	\$ 156,779	\$ 121,215	\$ 35,564	\$ -
Performance Years	Year 2	\$ 104,428	\$ 104,428	\$ 22,331	\$ -	\$ 22,331	\$ 126,759	\$ 90,484	\$ 36,275	\$ -
	Year 3	\$ 107,299	\$ 107,299	\$ 22,777	\$ -	\$ 22,777	\$ 130,077	\$ 93,077	\$ 37,000	\$ -
	Year 4	\$ 110,250	\$ 110,250	\$ 23,233	\$ -	\$ 23,233	\$ 133,483	\$ 133,483	\$ -	\$ -
	Year 5	\$ 113,282	\$ 113,282	\$ 23,698	\$ -	\$ 23,698	\$ 136,980	\$ 136,980	\$ -	\$ -
	Year 6	\$ 116,397	\$ 116,397	\$ 24,172	\$ -	\$ 24,172	\$ 140,569	\$ 140,569	\$ -	\$ -
	Year 7	\$ 119,598	\$ 119,598	\$ 24,655	\$ -	\$ 24,655	\$ 144,253	\$ 144,253	\$ -	\$ -
	Year 8	\$ 122,887	\$ 122,887	\$ 25,148	\$ -	\$ 25,148	\$ 148,035	\$ 148,035	\$ -	\$ -
	Year 9	\$ 126,267	\$ 126,267	\$ 25,651	\$ -	\$ 25,651	\$ 151,918	\$ 151,918	\$ -	\$ -
	Year 10	\$ 129,739	\$ 129,739	\$ 26,164	\$ -	\$ 26,164	\$ 155,903	\$ 155,903	\$ -	\$ -
	Year 11	\$ 133,307	\$ 133,307	\$ 26,687	\$ -	\$ 26,687	\$ 159,994	\$ 159,994	\$ -	\$ -
	Year 12	\$ 136,973	\$ 136,973	\$ 27,221	\$ -	\$ 27,221	\$ 164,194	\$ 164,194	\$ -	\$ -
	Year 13	\$ 140,739	\$ 140,739	\$ 27,766	\$ -	\$ 27,766	\$ 168,505	\$ 168,505	\$ -	\$ -
	Year 14	\$ 144,610	\$ 144,610	\$ 28,321	\$ -	\$ 28,321	\$ 172,931	\$ 172,931	\$ -	\$ -
	Year 15	\$ 148,587	\$ 148,587	\$ 28,887	\$ -	\$ 28,887	\$ 177,474	\$ 177,474	\$ -	\$ -
	Year 16	\$ 152,673	\$ 152,673	\$ 29,465	\$ -	\$ 29,465	\$ 182,138	\$ 182,138	\$ -	\$ -
	Year 17	\$ 156,871	\$ 156,871	\$ 30,054	\$ -	\$ 30,054	\$ 186,926	\$ 186,926	\$ -	\$ -
	Year 18	\$ 161,185	\$ 161,185	\$ 30,655	\$ -	\$ 30,655	\$ 191,841	\$ 191,489	\$ -	\$ 352
	Year 19	\$ 165,618	\$ 165,618	\$ 31,269	\$ -	\$ 31,269	\$ 196,886	\$ 191,489	\$ -	\$ 5,397
	Year 20	\$ 170,172	\$ 170,172	\$ 31,894	\$ -	\$ 31,894	\$ 202,066	\$ 191,489	\$ -	\$ 10,577
Total		\$2,666,575	\$2,666,575	\$ 531,942	\$ 33,253	\$565,195	\$ 3,231,770	\$ 3,102,545	\$ 108,839	\$ 20,386
Price		\$2,441,402								
Energy Escalation		2.75%								
TELP Interest Rate		3.90%								
Proposed Capital		\$ 430,000								

Revision Date: 1/16/2019

Milwaukee Public Library

Investment Grade Audit Report, Volume 2

#MPL-18-006



2019



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Disclaimer

The information contained with this Investment Grade Audit report has been prepared in accordance with the requirements of Contract #MPL-18-006 Investment Grade Energy Audit of Milwaukee Public Library Facilities and Systems. All content within this report is current as of the date of revision noted on the report; however, for the purposes of a Guaranteed Energy Savings contract based on the results of this report, the terms, conditions, and content of the GES contract shall supersede this report.

Revision Date: 1/16/2019

Executive Summary

As described in the proposal, the following energy conservation measures (ECMs) were investigated during the Investment Grade Audit. The investigation followed industry-standard ASHRAE auditing methodologies as described in ASHRAE Procedures for Commercial Building Energy Audits.

Our audit consists of two distinct phases – the preliminary walk-through and the detailed audit (IGA), which included utility and building surveys, and development of a baseline building simulation module. This in-depth level of analysis ensures that the Library's facilities will benefit from the most comprehensive conservation program possible.

Central Library

- Replace and upgrade chilled water plant
- Consolidate and convert existing ACs 1-3 from constant air volume (CAV) to variable air volume (VAV)
- Convert existing AC-7 from CAV to VAV
- Convert existing AC-23 from CAV to VAV
- Convert existing AC-25 field-erected dual-duct, constant air volume (DDCAV) to a modern dual-duct, variable air volume (DDVAV)
- Consolidate and convert existing ACs 12-14 from CAV to VAV
- Steam condensate recovery and heat maximization
- Roof replacement
- Interior lighting retrofits and upgrades
- New linear LED T8 tube and external driver systems, retrofit kits and new fixtures
- New lighting controls
- Connected lighting system in areas that benefit from occupancy sensing, daylight harvesting, and controllable window shades

Bay View Library

- Replace existing atmospheric hot water boiler plant
- Update controls and existing air handling unit (AHU)-1 with occupancy and demand controls ventilation (DCV) controls
- Replace ACCU-1
- Interior lighting retrofits and upgrades

Atkinson Library

- Replace split DX cooling and cooling tower system with new ACCU
- Interior lighting retrofits and upgrades

Center Street Library

- Replace existing atmospheric hot water boiler plant
- Update controls on existing AHUs 1 and 2 with occupancy and DCV controls
- Replace ACCUs 1 and 2
- Interior lighting retrofits and upgrades

Energy Conservation Measures Selected

The following ECMs were selected for implementation on the basis of forming a self-funding project with minimum capital contribution requirements, acceptable payback criteria, and customer preferences and priorities. For a full description of each ECM, refer to the ECM Summaries that follow.

ECM	Total Cost	Energy Cost Savings	Simple Payback
ECM-1-MCL Replace and Upgrade Chilled Water Plant (Base Bid Only)	\$412,622	\$21,816	18.91
ECM-3-MCL Convert Existing AC-7 from CAV to DOAS	\$549,776	\$11,259	48.83
ECM-12a-MCL Library Lighting (Interior)	\$1,126,547	\$60,895	18.50
ECM-12b-MCL Library Lighting (Exterior)	\$3,412	\$112	30.55
ECM-12c-MCL Library Lighting (Lighting Control Panels)	\$194,882	\$ -	NA
ECM-4a-BVL Library Lighting (Interior)	\$151,080	\$7,312	20.66
ECM-4b-BVL Library Lighting (Exterior)	\$3,082	\$238	12.95
Total All ECMs	\$2,441,402	\$101,633	24.02

Energy Conservation Measures Not Selected

The following measures were not selected to proceed to implementation due to customer preferences, total capital constraints, financing criteria, implementation timeline, complexity, or simple payback criteria.

ECM	Total Cost	Energy Cost Savings	Simple Payback
ECM-1-MCL Replace and Upgrade Chilled Water Plant (Add Alternate Only)	\$38,412	\$ -	NA
ECM-2-MCL Consolidate and Convert Existing AC-1, AC-2, & AC-3 from CAV to VAV	\$1,908,433	\$30,487	62.60
ECM-4-MCL Convert Existing AC-23 from CAV to VAV (Base Bid Only)	\$200,732	\$6,183	32.47
ECM-4-MCL Convert Existing AC-23 from CAV to VAV (Add Alternate Only)	\$159,770	\$ -	NA
ECM-5-MCL Convert Existing AC-25 field erected DDCAV to modern DDVAV (Base Bid Only)	\$277,681	\$6,755	41.11
ECM-5-MCL Convert Existing AC-25 field erected DDCAV to modern DDVAV (Add Alternate 1 Only)	\$157,018	\$ -	NA
ECM-5-MCL Convert Existing AC-25 field erected DDCAV to modern DDVAV (Add Alternate 2 Only)	\$393,824	\$ -	NA
ECM-6-MCL Convert Existing AC-12, AC-13, & AC-14 from CAV to VAV	\$411,168	(\$1,224)	NA
ECM-7-MCL Replace Fan Coils in 3rd Floor Business Area (Base Bid Only)	\$155,123	\$55	NA
ECM-7-MCL Replace Fan Coils in 3rd Floor Business Area (Add Alternate Only)	\$194,625	\$1,958	99.40
ECM-8-MCL Replace Rare Books ACCU and Cooling Coil	\$102,410	\$53	NA
ECM-9-MCL Steam condensate recovery and Heat Maximization	\$90,859	\$2,412	37.67
ECM-11-MCL Other Systems HVAC Controls Upgrades and Retro Commissioning	\$102,224	\$ -	NA
ECM-13-MCL Battery Storage Sealed Room and Fire Suppression	\$301,042	\$15,770	19.09
ECM-14-MCL Replace South Roof (Less Dome and Unexposed Roof under Rare Books Mechanical Room)	\$1,535,752	\$ -	NA
ECM-15-MCL Spline Ceiling Upgrade for Lighting Upgrades	\$2,125,633	\$33,805	62.88
ECM-17-MCL Sewage and Clear Water Ejector System Upgrades	\$116,372	\$ -	NA
ECM-1-BVL Replace and Reconfigure Existing Atmospheric Hot Water Boiler Plant	\$255,487	\$756	NA
ECM-2-BVL Update Controls on Existing AHU-1 with Occupancy and DCV Controls	\$44,784	\$1,834	24.42

ECM	Total Cost	Energy Cost Savings	Simple Payback
ECM-3-BVL Replace AHU-1 and ACCU-1	\$268,177	\$200	NA
ECM-5-BVL Battery Backup Egress Lighting	\$96,991	\$ -	NA
ECM-1-CSL Replace Existing Atmospheric Hot Water Boiler Plant	\$267,769	\$773	NA
ECM-2-CSL Update Controls on Existing AHU-1 & AHU-2 with Occupancy and DCV Controls	\$85,272	\$2,812	30.32
ECM-3-CSL Replace ACCU-1 and ACCU-2 (Base Bid Only)	\$246,822	\$656	NA
ECM-3-CSL Replace ACCU-1 and ACCU-2 (Add Alternate Only)	\$333,981	\$ -	NA
ECM-4a-CSL Library Lighting (Interior)	\$123,803	\$4,711	26.28
ECM-4b-CSL Library Lighting (Exterior)	\$913	\$66	13.92
ECM-5-CSL Battery Backup Egress Lighting	\$51,878	\$ -	NA
ECM-1-AL Replace Split DX cooling / Cooling Tower system with new ACCU	\$266,273	\$1,197	NA
ECM-2a-AL Library Lighting (Interior)	\$100,030	\$2,665	37.54
ECM-2b-AL Library Lighting (Exterior)	\$86	\$20	4.29
ECM-3-AL Battery Backup Egress Lighting	\$62,919	\$ -	NA
Total All ECMs	\$10,476,263	\$105,189	99.59

Note that although measures listed above as not selected may be selected at a future date, the total cost, energy cost savings, and simple payback are subject to change based on current information at the time of selection. The ECMs not selected are not included in the Assured Performance Guarantee in the Agreement.

Energy Conservation Measures Not Evaluated

All measures proposed for the four facilities were evaluated during the Investment Grade Audit process. Additional energy conservation measures may exist within the facilities on systems deemed too new to evaluate or within scope areas excluded from the analysis. Additionally, no facilities outside of the four selected for the Investment Grade Audit (Milwaukee Central Public Library, Bayview Public Library, Center Street Public Library, and Atkinson Public Library) were evaluated.

ECM Summaries

ECM-1-MCL Replace and Upgrade Chilled Water Plant

Existing Conditions

The building is served by a water-cooled Trane chiller (room SB-0005), a water-cooled York chiller (room B9), and an air-cooled York chiller (Rooftop). Currently the Trane Chiller is considered the best chiller in building and is used as the primary chiller. The water-cooled York chiller is approximately 25 years old and has had maintenance problems with leaks. The water-cooled York chiller tends to work well under full load but when a lower capacity is required, it tends to trip out on safety. Recently a condenser water flow switch was added for condenser water for reliability purposes.

The Trane chiller is 10 years old (installed in 2004). Each of the water-cooled chillers are tied to a common evaporative cooling tower. The cooling tower has had some reliability issues related to the water-cooled chillers and it has caused them to trip out on the weekend. The air-cooled chiller on the roof is typically run on the weekends because of reliability issues in the summer. The air-cooled chiller is also run between 65°F and 75°F in the spring shoulder months.

There is a fourth chiller (a water-cooled McQuay chiller in room SB-0006) that's currently abandoned, but still resides in the building basement.



Figure 1: Existing York Chiller



Figure 2: Existing Trane Chiller



Figure 3: Existing McQuay Chiller

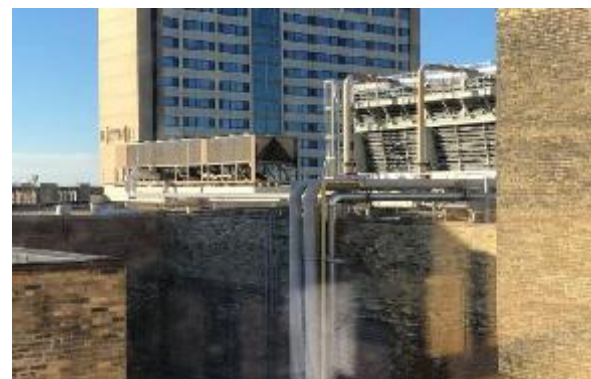


Figure 4: Existing air cooled York Chiller and existing cooling tower

Proposed Measure

This ECM proposes installing a new water-cooled York YMC2 magnetic bearing, variable speed, centrifugal chiller with a new primary pump and condenser water pump to serve the new chiller. The new YMC2 chiller is very efficient and would then be run as the primary chiller. The existing Trane chiller would be peak-load back-up, and the existing Air-Cooled York chiller would be used as a back-up shoulder season chiller.

BASE BID:

The existing water-cooled York chiller in room B9 will be removed, as well as the primary and condenser pumps that serve the water-cooled York chiller. The new YMC2 chiller and new primary pump would be installed in room B9 on the existing pads of the removed water-cooled York chiller and primary pump. The new condenser water pump will be installed on the existing pad of the removed condenser water pump in room SB-0005.

ADD ALTERNATE OPTION A (Removal of existing McQuay Chiller)

The existing water-cooled McQuay Chiller and the associated primary and condenser pumps in room SB-0006 will be removed. The primary pump and chilled water piping to the common chilled water header will be removed and capped at the existing chilled water header in room SB-0005. The existing condenser water pump and piping back to the condenser header will be removed and capped at the pipe header in room SB-0005.

Benefits

- Magnetic Bearing Chiller Provides:
 - Full load and part load efficiencies that exceed both Path A and Path B of the International Energy Conservation Code as adopted by the State of Wisconsin.
 - Lower kW/ton and better part-load efficiency ratios. During shoulder seasons, a magnetic bearing chiller can offer as low as 0.175 kW/ton at full capacity and below 0.1 kW/ton at part load.
 - A Magnetic bearing chiller is quieter than a household vacuum cleaner, the YMC2 achieves sound levels as low as 70 dBA.
 - Precise load matching with the variable speed compressor control, which limits short-cycling of the equipment.
- Direct Digital control provides:
 - The ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the unit.
- Removal of aged or abandoned equipment.
 - Removal of obsolete or abandoned equipment will simplify piping systems.
 - Removal of obsolete or abandoned equipment will simplify DDC Chiller plant controls.

ECM-2-MCL Consolidate and Convert Existing AC-1, AC-2, & AC-3 from CAV to VAV

Existing Conditions

The units AC-1, AC-2, & AC-3 are on the third-floor mechanical room and serves the portions of north section of the building. AC-1 serves the north section of the second floor, AC-2 serves the north section of the first floor, and AC-3 serves the north section of the 4T level.

Each system is constant air volume multizone unit with a steam coil hot deck and chilled water cold deck. AC-1 has a 15 HP supply fan, a 7.5 hp return fan, and four (4) zones. AC-2 has a 15 hp supply fan, a 7.5 hp return fan, and four (4) zones. AC-3 has a 5 hp supply fan, a 3 hp return fan, and three (3) zones. Each of the fan systems have a variable frequency drive on the supply and return fans.



Figure 5: Third floor mechanical room, AC unit.



Figure 6: Third floor mechanical room, Return fan

Proposed Measure

This ECM proposes removing the three constant air volume units (AC-1, AC-2, and AC-3) and installing one (1) variable air volume (VAV) Air Handling Unit. The three existing return fans will be removed and replaced with one (1) new return fan. The new fan systems shall deploy fan arrays to provide a level of N+1 redundancy for the fan system. Each chilled water and steam coil bank shall have three (3) control valves installed and be piped so that the failure of one section of the coil bank does not impede operation of the other sections of the coil bank.

For the minimum outside air intake, a separate min-OA duct shall be installed. The recent changes to the state of Wisconsin's energy code now requires heat recovery on all AHUs above 26,000 cfm when the AHU is between 10% and 20% outside air. To meet this code requirement, it is proposed that a pair of sensible glycol heat recovery coils be installed to recover energy from the relief or exhaust air. The glycol coils will be installed in the minimum outside air duct and a new minimum relief duct that will be sized to pair with the min-OA duct. The existing intake and relief louvers and dampers will be removed, and their wall locations patched. New outside air intake louvers and relief louvers shall be install within the existing walls.

In addition to the installation of one (1) new Air handling unit, new variable air volume (VAV) terminals will be installed. A total of eleven (11) new VAV terminals will be installed within the third-floor mechanical room, one new terminal for each existing zone and current duct. New space mounted occupancy sensors and CO2 based demand control ventilation for the high occupancy spaces will be installed.

Benefits

- The new VAV system will save energy by reducing the airflow to zones that do not require full cooling, and only providing as much heating as each individual zone requires.
- Digital control will enable zone by zone scheduling and occupancy controls that respond to space temperature and space use.
- Outdoor air demand ventilation control will greatly reduce the amount of outside air introduced through the systems when the outside air demand is lower due to reduced occupancy times.
- The ability of the VAV boxes to reduce supply airflow to 0 cfm when zones are unoccupied will generate substantial savings.
- Digital control of the VAV boxes will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the VAV boxes.
- Consolidation of these units will enable maximization of the previously stated energy saving strategies. A larger single unit can also be built with integral back-up provisions to provide better ventilation and cooling reliability.

ECM-3-MCL Convert Existing AC-7 from CAV to DOAS

Existing Conditions

The unit AC-7 is on the 1T level mechanical room and serves floors 1T, 2T and the north section of 3T. 1T, 2T, and 3T house part of the library's book and newspaper storage. The system is constant air volume, with zone dampers installed but locked into an open position, and the supply and return fan VFDs set to constant speed. The space has very little thermal loading but has been noted as having poor indoor air quality. In addition to the primary air service to 1T, 2T, and 3T, AC-7 also conditions the book-drop drive-up area which suffers from thermal comfort issues.



Figure 7: AHU-7 looking east.



Figure 8: AHU-7 looking west



Figure 9: AC-7 Return Fan



Figure 10: AC-7 zone control dampers



Figure 11: AC-7 supply grilles in space



Figure 12: AC-7 Return grille in space

Proposed Measure

This ECM proposes removal and replacement of AC-7 with a new built-up dedicated outdoor air (DOAS) air handling unit with energy recovery. To maintain thermal and humidity control, the new AC-7 shall be equipped with a chilled water cooling coil and a steam coil in reheat position.

The space is currently very lightly occupied, and the primary occupant concern is indoor air quality (IAQ). To improve the IAQ, this ECM proposes installing a unit sized to provide the ventilation levels recommended by ASHRAE 62.1-2016 of 0.12 cfm/sq. ft. The space is approximately 80,000 sq. ft. which would require 9,600 cfm of outside air. A preliminary calculation indicates the heat loads in the space are approximately 10,950 cfm. Thus, the new unit shall be approximately 12,000 cfm constant air volume.

In addition to the new unit, this ECM proposes installed a booster cooling coil and a reheat coil in the duct that serves the book-drop area and a new dedicated thermostat for that section of floor 3T. The cooling coil shall be chilled water and the reheat coil shall be steam.

Benefits

- The new DOAS system will provide ventilation at ASHRAE 62.1 recommended levels, improving IAQ.
- The Booster cooling coil and reheat coil for the book-drop area along with the dedicated thermostat should reduce thermal comfort issues.
- Digital control will enable space by space scheduling and occupancy controls that respond to space temperature and space use.
- Digital control of the system will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the AHU.
- Replacement of the existing unit will ensure the system controls as intended.

ECM-4-MCL Convert Existing AC-23 from CAV to VAV

Existing Conditions

The unit AC-23 is on the 3T level and serves floors Centennial Hall. The system serves the space via overhead distribution from the back of the venue and returns the air through return grille at the front of the venue and floor grilles to a return air plenum below the seating.

The steam piping below the floor causes Centennial Hall to overheat so the fan systems will cycle on and off all day to cool the space through the winter. The relief air from the space is pushed back to an equipment room, then into a steam tunnel and eventually the heat dissipates up through the attic space to the fourth floor. The system is currently constant air volume.



Figure 13: Centennial Hall



Figure 14: AC-23 unit that serves Centennial Hall

Proposed Measure

BASE BID:

This ECM proposes converting this unit from single-zone constant air volume to single-zone variable air volume. The system would operate via space temperature and CO2 based demand control ventilation as measured in the space.

In addition to converting AC-23 to VAV, a duct will be added to route the warm relief air from AC-23 to the parking and loading garage to heat the space. The duct will be routed to the north of room SB-70, up through room B44, and through the wall of T417 where the warm relief air will heat the parking and loading garage. Existing parking garage control scheme shall not be altered.

ADD ALTERNATE OPTION A (Complete replacement of AC-23 and return fan)

Option A proposes removing and replacing the existing AC-23 and return fan with a new modular air handling unit in the same location as AC-23. The unit will include new supply fan, steam heating coil, cooling coil, humidifier, filters, and cooling coil surface UV decontamination system. The return fan shall be a new mixed-flow fan.

This add alternate option is in addition to the base proposal above. All components shall be sized or broken down to fit within the existing freight elevator on the north end of the building.

Benefits

- The new VAV system will save energy by reducing the airflow to the space when full cooling effect is not required, and only providing as much airflow as the space requires.

- Digital control will enable remote scheduling and occupancy control that respond to space temperature and space use.
- Outdoor air demand ventilation control will greatly reduce the amount of outside air introduced through the systems when the outside air demand is lower due to reduced occupancy times.
- Ducting of the relief air from AC-23 to the parking garage would resolve several issues; the relief air currently rises through a shaft, warming the whole building. Re-ducting this air to the garage will warm the garage while stopping the overheating of the remainder of the building.

ECM-5-MCL Convert Existing AC-25 field erected DDCAV to modern DDVAV

Existing Conditions

The unit AC-25 is on the 3T and serves floor sections of south-east parts of 4T, 1st, 2nd, and 3rd floors. The existing system is a field erected Dual-Duct constant air volume system.



Figure 15: Original dual duct box



Figure 16: Original dual duct box



Figure 17: AC-25 discharge ducts



Figure 18: AC-25 Return Fan

Proposed Measure

BASE BID:

The ECM proposes replacing the twenty-two (22) existing dual duct constant air volume (DDCAV) boxes with twenty-two (22) new variable-air volume dual duct (DDVAV) boxes. Each box will be paired with a new DDC thermostat, a new space mounted occupancy sensor, and a new CO2 sensor to control demand control ventilation.

In addition to new DDVAV terminals, the existing controls systems for AC-25 shall be refurbished and replaced. The existing variable frequency drives shall remain. For the outside air, relief air, and return air dampers will be replaced with new dampers equipped with integral air-flow measuring stations (AFMS). To pair with the outside air, relief air, and return air air-flow measuring stations, an air flow measuring station shall be installed on the supply fan. The installation of these four AFMS will enable more effective economizer control, demand ventilation controls, and supply-to-return fan tracking. The control valves for the steam coils, chilled water coils, and humidifier will be replaced. The temperature sensors, humidistats, and pressure sensors for AC-25 will be replaced.

ADD ALTERNATE OPTION A (Replace fans with fan arrays, replace coils, and replace humidifier):

Option A proposes removing and replacing the various fan system components to ensure that all the components of AC-25 will be starting their lifecycle at the same time.

The existing components to be removed and replaced are the supply fan, return fans, VFDS, steam coils, chilled water coils, and existing humidifiers. The supply fan and return fan shall be replaced with new fan arrays.

This add alternate option is in addition to the base proposal above. All components shall be sized or broken down to fit through a series of double doors.

ADD ALTERNATE OPTION B (Replace AC-25 completely with a new Custom Built-up Air handling unit):

Option B proposed replacing AC-25 completely with a new built up unit to be installed in the same location.

Unit will include new supply and return fan arrays, steam coils, chilled water coils, humidifier, filters, and cooling coil surface UV decontamination system.

This add alternate option is in addition to the base proposal above, including alternate option A. All components shall be sized or broken down to fit through an opening through the north wall of the existing mechanical room.

Benefits

- The new VAV system will save energy by reducing the airflow to spaces that do not require full cooling, and only providing as much heating as each individual space requires.
- Digital control will enable space by space scheduling and occupancy controls that respond to space temperature and space use.
- Outdoor air demand ventilation control will greatly reduce the amount of outside air introduced through the systems when the outside air demand is lower due to reduced occupancy times.
- The ability of the VAV boxes to reduce supply airflow to 0 cfm when rooms are unoccupied will generate substantial savings.
- Digital control of the VAV boxes will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the VAV boxes.
- Refurbishing the existing unit will ensure the system controls as intended and will match the ASHRAE expected life expectancy of the new VAV air terminals.

ECM-6-MCL Convert Existing AC-12, AC-13, & AC-14 from CAV to VAV

Existing Conditions

The units AC-12, AC-13, & AC-14 are located in the space known as the alley and serve portions of the south section of the building. AC-12 serves the second floor business office, AC-13 serves the first floor fine arts area, and AC-14 serves the fourth floor catalog. Each an existing system is constant air volume. The space served by AC-13 is going to be converted to a rare books environment with specific indoor conditions (62°F and 30% RH).



Figure 19: AC-13 unit in the "alley" on the 4T level



Figure 20: AC-12 in the "alley" on the 4T level.

Proposed Measure

The ECM proposes removing and replacing AC-12, AC-13, and AC-14.

AC-12 and AC-14 serve office occupancies and will be removed and replaced with a new single-zone variable-air-volume (VAV) cooling unit. New thermostats, space mounted occupancy sensors, and space mounted CO₂ sensors for demand-controlled ventilation.

AC-13 is expected to be converted to a rare books space with new occupancy. The thermal and humidity requirements for a rare book occupancy are very specific, and the new system will be modeled after the existing rare books space on the second floor. AC-13 will be removed and replaced with a new single-zone cooling system. The primary cooling will be converted from chilled water to DX cooling, with the new ACCU unit placed in the neighboring court-yard. A heat recovery wheel will be installed, and the unit converted to full recirculation. The unit will also have a new humidifier installed in the unit. The unit will be sized for 3 air changes per hour (ACH) within the space, which requires 4,000 cfm. The interior space shall be designed to maintain 62°F with a humidity requirement of 30% RH.

Benefits

- The new single-zone VAV system will save energy by reducing the airflow to spaces that do not require full cooling, and only providing as much heating as each individual space requires.
- Digital control will enable space by space scheduling and occupancy controls that respond to space temperature and space use.
- Outdoor air demand ventilation control will greatly reduce the amount of outside air introduced through the systems when the outside air demand is lower due to reduced occupancy times.
- Digital control of the VAV boxes will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the VAV boxes.

ECM-7-MCL Replace Fan Coils in 3rd Floor Business Area

Existing Conditions

On the South west and west section of the third floor is the business office area. Within the perimeter spaces are fan coil units beneath each window. There are twenty-five (25) recirculation only units, each equipped with a chilled water and hot water coil. The units currently have pneumatic control valves and are controlled by a local switch. Each unit is loud and does not effectively heat and cool the space and fights with the adjacent spaces.



Figure 21: Existing Fan Coil unit (Exterior)



Figure 22: Existing Fan Coil unit (Interior)

Proposed Measure

BASE BID:

For this ECM it is proposed to remove and replace the existing twenty-five (25) fan coil units with new vertical fan coil units. Each new unit shall be a vertical unit and will be equipped with a chilled water coil, hot water coil, and new direct digital control. A new space mounted thermostat will be provided with each new fan coil unit.

ADD ALTERNATE OPTION A (Replace AC-15 and AC-16)

This add alternate option A proposes removing and replacing air handlers AC-15 and AC-16 located on the 3rd floor mechanical mezzanine. The new units will have new VFDs, control dampers, control valves, chilled water coils, and steam humidifiers.

This add alternate option is in addition to the base proposal above. All components shall be sized or broken down to fit within the existing freight elevator on the north end of the building and through the existing mezzanine man-door door.

Benefits

- Digital control will enable space by space scheduling and occupancy controls that respond to space temperature and space use.
- Digital control of the Fan Coils will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the fan coils.

ECM-8-MCL Replace Rare Books ACCU and Cooling Coil

Existing Conditions

The current rare books area within the library is located on the second floor of the building, and houses of MPL's rare collections. The controlled environment space where the collection is stored is conditioned by a desiccant dehumidification system that recirculates the room air, then re-cools or humidifies the air stream to maintain indoor conditions. The existing ACCU is aged and does not provide enough redundancy.



Figure 23: Rare book Air Cooled Condensing Unit



Figure 24: Existing indoor cooling coil for rare books.



Figure 25: Rare books Desiccant Dehumidification system.

Proposed Measure

This ECM proposes replacing the duct mounted DX coil and roof mounted ACCU with a new duct mounted DX coil and ACCU. The new DX coil and ACCU will be sized to be fully N+1 redundant. To achieve this, a single packaged system will be provided with two separate refrigeration circuits, with each circuit sized for the peak load. For capacity control, the lead compressor or each circuit will be equipped with a Rawal valve to modulate cooling capacity.

This scope of work is independent of the scope of work associated with AC-13

Benefits

- The new package system will provide fully N+1 redundancy for the cooling of the space.
- Rawal valves on the cooling circuits improve system turndown which enables more precise control of space humidity.

ECM-9-MCL Steam condensate recovery and Heat Maximization

Existing Conditions

Currently the condensate generated by the steam heating system is being drained down into the sewer of the building. Traditionally this condensate is returned back to the heating plant, and is still 140 degrees F or greater when it leaves the steam heating appliances (AHUs, wall fin, etc.)



Figure 26: Existing condensate receiver for the building.

Proposed Measure

This ECM proposes installing a Domestic Hot water heat recovery storage tank to extract heat remaining in the condensate before it leaves the building. The new heat recovery tank will be installed in the basement mechanical room SB-006 near building condensate pump and piped into the Domestic hot water (DHW) system return. The new tank will heat the fill water and return water before the existing water heaters. A diverting valve will be installed upstream of the heat recovery tank to provide temperature control. A new inline pump will be installed on the condensate return line to pump the heat recovery tank.

Benefits

- Any heat captured for domestic hot water use would reduce natural gas consumptions for water heating purposes.

ECM-11-MCL Other Systems HVAC Controls Upgrades and Retro Commissioning

Existing Conditions

The Central Library is currently served by an additional eleven (11) air handling units that range in age from approximately three (3) to ten (10) years old. These systems were identified as not needing the repair or replacement improvement measures recommended for the older air handling units addressed in other ECM, but the controls on some units are not aligned with the current building management system platform and some may be operating on incorrect or out-of-date sequences of operation.

Proposed Measure

The five (5) air handling units operating on older NCM controls will be upgraded to the current MESA controls. All eleven (11) air handling units will be retro-commissioned and sequences of operation updated to reflect more efficient operating strategies or reverted back to the intended sequence of operation to eliminate inefficient operating strategies.

Benefits

- Reduced energy usage from sequence of operation improvements.
- Streamlined control of all systems to increase maintenance and operations efficiency.

ECM-12-MCL Library Lighting

Existing Conditions

The Milwaukee Central Public Library has completed a partial retrofit of exterior lighting to LED sources, along with select interior areas. The predominant lighting sources are linear fluorescent, compact fluorescent, and high-intensity discharge (HID) sources.

Proposed Measure

This measure proposes upgrading a portion of the remaining existing interior and exterior lighting to LED sources. Additional controls and integration with the BAS are also proposed for additional energy savings. Lighting within areas that will require new ceilings to facilitate lighting upgrades are excluded from this measure, as well as lighting that has already been converted to LED sources. Additionally, egress lighting has been excluded pending a complete egress analysis for the facility.

- Re-lamp of Historic Décor Lighting Fixtures with LED comparable lamps
- Incandescent and Compact Fluorescent screw in lamps to be re-lamped with LED comparable lamps
- Linear fluorescent lighting fixtures to be retrofitted with LED tube and external driver
- Recess Can fixtures to be replaced with LED replacement kits
- Select Library spaces to be reviewed for LED fixture retrofit kits or whole fixture replacement
- Hardwired Occupancy Sensor controls installed in select areas with accessible ceiling space.

Benefits

- Reduced energy use and cooling loads.
- Less maintenance cost by eliminating lamp replacement.

ECM-13-MCL Battery Storage Sealed Room and Fire Suppression

Existing Conditions

The Central Library currently does not utilize battery storage as an energy demand management strategy. Energy generated by the existing solar PV system is net-metered by the utility company and the benefits received are only realized at the time that solar energy is generated, not necessarily at the optimal time for cost savings or GHG reductions.

Proposed Measure

A 125 kilowatt battery storage system is proposed to be installed in a new, fire-rated room constructed within the fourth floor (specific location to be determined). The system will be fed by the existing solar PV system and will be utilized for demand reduction and peak load management.

Benefits

- Provide utility cost savings to the library by reducing the demand (kW) of the building, especially during on-peak time periods when the peak demand for the month typically occurs.
- Enhance the utility savings potential of the existing and potential future solar PV by allowing the demand savings produced by the solar PV to be realized.

ECM-14-MCL Replace South Roof (Less Dome and Unexposed Roof under Rare Books Mechanical Room)

Existing Conditions

Various areas of the Central Library roof require replacement or repair in the near future. A new green roof covers a portion of the North roof and some smaller roof areas and parapet roofs have been replaced recently and are in good condition; these newer roof areas are not addressed in this improvement measure. Additionally, the mechanical room housing air conditioning equipment for the rare books collection is slightly elevated above an older section of roof that will require replacement.

Proposed Measure

The existing roofing materials will be removed to the structural deck and replaced with a new EPDM roof and insulation. Insulation levels will exceed the current insulation levels in these areas. Due to the need for detailed design of roofing systems for the library dome and the unexposed roof located under the rare books mechanical equipment room, these areas are excluded at this time.

Benefits

- Reduced energy consumption due to increased roof insulation.
- Reduced maintenance costs for new roofing materials compared to the existing roofing materials.

ECM-15-MCL Spline Ceiling Upgrade for Lighting Upgrades

Existing Conditions

Approximately 110,000 square feet of spline ceiling has been identified as aging and in need of replacement. These ceilings are predominantly in public areas or other spaces where new lighting will call attention to the condition of the existing ceiling, or where lighting replacement work will be difficult without significant ceiling removal and replacement.

Proposed Measure

The new ceiling will be a 2x2 grid ceiling with new lighting fixtures and HVAC diffusers. Installation would be coordinated in multiple phases to allow for relocation of library materials and staff, and to minimize dust and noise.

Benefits

- Improved aesthetics in public spaces.
- Reduced maintenance costs for older ceiling systems.

ECM-17-MCL Sewage and Clear Water Ejector System Upgrades

Existing Conditions

The current clear water sump and ejector system located in the 1st Tier mechanical room (near AHU-7) utilizes two (2) self-priming pumps coupled with water monitoring on the floor of the adjacent library materials storage. A separate sewage ejector system is located within the storage area and both ejector systems route to the combined sewer system serving the library.

Proposed Measure

This measure proposes replacing the self-priming pumps with submersible pumps in the existing clear water sump, along with adding level alarms for both ejector systems for advance notification of moisture concerns.

Benefits

- Reduced risk of water damage to library materials stored in the 1st Tier.

ECM-1-BVL Replace and Reconfigure Existing Atmospheric Hot Water Boiler Plant

Existing Conditions

The existing boiler plant is located within the basement mechanical room. It consists of two (2) 830 MBH Burnham atmospheric boilers that provide heating for the entire building. The existing boilers are original to the building, inefficient, and near the end of their life cycle. The boilers are pumped by the two (2) primary pumps that pump the building.



Figure 27: Existing boiler plant.



Figure 28: Existing Hot Water Pumps

Proposed Measure

This ECM proposes removing and replacing the two (2) existing hot water boilers and two (2) pumps with a condensing boiler plant with two (2) new sealed combustion boilers and two (2) new primary pumps. Two (2) new secondary pumps will be added to provide a primary-secondary variable flow system. Additionally, the plant shall have fully digital controls installed.

Benefits

- Energy savings based on the improved efficiency of the boilers.
- Maintenance savings based on equipment at the beginning of its life-cycle
- Direct Digital control provides:
 - The ability to alter the unit scheduling or control without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the unit.

ECM-2-BVL Update Controls on Existing AHU-1 with Occupancy and DCV Controls

Existing Conditions

The existing unit AHU-1 is in the basement mechanical room. The variable air volume system VAV box controls were recently updated. While the systems are VAV, they do not have occupancy or demand control on the VAV terminals.

Proposed Measure

This ECM proposes installation of new occupancy sensors and CO2 based demand control ventilation for the high occupancy spaces.

Benefits

- Outdoor air demand ventilation control will greatly reduce the amount of outside air introduced through the systems when the outside air demand is lower due to reduced occupancy times.
- The ability of the VAV boxes to reduce supply airflow to 0 cfm when rooms are unoccupied will generate substantial savings.
- Improvement of Digital control of the AHUs and VAV boxes will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the HVAC systems.

ECM-3-BVL Replace AHU-1 and ACCU-1

Existing Conditions

The existing unit AHU-1 is in the basement mechanical room. AHU-1 is a split DX cooled system with R-22. The existing unit was found with significant rust and damage due to water leaking from the exterior into the mechanical room and salt being stored onto of the unit. The nominal 60 ton outdoor unit ACCU-1 paired with AHU-1 and is at the end of its useful life and of lower efficiency.



Figure 29: AHU-1 DX coil connections



Figure 30: AHU-1 OA duct with significant rust.



Figure 31: Existing ACCU

Proposed Measure

This ECM proposes removing and replacing AHU-1 and ACCU-1. The new AHU and outdoor air cooled condensing unit would be paired with modern controls and capacity modulation capability.

AHU-1 which is both near the end of its useful life and was found with significant rust. The existing relief and outside air damper will be replaced with new Dampers with integral AFMSs.

Benefits

- Maintenance savings based on equipment at the beginning of its life-cycle
- Modern capacity control of the cooling would improve humidity control and thermal comfort.

- The existing unit uses refrigerant R-22 which is currently being phased out, after which R-22 availability will be more limited.
- Improved Digital control of the ACCUS will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the ACCUs.
- Replacement of the units would mean maintenance savings based on equipment at the beginning of its life-cycle
- Repair of the existing valves and actuators could resolve potentials issues such as in-operable economizers, heating and cooling over-shooting, and thermal comfort complaints.

ECM-4-BVL Library Lighting

Existing Conditions

The predominant lighting sources are linear fluorescent, compact fluorescent, and high-intensity discharge (HID) sources.

Proposed Measure

This measure proposes upgrading the existing interior and exterior lighting to LED sources. Additional controls and integration with the BAS are also proposed for additional energy savings.

- Replacement of Metal Halide uplighting floods with LED uplighting with integral controls for daylight and occupancy
- Incandescent and Compact Fluorescent screw in lamps to be re-lamped with LED comparable lamps
- Linear fluorescent lighting fixtures to be retrofitted with LED tube and external driver
- Recess Can fixtures to be replaced with LED replacement kits
- Select Library spaces to be reviewed for LED fixture retrofit kits or whole fixture replacement
- Select Interior and Exterior lighting to be controlled by Metasys
- Hardwired Occupancy Sensor controls installed in select areas with accessible ceiling space.

Benefits

- Reduced energy use and cooling loads.
- Less maintenance cost by eliminating lamp replacement.

ECM-5-BVL Battery Backup Egress Lighting

Existing Conditions

Emergency egress lighting at the library is currently on generator or other backup power source. During power outages, there are brief periods of black-out while the transfer switch brings the generator online.

Proposed Measure

An inverter system will be installed to provide fast-response transfer from grid to backup power in the event of an outage. The inverter system will provide status notifications through Metasys to allow for monitoring of power outage events.

Benefits

- Increased safety due to minimized periods of black-out in emergency events.

ECM-1-CSL Replace Existing Atmospheric Hot Water Boiler Plant

Existing Conditions

The existing boiler plant is located within the basement mechanical room. It consists of two (2) 198 MHB Burnham atmospheric boilers that provide heating for the entire building. The existing boilers are original to the building, inefficient, and near the end of their life cycle. The boilers are pumped by the primary pumps that pump the building.



Figure 32: Existing Boiler Plant.



Figure 33: Existing boiler plant

Proposed Measure

This ECM proposes removing and replacing of the two (2) 198 MBH existing hot water boilers and two pumps with a condensing boiler plant with two (2) new sealed combustion boilers, two (2) new primary pumps, and two (2) new secondary pumps.

Benefits

- Energy savings based on the improved efficiency of the boilers.
- Maintenance savings based on equipment at the beginning of its life-cycle
- Direct Digital control provides:
 - The ability to alter the unit scheduling or control without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the unit.

ECM-2-CSL Update Controls on Existing AHU-1 & AHU-2 with Occupancy and DCV Controls

Existing Conditions

The existing units AHU-1 and AHU-2 are in the basement mechanical room. Each system is variable air volume system that recently had the VAV terminal controls updated. While the systems are VAV, they do not have occupancy or demand control on the VAV terminals. Additionally, several of the actuators were found either disconnected or in disrepair.



Figure 34: AHU-1



Figure 35: AHU-2



Figure 36: AHU-2 Actuator, disconnected.

Proposed Measure

This ECM proposes installing new occupancy sensors and CO2 based demand control ventilation for the high occupancy spaces. This ECM will include reconditioning of the existing Digital controls, and actuators on each AHU to ensure that the system is operating properly.

Benefits

- Outdoor air demand ventilation control will greatly reduce the amount of outside air introduced through the systems when the outside air demand is lower due to reduced occupancy times.
- The ability of the VAV boxes to reduce supply airflow to 0 cfm when rooms are unoccupied will generate substantial savings.
- Improvement of Digital control of the AHUs and VAV boxes will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the HVAC systems.
- Repair of the existing valves and actuators could resolve potentials issues such as in-operable economizers, heating and cooling over-shooting, and thermal comfort complaints.

ECM-3-CSL Replace ACCU-1 and ACCU-2

Existing Conditions

AHU-1 and AHU-2 are each split DX cooled systems. The outdoor units ACCU-1 and ACCU-2 paired with AHU-1 and AHU-2, and are at the end of their useful life and of lower efficiency.

The existing units AHU-1 and AHU-2 are in the basement mechanical room. Each system is variable air volume system that recently had the VAV terminal controls updated.



Figure 37: ACCU-1 outdoor unit, with rust.



Figure 38: ACCU-2 outdoor unit, with rust.

Proposed Measure

BASE BID:

This ECM proposes removing and replacing ACCU-1 and ACCU-2 and the associated DX coils within the AHUs. The new outdoor air cooled condensing units would be paired with modern controls and capacity modulation capability. The new units will be located on the roof with a new chain link surround on roof with access gate and privacy slats.

ADD ALTERNATE OPTION A (Removed and replace AHU-1 and AHU-2)

The additional option proposes removing and replacing both AHU-1 and AHU-2 with new Modular air handling units. The new units will have new VFDs, control dampers, and new DX coils.

This add alternate option is in addition to the base proposal above.

Benefits

- Maintenance savings based on equipment at the beginning of its life-cycle
- Modern capacity control of the cooling would improve humidity control and thermal comfort.
- Improved Digital control of the ACCUS will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the ACCUs.

ECM-4-CSL Library Lighting

Existing Conditions

The predominant lighting sources are linear fluorescent, compact fluorescent, and high-intensity discharge (HID) sources.

Proposed Measure

This measure proposes upgrading the existing interior and exterior lighting to LED sources. Additional controls and integration with the BAS are also proposed for additional energy savings.

- Re-lamp of Metal Halide uplighting floods with LED comparable lamps
- Incandescent and Compact Fluorescent screw in lamps to be re-lamped with LED comparable lamps
- Linear fluorescent lighting fixtures to be retrofitted with LED tube and external driver
- Recess Can fixtures to be replaced with LED replacement kits
- Select Library spaces to be reviewed for LED fixture retrofit kits or whole fixture replacement
- Select Interior and Exterior lighting to be controlled by Metasys
- Hardwired Occupancy Sensor controls installed in select areas with accessible ceiling space.

Benefits

- Reduced energy use and cooling loads.
- Less maintenance cost by eliminating lamp replacement.

ECM-5-CSL Battery Backup Egress Lighting

Existing Conditions

Emergency egress lighting at the library is currently on generator or other backup power source. During power outages, there are brief periods of black-out while the transfer switch brings the generator online.

Proposed Measure

An inverter system will be installed to provide fast-response transfer from grid to backup power in the event of an outage. The inverter system will provide status notifications through Metasys to allow for monitoring of power outage events.

Benefits

- Increased safety due to minimized periods of black-out in emergency events.

ECM-1-AL Replace Split DX cooling / Cooling Tower system with new ACCU

Existing Conditions

AHU-1 is a split DX cooled system with a screw compressor, water-cooled condenser inside, and a cooling tower outside the building. The split DX system is near the end of its useful life. The cooling is provided for a multi-zone system that was recently retrofit with new DDC controls. The existing screw compressor is exceedingly noisy.



Figure 39: DX system Evaporator bundle



Figure 40: existing cooling tower enclosure.



Figure 41: Existing DX screw compressor unit.

Proposed Measure

This ECM proposes removing the Split DX system, Cooling tower, Condenser water pump, and the associated DX coils within the AHU, and replacing it with a new split system DX ACCU unit and new DX coil within the existing AHU. The new outdoor air cooled condensing unit would be paired with modern controls and capacity modulation capability. The new ACCU will be located on the roof within a new chain-link surround with access gate and privacy slats.

Benefits

- Maintenance savings based on equipment at the beginning of its life-cycle.
- Cost saving on chemical treatment for cooling towers
- Modern capacity control of the cooling would improve humidity control and thermal comfort.
- Improved Digital control of the ACCU will provide:
 - Ability to alter the unit scheduling without requiring a service call for a trained technician.
 - Streamlining of troubleshooting, diagnostics and maintenance of the ACCU.

ECM-2-AL Library Lighting

Existing Conditions

The predominant lighting sources are linear fluorescent, compact fluorescent, and high-intensity discharge (HID) sources.

Proposed Measure

This measure proposes upgrading the existing interior and exterior lighting to LED sources. Additional controls and integration with the BAS are also proposed for additional energy savings.

- Incandescent and Compact Fluorescent screw in lamps to be re-lamped with LED comparable lamps
- Unique 2x4 fixtures to be retrofitted with LED fixture retrofit kits
- Linear fluorescent lighting fixtures to be retrofitted with LED tube and external driver
- Recess Can fixtures to be replaced with LED replacement kits
- Select Library spaces to be reviewed for LED fixture retrofit kits or whole fixture replacement
- Select Interior and Exterior lighting to be controlled by Metasys
- Hardwired Occupancy Sensor controls installed in select areas with accessible ceiling space.

Benefits

- Reduced energy use and cooling loads.
- Less maintenance cost by eliminating lamp replacement.

ECM-3-AL Battery Backup Egress Lighting

Existing Conditions

Emergency egress lighting at the library is currently on generator or other backup power source. During power outages, there are brief periods of black-out while the transfer switch brings the generator online.

Proposed Measure

An inverter system will be installed to provide fast-response transfer from grid to backup power in the event of an outage. The inverter system will provide status notifications through Metasys to allow for monitoring of power outage events.

Benefits

- Increased safety due to minimized periods of black-out in emergency events.

Sample City Energy and Cost Savings Report

Sample Project Commissioning Plan



Commissioning Plan

MILWAUKEE PUBLIC LIBRARY – JOHNSON CONTROLS

Central Library

814 W. Wisconsin Ave, Milwaukee, WI 53233

Bay View Library

2566 S. Kinnickinnic Ave, Milwaukee, WI 53207

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1.0 Commissioning Overview

1.1 COMMISSIONING PURPOSE

The goal of commissioning is to ensure that the Owner is provided with a fully functional HVAC system that may be operated and maintained in conformance with the Owner's expectations and operational needs. These operational needs are the objectives of the commissioning process and are listed below:

- Ensure a thermally comfortable environment for occupants.
- Ensure system / equipment reliability.
- Ensure comprehensive and suitable training of O&M personnel.
- Ensure detailed and informative O&M documentation.
- Optimize building energy costs.
- Optimize building maintenance costs.

1.2 COMMISSIONING SCOPE

The commissioning process consists of distinct phases. Each phase follows sequentially from the previous, covering various aspects of the process and the objectives within that phase. In certain cases, phase overlap may occur due to the nature of ongoing work, which results in some phases running simultaneously.

The commissioning process phases for this project are:

Pre-Construction: Aspects of this phase normally begin as close to project inception as possible. However, the Cx process itself will be carried out retroactively. Objectives for this phase include developing the commissioning plan and setting up the issues database. A concurrent peer review of the MEP and envelope design is performed by the Cx Agent.

Construction Phase: During this phase of the Cx process, the systems are installed, started up and placed in operation. Primary objectives include submittal review, finalization of the CxP and installation checks.

Acceptance Phase: During the acceptance phase of the Cx process, functional and performance checks will take place. O&M personnel training is conducted to ensure maintenance familiarity with equipment prior to handover. The as built documents must be compiled, and prior to final acceptance of the facility, the system O&M manuals must be completed and submitted.

1.3 PURPOSE OF THE COMMISSIONING PLAN

From an overarching viewpoint, Commissioning is a pragmatic overlay to the general construction process that provides additional review, testing, and reporting throughout the lifetime of the project and offers assurance that, after construction and subsequent occupancy, installed systems operate as required by the Owner. As a complimentary function of both building design and construction, Commissioning is a method for ensuring the final building plan put forth for construction fully represents the Owners intent, and ensures the installation achieves the full scope of this final design.

The Commissioning Plan serves as the backbone of the commissioning process, and is a central reference location for any and all components. The information contained within outlines the overall process and identifies the required personnel, tests, checklists, and time constraints.

Accordingly, the following sections offer a detailed description of the Commissioning Team participants, their associated responsibilities, and the timeline in which the process should follow. Line-by-line equipment testing procedures (Functional Performance Tests) and closeout checklists are also included to illustrate the breadth of the testing and the specific points that must be addressed.

- Commissioning during design is intended to achieve the following specific objectives:
- Verify the Owners Project Requirements (OPR) and Basis of Design is clearly documented.
- Provide Design Review during Architect / Engineer design efforts to make sure that OPR and Basis of Design are reflected in the drawings and specifications.
- Verify commissioning for the construction phase is adequately reflected in the bid documents.

Commissioning during the construction is intended to achieve the following specific objectives:

- Verify that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
- Verify and document proper performance of equipment and systems.
- Verify that O&M documentation left on site is complete.
- Verify that the Owner's operating personnel are adequately trained.

1.4. DEFINITIONS

The following abbreviations are used throughout this document.

A/E	Architect and Design Engineers	MC	Mechanical Contractor
BAS	Building Automation System	Mfr	Manufacturer
BMS	Building Management System		
BOD	Basis of Design	O&M	Operation & Maintenance
CxA	Commissioning Agent	PFT	Pre-Functional Test
Cx	Commissioning	RFI	Request for Information
CxP	Commissioning Plan	SOP	Sequence of Operations
FT	Functional Test	TAB	Test Adjust Balance
HVAC	Heating, Vent. & Air Conditioning	TBA	To Be Advised
MEP	Mechanical, Electrical & Plumbing	MEL	Master Equipment List

2.0 Project Overview

2.1. PURPOSE OF THE PROJECT

Milwaukee Public Library is completing several ECM at Central Library and Bay View Library. These ECMs include:

ECM-1-MCL	Central Library Replace and Upgrade Chilled Water Plant with Mag-Lev Chiller
ECM-3-MCL	Central Library Convert Existing AC-7 from CAV to DOAS
ECM-12a-MCL	Central Library Interior Lighting Retrofits
ECM-12b-MCL	Central Library Exterior Lighting Retrofits
ECM-12c-MCL	Central Library Lighting Control Panel Upgrades
ECM-4a-BVL	Bayview Library Interior Lighting Retrofits
ECM-4b-BVL	Bayview Library Exterior Lighting Retrofits

2.2. SYSTEMS TO BE COMMISSIONED

The following systems are to be commissioned as part of the project:

- Water Cooled Chiller (qty. 1)
- DOAS Unit (qty. 1)
- Central Library Interior Lighting
- Central Library Exterior Lighting
- Central Library Lighting Controls
- Bay View Library Interior Lighting
- Bay View Library Exterior Controls

3.0 Commissioning Team

3.1. ROLES / RESPONSIBILITIES OVERVIEW

Descriptions of the roles and responsibilities of each team member during the Cx process are:

Owner: Makes the final decisions, sets the goals for all work and stipulates their requirements within the Owner's Project Requirements document. Coordinates staff involvement and answers facility operational questions.

Owner's Operation & Maintenance Personnel: Reviews construction progression to identify maintenance and interface of equipment and ensure familiarization with the systems. Understands the DI / BOD and how these relate to the operation of systems; attends training and system tests as appropriate.

CM: Monitors commissioning progress and facilitates issues relating to the commissioning process. Ensures contractors schedule and perform expected commissioning tasks; resolves any open issues. Ensures all subcontractors execute commissioning tasks in accordance with the CxP, CDs and specifications. This includes completing IC, FC and PC sheets as developed by EAS, along with additional items indicated in the commissioning specifications. The GC will incorporate the commissioning schedule (developed by EAS) into the project schedule.

EAS: Coordinates the overall Cx process and acts as Owner's advocate regarding Cx activities. Core activities include commissionability design reviews, maintenance of the issues database and establishing a training plan. EAS develops, executes and documents testing protocols to ensure that the commissioned systems are functioning in accordance with the DI, plans and specifications. Facilitates commissioning meetings and issues periodic status reports and updated issues lists.

Contractor and / or Subcontractor: Completes IC sheets and participates in execution of FC & PC as developed by EAS. Contractors shall also assist the CxA with field testing as requested. If problems arise, or if work performed will not meet the DI, plans and/or specifications, the Contractors shall notify the CM. The CM will then forward information to EAS to coordinate and resolve any problems. Owner will be copied with relevant documentation as appropriate by EAS and the CM.

TAB Subcontractor: Tests and balances all HVAC systems. Provides reports on system and equipment performance. Responsible for integrating commissioning into the TAB process and will work closely with other team members in problem resolution. The TAB subcontractor shall notify the CM if problems arise or if work performed will not meet the design intent, plans and / or specifications. The CM will forward the information to EAS and Owner to enable resolution of problems.

Controls Subcontractor: Provides information and services to enable functional and performance testing on the building HVAC and integrated systems. The TAB subcontractor integrates commissioning into the controls installation and programming scope and works with EAS, CM and Owner in training and controls problem resolution. The Controls Contractor shall execute and submit the pre-commissioning checkout, startup and test reports as specified in the contract documents. The Controls Subcontractor's assistance is essential in the execution of the final commissioning test procedures developed by EAS.

Equipment Manufacturer: Provides documentation for all equipment supplied. Perform required equipment start-up and training in accordance with the contract documents.

3.2 ROLES / RESPONSIBILITIES DETAIL

City of Milwaukee

- Responsibilities:** Assign operation and maintenance personnel and coordinate schedules for them to participate in Commissioning Team's activities including, but not limited to, the following:
- Coordination meetings
 - Functional Performance Testing
 - Demonstration of proper operation of systems and equipment.
 - Seasonal Testing
 - Warranty Review

CxA Edison Energy

- Responsibilities:** Review submittals for compliance with the BOD, Contract Documents, and Commissioning Plan. Review and comment on performance expectations of systems and equipment and interfaces between systems as they relate to the performance of Functional Testing.
- Compile checklists provided by the general contractor and any additional requirements into draft "Pre-Functional Checklists".
 - Verify along with Engineer that equipment records support initial startup.
 - Prepare Pre-Functional and Functional Performance Test procedures.
 - Witness, direct and document Pre-Functional and Functional Performance Testing.
 - Issue final Commissioning Report

Engineer JCI

- Responsibilities:**
- Verify that equipment records support initial startup of equipment.
 - Identify design intent and acceptance criteria for required systems in support of Functional Performance Testing.
 - Review Functional Performance Test results and identify test exceptions.
 - Confirm design intent and acceptance criteria for required systems in support of Functional Performance Testing.
 - Identify Functional Performance Tests that require Engineer to review and/or witness.
 - Review Functional Performance Test procedures prior to testing.
 - Verify TAB is complete for associated systems prior to Functional Performance Testing.
 - Throughout project, respond to items on Corrective Action Checksheet issued by the CxA, as applicable

Construction Manager JCI

- Responsibilities:**
- Facilitate the coordination and development of the various stages of the commissioning process between all parties involved.
 - Assign representatives with expertise and authority to act on behalf of the contractor and schedule them to participate in and perform commissioning activities including, but not limited to, the following:
 - In addition to compliance with the BoD, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
 - Provide schedule for Operation and Maintenance data submittals,

equipment startup, and testing to Cx Agent for incorporation into the Commissioning Plan. Update the schedule as required throughout the construction period.

- Provide “Certificate of Readiness” certifying that systems, subsystems, equipment and associated controls are ready for functional testing.
- Provide manufacturers checklists including field installation verification checklists and equipment startup checklists to the Cx Agent for Pre-functional checklist development.
- Evaluate performance deficiencies identified in test reports and, in collaboration with the Cx Agent and entity responsible for system and equipment installation, recommend corrective action.
- Address items noted in any Corrective Action Checklist.
- Prepare operation and maintenance training program and provide qualified instructors to conduct operation and maintenance training.
- Provide training documentation.
- Assemble the O&M Manuals.

Mechanical Contractor

JM Brennan

Responsibilities:

- Contractor shall assign representatives with expertise and authority to act on behalf of the contractor and schedule them to participate in and perform commissioning activities including, but not limited to, the following:
 - Participate in design and construction phase coordination meetings.
 - Participate in training sessions for Owner’s operation and maintenance personnel.
 - Provide and review manufacturer’s checklists including field installation verification checklists and equipment startup checklists. Provide these to GC for pre-functional checklist development.
 - Execute the pre-functional checklists for all commissioned equipment.
 - Participate in the preparation of Functional Performance Test procedures.
 - Perform Functional Performance Testing.
 - Throughout project, respond to items on Corrective Action Checksheet issued by the CxA, as applicable.

Controls Contractor

JCI

Responsibilities:

- Contractor shall assign representatives with expertise and authority to act on behalf of the contractor and schedule them to participate in and perform commissioning activities including, but not limited to, the following:
 - Participate in design and construction phase coordination meetings.
 - Participate in training sessions for Owner’s operation and maintenance personnel.
 - Provide and review manufacturer’s checklists including field installation verification checklists and equipment startup checklists. Provide these to GC for pre-functional checklist development.
 - Provide Detailed Sequences of Operation and testing protocol for BAS system components

-
- Assist with execution of the pre-functional checklists for all commissioned equipment controlled by the BAS
 - Participate in the preparation of Functional Performance Test procedures (particular to determining AHU and VAV operation)
 - Perform Functional Performance Testing and provide documentation on point-to-point verification.
 - Throughout project, respond to items on Corrective Action Checksheet issued by the CxA, as applicable.

3.2 COMMISSIONING TEAM RESPONSIBILITY MATRIX

Activity	CxA	Owner	CM	MC	TAB	BAS
Oversee & facilitate commissioning process; serve as Commissioning Team leader.	X					
Pre-Construction or Design Phase						
Develop BOD/OPR		X				
Prepare CxP.	X					
Coordinate commissioning activities with schedule.	X		X			
Prepare commissioning specifications.	X					
Update CxP.	X					
Attend Design review meetings.	X	X				
Construction Phase						
Coordinate commissioning activities into the master construction schedule.			X			
Attend regular commissioning team meetings.	X	X	X	X		
Review submittals of commissioned equipment and systems – for project acceptance.			X			
Review submittals and shop drawings for commissioning related use.	X					
Write and distribute IC sheets for commissioned equipment and systems.	X					
Inspect ongoing installation of work – with respect to commissioning.	X					
Periodic installation checks and reports.	X					
Provide equipment startup procedures.				X		X
Perform equipment startups.				X		X
Prepare and maintain the Commissioning Issues Database.	X					
Witness or review equipment startups.	X					
Perform duct leakage testing.				X		
Perform pipe pressure testing.				X		
Perform ICs and submit completed check sheets.				X		X
Audit ICs of major and primary equipment; sample of secondary equipment.	X					
Review completed IC check sheets.	X					
Acceptance Phase						
Develop FC and / or PCs for commissioned systems and equipment.	X					
Perform FC and / or PCs and submit completed check sheets.	X					X
Review completed FC sheets.	X					

Activity	CxA	Owner	CM	MC	TAB	BAS
Update Issues Database.	X					
Provide standard test instrumentation for commissioning.	X					
Provide ladders and proprietary test equipment to CxA as required.			X	X		X
Prepare TAB plan.					X	
Perform TAB work.					X	
Review TAB report.	X					
Spot test TAB readings in field.	X					
Correction of deficiencies and open issues.				X	X	X
O&M Activities						
Define training requirements.		X				
Provide training materials and syllabus.				X		X
Review training materials.	X					
Provide training sessions.				X		X
Attend training.		X		X		X
Verify and document training.	X					
Video record training sessions.				X		X
Provide O&M manuals.				X		X
Review O&M manuals.	X	X				
Provide as built drawings.				X		X
Post Construction						
Prepare final commissioning report.	X					
Prepare Systems Manual.	X		X	X		

4.0 Communication Procedures

As the CxA, Eneractive will coordinate the commissioning activities and report to the Owner and CM, who will relay the information to the necessary parties. Communication is maintained throughout the project by a conscious effort of all parties to ensure the effectiveness of the commissioning process. All members will work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

4.1. MANAGEMENT PROTOCOL

The following protocols should be followed during the Commissioning Process:

Issue	Protocol
Requests for information (RFI) or formal documentation requests	Edison Energy requests information from Construction Manager and/or Design Engineer. Edison Energy will not formally contact sub-contractors. Owner will be copied on all information requests.
Information and/or minor clarifications required in the field	The Commissioning Authority goes direct to the informed party and informs Owner of actions. (If agreed by parties involved).
Notifying contractors of deficiencies	Edison Energy issues deficiency report to the CM, who distributes report separated by contractor to responsible sub-contractor. In the field, Edison Energy may discuss a deficiency issues with a contractor. The contractor may choose to correct a deficiency at that time. Edison Energy will not give direction to the sub-contractors.
Scheduling of pre-functional and functional training, equipment start-ups, and training	Edison Energy and the CM will coordinate scheduling during the Cx meetings and inform Owner and all required attendees.
Scheduling of Commissioning meetings	Edison Energy will schedule based on construction schedule and inform the Cx Team.
Making a request for major or significant changes:	The Commissioning Authority has no authority to issue change orders.
Contractors disagreeing with the Commissioning process, deficiencies, or failure to cooperate with the Cx team	Edison Energy, Construction Manager, and Owner shall attempt to resolve issues during the project meetings.

5.0 Step Progression of the Commissioning Process

5.1 DESIGN PHASE ITEM PROGRESSION

- Commissioning Agent reviews the Basis of Design, completed by the Engineer of Record, and provides comments relative to consistency with the OPR.
- Commissioning Agent receives and reviews design submissions
- Commissioning Agent receives and reviews specifications
- Commissioning Agent develops a draft of the Commissioning Plan.

5.2 CONSTRUCTION PHASE ITEM PROGRESSION

- Commissioning Agent receives and reviews construction submissions (as necessary)
- Building is constructed while Commissioning Agent will assemble the following:
 - Equipment Start-up checklists; Provided by Contractor.
 - Controls Point-to-Point checklist; Provided by Contractor.
 - Testing and Balancing Submittal; Provided by Contractor.
 - Pre-Functional and Functional Performance Testing Procedures; Developed and finalized by Commissioning Agent.
 - Pre-Functional Checklists are completed; Performed by the Contractor and reviewed by the Commissioning Agent.
- Throughout the construction phase, the Commissioning Agent shall develop and periodically issue a Corrective Action Checklist as an ongoing deliverable. This checklist will incorporate general non-conformance items noted during periodic site walk-throughs, as well as issues noted during equipment testing.
 - A Corrective Action Checklist shall be issued based upon field observations and Results of the FPT; developed by Commissioning Agent.
 - Corrective Action Checklist shall be addressed by contractor through as much iteration as necessary to satisfactorily complete the process.

5.3 ACCEPTANCE PHASE ITEM PROGRESSION

- Upon completion of the above, the Contractor shall issue a “certificate of readiness” indicating that the installation of the building equipment and systems covered under the Functional Performance Test checklist is complete, and the following shall occur:
 - The Owner, Contractor, Controls Sub-Contractor, and Commissioning Agent Shall test equipment and complete the Functional Performance Checklist.
 - Commissioning Agent shall document the testing procedure, and note all conforming and non-conforming items accordingly.

5.4 POST- ACCEPTANCE PHASE ITEM PROGRESSION

- Upon completion of the Functional Performance Tests and the final corrective action checklist, the Commissioning Agent shall ensure the necessary closeout documents are assembled and provided by the contractor, which shall include:
 - Operation and Maintenance manuals
 - Demonstration & Training of Mechanical Systems to Owner's Personnel and outline of coursework.

-
- Warranty Information
 - Commissioning Agent shall issue a final Commissioning Plan / Report with all completed checklists, test results, and the remainder of Commissioning Documentation described herein.

5.1 COMMISSIONING SCHEDULE

To be developed concurrently with the project schedule in the Construction Phase. Construction schedules and scheduling are the responsibility of the CM. The CxA shall provide commissioning scheduling information to the Owner's Representative and CM for review and planning activities.

6.0 Components of the Commissioning Process

6.1. DESIGN PHASE TASKS

6.1.1. Commissioning Kickoff Meeting

A commissioning kickoff meeting will be scheduled and requires the attendance of the project team representatives outlined earlier. At this meeting an overview of the requirements, objectives, processes and benefits of commissioning will be discussed. Any schedule requirements that will affect the execution of the commissioning deliverables will be covered. Specification detail requirements, including documentation and training, will also be addressed.

6.1.2. Owner's Project Requirements

The Owner's Project Requirements (OPR) outlines the owner's overall vision for the facility and expectations of how it will be used and operated. The OPR should contain known goals and objectives, important items and criteria, costs and other limitations. The OPR may include building utilization, user needs, occupancy requirements, type of building construction, system functions and energy, air quality and environmental performance criteria. It should define the scope of the commissioning process and the preferred organizational structure and contain all requirements important to enable the development of the initial Basis of Design Document and the Commissioning Plan. It is a critical document that forms the basis from which all other documentation is developed. The Commissioning Authority will help the Owner develop the OPR.

6.1.3. Corrective Action Checklist Development

Throughout the design and construction process the Cx Agent will generate a Corrective Action Checklist, a database utilized for itemizing the system, equipment, date found, priority, recommendation and response associate with all identified issues. This Checklist included defects, problems, deficiencies and errors that may impact project completion and post-occupancy operations. Through design reviews, building walkthroughs during construction, installation checks and functional testing, the Cx Agent will note any instances that deviate from the intended design, or do not provide adequate service and maintenance opportunities. The checklist will be circulated to applicable parties such that open items can be resolved as soon as possible; the Cx Agent will back-check issued notifications to verify corrections are implemented.

The Cx Agent requests that all posted deficiencies shall be corrected within time period to be agreed by the commissioning team depending on priority levels. Priority levels shall be established upon deficiencies' impact to the construction progress.

6.1.4. Commissioning Design Review

This review is intended to comment on system functionality and control, instrumentation, energy performance, water usage performance, access and maintainability, sustainability and indoor air quality impact and is limited to the building systems being commissioned.

This review will cover topics such as:

- Areas that need clarification or more definition in order to prevent change orders, rework or construction errors

- Potential commissioning testing issues
- Occupant comfort issues (temperature, drafts, noise, etc.)
- Maintenance and operational issues (accessibility, serviceability, etc)
- Technical errors and omissions
- System sequences of operation

Any commissioning review observations are entered into the Corrective Action Checklist for tracking and closeout.

E.2 CONSTRUCTION PHASE TASKS

E.2.1. Submittal Review

The official review of submittals shall be the responsibility of Engineer prior to equipment installation. As the submittals for equipment and materials are received, select submittals will be reviewed by the Commissioning Authority to ensure conformance with the construction requirements, and to ensure that the equipment / material can be properly commissioned. This review is carried out in conjunction with ENGINEER submittal review. Submittal Review Reports will be issued by the Commissioning Authority as necessary to document identified concerns; responses will be required by the applicable Contractor. The TAB Plan and BAS submittals are particularly critical to the commissioning process and may require extensive review. Selected shop drawings may also be reviewed.

The approved submittals will be utilized to generate the Pre-Functional and Functional Performance Tests.

E.2.2. Pre-Functional Test Sheets

As specifics of equipment become known, the Pre-Functional Test Sheets are developed. These are comprehensive check sheets to verify that the equipment has been correctly installed. The Cx Agent develops these tests for completion by the contractors. Once completed, the Cx Agent verifies the accuracy of the completed tests for a percentage of each piece of equipment installed and enters any issues into the database.

E.2.3. Equipment Start-up

Acting as a third party observer or as the Owner's representation, Equipment Start-up Observation serves as confirmation that equipment is started properly. The CxA observes the start-up and provides valuable experience and knowledge to the contractor, which assists in reducing time and errors. This service helps confirm start-ups are performed properly, the first time.

The CxA assists the commissioning team members responsible for startup in developing detailed start-up plans for all equipment. The parties responsible for each part of startup and initial checkout are identified in the Project Specifications, and all requirements are documented in ENERActive Solution's Commissioning Checklists.

The following procedures will be used for this project:

- The CxA obtains manufacturer installation, startup and checkout data, including actual field checkout sheets used by the field technicians from the contractor (through an RFI).
- The CxA copies all pages with important instructional data and procedures from the operation and

maintenance manuals not covered in manufacturer field checkout sheets to ensure that they are covered during start-up.

- The copied pages from the operation and maintenance manuals, along with the Cx checklist provided by the CxA and the manufacturer field checkout sheets become the “Startup and Checkout Plan”.
- For systems that may not have adequate manufacturer startup and checkout procedures, particularly for components being integrated with other equipment, the Sub should provide the added necessary detail and documenting format to the CxA for approval, prior to execution.
- The CxA transmits the full Startup Plan to the CM. The CM then transmits the full start-up plan to the Subs for their review and use. The CxA will be present at the start-up to fill out the Cx Checklist.

Four weeks prior to startup, the Subs and vendors schedule startup and initial checkout with the CM and CxA. The startup and initial checkout are directed and executed by the Sub or vendor. The CxA, and CM if necessary, observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, when a sampling strategy is used. For components of equipment, (e.g., VAV boxes), the CxA observes a sampling of the Cx checklists and start-up procedures. To document the process of startup and checkout, the site technician performing the line task along with the CxA initials and dates each paragraph of procedures in the “Startup Plan” and completes the manufacturer field checkout sheets, while the CxA fills in the Cx checklist as they are completed. Only individuals having direct knowledge of a line item being completed shall check or initial the forms. The subs, vendors, and CM execute the checklists and tests and submit a signed copy of the completed start-up reports to the CxA and CM.

6.2.4. Review of the Testing & Balance Reports

Verification of the TAB report demonstrates the accuracy of completed work as well as the functionality of the automatic control system. Verification also comprises a full range of checks and tests determining that all components, equipment, systems and interfaces operate in accordance with contract documentation. A 25% sample verification is carried out on the TAB work.

6.3 CONSTRUCTION PHASE REQUIREMENTS PRIOR TO FUNCTIONAL TESTING

Prior to the scheduling, coordination and performance of the Functional Test Procedures, the following requirements must be observed and documented:

- The specific system and all associated components have been completed, calibrated, started up and operated in accordance with contract documentation. This will be determined by a review of the Equipment Startup Checklists and Pre-Functional Tests.
- Automatic control systems have been completed, calibrated and operated in accordance with contract documentation.
- TAB procedures have been completed and all TAB reports have been submitted and reviewed.
- Open items on the Corrective Action Checklist that would prevent testing are resolved.

6.4 ACCEPTANCE PHASE TASKS

6.4.1. Functional Performance Testing

The Functional Performance Tests (FPT’s) are developed by the Cx Agent using the design documents and approved BMS submittals. In summary, these tests act as a final check confirming that the building systems operate as designed. All results of these tests are documented by the Cx Agent and the results are displayed in the Pre-FPT and FPT section of the Appendices in the final issuance of this document. The FPT’s ultimately show that individual pieces of equipment are able to operate in unison as part of an overall

building system. Inherent to compiling this overall building system out of individual pieces of equipment, the success is strongly dependant on a correctly functioning BMS control system. For that reason, the control subcontractor must submit an approved point-to-point checklist, where all interlocks were programmed to bring systems into proper operation. Subsequently, the final FPT's are performed.

0.5. POST ACCEPTANCE PHASE TASKS

0.5.1. Systems Manual

The system manual is a system-focused composite document that includes the Commissioning Record, operation manual, maintenance manual, and additional information of use to the owner during the Occupancy and Operations Phase.

The Systems Manual will consist of the following:

- Final version of the owner's project requirements and basis of design.
- As-built sequences of operations for all equipment as provided by the design professionals and contractors
- Time-of-day schedules and schedule frequency, and detailed point listings with ranges and initial setpoints.
- Ongoing operating instructions for all energy- and water-saving features and strategies.
- Functional performance tests results (benchmarks), blank test forms, and recommended schedule for ongoing benchmarking.
- Seasonal operational guidelines.
- Recommendations for recalibration frequency of sensors and actuators by type and use.
- Single line diagrams of each commissioned system.
- Troubleshooting table for ongoing achievement of the owner's project requirements.
- Guidelines for continuous maintenance of the owner's project requirements (operation requirements) and basis of design (basis of operation).

0.5.2. Record Drawing List

Record documents or 'as-builts' are intended to show exactly how equipment, components and systems were installed. These documents indicate field conditions at the time of construction completion. 'As-builts' are valuable for maintenance personnel for identifying specific equipment or component locations that require maintenance or repair. The CxA will verify the accuracy of the submitted as-built drawings, and distribute comments to the appropriate contractors if required. All CxA as-built documentation will be turned over to the owner at the completion of the project.

0.5.3. Commissioning Report

The Commissioning Plan compiles all the vital documents from a system examination standpoint, and is inclusive of equipment checklists, control system checklists, FPT's, and field observation checklists. The following is a brief description of the included supporting documents.

Startup Checklists

The startup checklists for major equipment that comprise each system are included in the final Commissioning Plan as well as the O&M Manuals. These checklists show that each piece of equipment has

been started up in accordance with factory recommendations and standards, and that any problems found at the start up have been corrected and noted on the checklists.

Pre-FPT's and FPT's Checklists

Functional Performance Tests are the backbone of the commissioning process and demonstrate that individual pieces of equipment are adequately installed and able to seamlessly work together in systems and subsystems. These tests are broken down into Pre-FPT's, indicating preliminary installation procedures are complete, and FPT's, indicating the system operates as the design engineer specified and responds to changing building parameters accordingly.

Corrective Action Checklists

Throughout the construction process the Cx Agent will conduct building walkthroughs and make note of instances that deviate from the intended design, or do not provide adequate service and maintenance opportunity. While this checklist becomes a living document that is updated and issued at various points to allow for correction in a timely manner, the final form of the document will be inserted in the Commissioning Plan and indicate that all necessary items have been addressed.

7.0 Appendices

Appendices below shall be generated once the documentation is made available.

7.1. EQUIPMENT STARTUP CHECKLIST

Reviewed and Compiled as submitted by Contractor during construction phase.

7.2. PRE-FUNCTIONAL PERFORMANCE TEST CHECKLISTS

Developed by Cx Agent and compliment the manufacturer's equipment start-up checks.

7.3. FUNCTIONAL PERFORMANCE TEST CHECKLISTS

Developed and witnessed by Cx Agent, these detailed tests are completed by the contractors and ensure proper operation of the system equipment.

7.4. CORRECTIVE ACTION CHECKLIST

Provided by Cx Agent; additive chart reflecting items that had been noted during site walkthroughs. Will show item, status, date of issue, and date it was addressed.

Sample Measurement and Verification Plan

ASSURED PERFORMANCE GUARANTEE

I. PROJECT BENEFITS

A. Certain Definitions. For purposes of this Agreement, the following terms have the meanings set forth below:

Annual Project Benefits are the portion of the projected Total Project Benefits to be achieved in any one year of the Guarantee Term.

Annual Project Benefits Realized are the Project Benefits actually realized for any one year of the Guarantee Term.

Annual Project Benefits Shortfall is the amount by which the Annual Project Benefits exceed the Annual Project Benefits Realized in any one year of the Guarantee Term.

Annual Project Benefits Surplus is the amount by which the Annual Project Benefits Realized exceed the Annual Project Benefits in any one year of the Guarantee Term.

Baseline is the mutually agreed upon data and/or usage amounts that reflect conditions prior to the installation of the Improvement Measures as set forth in Section IV below.

Guarantee Term will commence on the first day of the month next following the Substantial Completion date and will continue through the duration of the M&V Services, subject to earlier termination as provided in this Agreement.

Installation Period is the period beginning on JCI's receipt of Customer's Notice to Proceed and ending on the commencement of the Guarantee Term.

Measured Project Benefits are the utility savings and cost avoidance calculated in accordance with the methodologies set forth in Section III below.

Non-Measured Project Benefits are identified in Section II below. The Non-Measured Project Benefits have been agreed to by Customer and will be deemed achieved in accordance with the schedule set forth in the Total Project Benefits table below. Customer and JCI agree that: (i) the Non-Measured Project Benefits may include, but are not limited to, future capital and operational costs avoided as a result of the Work and implementation of the Improvement Measures, (ii) achievement of the Non-Measured Project Benefits is outside of JCI's control, and (iii) Customer has evaluated sufficient information to conclude that the Non-Measured Project Benefits will occur and bears sole responsibility for ensuring that the Non-Measured Project Benefits will be realized. Accordingly, the Non-Measured Project Benefits shall not be measured or monitored by JCI at any time during the Guarantee Term, but rather shall be deemed achieved in accordance with the schedule set forth in the Total Project Benefits table below.

Project Benefits are the Measured Project Benefits plus the Non-Measured Project Benefits to be achieved for a particular period during the term of this Agreement.

Total Project Benefits are the projected Project Benefits to be achieved during the entire term of this Agreement.

B. Project Benefits Summary. Subject to the terms and conditions of this Agreement, JCI and Customer agree that Customer will be deemed to achieve a total of \$995,195 in Non-Measured Project Benefits and JCI guarantees that Customer will achieve a total of \$2,662,516 in Measured Project Benefits during the term of this Agreement, for Total Project Benefits of \$3,657,711, as set forth in the Total Project Benefits table below.

Total Project Benefits

Year	Utility Cost Avoidance*	Operations & Maintenance Cost Avoidance**	Focus on Energy Incentive Benefit***	Future Capital Cost Avoidance**	Annual Project Benefits
1	\$ 101,633	\$ 21,893	\$ 33,253	\$ 430,000	\$ 586,779
2	\$ 104,428	\$ 22,331	\$ -	\$ -	\$ 126,759
3	\$ 107,299	\$ 22,777	\$ -	\$ -	\$ 130,077
4	\$ 110,250	\$ 23,233	\$ -	\$ -	\$ 133,483
5	\$ 113,282	\$ 23,698	\$ -	\$ -	\$ 136,980
6	\$ 116,397	\$ 24,172	\$ -	\$ -	\$ 140,569
7	\$ 119,598	\$ 24,655	\$ -	\$ -	\$ 144,253
8	\$ 122,887	\$ 25,148	\$ -	\$ -	\$ 148,035
9	\$ 126,267	\$ 25,651	\$ -	\$ -	\$ 151,918
10	\$ 129,739	\$ 26,164	\$ -	\$ -	\$ 155,903
11	\$ 133,307	\$ 26,687	\$ -	\$ -	\$ 159,994
12	\$ 136,973	\$ 27,221	\$ -	\$ -	\$ 164,194
13	\$ 140,739	\$ 27,766	\$ -	\$ -	\$ 168,505
14	\$ 144,610	\$ 28,321	\$ -	\$ -	\$ 172,931
15	\$ 148,587	\$ 28,887	\$ -	\$ -	\$ 177,474
16	\$ 152,673	\$ 29,465	\$ -	\$ -	\$ 182,138
17	\$ 156,871	\$ 30,054	\$ -	\$ -	\$ 186,926
18	\$ 161,185	\$ 30,655	\$ -	\$ -	\$ 191,841
19	\$ 165,618	\$ 31,269	\$ -	\$ -	\$ 196,886
20	\$ 170,172	\$ 31,894	\$ -	\$ -	\$ 202,066
Total	\$ 2,662,516	\$ 531,942	\$ 33,253	\$ 430,000	\$ 3,657,711

*Utility Cost Avoidance is a Measured Project Benefit. Utility Cost Avoidance figures in the table above are based on anticipated increases in unit energy costs as set forth in the table in Section IV below.

** Operations & Maintenance Cost Avoidance and Future Capital Cost Avoidance are Non-Measured Project Benefits. Operations & Maintenance Cost Avoidance and Future Capital Cost Avoidance figures in the table above are based on a mutually agreed fixed annual escalation rate of two percent (2.0%).

*** Focus on Energy Incentive Benefits are estimated based on funding formulas current at the time of development but are not part of the financial guarantee. Focus on Energy Incentive Benefits are a one-time rebate anticipated to occur during Year 1 of the Project Benefits Term.

Within sixty (60) days of the commencement of the Guarantee Term, JCI will calculate the Measured Project Benefits achieved during the Installation Period plus any Non-Measured Project Benefits applicable to such period and advise Customer of same. Any Project Benefits achieved during the Installation Period may, at the Customer's discretion, be allocated to the Annual Project Benefits for the first year of the Guarantee Term. Within sixty (60) days of each anniversary of the commencement of the Guarantee Term, JCI will calculate the Measured Project Benefits achieved for the applicable year plus any Non-Measured Project Benefits applicable to such period and advise Customer of same.

Customer acknowledges and agrees that if, for any reason, it (i) cancels or terminates receipt of M&V Services, (ii) fails to pay for M&V Services in accordance with Schedule 4, (iii) fails to fulfill any of its responsibilities necessary to enable JCI to complete the Work and provide the M&V Services, or (iv) otherwise cancels, terminates or materially breaches this Agreement, the Assured Performance Guarantee shall automatically terminate and JCI shall have no liability hereunder.

C. Project Benefits Shortfalls or Surpluses.

- (i) Project Benefits Shortfalls. If an Annual Project Benefits Shortfall occurs for any one year of the Guarantee Term, JCI shall provide the amount of the Annual Project Benefits Shortfall to Customer via any combination of the following, (a) set off the amount of such shortfall against any unpaid balance Customer then owes to JCI, (b) pay to Customer the amount of such shortfall, or (c) subject to Customer's agreement, provide to Customer additional products or services, in the value of such shortfall, at no additional cost to Customer.
- (ii) Project Benefits Surpluses. If there is an Annual Project Benefits Surplus in respect of a year, Customer shall be entitled to retain the benefit of such surplus, except any surplus achieved during the Installation Period, to the extent such Annual Project Benefits Surplus was not applied to reduce any other Annual Project Benefits Shortfall.
- (iii) Additional Improvements. Where an Annual Project Benefits Shortfall has occurred, JCI may, subject to Customer's approval (which approval shall not be unreasonably withheld, conditioned, or delayed), implement additional Improvement Measures, at no cost to Customer, which may generate additional Project Benefits in future years of the Guarantee Term.

II. NON-MEASURED PROJECT BENEFITS

The Project Benefits identified below were derived using engineering calculations based on industry standards and data provided by the Customer. These Project Benefits shall be Non-Measured Project Benefits (as defined above).

The parties acknowledge that Customer's capital contribution of \$430,000, to be paid in full to JCI during the construction period, shall result in the receipt by Customer of certain "Capital Cost Avoidance" benefits, which benefits are Non-Measured Project Benefits, as set forth below. It is understood between the Parties that (a) any equipment included in the Work for which capital outlay funds have been allocated for replacement are included in such Capital Cost Avoidance benefits; (b) equipment to be replaced pursuant to this Project that is at or near the end of its useful life is included in Capital Cost Avoidance benefits even if not budgeted, and Owner stipulates that for such equipment, failure and replacement is imminent within the Guaranty Term; and (c) Project Benefits allocable to Capital Cost Avoidance shall be the amortized cost of the equipment being replaced over the desired period, which must be no longer than the useful life of the equipment or the Guaranty Term (calculated as total installed cost / number of years).

The information in this section summarizes the Non-Measured Project Benefits. The details on the calculations and other supporting material are provided in the Investment Grade Audit report.

Non-Measured Project Benefits

Year	Non-Measured Utility Benefits	Non-Measured Operational Benefits	Focus on Energy Incentive Benefits	Future Capital Cost Avoidance	Annual Non-Measured Project Benefits
1	\$ -	\$ 21,893	\$ 33,253	\$ 430,000	\$ 485,146
2	\$ -	\$ 22,331	\$ -	\$ -	\$ 22,331
3	\$ -	\$ 22,777	\$ -	\$ -	\$ 22,777
4	\$ -	\$ 23,233	\$ -	\$ -	\$ 23,233
5	\$ -	\$ 23,698	\$ -	\$ -	\$ 23,698
6	\$ -	\$ 24,172	\$ -	\$ -	\$ 24,172
7	\$ -	\$ 24,655	\$ -	\$ -	\$ 24,655
8	\$ -	\$ 25,148	\$ -	\$ -	\$ 25,148
9	\$ -	\$ 25,651	\$ -	\$ -	\$ 25,651
10	\$ -	\$ 26,164	\$ -	\$ -	\$ 26,164
11	\$ -	\$ 26,687	\$ -	\$ -	\$ 26,687
12	\$ -	\$ 27,221	\$ -	\$ -	\$ 27,221
13	\$ -	\$ 27,766	\$ -	\$ -	\$ 27,766
14	\$ -	\$ 28,321	\$ -	\$ -	\$ 28,321
15	\$ -	\$ 28,887	\$ -	\$ -	\$ 28,887
16	\$ -	\$ 29,465	\$ -	\$ -	\$ 29,465
17	\$ -	\$ 30,054	\$ -	\$ -	\$ 30,054
18	\$ -	\$ 30,655	\$ -	\$ -	\$ 30,655
19	\$ -	\$ 31,269	\$ -	\$ -	\$ 31,269
20	\$ -	\$ 31,894	\$ -	\$ -	\$ 31,894

In the table above, each column before Annual Non-Measured Project Benefits contains rounded amounts.

Non-Measured Utility Benefits	ECM	Year 1 Benefits	Escalation
None	None	\$ -	0%

Schedule 2

Total Non-Measured Utility Benefits =		\$ -	
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Non-Measured Operational Benefits	ECM	Year 1 Benefits	Escalation
The Non-Measured Operational Benefits of ECM-1-MCL are a result of Operational Subcontracted Maintenance Costs avoided due to the new chiller	ECM-1-MCL	\$ 15,000	2.00%
The Non-Measured Operational Benefits of ECM-12a-MCL are the result of Operational Material Savings due to Lighting Replacement	ECM-12a-MCL	\$ 6,259	2.00%
The Non-Measured Operational Benefits of ECM-12b-MCL are the result of Operational Material Savings due to Lighting Replacement	ECM-12b-MCL	\$ 6	2.00%
The Non-Measured Operational Benefits of ECM-4a-BVL are the result of Operational Material Savings due to Lighting Replacement	ECM-4a-BVL	\$ 611	2.00%
The Non-Measured Operational Benefits of ECM-4b-BVL are the result of Operational Material Savings due to Lighting Replacement	ECM-4b-BVL	\$ 17	2.00%
Total Non-Measured Operational Benefits =		\$ 21,893	

Focus on Energy Incentive Benefits	ECM	Year 1 Benefits	Escalation
The Focus on Energy Incentive Benefit is the result of lighting energy savings	ECM-12a-MCL	\$ 29,537	0%
The Focus on Energy Incentive Benefit is the result of lighting energy savings	ECM-4a-BVL	\$ 3,716	0%
Total Non-Measured Demand Response Benefits =		\$ 33,253	

The Non-measured Project Benefits described in the table above run for the entire performance period. Details on data and associated calculations are presented in the final audit report used to develop the project. Focus on Energy Incentive Benefits are estimated based on funding formulas current at the time of development but are not part of the financial guarantee. Focus on Energy Incentive Benefits are a one-time rebate anticipated to occur during Year 1 of the Project Benefits Term.

Post-installation, the proposed efficiency rating in scope of work will be compared with the ECMs As-built documentation to confirm actual units installed. The achieved non-measured benefits will be adjusted one-time only and documented in the Post-Installation Report if proposed unit efficiency does not meet or exceed efficiency listed in scope of work.

Customer agrees that the Non-Measured Project Benefits are reasonable and that the installation of the Improvement Measures will enable Customer to take actions that will result in the achievement of such Non-Measured Project Benefits.

III. MEASUREMENT AND VERIFICATION METHODOLOGIES

The following is a brief overview of the measurement and verification methodologies applicable to the Improvement Measures set forth below. JCI shall apply these methodologies, as more fully detailed in the guidelines and standards of the International Measurement and Verification Protocol (IPMVP) and/or the Federal Energy Management Program (FEMP), in connection with the provision of M&V Services hereunder.

A. Measured Project Benefits Summary. The information in this section summarizes the estimated Measured Project Benefits. The calculation of the Measured Project Benefits is based on the energy consumption and demand savings projected for each measure individually, but are not individually guaranteed and are not individually severable. All values reported below are estimated for Year 1 of the Project Benefits Term.

		Energy						Total Annual Utility Savings	
		Electric Consumption		Natural Gas		Steam			
		kWh	kBtu	therm	kBtu	klbs	kBtu	kBtu (site)	kBtu (source)
ECM-1-MCL	Dollars	\$ 21,817		\$ -		\$ -		\$ 21,817	
	Units	108,110.00	368,871.32	-	-	-	-	368,871.32	1,032,839.70
ECM-3-MCL	Dollars	\$ 5,014		\$ -		\$ 6,245		\$ 11,259	
	Units	31,255.00	106,642.06	-	-	558.00	666,252.00	772,894.06	1,098,100.17
ECM-12a-MCL	Dollars	\$ 60,895		\$ -		\$ -		\$ 60,895	
	Units	541,972.00	1,849,208.46	-	-	-	-	1,849,208.46	5,177,783.70
ECM-12b-MCL	Dollars	\$ 109		\$ -		\$ -		\$ 109	
	Units	1,767.00	6,029.00	-	-	-	-	6,029.00	16,881.21
ECM-12c-MCL	Dollars	\$ -		\$ -		\$ -		\$ -	
	Units	-	-	-	-	-	-	-	-
ECM-4a-BVL	Dollars	\$ 7,312		\$ -		\$ -		\$ 7,312	
	Units	68,656.00	234,254.27	-	-	-	-	234,254.27	655,911.96
ECM-4b-BVL	Dollars	\$ 238		\$ -		\$ -		\$ 238	
	Units	2,537.00	8,656.24	-	-	-	-	8,656.24	24,237.48
Total All ECMs	Dollars	\$ 90,371		\$ -		\$ 6,245		\$ 101,630	
	Units	754,297.00	2,573,661.36	-	-	558.00	666,252.00	3,239,913.36	8,005,754.22

The calculated benefits are based on the following conversion factors as well as the agreed upon utility rates described in this Schedule 2. This table is provided for information only and is not guaranteed. Note that the conversion from kBtu (site) to kBtu (source) is subject to update by the U.S. Environmental Protection Agency on an annual basis.

Fuel	Base Units	Conversion factor to kBtu	Conversion from kBtu (site) to kBtu (source)
Electricity (Grid)	kWh	3.412	2.80
Electricity (On-site Renewable)	kWh	3.412	1.00
Natural Gas	Therm	100	1.05
District Steam	kLbs	1,194	1.20

B. General M&V Methods. The following is a brief overview of the measurement and verification methodologies applicable to the Improvement Measures set forth below. JCI shall apply these methodologies, as more fully detailed in the guidelines and standards of the International Measurement and Verification Protocol (IPMVP) and/or the Federal Energy Management Program (FEMP), in connection with the provision of M&V Services hereunder.

The following table summarizes the M&V method applied by ECM.

Facility	ECM Number	ECM Name	M&V Method	
			Year 1-3	Year 4+
Central Library	ECM-1-MCL	Central Library Replace and Upgrade Chilled Water Plant with Mag-Lev Chiller	Option C	None
	ECM-3-MCL	Central Library Convert Existing AC-7 from CAV to DOAS	Option C	None
	ECM-12a-MCL	Central Library Interior Lighting Retrofits	Option C	None
	ECM-12b-MCL	Central Library Exterior Lighting Retrofits	Option C	None
	ECM-12c-MCL	Central Library Lighting Control Panel Upgrades	Option C	None
Bayview Library	ECM-4a-BVL	Bayview Library Interior Lighting Retrofits	Option A	None
	ECM-4b-BVL	Bayview Library Exterior Lighting Retrofits	Option A	None

Option A Partially Measured Retrofit Isolation

Measured Project Benefits are determined by partial field measurement of the energy use of the system(s) to which an Improvement Measure was applied separate from the energy use of the rest of the facility. Measurements will be short-term with only one-time measurements before and after the Installation Period.

Partial measurement means that some but not all parameters will be measured. Careful review of the design and installation of Improvement Measures is intended to demonstrate that the stipulated values fairly represent the probable actual values. Agreed-upon values will be shown in the measurement and verification plan, along with analysis of the significance of the error they may introduce. Engineering calculations using short-term pre and post-retrofit measurements and stipulations are used to calculate Measured Project Benefits for the duration of the Guarantee Term.

Measured Project Benefits from the following Improvement Measures will be calculated using Option A:

ECM Number	ECM Name
ECM-4a-BVL	Bayview Library Interior Lighting Retrofits
ECM-4b-BVL	Bayview Library Exterior Lighting Retrofits

Lighting Improvements – ECM 4a-BVL, & 4b-BVL

The savings for this ECM are generated through a reduction in energy used by the lighting system; therefore the measurement boundary is the lighting system itself.

The existing power draw will be measured using a true RMS meter. The pre and post sample plan will adhere to the 80/20 guidelines. Fixtures with similar lamps and ballasts, counts and types, will be grouped together with a lamp/ballast code. Measured wattages will be used where collected. In some situations, such as when a certain type of lighting fixture is not available by itself on a switch, typical wattages as published by ANSI (American National Standards Institute) will be used. These values will be measured only once prior to retrofit.

Expected Pre Retrofit Sample Plan

Pre-Construction Component Code	Pre-Construction Population	Existing System kW	Projected kWh Savings	Percentage of Connected Load	Percentage of Saving Contribution	Population Sample Size for Coefficient of Variation: 0.5	Minimum Required Fixture Samples
2X32T8EBN	2290	132.82	98,165.6	24%	15%	11	11
4X32T8EBN	397	44.46	69,082.0	8%	11%	11	11
3X32T8EBN	563	50.11	65,345.0	9%	10%	11	11
1X13CFLSI	3453	44.89	61,349.2	8%	9%	11	11
2X400MH	24	21.98	45,937.9	4%	7%	8	8
1X32T8EBN	1752	54.31	39,606.1	10%	6%	11	11
1X250MH	42	12.39	21,908.1	2%	3%	9	9
12X42CFL4P	16	8.93	21,226.8	2%	3%	7	7
2X34T12MB	160	11.52	18,579.3	2%	3%	11	11
2X60T12HOM B	75	10.88	18,173.7	2%	3%	10	10
1X50HAL	106	5.30	12,391.4	1%	2%	10	10
9X32T8EBN3	30	7.62	10,877.1	1%	2%	9	9
4X42CFL4P	31	5.77	10,778.7	1%	2%	9	9
6X32T8EBN2	57	9.69	10,340.7	2%	2%	10	10
1X75HAL	56	4.20	10,193.0	1%	2%	10	10
4X65HAL	13	3.38	10,060.6	1%	2%	6	6
4X32T8EBN2	60	6.96	8,595.2	1%	1%	10	10
1X26CFLSI	131	3.41	7,591.8	1%	1%	11	11
1X150HAL	22	3.30	7,549.4	1%	1%	8	8
4X34T12MB2	25	3.60	6,312.8	1%	1%	8	8
1X60INCA	211	12.66	6,243.3	2%	1%	11	11

Expected Post Retrofit Sample Plan

Schedule 2

Post-Construction Component Code	Post-Construction Population	Proposed System kW	Projected kWh Savings	Percentage of Connected Load	Percentage of Savings Contribution	Population Sample Size for Coefficient of Variation: 0.5	Minimum Required Fixture Samples
4XLEDT4FT-DR-STD	522	27.14	98,615.4	8%	15%	11	11
2XLEDT4FT-DR-STD	871	22.65	87,682.4	7%	13%	11	11
1X6LEDSI	3502	21.01	76,100.0	6%	12%	11	11
1X319LEDF-UP	25	7.98	45,474.1	2%	7%	8	8
3XLEDT4FT-DR-STD	312	12.17	45,387.4	4%	7%	11	11
2XLEDT4FT-HO-DR-STD	320	10.56	25,249.6	3%	4%	11	11
1X37LEDF-RETRO	155	5.74	25,179.7	2%	4%	11	11
1XLEDT4FT-DR-STD	381	4.95	23,985.4	2%	4%	11	11
12X8.5LED4 P	16	2.02	21,226.8	1%	3%	7	7
1XLEDT4FT-HO-DR-STD	434	7.38	19,784.5	2%	3%	11	11
1X9LEDSI	200	1.80	19,362.8	1%	3%	11	11
1X45LED HID	23	1.04	18,867.5	0%	3%	8	8
1X6 LED-MR16	96	0.58	12,391.4	0%	2%	10	10
9XLEDT4FT-DR-STD	30	4.32	10,877.1	1%	2%	9	9
1X25LEDF-6RC	176	4.58	10,876.8	1%	2%	11	11
4X8.5LED4P	31	1.30	10,778.7	0%	2%	9	9
1X17LED PAR38	49	0.83	10,711.9	0%	2%	9	9

The lighting system annual run hours by space type are agreed to be as shown in the table below. These run hours are based on schedules and sample loggers used during the audit phase. These values are considered non-measured and agreed upon by the Customer.

Include (Yes/No)	All Areas Usage Group Code	Description	Existing Burn Hours Assigned	Proposed Controlled Burn Hours
Yes	E	Exterior	4380	4380
Yes	X	Exit Signs	8760	8760

Schedule 2

Include (Yes/No)	All Areas Usage Group Code	Description	Existing Burn Hours Assigned	Proposed Controlled Burn Hours
No	VEND	Vending Machines	8760	6132
Yes	AU	Auditorium/Stage	4038	2827
Yes	BR	Break room	1205	603
No	CL	Classroom	4038	2827
Yes	CR	Conference Room	1000	500
No	CT	Court Room/Trial Areas	4038	2827
Yes	GA	Garage/Parking Decks	4038	2827
No	GYM	Gymnasium	4038	2827
Yes	HW	Hallway	3432	1716
Yes	KT	Kitchen	1385	693
No	LAB	Laboratory	4038	2827
Yes	LO	Lobby/Entry Vestibule	4038	2827
No	LI	Library	4038	2827
No	LQ	Living Quarters/Bunk Rooms	4038	2827
No	LR	Locker Room	4038	2827
Yes	ME	Mechanical/Electrical Rooms	2493	1745
Yes	MP	Multipurpose	4038	2827
Yes	OO	Open Office	2850	2280
No	OS	Office Support (copy room, coffee room, etc)	4038	2827
Yes	PO	Private Office	2493	1745
No	PR	Patient Room	4038	2827
Yes	RR	Restroom	1500	375
Yes	RT	Retail	4038	2827
Yes	ST	Storage	2493	1745
No	WH	Warehouse	4038	2827
Yes	UT	Utility/Janitor Closets	2493	1246
Yes	WS	Workshop	4038	2827
Yes	SW	Stairwell	4038	2827
Yes	CF	Cafeteria	4038	2827
Yes	LIB	Library Public Space	3071	2150
Yes	EMG	Emergency Lighting	8760	6132
Yes	24/7	Night Light	8760	6132
Yes	LOL	Lobby - Low Use	2493	1745
No	DW		4038	2827
Yes	LIBL	Library Space - low use	2493	1745
Yes	LABL	Lab Space - low use	2493	1745
Yes	STH	Stairwell - High Use	4038	2827
Yes	LOAS	Lobby - Already Sensored	4038	4038
Yes	HWAS	Hallway - Already Sensored	3432	3432
Yes	OOAS	Open Office - Already Sensored	2850	2850

Include (Yes/No)	All Areas Usage Group Code	Description	Existing Burn Hours Assigned	Proposed Controlled Burn Hours
Yes	CRAS	Conference Room - Already Sensored	1000	1000
Yes	LIBAS	Library - Already Sensored	4038	4038
Yes	STAS	Storage - Already Sensored	4038	4038
Yes	RRAS	Restroom - Already Sensored	1500	1500
Yes	POAS	Private Office - Already Sensored	4038	4038
Yes	SWAS	Stairwell - Already Sensored	4038	4038
Yes	UTAS	Utility/Janitor Closets - Already Sensored	2493	2493
Yes	EMG EGRESS	Emergency Egress Lighting	299	299

Equations for Calculating Lighting Retrofit Savings (Option A)

Demand (kW)

$$\text{Connected kW Saving} = \sum_u [(\text{kW/Fixture}_{\text{baseline}} \times \text{Quantity}_{\text{baseline}} - \text{kW/Fixture}_{\text{post}} \times \text{Quantity}_{\text{post}})]_{t,u}$$

where:

- kW/fixture_{baseline} = lighting baseline demand per fixture for usage group u
- kW/fixture_{post} = lighting demand per fixture during post-installation period for usage group
- Quantity_{baseline} = quantity of affected fixtures before the lighting retrofit for usage group u
- Quantity_{post} = quantity of affected fixtures after the lighting retrofit for usage group u

Examples of usage groups include hallways and offices.

Energy (kWh)

$$\text{kWh Savings}_{\text{Lighting}} = \sum_u [\text{Connected kW Savings}_u \times \text{Hours of Operation}]_{t,u}$$

where:

- kW Savings_u = kilowatt savings realized during the post-installation time for usage group u
- Hours of Operation = number of operating hours during the time period t for the usage group u

Option B Retrofit Isolation

Measured Project Benefits are determined by field measurement of the energy use of the systems to which an Improvement Measure was applied separate from the energy use of the rest of the facility. Short-term, long-term or continuous measurements are taken throughout the pre and post-retrofit periods. Engineering calculations using

Schedule 2

short term, long-term or continuous pre and post-retrofit measurements are used to calculate the Measured Project Benefits for the duration of the Guarantee Term.

Measured Project Benefits from the following Improvement Measures will be calculated using Option B:

ECM Number	ECM Name
None	None

Option C Whole Facility

Option C involves use of utility meters or whole-building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of Improvement Measure, but not individually if more than one is applied to an energy meter. This option determines the collective Measured Project Benefits of all Improvement Measures applied to the part of the facility monitored by the energy meter. Also, since whole building meters are used, Measured Project Benefits reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Measured Project Benefits from the following Improvement Measures will be calculated using Option C:

ECM Number	ECM Name
ECM-1-MCL	Central Library Replace and Upgrade Chilled Water Plant with Mag-Lev Chiller
ECM-3-MCL	Central Library Convert Existing AC-7 from CAV to DOAS
ECM-12a-MCL	Central Library Interior Lighting Retrofits
ECM-12b-MCL	Central Library Exterior Lighting Retrofits
ECM-12c-MCL	Central Library Lighting Control Panel Upgrades

Savings will be proved by using Metrix Utility Accounting System. An example M&V report demonstrating how Metrix Utility Accounting System is used to determine savings is included as Attachment 7. This example report is provided for information purposes only. All M&V reports for this project will reflect the scope of work and performance of the project and facilities described in Schedule 1 and this Schedule 2. Additionally, the results will be inputted into Energy Star Portfolio Manager.

Option D Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use. Such simulation model must be "calibrated" so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year.

Option D may be used to assess the performance of all Improvement Measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation tool in Option D allow estimates of the Measured Project Benefits attributable to each Improvement Measure within a multiple Improvement Measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Options A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters.

Measured Project Benefits from the following Improvement Measures will be calculated using Option D:

ECM Number	ECM Name
None	None

**CHANGES IN USE OR CONDITION; ADJUSTMENT TO BASELINE
AND/OR ANNUAL PROJECT BENEFITS**

Customer agrees to notify JCI, within fourteen (14) days, of (i) any actual or intended change, whether before or during the Guarantee Term, in the use of any facility, equipment, or Improvement Measure to which this Schedule applies; (ii) any proposed or actual expansions or additions to the premises or any building or facility at the premises; (iii) a change to utility services to all or any portion of the premises; or (iv) any other change or condition arising before or during the Guarantee Term that reasonably could be expected to change the amount of Project Benefits realized under this Agreement.

Such a change, expansion, addition, or condition would include, but is not limited to: (a) changes in the primary use of any facility, Improvement Measure, or portion of the premises; (b) changes to the hours of operation of any facility, Improvement Measure, or portion of the premises; (c) changes or modifications to the Improvement Measures or any related equipment; (d) changes to the M&V Services provided under this Agreement; (e) failure of any portion of the premises to meet building codes; (f) changes in utility suppliers, utility rates, method of utility billing, or method of utility purchasing; (g) insufficient or improper maintenance or unsound usage of the Improvement Measures or any related equipment at any facility or portion of the premises (other than by JCI); (h) changes to the Improvement Measures or any related equipment or to any facility or portion of the premises required by building codes or any governmental or quasi-governmental entity; or (i) additions or deletions of Improvement Measures or any related equipment at any facility or portion of the premises.

Such a change or condition need not be identified in the Baseline in order to permit JCI to make an adjustment to the Baseline and/or the Annual Project Benefits. If JCI does not receive the notice within the time period specified above or travels to either Customer's location or the project site to determine the nature and scope of such changes, Customer agrees to pay JCI, in addition to any other amounts due under this Agreement, the applicable hourly consulting rate for the time it took to determine the changes and to make any adjustments and/or corrections to the project as a result of the changes, plus all reasonable and documented out-of-pocket expenses, including travel costs. Upon receipt of such notice, or if JCI independently learns of any such change or condition, JCI shall calculate and send to Customer a notice of adjustment to the Baseline and/or Annual Project Benefits to reflect the impact of such change or condition, and the adjustment shall become effective as of the date the change or condition first arose. Should Customer fail to promptly provide JCI with notice of any such change or condition, JCI may make reasonable estimates as to the impact of such change or condition and as to the date on which such change or condition first arose in calculating the impact of such change or condition, and such estimates shall be conclusive.

IV. BASELINE CALCULATIONS AND UTILITY RATES

The unit utility costs for the Baseline period are set forth below as "Base Utility Cost" and shall be used for all calculations made under this Schedule. The Base Utility Cost shall be escalated annually by the actual utility cost escalation but such escalation shall be no less than the mutually agreed "floor" escalation rate of two and three quarters percent (2.75%).

The calculations for baseline utility costs are further explained below. Baseline Source EUI information has been retrieved from ENERGY STAR Portfolio Manager and is presented for information only. Determination of the conversion factor from kBtu (site) to kBtu (source) are by the U.S. Environmental Protection Agency and are not within JCI's guarantee. Additionally, no baseline natural gas usage has been included for facilities where natural gas consumption will be unaffected by the implemented ECMs.

Baseline (July 2016 to June 2017)		Energy			Total Annual Utility Spend
		Electric Consumption	Natural Gas	Steam	
		kWh	therm	klbs	
Milw Central Public Library (MCL)	Dollars	\$297,681		\$119,812	\$417,493
	Units	2,904,947		9,335	
Bay View Public Library (BVL)	Dollars	\$24,340	\$5,866		\$30,206
	Units	204,320	7,485		
Sites Total	Dollars	\$322,021	\$5,866	\$119,812	\$447,699
	Units	3,109,267	7,485	9,335	

For the Central Library facility, the following additional baseline information has been retrieved from ENERGY STAR Portfolio Manager and is presented for information relative to the M&V responsibilities outlined in this Schedule 2.

2009 Better Buildings Challenge Baseline Year Source kBtu	40,597,443 kBtu
2017 Benefit Term Baseline Year Source kBtu	38,198,387 kBtu
Projected Savings Source kBtu due to all MCL ECMs	7,325,605 kBtu
Projected 2019 Source kBtu	30,192,633 kBtu
Estimated Percent Reduction from 2017 Baseline due to all ECMs	19.2%

The unit utility costs for the Baseline period are set forth below as "Base Utility Cost" and shall be used for all calculations made under this Schedule. The Base Utility Cost for electric, natural gas, and fuel represents the 12 or 24 month average utility costs between June 2017 and June 2018 as described in detail in the following tables.

Rate Summary

Building	Account	Rate Code	Tariff	Unit	Rate
818 W WISCONSIN AVE	8026753497	AG1	Milwaukee	Steam Used (mlbs)	\$11.197480
814 W WISCONSIN AVE	6606872777	FG-1	WGC	Gas Used (therms)	\$0.855000
814 W WISCONSIN AVE	6276451235	FG-1	WGC	Gas Used (therms)	\$0.855000
814 W WISCONSIN AVE	4296319834	CP1, CP1PV	Wisconsin	Standard/ On-Peak Usage Charge	\$0.074150
				Off-Peak Usage Charge	\$0.052810

Schedule 2

Building	Account	Rate Code	Tariff	Unit	Rate
2566 S KINNICKINNIC AVE	6840261981			On-Peak Demand Charge	\$13.519000
				Customer Demand Charge	\$1.380000
		FG-2	WGC	Gas Used (therms)	\$0.783700
		CG2	Wisconsin	Standard/ On-Peak Usage Charge	\$0.121010
				Off-Peak Usage Charge	\$0.091700
				On-Peak Demand Charge	\$6.860000

Effective Electric Rates used in Calculations

MPL 814 West Wisconsin

Energy

Usage from 6/13/17-6/13/18

on peak	1,413,807	48.7%	\$ 0.0742	\$ 0.0742	\$ 0.0742
off peak	1,491,140	51.3%	\$ 0.0528	\$ 0.0528	\$ 0.0528
	2,904,947			Effective kWh rate	\$ 0.06320

Demand

Elect Service Distribution

On-Peak Demand Charge	\$ 13.52
Customer Demand Charge	\$ 1.38

2566 S KINNICKINNIC AVE

Energy

Usage from 6/28/17-6/27/18

on peak	115,680	56.6%	\$ 0.0742	\$ 0.1210	\$ 0.1054
off peak	88,640	43.4%	\$ 0.0528	\$ 0.0917	\$ 0.0787
	204,320			Effective kWh rate	\$ 0.09383

Demand

Elect Service Distribution

On-Peak Demand Charge	\$6.860000
Customer Demand Charge	\$ -

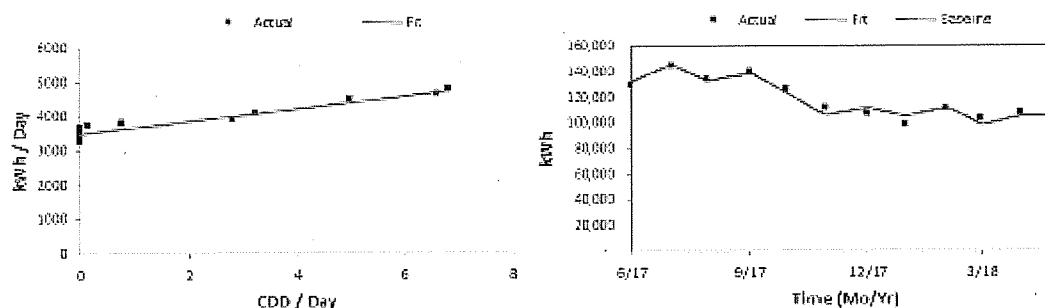
The following is the expected baseline and may be updated for anything found during construction.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kWh(Qty OnPk)



From	To	# Days	Reading	Incl?	HDD	CDD	Offset	Baseline	Deviation
05/12/17	06/13/17	33	129,055	<input checked="" type="checkbox"/>	0.0	93.0	-	132,474	2.6%
06/14/17	07/14/17	31	143,932	<input checked="" type="checkbox"/>	0.0	204.5	-	145,919	1.4%
07/15/17	08/11/17	28	133,729	<input checked="" type="checkbox"/>	0.0	190.5	-	132,850	-0.7%
08/12/17	09/14/17	34	139,507	<input checked="" type="checkbox"/>	0.0	110.5	-	139,180	-0.2%
09/15/17	10/12/17	28	125,908	<input checked="" type="checkbox"/>	0.0	140.0	-	123,601	-1.8%
10/13/17	11/11/17	30	111,538	<input checked="" type="checkbox"/>	0.0	4.5	-	105,757	-5.2%
11/12/17	12/13/17	32	105,869	<input checked="" type="checkbox"/>	0.0	0.0	-	111,928	5.7%
12/14/17	01/12/18	30	97,660	<input checked="" type="checkbox"/>	0.0	0.0	-	104,933	7.4%
01/13/18	02/13/18	32	109,749	<input checked="" type="checkbox"/>	0.0	0.0	-	111,928	2.0%
02/14/18	03/13/18	28	102,122	<input checked="" type="checkbox"/>	0.0	0.0	-	97,937	-4.1%
03/14/18	04/12/18	30	107,098	<input checked="" type="checkbox"/>	0.0	0.0	-	104,933	-2.0%
04/13/18	05/11/18	29	110,841	<input checked="" type="checkbox"/>	0.0	22.5	-	105,559	-4.8%
Sum/Average/Max		365	1,417,008		0.0	765.5	-	1,417,008	0% +/- 3.6%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kWh)} = 3497.749 \times \# \text{Days} + 183.3175 \times \text{CDD}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-3.6082%. The underlying regression has a $R^2=0.9247$

Baseline Costs are calculated using Average Cost/Consumption.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

CDD = Cooling Degree-Days calculated for MILWAUKEE WI for a 65.0 F° balance point.

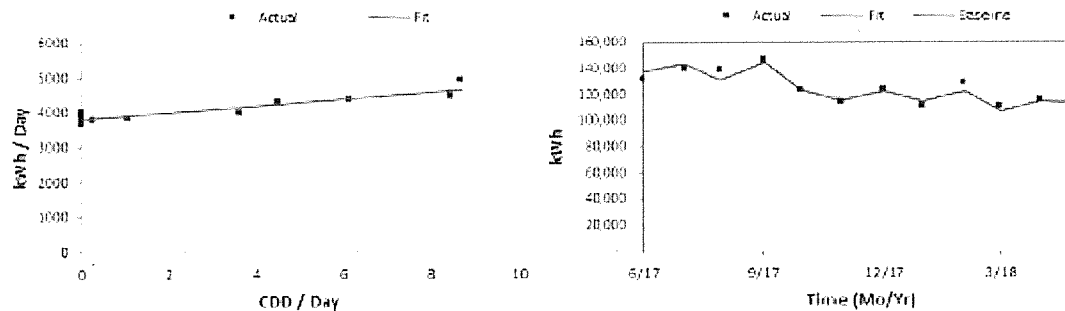
Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kWh(Qty OffPk)



From	To	# Days	Reading	Incl?	HDD	CDD	Offset	Baseline	Deviation
05/12/17	06/13/17	33	131,352	<input checked="" type="checkbox"/>	0.0	119.5	-	137,612	4.8%
06/14/17	07/14/17	31	138,732	<input checked="" type="checkbox"/>	0.0	262.5	-	143,938	3.8%
07/15/17	08/11/17	28	138,040	<input checked="" type="checkbox"/>	0.0	243.5	0	130,633	-5.4%
08/12/17	09/14/17	34	146,167	<input checked="" type="checkbox"/>	0.0	153.5	-	144,748	-1.0%
09/15/17	10/12/17	28	122,674	<input checked="" type="checkbox"/>	0.0	172.5	-	123,703	0.8%
10/13/17	11/11/17	30	114,378	<input checked="" type="checkbox"/>	0.0	8.5	-	115,327	0.8%
11/12/17	12/13/17	32	123,580	<input checked="" type="checkbox"/>	0.0	0.0	-	122,131	-1.2%
12/14/17	01/12/18	30	110,399	<input checked="" type="checkbox"/>	0.0	0.0	-	114,497	3.7%
01/13/18	02/13/18	32	128,424	<input checked="" type="checkbox"/>	0.0	0.0	-	122,131	-4.9%
02/14/18	03/13/18	28	109,993	<input checked="" type="checkbox"/>	0.0	0.0	-	106,864	-2.8%
03/14/18	04/12/18	30	114,605	<input checked="" type="checkbox"/>	0.0	0.0	-	114,497	-0.1%
04/13/18	05/11/18	29	111,394	<input checked="" type="checkbox"/>	0.0	30.5	-	113,658	2.0%
Sum/Average/Max		365	1,489,738		0.0	990.5	0	1,489,738	0% +/- 3.4%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kWh)} = 3816.577 \times \text{\#Days} + 97.6148 \times \text{CDD} + \text{Offset}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-3.4223%. The underlying regression has a $R^2=0.8517$

Baseline Costs are calculated using Average Cost/Consumption.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

CDD = Cooling Degree-Days calculated for MILWAUKEE WI for a 63.0 F° balance point.

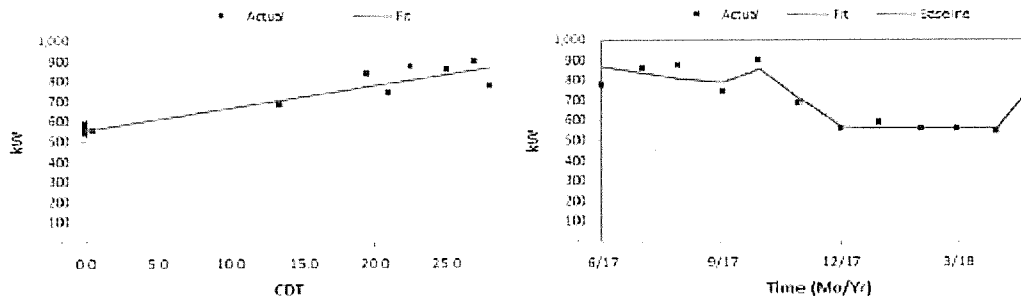
Multiplier and Offset are derived from Modification(s) in effect during the tuning period and are replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kW(Dmd OnPk)



From	To	# Days	Reading	Incl?	HDT	CDT	Offset	Baseline	Deviation
05/12/17	06/13/17	33	776	<input checked="" type="checkbox"/>	0.0	28.0	-	868	11.9%
06/14/17	07/14/17	31	856	<input checked="" type="checkbox"/>	0.0	25.0	-	835	-2.5%
07/15/17	08/11/17	28	868	<input checked="" type="checkbox"/>	0.0	22.5	-	807	-6.9%
08/12/17	09/14/17	34	738	<input checked="" type="checkbox"/>	0.0	21.0	-	791	7.2%
09/15/17	10/12/17	28	895	<input checked="" type="checkbox"/>	0.0	27.0	-	857	-4.2%
10/13/17	11/11/17	30	684	<input checked="" type="checkbox"/>	0.0	13.5	-	708	3.5%
11/12/17	12/13/17	32	556	<input checked="" type="checkbox"/>	0.0	0.5	-	564	1.5%
12/14/17	01/12/18	30	587	<input checked="" type="checkbox"/>	0.0	0.0	-	559	-4.9%
01/13/18	02/13/18	32	557	<input checked="" type="checkbox"/>	0.0	0.0	-	559	0.4%
02/14/18	03/13/18	28	554	<input checked="" type="checkbox"/>	0.0	0.0	-	559	0.9%
03/14/18	04/12/18	30	538	<input checked="" type="checkbox"/>	0.0	0.0	-	559	3.8%
04/13/18	05/11/18	29	832	<input checked="" type="checkbox"/>	0.0	19.5	-	774	-7.0%
Sum/Average/Max		365	8,440		0.0	157.0	-	8,440	0% +/- 6.4%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kW)} = 558.8385 + 11.0467 \times \text{CDT}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-0.379%. The underlying regression has a $R^2=0$

Baseline Costs are calculated using Average Cost/Demand, but no less than \$0/ kW.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

CDT = Cooling Delta T calculated for MILWAUKEEWI for a 55.0 F° balance point.

CDT was calculated using Maximum Temperatures.

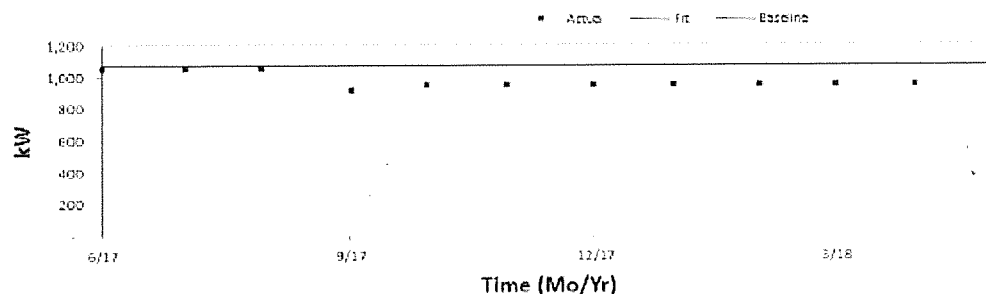
Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 4296319834

Site: Site1
Meter: Main-Electric5
Unit: kW(Dmd OffPk)



From	To	# Days	Reading	Incl?	HDT	CDT	Offset	Baseline	Deviation
05/12/17	06/13/17	33	1,042	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	3.1%
06/14/17	07/14/17	31	1,042	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	3.1%
07/15/17	08/11/17	28	1,042	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	3.1%
08/12/17	09/14/17	34	909	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	18.3%
09/15/17	10/12/17	28	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
10/13/17	11/11/17	30	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
11/12/17	12/13/17	32	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
12/14/17	01/12/18	30	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
01/13/18	02/13/18	32	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
02/14/18	03/13/18	28	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
03/14/18	04/12/18	30	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
04/13/18	05/11/18	29	937	<input checked="" type="checkbox"/>	0.0	0.0	-	1,075	14.7%
Sum/Average/Max		365	11,535		0.0	0.0	-	12,900	10.6% +/- 13.4%

Main-Electric5 (Account # 4296319834): Tuning Period is 365 days from 5/12/2017 until 5/11/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (kW)} = 1075$$

The Baseline Equation has a Net Mean Bias of 10.5798% and a Monthly Mean Error of +/-13.3915%. The underlying regression has a $R^2=0$

Baseline Costs are calculated using Average Cost/Demand, but no less than \$0/ kW.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

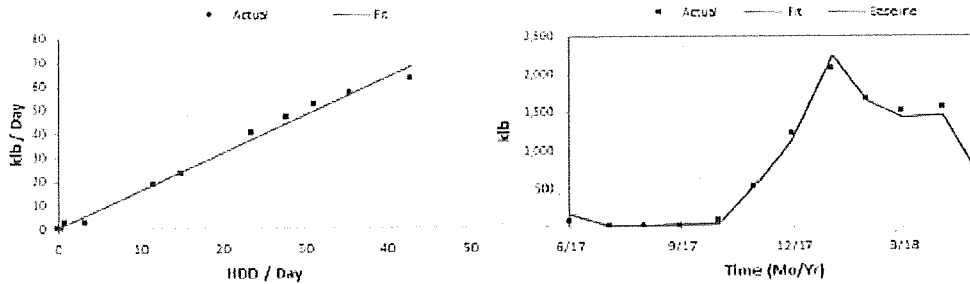
Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.



Meter Tuning Contract

Project: MPL
Area: Main Library
Account: 8026753497

Site: Site 1
Meter: Main-Steam
Unit: klb(Qty OnPk)



From	To	# Days	Reading	Incl?	HDD	CDD	Offset	Baseline	Deviation
05/11/17	06/09/17	30	67	<input checked="" type="checkbox"/>	97.0	0.0	-	156	132.6%
06/10/17	07/12/17	33	-	<input checked="" type="checkbox"/>	0.5	0.0	-	3	0.0%
07/13/17	08/09/17	28	-	<input checked="" type="checkbox"/>	0.0	0.0	-	2	0.0%
08/10/17	09/08/17	30	-	<input checked="" type="checkbox"/>	12.5	0.0	-	22	0.0%
09/09/17	10/10/17	32	77	<input checked="" type="checkbox"/>	26.5	0.0	-	44	-42.4%
10/11/17	11/07/17	28	521	<input checked="" type="checkbox"/>	325.0	0.0	-	517	-0.8%
11/08/17	12/07/17	30	1,209	<input checked="" type="checkbox"/>	708.5	0.0	-	1,124	-7.0%
12/08/17	01/09/18	33	2,069	<input checked="" type="checkbox"/>	1419.0	0.0	-	2,250	8.7%
01/10/18	02/07/18	29	1,655	<input checked="" type="checkbox"/>	1031.5	0.0	-	1,636	-1.2%
02/08/18	03/08/18	29	1,512	<input checked="" type="checkbox"/>	901.0	0.0	-	1,429	-5.5%
03/09/18	04/10/18	33	1,554	<input checked="" type="checkbox"/>	921.0	0.0	-	1,461	-6.0%
04/11/18	05/09/18	29	671	<input checked="" type="checkbox"/>	435.0	0.0	-	691	3.0%
Sum/Average/Max		364	9,335		5877.5	0.0	-	9,335	0% +/- 9.9%

Main-Steam (Account # 8026753497): Tuning Period is 364 days from 5/11/2017 until 5/9/2018.

Below is the equation used to calculate the Baseline values for the tuning period and all future periods:

$$\text{Baseline (klb)} = 0.0746 \times \# \text{Days} + 1.5836 \times \text{HDD}$$

The Baseline Equation has a Net Mean Bias of 0% and a Monthly Mean Error of +/-9.9275%. The underlying regression has a $R^2=0.9905$

Baseline Costs are calculated using Average Total Cost/Consumption.

Explanations and Assumptions:

☐ (empty checkbox) under 'Incl?' indicates that the bill is excluded from the regression. However the Baseline Equation is always applied for all billing periods, even those excluded from the regression.

HDD = Heating Degree-Days calculated for MILWAUKEE WI for a 62.0 F° balance point.

Multiplier is derived from Modification(s) in effect during the tuning period and is replicated annually for all future periods.

V. PRIMARY OPERATIONS SCHEDULE PRE & POST RETROFIT

Lighting hours of operation are as described above in Section III, Paragraph B. HVAC Schedules, setpoints and operating parameters are listed in the eQuest Review of Building Simulation Assumptions Attachment 6.

VI. MEASUREMENT & VERIFICATION SERVICES

JCI will provide the M&V Services set forth below in connection with the Assured Performance Guarantee.

1. During the Installation Period, a JCI Performance Assurance Specialist will track Measured Project Benefits. JCI will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 60 days of the commencement of the Guarantee Term.
2. Within 60 days of each anniversary of the commencement of the Guarantee Term, JCI will provide Customer with an annual report containing:
 - A. an executive overview of the project's performance and Project Benefits achieved to date;
 - B. a summary analysis of the Measured Project Benefits accounting; and
 - C. depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.
3. During the Guarantee Term, a JCI Performance Assurance Specialist will monitor the on-going performance of the Improvement Measures, as specified in this Agreement, to determine whether anticipated Measured Project Benefits are being achieved. For the duration of the Option C portion of the M&V scope, monitoring will occur at a minimum through two (2) on-site reviews per year, twelve (12) monthly conference calls per year, and several remote checks of monitoring data per month per year. For the duration of the Option A portion of the M&V scope, monitoring will occur through one (1) on-site review and periodic remote checks of monitoring data as necessary. In this regard, the Performance Assurance Specialist will periodically assist Customer, on-site or remotely, with respect to the following activities:
 - A. review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
 - B. advise Customer's designated personnel of any performance deficiencies based on such information;
 - C. coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
 - D. inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
 - E. provide the Customer with ENERGY STAR Portfolio Manager baseline and use adjustments as necessary as they relate to work done under the Contract and that may be in addition to any agreed upon baseline and savings adjustments and savings calculations associated with the provisions of the Contractor's energy savings guarantee.
4. For specified Improvement Measures utilizing an "Option A" M&V protocol, JCI will:
 - A. conduct pre and post installation measurements required under this Agreement;
 - B. confirm the building management system employs the control strategies and set points specified in this Agreement; and
 - C. analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting and water benefits calculations will be

Audited Financial Statement

UNITED STATES SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549
FORM 10-K

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the Fiscal Year Ended September 30, 2022
OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the Transition Period From ____ To ____

Commission File Number 001-13836

JOHNSON CONTROLS INTERNATIONAL PLC

(Exact name of registrant as specified in its charter)

Ireland

(Jurisdiction of Incorporation)

One Albert Quay, Cork, Ireland, T12 X8N6

(Address of Principal Executive Offices and Postal Code)

98-0390500

(I.R.S. Employer Identification No.)

(353) 21-423-5000

(Registrant's Telephone Number)

Securities Registered Pursuant to Section 12(b) of the Exchange Act:

<u>Title of Each Class</u>	<u>Trading Symbol</u>	<u>Name of Each Exchange on Which Registered</u>
Ordinary Shares, Par Value \$0.01	JCI	New York Stock Exchange
4.625% Notes due 2023	JCI23	New York Stock Exchange
1.000% Senior Notes due 2023	JCI23A	New York Stock Exchange
3.625% Senior Notes due 2024	JCI24A	New York Stock Exchange
1.375% Notes due 2025	JCI25A	New York Stock Exchange
3.900% Notes due 2026	JCI26A	New York Stock Exchange
0.375% Senior Notes due 2027	JCI27	New York Stock Exchange
3.000% Senior Notes due 2028	JCI28	New York Stock Exchange
1.750% Senior Notes due 2030	JCI30	New York Stock Exchange
2.000% Sustainability-Linked Senior Notes due 2031	JCI31	New York Stock Exchange
1.000% Senior Notes due 2032	JCI32	New York Stock Exchange
4.900% Senior Notes due 2032	JCI32A	New York Stock Exchange
6.000% Notes due 2036	JCI36A	New York Stock Exchange
5.70% Senior Notes due 2041	JCI41B	New York Stock Exchange
5.250% Senior Notes due 2041	JCI41C	New York Stock Exchange
4.625% Senior Notes due 2044	JCI44A	New York Stock Exchange
5.125% Notes due 2045	JCI45B	New York Stock Exchange
6.950% Debentures due December 1, 2045	JCI45A	New York Stock Exchange
4.500% Senior Notes due 2047	JCI47	New York Stock Exchange
4.950% Senior Notes due 2064	JCI64A	New York Stock Exchange

Securities Registered Pursuant to Section 12(g) of the Exchange Act: **None**

Indicate by check mark whether the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☒ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Exchange Act. Yes ☐ No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Exchange Act during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	<input checked="" type="checkbox"/>	Accelerated filer	<input type="checkbox"/>
Non-accelerated filer	<input type="checkbox"/>	Smaller reporting company	<input type="checkbox"/>
Emerging growth company	<input type="checkbox"/>		

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report ☒

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ No ☒

As of March 31, 2022, the aggregate market value of Johnson Controls International plc Common Stock held by non-affiliates of the registrant was approximately \$45.5 billion based on the closing sales price as reported on the New York Stock Exchange. As of October 31, 2022, 686,703,889 ordinary shares, par value \$0.01 per share, were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the definitive Proxy Statement to be delivered to shareholders in connection with the annual general meeting of shareholders to be held on March 8, 2023 are incorporated by reference into Part III.

JOHNSON CONTROLS INTERNATIONAL PLC

Index to Annual Report on Form 10-K

Year Ended September 30, 2022

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CAUTIONARY STATEMENTS FOR FORWARD-LOOKING INFORMATION

Unless otherwise indicated, references to "Johnson Controls," the "Company," "we," "our" and "us" in this Annual Report on Form 10-K refer to Johnson Controls International plc and its consolidated subsidiaries.

The Company has made statements in this document that are forward-looking and therefore are subject to risks and uncertainties. All statements in this document other than statements of historical fact are, or could be, "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. In this document, statements regarding the Company's future financial position, sales, costs, earnings, cash flows, other measures of results of operations, synergies and integration opportunities, capital expenditures, debt levels and market outlook are forward-looking statements. Words such as "may," "will," "expect," "intend," "estimate," "anticipate," "believe," "should," "forecast," "project" or "plan" and terms of similar meaning are also generally intended to identify forward-looking statements. However, the absence of these words does not mean that a statement is not forward-looking. The Company cautions that these statements are subject to numerous important risks, uncertainties, assumptions and other factors, some of which are beyond the Company's control, that could cause the Company's actual results to differ materially from those expressed or implied by such forward-looking statements, including, among others, risks related to: The Company's ability to manage general economic, business and capital market conditions, including the impact of recessions and economic downturns; the ability to manage macroeconomic and geopolitical volatility, including global price inflation, shortages impacting the availability of raw materials and component products and the conflict between Russia and Ukraine; the ability to develop or acquire new products and technologies that achieve market acceptance and meet applicable regulatory requirements; the strength of the U.S. or other economies; fluctuations in currency exchange rates; changes or uncertainty in laws, regulations, rates, policies or interpretations that impact the Company's business operations or tax status; changes to laws or policies governing foreign trade, including economic sanctions, tariffs or trade restrictions; maintaining and improving the capacity, reliability and security of the Company's enterprise information technology infrastructure; the ability to manage the lifecycle cybersecurity risk in the development, deployment and operation of the Company's digital platforms and services; the outcome of litigation and governmental proceedings; the risk of infringement or expiration of intellectual property rights; the Company's ability to manage the impacts of natural disasters, climate change, pandemics and outbreaks of contagious diseases and other adverse public health developments, such as the COVID-19 pandemic; the ability of the Company to drive organizational improvement; any delay or inability of the Company to realize the expected benefits and synergies of recent portfolio transactions; the ability to hire and retain senior management and other key personnel; the tax treatment of recent portfolio transactions; significant transaction costs and/or unknown liabilities associated with such transactions; labor shortages, work stoppages, union negotiations, labor disputes and other matters associated with the labor force; and the cancellation of or changes to commercial arrangements. A detailed discussion of risks related to Johnson Controls' business is included in the section entitled "Risk Factors" (refer to Part I, Item 1A, of this Annual Report on Form 10-K). The forward-looking statements included in this document are made only as of the date of this document, unless otherwise specified, and, except as required by law, Johnson Controls assumes no obligation, and disclaims any obligation, to update such statements to reflect events or circumstances occurring after the date of this document.

PART I

ITEM 1 **BUSINESS**

General

Johnson Controls International plc, headquartered in Cork, Ireland, is a global leader in smart, healthy and sustainable buildings, serving a wide range of customers in more than 150 countries. The Company's products, services, systems and solutions advance the safety, comfort and intelligence of spaces to serve people, places and the planet. The Company is committed to helping its customers win and creating greater value for all of its stakeholders through its strategic focus on buildings.

Johnson Controls was originally incorporated in the state of Wisconsin in 1885 as Johnson Electric Service Company to manufacture, install and service automatic temperature regulation systems for buildings and was renamed Johnson Controls, Inc. in 1974. In 2005, Johnson Controls acquired York International, a global supplier of heating, ventilating, air-conditioning ("HVAC") and refrigeration equipment and services. In 2014, Johnson Controls acquired Air Distribution Technologies, Inc., one of the largest independent providers of air distribution and ventilation products in North America. In 2015, Johnson Controls formed a joint venture with Hitachi to expand its building related product offerings. In 2016, Johnson Controls, Inc. and Tyco International plc ("Tyco") completed their combination (the "Merger"), combining Johnson Controls' portfolio of building efficiency solutions with Tyco's portfolio of fire and security solutions. Following the Merger, Tyco changed its name to "Johnson Controls International plc."

In 2016, the Company completed the spin-off of its automotive business into Adient plc, an independent, publicly traded company. In 2019, the Company closed the sale of its Power Solutions business, completing the Company's transformation into a pure-play building technologies and solutions provider.

The Company is a global leader in engineering, manufacturing and commissioning building products and systems, including residential and commercial HVAC equipment, industrial refrigeration systems, controls, security systems, fire-detection systems and fire-suppression solutions. The Company further serves customers by providing technical services, including maintenance, management, repair, retrofit and replacement of equipment (in the HVAC, industrial refrigeration, security and fire-protection space), and energy-management consulting. In 2020, the Company launched its OpenBlue software platform, enabling enterprises to manage all aspects of their physical spaces by combining the Company's building products and services with cutting-edge technology and digital capabilities to enable data-driven "smart building" services and solutions. The Company partners with customers by leveraging its broad product portfolio and digital capabilities powered by OpenBlue, together with its direct channel service and solutions capabilities, to deliver outcome-based solutions across the lifecycle of a building that address customers' needs to improve energy efficiency, enhance security, create healthy environments and reduce greenhouse gas emissions.

Business Segments

The Company conducts its business through four business segments: Building Solutions North America, Building Solutions EMEA/LA, Building Solutions Asia Pacific and Global Products.

Building Solutions North America: Building Solutions North America designs, sells, installs and services HVAC, controls, building management, refrigeration, integrated electronic security and integrated fire-detection and suppression systems for commercial, industrial, retail, small business, institutional and governmental customers in the United States and Canada. Building Solutions North America also provides energy efficiency solutions and technical services, including inspection, scheduled maintenance, and repair and replacement of mechanical and controls systems, as well as data-driven "smart building" solutions, to non-residential building and industrial applications in the United States and Canadian marketplace.

Building Solutions EMEA/LA: Building Solutions EMEA/LA designs, sells, installs and services HVAC, controls, building management, refrigeration, integrated electronic security, integrated fire-detection and suppression systems, and provides technical services, including data-driven "smart building" solutions, to markets in Europe, the Middle East, Africa and Latin America.

Building Solutions Asia Pacific: Building Solutions Asia Pacific designs, sells, installs and services HVAC, controls, building management, refrigeration, integrated electronic security, integrated fire-detection and suppression systems, and provides technical services, including data-driven "smart building" solutions, in the Asia Pacific marketplace.

Global Products: Global Products designs, manufactures and sells HVAC equipment, controls software and software services for residential and commercial applications to commercial, industrial, retail, residential, small business, institutional and governmental customers worldwide. In addition, Global Products designs, manufactures and sells refrigeration equipment and controls globally. The Global Products business also designs, manufactures and sells fire protection, fire suppression and security products, including intrusion security, anti-theft devices, access control, and video surveillance and management systems, for commercial, industrial, retail, residential, small business, institutional and governmental customers worldwide. Global Products includes the Johnson Controls-Hitachi joint venture.

For more information on the Company's segments, refer to Note 19, "Segment Information," of the notes to consolidated financial statements.

Products, Systems, Services and Solutions

The Company sells and installs its commercial HVAC equipment and systems, control systems, security systems, fire-detection and fire suppression systems, equipment and services primarily through its extensive direct channel, consisting of a global network of sales and service offices. Significant sales are also generated through global third-party channels, such as distributors of air-conditioning, controls, security and fire-detection and suppression products. The Company's large base of current customers leads to significant repeat business for the maintenance, retrofit and replacement markets. The Company is also able to leverage its installed base to generate sales for its service business. Trusted building brands, such as YORK®, Hitachi Air Conditioning, Metasys®, Ansul, Ruskin®, Titus®, Frick®, PENN®, Sabroe®, Silent-Aire®, Simplex® and

Grinnell®, together with the breadth and depth of the products, systems and solutions offered by the Company, give it what it believes to be the most diverse portfolio in the building technology industry.

The Company has developed software platforms, including on-premises platforms and cloud-based software services, and integrated its products and services with digital capabilities to provide data-driven solutions to create smarter, safer and more sustainable buildings. The Company's OpenBlue platform enables enterprises to manage all aspects of their physical spaces delivering sustainability, new occupant experiences, safety and security by combining the Company's building expertise with cutting-edge technology, including AI-powered service solutions such as remote diagnostics, predictive maintenance, compliance monitoring and advanced risk assessments. The Company leverages its digital and data-driven products and services to offer integrated and customizable solutions focused on delivering outcomes to customers, including OpenBlue Buildings-as-a-Service, OpenBlue Net Zero Buildings-as-a-Service and OpenBlue Healthy Buildings. These services are generally designed to generate recurring revenue for the Company as it supports its customers in achieving their desired outcomes.

In fiscal 2022, approximately 37% of sales originated from product offerings, 39% of sales originated from installations and 24% of sales originated from service offerings.

Competition

The Company conducts its operations through a significant number of individual contracts that are either negotiated or awarded on a competitive basis. Key factors in the award of contracts include system and service performance, quality, price, design, reputation, technology, application engineering capability and construction or project management expertise. Competitors for HVAC equipment, security, fire-detection, fire suppression and controls in the residential and non-residential marketplace include many local, regional, national and international providers. Larger competitors include Honeywell International, Inc.; Siemens Smart Infrastructure, an operating group of Siemens AG; Schneider Electric SA; Carrier Global Corporation; Trane Technologies plc; Daikin Industries, Ltd.; Lennox International, Inc.; GC Midea Holding Co, Ltd. and Gree Electric Appliances, Inc. In addition, the Company competes in a highly fragmented building services market. The Company also faces competition from a diverse range of established companies, start-ups and other emerging entrants to the buildings industry in the areas of digital services, software as a service and the Internet of Things. The loss of any individual contract or customer would not have a material adverse effect on the Company.

Business Strategy

The Company's business strategy is to sustain and expand its position as a leader in smart and sustainable building solutions by offering a full spectrum of products and solutions for customer buildings across the globe. The Company's core strategy remains focused on creating growth platforms, driving operational improvements and creating a high-performance culture. The Company has strong positions in attractive and growing end-markets across HVAC, controls, fire, security and services, enhanced by its comprehensive product portfolio and substantial installed base. The Company believes that it is well positioned to capitalize on the emerging and prevalent trends in the buildings industry, including sustainability, healthy buildings/indoor environmental quality and smart buildings. To capitalize on these trends, the Company remains focused on maintaining leading positions in commercial HVAC and building management systems, as well as enabling growth through digital, to develop and leverage new digital technologies and capabilities into outcomes powered by its OpenBlue software platform. In furtherance of these goals, the Company has three strategic priorities:

Capitalize on Key Growth Vectors: Sustainability, healthy buildings/indoor environmental quality and smart buildings represent key growth opportunities for the Company. The Company seeks to leverage its existing portfolio breadth and investments in product development, combined with the expansion of its digital products and capabilities powered by OpenBlue, to offer differentiated solutions and innovative deal structures to help customers achieve their objectives. The Company intends to expand its capabilities by investing in products and technologies, as well as expanding its partnerships, to power innovation that will allow it to provide differentiated services that are tailored to its customers' desired outcomes.

Accelerate in High Growth Digital Services, Regions and Verticals: The Company is focused on transforming its large service business through its digital technologies, further enabled by the Company's installed base, domain expertise and global coverage. The Company is focused on developing and deploying connected equipment, systems and controls that will support the provision of digital services and solutions. The Company further intends to expand its presence in high growth regions and invest in high growth verticals within the markets it serves, including healthcare, commercial offices/campus, education and data centers.

Sustain a High-Performance, Customer-Centric Culture: The Company recognizes that developing talent and creating positive customer experiences is central to accomplishing its business strategies. The Company is investing in its talent to build a diverse workforce that is digital capable, solutions oriented and focused on continuous learning and growth. The Company aims to leverage its talent capabilities and training to create a customer-focused culture to drive customer loyalty and decisions.

To realize these priorities, the Company is leveraging its technology leadership, comprehensive product portfolio, global presence, substantial installed base and strong channels to monetize the lifecycle opportunities of install, service, retrofit and replacement which are established and delivered by the Company's direct field businesses and third-party channels across the globe. The Company is augmenting its strategic priorities with disciplined execution, productivity enhancements and sustainable cost management to create a path to realize expanded margins and enhanced profitability.

Backlog

The Company's backlog is applicable to its sales of systems and services. At September 30, 2022, the backlog was \$11.7 billion, of which \$11.1 billion was attributable to the field business. The backlog amount outstanding at any given time is not necessarily indicative of the amount of revenue to be earned in the upcoming fiscal year.

At September 30, 2022, remaining performance obligations were \$17.5 billion, which is \$5.8 billion higher than the Company's backlog of \$11.7 billion. Differences between the Company's remaining performance obligations and backlog are primarily due to the following:

- Remaining performance obligations include large, multi-purpose contracts to construct hospitals, schools and other governmental buildings, which are services to be performed over the building's lifetime with average initial contract terms of 25 to 35 years for the entire term of the contract versus backlog which includes only the lifecycle period of these contracts which approximates five years;
- Remaining performance obligations exclude certain customer contracts with a term of one year or less and contracts that are cancelable without substantial penalty versus backlog which includes short-term and cancelable contracts; and
- Remaining performance obligations include the full remaining term of service contracts with substantial termination penalties versus backlog which includes one year for all outstanding service contracts.

The Company will continue to report backlog as it believes it is a useful measure of evaluating the Company's operational performance and relationship to total orders.

Raw Materials

Raw materials used by the Company's businesses in connection with their operations include steel, aluminum, brass, copper, polypropylene and certain fluorochemicals used in fire suppression agents. The Company also uses semiconductors and other electronic components in the manufacture of its products. During fiscal 2022, the Company experienced material cost increases due to global inflation, supply chain disruptions, labor shortages, increased demand and other regulatory and macroeconomic factors. These trends had an unfavorable impact on the Company's results of operations in fiscal 2022, as discussed in Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations. The Company believes that the macroeconomic trends experienced in fiscal 2022 will continue into fiscal 2023. Therefore, the Company could experience further disruptions, shortages and price inflation in the future, the effect of which will depend on the Company's ability to successfully mitigate and offset the impact of these events. In fiscal 2023, commodity prices and availability could fluctuate throughout the year and could significantly affect the Company's results of operations. For a more detailed description of the risks related to the availability of raw materials, components and commodities, see Item 1A. Risk Factors.

Intellectual Property

Generally, the Company seeks statutory protection for strategic or financially important intellectual property developed in connection with its business. Certain intellectual property, where appropriate, is protected by contracts, licenses, confidentiality or other agreements. From time to time, the Company takes action to protect its businesses by asserting its intellectual property rights against third-party infringers.

The Company owns numerous U.S. and non-U.S. patents (and their respective counterparts), the more important of which cover those technologies and inventions embodied in current products or which are used in the manufacture of those products. While the Company believes patents are important to its business operations and in the aggregate constitute a valuable asset, no single

patent, or group of patents, is critical to the success of the business. The Company, from time to time, grants licenses under its patents and technology and receives licenses under patents and technology of others.

The Company's trademarks, certain of which are material to its business, are registered or otherwise legally protected in the U.S. and many non-U.S. countries where products and services of the Company are sold. The Company, from time to time, becomes involved in trademark licensing transactions.

Most works of authorship produced for the Company, such as computer programs, catalogs and sales literature, carry appropriate notices indicating the Company's claim to copyright protection under U.S. law and appropriate international treaties.

Environmental, Health and Safety Matters

Laws addressing the protection of the environment and workers' safety and health govern the Company's ongoing global operations. They generally provide for civil and criminal penalties, as well as injunctive and remedial relief, for noncompliance or require remediation of sites where Company-related materials have been released into the environment.

A portion of the Company's products consume energy and use refrigerants. Increased public awareness and concern regarding global climate change has resulted in more regulations designed to reduce greenhouse gas emissions. These regulations tend to be implemented under global, national and sub-national climate objectives or policies, and target the global warming potential ("GWP") of refrigerants, equipment energy efficiency, and the combustion of fossil fuels as a heating source. The Company continues to invest in its product portfolio to meet emerging emissions regulations and standards.

The Company has expended substantial resources globally, both financial and managerial, to comply with environmental laws and worker safety laws and maintains procedures designed to foster and ensure compliance. Certain of the Company's businesses are, or have been, engaged in the handling or use of substances that may impact workplace health and safety or the environment. The Company is committed to protecting its workers and the environment against the risks associated with these substances.

The Company's operations and facilities have been, and in the future may become, the subject of formal or informal enforcement actions or proceedings for noncompliance with environmental laws and worker safety laws or for the remediation of Company-related substances released into the environment. Such matters typically are resolved with regulatory authorities through commitments to compliance, abatement or remediation programs and, in some cases, payment of penalties. See Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for further discussion of environmental matters.

Government Regulation and Supervision

The Company's operations are subject to numerous federal, state and local laws and regulations, both within and outside the United States, in areas such as consumer protection, government contracts, international trade, environmental protection, labor and employment, tax, licensing and others. For example, most U.S. states and non-U.S. jurisdictions in which the Company operates have licensing laws directed specifically toward the alarm and fire suppression industries. The Company's security businesses currently rely extensively upon the use of wireline and wireless telephone service to communicate signals. Wireline and wireless telephone companies in the U.S. are regulated by the federal and state governments. In addition, government regulation of fire safety codes can impact the Company's fire businesses. The Company's businesses may also be affected by changes in governmental regulation of refrigerants and energy efficiency standards, noise regulation and product safety regulations, including changes related to hydro fluorocarbons/emissions reduction efforts, energy conservation standards and the regulation of fluorinated gases. These and other laws and regulations impact the manner in which the Company conducts its business, and changes in legislation or government policies can affect the Company's worldwide operations, both favorably and unfavorably. For a more detailed description of the various laws and regulations that affect the Company's business, see Item 1A. Risk Factors.

Regulatory Capital Expenditures

The Company's efforts to comply with numerous federal, state and local laws and regulations applicable to its business and products often results in capital expenditures. The Company makes capital expenditures to design and upgrade its fire and security products to comply with or exceed standards applicable to the alarm, fire suppression and security industries. The Company also makes capital expenditures to meet or exceed energy efficiency standards, including the regulation of refrigerants, hydro fluorocarbons/emissions reductions efforts and the regulation of fluorinated gasses, particularly with respect

to the Company's HVAC products and solutions. The Company's ongoing environmental compliance program also results in capital expenditures. Regulatory and environmental considerations are a part of all significant capital expenditure decisions; however, expenditures in fiscal 2022 related solely to regulatory compliance were not material. It is management's expectation that the amount of any future capital expenditures related to compliance with any individual regulation or grouping of related regulations will not have a material adverse effect on the Company's financial results or competitive position in any one year. See Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for further discussion of environmental matters.

Human Capital Management

Overview and Governance

The Company strives to continuously drive and develop its High-Performance Culture. The Company's High-Performance Culture represents the practices and behaviors, underpinned by the Company's values, that lead to sustained growth, winning results and satisfied customers.

The responsibility to develop and maintain a High-Performance Culture is owned, embedded and executed throughout the Company. The Chief Human Resources Officer ("CHRO") is responsible for establishing the Company's strategy to drive a High-Performance Culture and ensuring its execution across the Company. The Compensation and Talent Development Committee of the Board of Directors is the primary overseer of the Company's High-Performance Culture strategy and execution. The Chief Executive Officer ("CEO"), the CHRO, the Vice President of Diversity and Inclusion and other senior leaders within the Company are responsible for the execution of the strategy and engage with the Compensation and Talent Development Committee, the Governance and Sustainability Committee and the full Board of Directors on the critical components driving the Company's High-Performance Culture, including discussions of human capital trends, practices and operations, diversity and inclusion, health and safety, leadership development and succession planning. Key components driving the Company's High-Performance Culture include:

Health and Safety

Health and Wellness, Safety and Environment are the three pillars of the Company's Zero Harm vision. The Company's health and safety programs are designed around global standards with appropriate variations addressing multiple jurisdictions and regulations, specific hazards and unique working environments of the Company's manufacturing, service and install, and headquarter operations. In its continuous efforts to ensure the health, safety and well-being of its employees and workplaces, during fiscal 2022, the Company created new Zero Harm Well-Being and Zero Harm Sustainability Behaviors, each of them consisting of ten guiding principles to protect employees and the environment. In addition, the Company launched a vehicle telematics program to identify unsafe driving practices and further reduce the occurrence of motor vehicle accidents. Today, the Company's focus on employee well-being continues with the utilization of global and regional well-being councils, addressing physical, mental, social and financial aspects of employee well-being.

The Company requires each of its locations to perform regular safety audits to ensure proper safety policies, program procedures, analyses and training are in place. In addition, the Company engages an independent third-party conformity assessment and certification vendor to audit selected operations for adherence to its global health and safety standards. Safety culture and behavior-based safety initiatives have been deployed within the Company, including a multi-faceted policy focused on preventing distracted driving and the design and rollout of a new style of platform ladder built to provide a safe working platform for employees. One safety policy that applies to all employees around the globe, regardless of rank, is every individual worker's right to apply the "Stop Work" principle when uncertain about the health and safety of a particular task.

The Company utilizes a mixture of leading and lagging indicators to assess the health and safety performance of its operations. Lagging indicators include the OSHA Total Recordable Incident Rate ("TRIR") and the Lost Time (or Lost Workday) Incident Rate ("LTIR") based upon the number of incidents per 100 employees (or per 200,000 work hours). In fiscal 2022, the Company had a TRIR of 0.40 and a LTIR of 0.14.

Diversity and Inclusion

Diversity and inclusion are embedded throughout the Company's strategy to drive a High-Performance Culture. The Company recognizes that an inclusive culture that is diverse adds value to the Company and its customers through: the creation and delivery of innovative and outstanding products, services and outcomes; the cultivation of an engaged and empowered environment where employee productivity drives company growth; and the onboarding of high-performing talent into the

organization to propel the Company's transformation and future. The Company believes that all employees and leaders are responsible for creating a diverse and inclusive workplace. Employees are empowered to take an active role in creating a culture that values uniqueness, celebrates creativity and drives innovation. The Company places a high value on inclusion, engaging employees in Business Resource Groups ("BRGs") — employee-led voluntary organizations of people with similar interests, experiences, or demographic characteristics. The Company maintains its BRG chapters worldwide across nine categories: African American, Asia Pacific, LGBTQ+, Emerging Leaders, Hispanic, Disabilities, Veterans, Women and Sustainability. The Company uses these groups to serve as a source of inclusion and to support the acquisition and development of diverse talent internally and externally. Each BRG is open to all employees and sponsored and supported by senior leaders across the enterprise. The Company's BRG structure includes monthly learning series, an active recruitment platform, an innovation hub, and community engagement. In fiscal 2022, the Company continued to realize meaningful growth in BRG membership.

The Company has implemented several measures that focus on ensuring accountabilities exist for making progress in diversity:

- **Diversity Performance Goals:** The CEO and other senior leaders have diversity and inclusion objectives in their annual performance goals.
- **Attracting Diverse Talent:** The Company commits to having a diverse talent pipeline by partnering with its business units in their workforce planning forecasts, as well as external organizations, to develop initiatives and goals to recruit diverse talent across all leadership and skill areas. In furtherance of this commitment, the Company continues to enhance its Future Leaders Internship Program, an enterprise-wide internship program designed to build a sustainable, diverse pipeline of talent with the critical skills needed to support the Company's growth initiatives.
- **Facilitating Engagement:** The Company launched the Perspectives Listening Series to facilitate honest, courageous and authentic conversations between colleagues on topics that are relevant and important to employees, communities and society as a whole. Topics covered include next generation leadership, gender equality, the social justice movement and fatherhood.

Talent Development

To maintain a High-Performance Culture, the Company must ensure the continued development and advancement of its people. Strategic talent reviews and succession planning occur on a planned cadence annually – globally and across all business areas. The Company continues to provide opportunities for the Company's employees to grow their careers, with approximately half of open management positions filled internally during fiscal year 2022.

The Company believes that high performance is an outcome of a person's ability to change, adapt, and grow their capabilities throughout their career. The Company emphasizes real-life, real-time learning that enables a person to meet the demands of challenging and changing work and focuses on reinforcing key principles that are designed to support an individual's effectiveness in his or her current job and in their future development. The Company provides technical and leadership training to employees, customers and suppliers who work for or with the Company's products and services. In particular, the Company's focus on employee development has been structured over the last several years through programs designed to imbue essential skills and reinforce strategic goals that are aligned to the Company's culture, including:

- **Digital Transformation:** In support of Company's growth strategy, the Company is investing in developing digital leadership with personalized and targeted training programs designed to create digitally capable leaders, salespersons and technicians.
- **Diversity and Inclusion:** The Company has developed a structured diversity and inclusion training continuum across the levels and stages of individuals' careers to develop and align employees with the Company's diversity and inclusion strategy and values.
- **Organizational Health:** The Company regularly assesses its progress using an Organizational Health Index survey and develops annual health plans comprised of priority initiatives to drive key behaviors and practices that is informed by the survey's results. These plans are specifically tailored for each business unit and regularly assessed during the year, with managers accountable for introducing and teaching new skills or toolsets to their teams.

In fiscal 2022, the Company offered a robust curriculum of over 232,000 learning activities available to employees, consisting of videos, courses, e-learning, documentation, articles and books, including over 4,000 active (in person or virtual) learning courses. In fiscal 2022, over 1.25 million learning activities were completed by approximately 93,000 employees. The total

learning hours consumed by employees was 1.02 million hours, averaging almost 11 hours per employee including time invested in formal learning and standard time invested in self-paced reading or video consumption.

Employee Population and Demographics

As of September 30, 2022, the Company employed approximately 102,000 people worldwide, of which approximately 38,000 were employed in the United States and approximately 64,000 were outside the United States. Approximately 22,000 employees are covered by collective bargaining agreements or works councils and the Company believes that its relations with its labor unions are generally positive.

Employee Diversity as of September 30, 2022

Employees	Male	Female	Minority ⁽¹⁾
Total	76%	24%	30%
Managers	80%	20%	21%

⁽¹⁾ Male and female data represents all employees globally. Minority data represents U.S. employees only.

Seasonal Factors

Certain of the Company's sales are seasonal as the demand for residential air conditioning equipment and services generally increases in the summer months. This seasonality is mitigated by the other products and services provided by the Company that have no material seasonal effect.

Research and Development Expenditures

Refer to Note 1, "Summary of Significant Accounting Policies," of the notes to consolidated financial statements for research and development expenditures. The Company has committed to invest a substantial portion of its new product research and development in climate-related innovation to develop sustainable products and services. The Company invests in enhancements to the capabilities of its product lines and services to support its strategy, meet consumer preferences and achieve regulatory compliance. This includes investments in the development of the Company's OpenBlue platform and related service offerings, digital product capabilities, energy efficiency and low GWP refrigerants and technology.

Available Information

The Company's filings with the U.S. Securities and Exchange Commission ("SEC"), including annual reports on Form 10-K, quarterly reports on Form 10-Q, definitive proxy statements on Schedule 14A, current reports on Form 8-K, and any amendments to those reports filed pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934, are made available free of charge through the Investor Relations section of the Company's Internet website at <http://www.johnsoncontrols.com> as soon as reasonably practicable after the Company electronically files such material with, or furnishes it to, the SEC. Copies of any materials the Company files with the SEC can also be obtained free of charge through the SEC's website at <http://www.sec.gov>. The Company also makes available, free of charge, its Code of Ethics, Corporate Governance Guidelines, Board of Directors committee charters and other information related to the Company on the Company's Internet website or in printed form upon request. The Company is not including the information contained on the Company's website as a part of, or incorporating it by reference into, this Annual Report on Form 10-K.

ITEM 1A **RISK FACTORS**

Provided below is a cautionary discussion of what we believe to be the most important risk factors applicable to the Company. Discussion of these factors is incorporated by reference into and considered an integral part of Part II, Item 7, “Management’s Discussion and Analysis of Financial Conditions and Results of Operations.” The disclosure of a risk should not be interpreted to imply that such risk has not already materialized. Additional risks not currently known to the Company or that the Company currently believes are immaterial may also impair the Company’s business, financial condition, results of operations and cash flows.

Risks Related to Macroeconomic and Political Conditions

Economic, political, credit and capital market conditions could adversely affect our financial performance, our ability to grow or sustain our business and our ability to access the capital markets.

We compete around the world in various geographic regions and product markets. Global economic and political conditions affect each of our primary businesses and the businesses of our customers and suppliers. Recessions, economic downturns, price instability, inflation, slowing economic growth and social and political instability in the industries and/or markets where we compete could negatively affect our revenues and financial performance in future periods, result in future restructuring charges, and adversely impact our ability to grow or sustain our business. For example, current macroeconomic and political instability caused by the conflict between Russia and Ukraine, global supply chain disruptions, inflation and the strengthening of the U.S. dollar, have and could continue to adversely impact our results of operations. Other potential consequences arising from the Russia/Ukraine conflict and its effect on our business and results of operations as well as the global economy, cannot be predicted. This may include further sanctions, embargoes, regional instability, geopolitical shifts, energy instability, potential retaliatory action by the Russian government, increased cybersecurity attacks, increased tensions among countries in which we operate.

The capital and credit markets provide us with liquidity to operate and grow our business beyond the liquidity that operating cash flows provide. A worldwide economic downturn and/or disruption of the credit markets could reduce our access to capital necessary for our operations and executing our strategic plan. If our access to capital were to become significantly constrained, or if costs of capital increased significantly due to lowered credit ratings, prevailing industry conditions, the volatility of the capital markets or other factors; then our financial condition, results of operations and cash flows could be adversely affected.

If we are unable to adequately react to negative economic impacts that decrease demand for our products and services and/or negative movements in capital markets our results of operations, financial condition or liquidity could be adversely affected.

Some of the industries in which we operate are cyclical and, accordingly, demand for our products and services could be adversely affected by downturns in these industries.

Much of the demand for installation of HVAC, security products, and fire detection and suppression solutions is driven by commercial and residential construction and industrial facility expansion and maintenance projects. Commercial and residential construction projects are heavily dependent on general economic conditions, localized demand for commercial and residential real estate and availability of credit. Commercial and residential real estate markets are prone to significant fluctuations in supply and demand. In addition, most commercial and residential real estate developers rely heavily on project financing in order to initiate and complete projects. Declines in real estate values and increases in prevailing interest rates could lead to significant reductions in the demand for and availability of project financing, even in markets where demand may otherwise be sufficient to support new construction. These factors could in turn temper demand for new HVAC, fire detection and suppression and security installations.

Levels of industrial capital expenditures for facility expansions and maintenance are dependent on general economic conditions, economic conditions within specific industries we serve, expectations of future market behavior and available financing. The businesses of many of our industrial customers are to varying degrees cyclical and have experienced periodic downturns. During such economic downturns, customers in these industries tend to delay major capital projects, including greenfield construction, maintenance projects and upgrades. Additionally, demand for our products and services may be affected by volatility in energy, component and commodity prices, commodity and component availability and fluctuating demand forecasts, as our customers may be more conservative in their capital planning, which may reduce demand for our products and services as projects are postponed or cancelled. Although our industrial customers tend to be less dependent on project financing than real estate developers, increases in prevailing interest rates or disruptions in financial markets and banking systems could make credit and capital markets difficult for our customers to access and could significantly raise the cost of new debt for our customers. Any difficulty in accessing these markets and the increased associated costs can have a negative effect

on investment in large capital projects, including necessary maintenance and upgrades, even during periods of favorable end-market conditions.

Many of our customers inside and outside of the industrial and commercial sectors, including governmental and institutional customers, have experienced budgetary constraints as sources of revenue have been negatively impacted by adverse or stagnant economic conditions. These budgetary constraints have in the past, and may in the future, reduce demand for our products and services among governmental and institutional customers.

Reduced demand for our products and services could result in the delay or cancellation of existing orders or lead to excess capacity, which unfavorably impacts our absorption of fixed costs. This reduced demand may also erode average selling prices in the industries we serve. Any of these results could materially and adversely affect our business, financial condition, results of operations and cash flows.

Volatility in commodity prices may adversely affect our results of operations.

Increases in commodity costs can negatively impact the profitability of orders in backlog as prices on such orders are typically fixed; therefore, in the short-term, our ability to adjust for changes in certain commodity prices is limited. In these cases, if we are not able to recover commodity cost increases through price increases to our customers on new orders, then such increases will have an adverse effect on our results of operations. In cases where commodity price risk cannot be naturally offset or hedged through supply-based fixed-price contracts, we use commodity hedge contracts to minimize overall price risk associated with our anticipated commodity purchases. Unfavorability in our hedging programs during a period of declining commodity prices could result in lower margins as we reduce prices to match the market on a fixed commodity cost level. Additionally, to the extent we do not or are unable to hedge certain commodities and the commodity prices substantially increase, such increases will have an adverse effect on our results of operations.

We have experienced, and expect to continue to experience, increased commodity costs as a result of global macroeconomic trends, including global price inflation, supply chain disruption and the Russia/Ukraine conflict. While we have taken action to offset increasing commodity costs as described above, we have nonetheless experienced negative impacts on profitability as a result of such increased costs. Continued increases in commodity costs could negatively impact our results of operations to the extent we are unable to successfully mitigate and offset the impact of increased costs.

Risks associated with our non-U.S. operations could adversely affect our business, financial condition and results of operations.

We have significant operations in a number of countries outside the U.S., some of which are located in emerging markets. Long-term economic and geopolitical uncertainty in any of the regions of the world in which we operate, such as Asia, South America, the Middle East, Europe and emerging markets, could result in the disruption of markets and negatively affect cash flows from our operations to cover our capital needs and debt service requirements.

In addition, as a result of our global presence, a significant portion of our revenues and expenses is denominated in currencies other than the U.S. dollar. We are therefore subject to non-U.S. currency risks and non-U.S. exchange exposure. While we employ financial instruments to hedge some of our transactional foreign exchange exposure, these activities do not insulate us completely from those exposures. Exchange rates can be volatile and a substantial weakening of foreign currencies against the U.S. dollar could reduce our profit margin in various locations outside of the U.S. and adversely impact the comparability of results from period to period. During 2022, we experienced a reduction in revenue and profits as a result of the significant strengthening of the U.S. dollar against foreign currencies. The continued strength of the U.S. dollar could continue to adversely impact our revenue and profit in non-U.S. jurisdictions.

There are other risks that are inherent in our non-U.S. operations, including the potential for changes in socio-economic conditions, laws and regulations, including anti-trust, import, export, labor and environmental laws, and monetary and fiscal policies; the ability to enforce rights, collect revenues and protect assets in foreign jurisdictions; protectionist measures that may prohibit acquisitions or joint ventures, or impact trade volumes; unsettled or unstable political conditions; international conflict; government-imposed plant or other operational shutdowns; backlash from foreign labor organizations related to our restructuring actions; corruption; natural and man-made disasters, hazards and losses; violence, civil and labor unrest, and possible terrorist attacks.

These and other factors may have a material adverse effect on our business and results of operations.

Impacts related to the COVID-19 pandemic could have an adverse effect on our business, financial condition, results of operations and cash flows.

The COVID-19 global pandemic created significant volatility, uncertainty and economic disruption. In response to the challenges presented by COVID-19, we modified our business practices and we may take further actions as may be required by government authorities or that we determine are in the best interests of our employees, customers, partners and suppliers. These actions, may cause us to experience increases in costs, reductions in productivity and disruptions to our business routines.

Vaccine mandates and testing requirements have been implemented in some jurisdictions where we operate. In addition, a number of our customers have issued vaccine requirements with respect to our employees who provide on-site service at customer facilities. Our efforts to comply with these or other mandates could result in increased labor attrition and disruption, as well as difficulty securing future labor needs, and could materially impact our ability to deliver services to our customers, which could in turn adversely impact our results of operations.

We may also experience impacts from market forces and changes in consumer behavior related to pandemic fears as a result of COVID-19. Challenges in achieving sufficient vaccination levels and the introduction of new variants of COVID-19 have and could continue to negatively impact our results of operations due to the extension or reinstitution of lockdowns and similar restrictive measures, limited access to customer sites to perform installation and service work, the delay or abandonment of projects on which we provide products and/or services, and the general adverse impacts on demand and sales volumes from industries that are sensitive to economic downturns and volatility in commodity prices. For example, the Company has experienced, and could continue to experience, disruptions to its business in China due to the application of lockdowns and other restrictive measures under China's "zero-COVID" policy. Further, the COVID-19 pandemic could result in permanent changes in the behaviors of our customers, including the increased prevalence of remote work and a corresponding decline in demand for the construction and maintenance of commercial buildings. Any of these impacts could adversely affect our results of operations.

The extent to which the COVID-19 pandemic continues to impact our results of operations and financial condition will depend on future developments that are highly uncertain and cannot be predicted, including the resurgence of COVID-19 and its variants, the effectiveness of COVID-19 vaccines and the speed at which populations are vaccinated, impacts on economic activity and regulatory actions taken to mitigate the impacts of COVID-19. The impact of COVID-19 may also exacerbate other risks discussed in Item 1A of this Annual Report on Form 10-K.

Risks Related to Our Business Operations

The ability of suppliers to deliver raw materials, parts and components to our manufacturing facilities, and our ability to manufacture and deliver services without disruption, could affect our results of operations.

We use a wide range of materials (primarily steel, copper and aluminum) and components (including semiconductors and other electronic components) in the global production of our products, which come from numerous suppliers around the world. Because not all of our business arrangements provide for guaranteed supply and some key parts may be available only from a single supplier or a limited group of suppliers, we are subject to supply and pricing risk. Our operations and those of our suppliers are subject to disruption for a variety of reasons, including supplier plant shutdowns or slowdowns, transportation delays, work stoppages, labor relations, labor shortages, global geopolitical instability, price inflation, governmental regulatory and enforcement actions, intellectual property claims against suppliers, financial issues such as supplier bankruptcy, information technology failures, and hazards such as fire, earthquakes, flooding, or other natural disasters. For example, we expect to continue to be impacted by the following supply chain issues, due to economic, political and other factors largely beyond our control: increased input material costs and component shortages; supply chain disruptions and delays and cost inflation, all of which could continue or escalate in the future. In addition, some of our subcontractors have also experienced supply chain and labor disruptions, which have continued to impact our ability to timely complete projects and convert our backlog. Such disruptions have and could continue to interrupt our ability to manufacture or obtain certain products and components, thereby adversely impacting our ability to provide products to customers, convert our backlog into revenue and realize expected profit margins. Any significant disruption could materially and adversely affect our business, financial condition, results of operations and cash flows.

Material supply shortages and delays in deliveries, along with other factors such as price inflation, can also result in increased pricing. While many of our customers permit quarterly or other periodic adjustments to pricing based on changes in component prices and other factors, we may bear the risk of price increases that occur between any such repricing or, if such repricing is not permitted, during the balance of the term of the particular customer contract. The inability to timely convert our backlog due

to supply chain disruptions subjects us to pricing risk due to cost inflation occurring between the generation of backlog and its conversion into revenue. If we are unable to effectively manage the impacts of price inflation and timely convert our backlog, our results of operations, financial condition and cash flows could materially and adversely be affected.

Our future growth is dependent upon our ability to develop or acquire new products and technologies that achieve market acceptance with acceptable margins.

Our future success depends on our ability to develop or acquire, manufacture and bring competitive, and increasingly complex, products and services to market quickly and cost-effectively. Our ability to develop or acquire new products, services and technologies requires the investment of significant resources. These acquisitions and development efforts divert resources from other potential investments in our businesses, and they may not lead to the development of new technologies, products or services on a timely basis. Moreover, as we introduce new products, we may be unable to detect and correct defects in the design of a product or in its application to a specified use, which could result in loss of sales or delays in market acceptance. Even after introduction, new or enhanced products may not satisfy customer preferences and product failures may cause customers to reject our products. As a result, these products may not achieve market acceptance and our brand image could suffer. We must also attract, develop and retain individuals with the requisite technical expertise and understanding of customers' needs to develop new technologies and introduce new products, particularly as we increase investment in our digital services and solutions business and our OpenBlue software platform. The laws and regulations applicable to our products, and our customers' product and service needs, change from time to time, and regulatory changes may render our products and technologies noncompliant. We must also monitor disruptive technologies and business models. In addition, the markets for our products, services and technologies may not develop or grow as we anticipate. The failure of our technology, products or services to gain market acceptance due to more attractive offerings by our competitors, the introduction of new competitors to the market with new or innovative product offerings or the failure to address any of the above factors could significantly reduce our revenues, increase our operating costs or otherwise materially and adversely affect our business, financial condition, results of operations and cash flows.

Cybersecurity incidents impacting our IT systems and digital products could disrupt business operations, result in the loss of critical and confidential information, and adversely impact our reputation and results of operations.

We rely upon the capacity, reliability and security of our IT and data security infrastructure and our ability to expand and continually update this infrastructure in response to the changing needs of our business. As we implement new systems or integrate existing systems, they may not perform as expected. We also face the challenge of supporting our older systems and implementing necessary upgrades. In addition, we are relying on our IT infrastructure to support our employees' ability to work remotely. If we experience a problem with the functioning of an important IT system as a result of increased burdens placed on our IT infrastructure or a security breach of our IT systems, the resulting disruptions could have an adverse effect on our business.

Global cybersecurity threats and incidents can range from uncoordinated individual attempts to gain unauthorized access to IT systems to sophisticated and targeted measures known as advanced persistent threats directed at the Company, its products, its customers and/or its third-party service providers, including cloud providers. These threats and incidents originate from many sources globally and include malwares that take the form of computer viruses, ransomware, worms, Trojan horses, spyware, adware, scareware, rogue software, and programs that act against the computer user. While we have experienced, and expect to continue to experience, these types of threats and incidents, none of them to date has been material to the Company. Our customers, including the U.S. government, are increasingly requiring cybersecurity protections and mandating cybersecurity standards in our products, and we may incur additional costs to comply with such demands. We seek to deploy comprehensive measures to deter, prevent, detect, respond to and mitigate these threats, including identity and access controls, data protection, vulnerability assessments, product software designs which we believe are less susceptible to cyber-attacks, continuous monitoring of our IT networks and systems, maintenance of backup and protective systems and the incorporation of cybersecurity design throughout the lifecycle of our products. Despite these efforts, cybersecurity incidents, depending on their nature and scope, could potentially result in the misappropriation, destruction, corruption or unavailability of critical data and confidential or proprietary information (our own or that of third parties) and the disruption of business operations. Such incidents could remain undetected for an extended period of time, and the losses arising from such incidents could exceed our available insurance coverage for such matters.

An increasing number of our products, services and technologies, including our OpenBlue software platform, are delivered with digital capabilities and accompanying interconnected device networks, which include sensors, data, building management systems and advanced computing and analytics capabilities. If we are unable to manage the lifecycle cybersecurity risk in development, deployment and operation of our digital platforms and services, they could become susceptible to cybersecurity

incidents and lead to third-party claims that our product failures have caused damages to our customers. This risk is enhanced by the increasingly connected nature of our products and the role they play in managing building systems.

The potential consequences of a material cybersecurity incident include financial loss, reputational damage, adverse health, safety, and environmental consequences, exposure to legal claims or enforcement actions, theft of intellectual property, fines levied by the Federal Trade Commission or other governmental organizations, diminution in the value of our investment in research, development and engineering, and increased cybersecurity protection and remediation costs, which in turn could materially and adversely affect our competitiveness and results of operations.

Data privacy, identity protection and information security compliance may require significant resources and presents certain risks.

We collect, store, have access to and otherwise process certain confidential or sensitive data, including proprietary business information, personal data or other information that is subject to privacy and security laws, regulations and/or customer-imposed controls. Despite our efforts to protect such data, our business and our products may be vulnerable to material security breaches, theft, misplaced or lost data, programming errors, or errors that could potentially lead to compromising such data, improper use of our products, systems, software solutions or networks, unauthorized access, use, disclosure, modification or destruction of information, defective products, production downtimes and operational disruptions. A significant actual or perceived risk of theft, loss, fraudulent use or misuse of customer, employee or other data, whether by us, our suppliers, channel partners, customers or other third parties, as a result of employee error or malfeasance, or as a result of the imaging, software, security and other products we incorporate into our products, as well as non-compliance with applicable industry standards or our contractual or other legal obligations or privacy and information security policies regarding such data, could result in costs, fines, litigation or regulatory actions, or could lead customers to select the products and services of our competitors. Any such event could harm our reputation, cause unfavorable publicity or otherwise adversely affect certain potential customers' perception of the security and reliability of our services as well as our credibility and reputation, which could result in lost sales. In addition, we operate in an environment in which there are different and potentially conflicting data privacy laws in effect in the various U.S. states and foreign jurisdictions in which we operate and we must understand and comply with each law and standard in each of these jurisdictions while ensuring the data is secure. For example, proposed regulations restricting the use of biometric security technology could impact the products and solutions offered by our security business. Government enforcement actions can be costly and interrupt the regular operation of our business, and violations of data privacy laws can result in fines, reputational damage and civil lawsuits, any of which may adversely affect our business, reputation and financial statements.

Failure to increase organizational effectiveness through organizational improvements may reduce our profitability or adversely impact our business.

Our results of operations, financial condition and cash flows are dependent upon our ability to drive organizational improvement. We seek to drive improvements through a variety of actions, including integration activities, digital transformation, business portfolio reviews, productivity initiatives, functionalization, executive management changes, and business and operating model assessments. Risks associated with these actions include delays in execution, additional unexpected costs, realization of fewer than estimated productivity improvements, and adverse effects on employee morale. We may not realize the full operational or financial benefits we expect, the recognition of these benefits may be delayed, and these actions may potentially disrupt our operations. In addition, our failure to effectively manage organizational changes may lead to increased attrition and harm our ability to attract and retain key talent.

Infringement or expiration of our intellectual property rights, or allegations that we have infringed upon the intellectual property rights of third parties, could negatively affect us.

We rely on a combination of trademarks, trade secrets, patents, copyrights, know-how, confidentiality provisions and licensing arrangements to establish and protect our proprietary rights. We cannot guarantee, however, that the steps we have taken to protect our intellectual property will be adequate to prevent infringement of our rights or misappropriation or theft of our technology, trade secrets or know-how. For example, effective patent, trademark, copyright and trade secret protection may be unavailable or limited in some of the countries in which we operate. In addition, while we generally enter into confidentiality agreements with our employees and third parties to protect our trade secrets, know-how, business strategy and other proprietary information, such confidentiality agreements could be breached or otherwise may not provide meaningful protection for our trade secrets and know-how related to the design, manufacture or operation of our products. From time to time we resort to litigation to protect our intellectual property rights. Such proceedings can be burdensome and costly, and we may not prevail. Further, adequate remedies may not be available in the event of an unauthorized use or disclosure of our trade secrets and manufacturing expertise. Finally, for those products in our portfolio that rely on patent protection, once a patent has expired, the

product is generally open to competition. Products under patent protection usually generate significantly higher revenues than those not protected by patents. If we fail to successfully enforce our intellectual property rights, our competitive position could suffer, which could harm our business, financial condition, results of operations and cash flows.

In addition, we are, from time to time, subject to claims of intellectual property infringement by third parties, including practicing entities and non-practicing entities. Regardless of the merit of such claims, responding to infringement claims can be expensive and time-consuming. The litigation process is subject to inherent uncertainties, and we may not prevail in litigation matters regardless of the merits of our position. Intellectual property lawsuits or claims may become extremely disruptive if the plaintiffs succeed in blocking the trade of our products and services and they may have a material adverse effect on our business, financial condition, results of operations and cash flows.

We rely on our global direct installation channel for a significant portion of our revenue. Failure to maintain and grow the installed base resulting from direct channel sales could adversely affect our business.

Unlike many of our competitors, we rely on a direct sales channel for a substantial portion of our revenue. The direct channel provides for the installation of fire and security solutions, and HVAC equipment manufactured by us. This represents a significant distribution channel for our products, creates a large installed base of our fire and security solutions and HVAC equipment, and creates opportunities for longer term service and monitoring revenue. If we are unable to maintain or grow this installation business, whether due to changes in economic conditions, a failure to anticipate changing customer needs, a failure to introduce innovative or technologically advanced solutions, or for any other reason, our installation revenue could decline, which could in turn adversely impact our product pull-through and our ability to grow service and monitoring revenue.

Our business success depends on attracting and retaining qualified personnel.

Our ability to sustain and grow our business requires us to hire, retain and develop a high-performance, customer-centric and diverse management team and workforce. Continuous efficient and timely customer service, customer support and customer intimacy are essential to enabling customer loyalty and driving our financial results. Our growth strategies require that we pivot to new talent capability investments and build the workforce of the future, with an emphasis on developing skills in digital and consultative, outcome-based selling. Failure to ensure that we have the leadership and talent capacity with the necessary skillset and experience could impede our ability to deliver our growth objectives, execute our strategic plan and effectively transition our leadership. Any unplanned turnover or inability to attract and retain key employees could have a negative effect on our results of operations.

Our ability to convert backlog into revenue requires us to maintain a labor force that is sufficiently large enough to support our manufacturing operations to meet customer demand, as well as provide on-site services and project support for our customers. This includes recruiting, hiring and retaining skilled trade workers to support our direct channel field businesses. Recently, we have experienced the impacts of shortages for both skilled and unskilled labor. While we have taken measures to mitigate the impact of these shortages, we can provide no assurance that such efforts will be successful. The impacts of labor shortages could limit our ability to convert backlog into revenue and negatively impact our results of operations.

A material disruption of our operations, particularly at our monitoring and/or manufacturing facilities, could adversely affect our business.

If our operations, particularly at our monitoring facilities and/or manufacturing facilities, were to be disrupted as a result of significant equipment failures, natural disasters, climate change, cybersecurity breaches, power outages, fires, explosions, terrorism, sabotage, adverse weather conditions, public health crises (including COVID-19 related shutdowns), labor disputes, labor shortages or other reasons, we may be unable to effectively respond to alarm signals, fill customer orders, convert our backlog and otherwise meet obligations to or demand from our customers, which could adversely affect our financial performance. For example, during the COVID-19 pandemic, we experienced disruptions in certain of our manufacturing facilities resulting from government-mandated shutdowns and labor shortages. The continuation or recurrence of either of these trends could adversely affect our financial performance.

Interruptions to production could increase our costs and reduce our sales. Any interruption in production capability could require us to make substantial capital expenditures or purchase alternative material at higher costs to fill customer orders, which could negatively affect our profitability and financial condition. We maintain property damage insurance that we believe to be adequate to provide for reconstruction of facilities and equipment, as well as business interruption insurance to mitigate losses resulting from significant production interruption or shutdown caused by an insured loss. However, any recovery under our insurance policies may not offset the lost sales or increased costs that may be experienced during the disruption of operations, which could adversely affect our business, financial condition, results of operations and cash flows.

Our business may be adversely affected by work stoppages, union negotiations, labor disputes and other matters associated with our labor force.

We employ approximately 102,000 people worldwide. Approximately 22% of these employees are covered by collective bargaining agreements or works councils. Although we believe that our relations with the labor unions and works councils that represent our employees are generally good and we have experienced no material strikes or work stoppages recently, no assurances can be made that we will not experience in the future these and other types of conflicts with labor unions, works councils, other groups representing employees or our employees generally, or that any future negotiations with our labor unions will not result in significant increases in our cost of labor. Additionally, a work stoppage at one of our suppliers could materially and adversely affect our operations if an alternative source of supply were not readily available. Work stoppages by employees of our customers could also result in reduced demand for our products.

Risks Related to Government Regulations

Our businesses operate in regulated industries and are subject to a variety of complex and continually changing laws and regulations.

Our operations and employees are subject to various U.S. federal, state and local licensing laws, codes and standards and similar foreign laws, codes, standards and regulations. Changes in laws or regulations could require us to change the way we operate or to utilize resources to maintain compliance, which could increase costs or otherwise disrupt operations. In addition, failure to comply with any applicable laws or regulations could result in substantial fines or revocation of our operating permits and licenses. Competition or other regulatory investigations can continue for several years, be costly to defend and can result in substantial fines. If laws and regulations were to change or if we or our products failed to comply, our business, financial condition and results of operations could be adversely affected.

Due to the international scope of our operations, the system of laws and regulations to which we are subject is complex and includes regulations issued by the U.S. Customs and Border Protection, the U.S. Department of Commerce's Bureau of Industry and Security, the U.S. Treasury Department's Office of Foreign Assets Control and various non U.S. governmental agencies, including applicable export controls, anti-trust, customs, currency exchange control and transfer pricing regulations, laws regulating the foreign ownership of assets, and laws governing certain materials that may be in our products. No assurances can be made that we will continue to be found to be operating in compliance with, or be able to detect violations of, any such laws or regulations.

Existing free trade laws and regulations, provide certain beneficial duties and tariffs for qualifying imports and exports, subject to compliance with the applicable classification and other requirements. Changes in laws or policies governing the terms of foreign trade, and in particular increased trade restrictions, tariffs or taxes on imports from countries where we manufacture products or from where we import products or raw materials (either directly or through our suppliers) could have an impact on our competitive position, business and financial results. For example, the U.S., China and other countries continue to implement restrictive trade actions, including tariffs, export controls, sanctions, legislation favoring domestic investment and other actions impacting the import and export of goods, foreign investment and foreign operations in jurisdictions in which we operate. Additional measures imposed by such countries on a broader range of imports or economic activity, or retaliatory trade measures taken by other countries in response, could increase the cost of our products, create disruptions to our supply chain and impair our ability to effectively operate and compete in such countries.

We are also subject to a complex network of tax laws and tax treaties that impact our effective tax rate. For more information on risks related to tax regulation, see "Risks Related to Tax Matters" below.

We cannot predict the nature, scope or effect of future regulatory requirements to which our operations might be subject or the manner in which existing laws might be administered or interpreted.

Global climate change and related regulations could negatively affect our business.

The effects of climate change create financial risks to our business. For example, the effects of climate change could disrupt our operations by impacting the availability and cost of materials needed for manufacturing, exacerbate existing risks to our supply chain and increase insurance and other operating costs. These factors may impact our decisions to construct new facilities or maintain existing facilities in areas most prone to physical climate risks. We could also face indirect financial risks passed through the supply chain and disruptions that could result in increased prices for our products and the resources needed to produce them.

Increased public awareness and concern regarding global climate change has resulted in more regulations designed to reduce greenhouse gas emissions. These regulations tend to be implemented under global, national and sub-national climate objectives or policies, and target the global warming potential (“GWP”) of refrigerants, equipment energy efficiency, and the combustion of fossil fuels as a heating source. Many of our products consume energy and use refrigerants. Regulations which seek to reduce greenhouse gas emissions present a risk to our global products business, predominantly our HVAC business, if we do not adequately prepare our product portfolio. As a result, we may be required to make increased research and development and other capital expenditures to improve our product portfolio in order to meet new regulations and standards. Further, our customers and the markets we serve may impose emissions or other environmental standards through regulation, market-based emissions policies or consumer preference that we may not be able to timely meet due to the required level of capital investment or technological advancement. While we have been committed to continuous improvements to our product portfolio to meet and exceed anticipated regulations and preferences, there can be no assurance that our commitments will be successful, that our products will be accepted by the market, that proposed regulation or deregulation will not have a negative competitive impact or that economic returns will reflect our investments in new product development.

We are subject to emerging and competing climate regulations. There continues to be a lack of consistent climate legislation, which creates economic and regulatory uncertainty. Such regulatory uncertainty extends to incentives, which if discontinued, could adversely impact the demand for energy efficient buildings, and could increase costs of compliance. These factors may impact the demand for our products, obsolescence of our products and our results of operations.

As of the date of this filing, we have made several public commitments regarding our intended reduction of carbon emissions, including commitments to achieve net zero carbon emissions by 2040 and the establishment of science-based targets to reduce carbon emissions from our operations and the operations of our customers. Although we intend to meet these commitments, we may be required to expend significant resources to do so, which could increase our operational costs. Further, there can be no assurance of the extent to which any of our commitments will be achieved, or that any future investments we make in furtherance of achieving such targets and goals will meet investor expectations or any binding or non-binding legal standards regarding sustainability performance. Moreover, we may determine that it is in the best interest of our company and our shareholders to prioritize other business, social, governance or sustainable investments over the achievement of our current commitments based on economic, regulatory and social factors, business strategy or pressure from investors, activist groups or other stakeholders. If we are unable to meet these commitments, then we could incur adverse publicity and reaction from investors, activist groups and other stakeholders, which could adversely impact the perception of our brand and our products and services by current and potential customers, as well as investors, which could in turn adversely impact our results of operations.

We are subject to requirements relating to environmental and safety regulations and environmental remediation matters which could adversely affect our business, results of operation and reputation.

We are subject to numerous federal, state and local environmental laws and regulations governing, among other things, solid and hazardous waste storage, treatment and disposal, and remediation of releases of hazardous materials. There are significant capital, operating and other costs associated with compliance with these environmental laws and regulations. Environmental laws and regulations may become more stringent in the future, which could increase costs of compliance or require us to manufacture with alternative technologies and materials. For example, proposed federal, state and European Union legislative action concerning the use and clean-up of fire-fighting foam products, including the United States Environmental Protection Agency’s proposal to designate perfluorooctane sulfonate (“PFOS”) and perfluorooctanoic acid (“PFOA”) as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act, could negatively impact our fire-fighting business and our results of operations, thereby enhancing the risks to our business described under “Potential liability for environmental contamination could result in substantial costs” below.

Federal, state and local authorities also regulate a variety of matters, including, but not limited to, health, safety laws governing employee injuries, and permitting requirements in addition to the environmental matters discussed above. If we are unable to adequately comply with applicable health and safety regulations and provide our employees with a safe working environment, we may be subject to litigation and regulatory action, in addition to negatively impacting our ability to attract and retain talented employees. New legislation and regulations may require us to make material changes to our operations, resulting in significant increases to the cost of production. Additionally, violations of environmental, health and safety laws are subject to civil, and, in some cases, criminal sanctions. As a result of these various uncertainties, we may incur unexpected interruptions to operations, fines, penalties or other reductions in income which could adversely impact our business, financial condition and results of operations.

We could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act, the U.K. Bribery Act and similar anti-bribery laws around the world.

The U.S. Foreign Corrupt Practices Act (the "FCPA"), the U.K. Bribery Act and similar anti-bribery laws in other jurisdictions generally prohibit companies and their intermediaries from making improper payments to government officials or other persons for the purpose of obtaining or retaining business. Our policies mandate compliance with these anti-bribery laws. We operate in many parts of the world that are recognized as having governmental and commercial corruption and local customs and practices that can be inconsistent with anti-bribery laws. We cannot assure you that our internal control policies and procedures will preclude reckless or criminal acts committed by our employees or third-party intermediaries. In the event that we believe or have reason to believe that our employees or agents have or may have violated applicable anti-corruption laws, or if we are subject to allegations of any such violations, we will investigate the allegations and may engage outside counsel to investigate the relevant facts and circumstances, which can be expensive and require significant time and attention from senior management. Violations of these laws may result in criminal or civil sanctions, which could disrupt our business and result in a material adverse effect on our reputation, business, financial condition, results of operations and cash flows. In addition, we could be subject to commercial impacts such as lost revenue from customers who decline to do business with us as a result of such compliance matters, which also could have a material adverse effect on our reputation, business, financial condition, results of operations and cash flows.

We are subject to risks arising from regulations applicable to companies doing business with the U.S. government.

Our customers include many U.S. federal, state and local government authorities. Doing business with the U.S. federal, state and local governments subjects us to certain particular risks, including dependence on the level of government spending and compliance with and changes in governmental procurement and security regulations. Agreements relating to the sale of products to government entities may be subject to termination, reduction or modification, either at the convenience of the government or for failure to perform under the applicable contract. We are subject to potential government investigations of business practices and compliance with government procurement and security regulations, which can be expensive and burdensome. If we were charged with wrongdoing as a result of an investigation, we could be suspended from bidding on or receiving awards of new government contracts, which could have a material adverse effect on our results of operations. In addition, various U.S. federal and state legislative proposals have been made in the past that would deny governmental contracts to U.S. companies that have moved their corporate location abroad. We are unable to predict the likelihood that, or final form in which, any such proposed legislation might become law, the nature of regulations that may be promulgated under any future legislative enactments, or the effect such enactments and increased regulatory scrutiny may have on our business.

Risks Related to Litigation

Potential liability for environmental contamination could result in substantial costs.

We have projects underway at multiple current and former manufacturing and testing facilities to investigate and remediate environmental contamination resulting from past operations by us or by other businesses that previously owned or used the properties, including our Fire Technology Center and Stanton Street manufacturing facility located in Marinette, Wisconsin. These projects relate to a variety of activities, including arsenic, solvent, oil, metal, lead, PFOS, PFOA and/or other per- and polyfluorinated substances ("PFAS") and other hazardous substance contamination cleanup; and structure decontamination and demolition, including asbestos abatement. Because of uncertainties associated with environmental regulation and environmental remediation activities at sites where we may be liable, future expenses that we may incur to remediate identified sites and resolve outstanding litigation could be considerably higher than the current accrued liability on our consolidated statements of financial position, which could have a material adverse effect on our business, results of operations and cash flows.

In addition, we have been named, along with others, in a number of class action and other lawsuits relating to the use of fire-fighting foam products by the U.S. Department of Defense, the U.S. military and others for fire suppression purposes and related training exercises. It is difficult to predict the outcome or ultimate financial exposure, if any, represented by these matters, and there can be no assurance that any such exposure will not be material. Such claims may also negatively affect our reputation. See Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for additional information on these matters.

We are party to asbestos-related product litigation that could adversely affect our financial condition, results of operations and cash flows.

We and certain of our subsidiaries, along with numerous other third parties, are named as defendants in personal injury lawsuits based on alleged exposure to asbestos containing materials. These cases typically involve product liability claims based

primarily on allegations of manufacture, sale or distribution of industrial products that either contained asbestos or were used with asbestos containing components. We cannot predict with certainty the extent to which we will be successful in litigating or otherwise resolving lawsuits on satisfactory terms in the future and we continue to evaluate different strategies related to asbestos claims filed against us including entity restructuring and judicial relief. Unfavorable rulings, judgments or settlement terms could have a material adverse impact on our business and financial condition, results of operations and cash flows. See Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for additional information on these matters.

Legal proceedings in which we are, or may be, a party may adversely affect us.

We are currently, and may in the future, become subject to legal proceedings and commercial or contractual disputes. These are typically claims that arise in the normal course of business including, without limitation, commercial or contractual disputes with our suppliers or customers, intellectual property matters, third party liability, including product liability claims, and employment claims. In addition, we may be exposed to greater risks of liability for employee acts or omissions, or system failure, in our fire and security businesses than may not be inherent in other businesses. In particular, because many of our fire and security products and services are intended to protect lives and real and personal property, we may have greater exposure to litigation risks than other businesses. The nature of the services we provide exposes us to the risks that we may be held liable for employee acts or omissions or system failures. As a result, such employee acts or omissions or system failures could have a material adverse effect on our business, financial condition, results of operations and cash flows.

Risks Relating to Strategic Transactions

We may be unable to successfully execute or effectively integrate acquisitions or joint ventures.

We expect acquisitions of businesses and assets, as well as joint ventures (or other strategic arrangements), to play a role in our future growth and our ability to build capabilities in our products and services. We cannot be certain that we will be able to identify attractive acquisition or joint venture targets, obtain financing for acquisitions on satisfactory terms, successfully acquire identified targets or form joint ventures, or manage the timing of acquisitions with capital obligations across our businesses.

Acquisitions and investments may involve significant cash expenditures, debt incurrences, equity issuances, operating losses and expenses. Acquisitions and investments may be dilutive to earnings. Acquisitions involve numerous other risks, including: the diversion of management attention to integration matters; difficulties in integrating operations and systems; challenges in conforming standards, controls, procedures and accounting and other policies, business cultures and compensation structures; difficulties in assimilating employees and in attracting and retaining key personnel; challenges in successfully integrating and operating businesses with different characteristics than our current core businesses; challenges in keeping existing customers and obtaining new customers; difficulties in achieving anticipated cost savings, synergies, business opportunities and growth prospects; contingent liabilities (including contingent tax liabilities and earn-out obligations) that are larger than expected; and potential unknown liabilities, adverse consequences and unforeseen increased expenses associated with acquired companies.

The goodwill and intangible assets recorded with past acquisitions were significant and impairment of such assets could result in a material adverse impact on our financial condition and results of operations. Competition for acquisition opportunities may rise, thereby increasing our costs of making acquisitions or causing us to refrain from making further acquisitions.

Many of these factors are outside of our control, and any one of them could result in increased costs, decreased expected revenues and diversion of management time and energy, which could materially and adversely impact our business, financial condition and results of operations.

Risks associated with joint venture investments may adversely affect our business and financial results.

We have entered into several joint ventures and we may enter into additional joint ventures in the future. Our joint venture partners may at any time have economic, business or legal interests or goals that are inconsistent with our goals or with the goals of the joint venture. In addition, we may compete against our joint venture partners in certain of our other markets. Disagreements with our business partners may impede our ability to maximize the benefits of our partnerships. Our joint venture arrangements may require us, among other matters, to pay certain costs or to make certain capital investments or to seek our joint venture partner's consent to take certain actions. In addition, our joint venture partners may be unable or unwilling to meet their economic or other obligations under the operative documents, and we may be required to either fulfill those obligations alone to ensure the ongoing success of a joint venture or to dissolve and liquidate a joint venture. These risks could result in a material adverse effect on our business and financial results.

Divestitures of some of our businesses or product lines may materially adversely affect our financial condition, results of operations or cash flows.

We continually evaluate the performance and strategic fit of all of our businesses and may sell businesses or product lines. Divestitures involve risks, including difficulties in the separation of operations, services, products and personnel, the diversion of management's attention from other business concerns, the disruption of our business, the potential loss of key employees and the retention of uncertain environmental or other contingent liabilities related to the divested business. Some divestitures may be dilutive to earnings. In addition, divestitures may result in significant asset impairment charges, including those related to goodwill and other intangible assets, which could have a material adverse effect on our financial condition and results of operations. In the event we are unable to successfully divest a business or product line, we may be forced to wind down such business or product line, which could materially and adversely affect our results of operations and financial condition. We cannot assure you that we will be successful in managing these or any other significant risks that we encounter in divesting a business or product line, and any divestiture we undertake could materially and adversely affect our business, financial condition, results of operations and cash flows, and may also result in a diversion of management attention, operational difficulties and losses.

Risks Related to Tax Matters

Future potential changes to the tax laws could adversely affect us and our affiliates.

Legislative and regulatory action may be taken in the U.S. and other jurisdictions in which we operate, which, if ultimately enacted, could override tax treaties upon which we rely, or broaden the circumstances under which we would be considered a U.S. resident, each of which could materially and adversely affect our effective tax rate. We cannot predict the outcome of any specific legislative or regulatory proposals and such changes could have a prospective or retroactive application. However, if proposals were enacted that had the effect of disregarding our incorporation in Ireland or limiting Johnson Controls International plc's ability, as an Irish company, to take advantage of tax treaties with the U.S., we could be subject to increased taxation, potentially significant expense, and/or other adverse tax consequences.

The U.S. enacted the Inflation Reduction Act of 2022 ("IRA") in August 2022, which, among other sections, creates a new book minimum tax of at least 15% of consolidated GAAP pre-tax income for corporations with average book income in excess of \$1 billion. The book minimum tax will first apply to us in fiscal 2024. We do not expect the IRA to have a material impact on our effective tax rate, however, it is possible that the U.S. Congress could advance other tax legislation proposals in the future that could have a material impact on our tax rate. In addition, in October 2021, 136 out of 140 countries in the Organization for Economic Co-operation and Development ("OECD") Inclusive Framework on Base Erosion and Profit Shifting ("IF"), including Ireland, politically committed to potentially fundamental changes to the international corporate tax system, including the potential implementation of a global minimum corporate tax rate. While the details of these pronouncements remain unclear and timing of implementation uncertain, the impact of local country IF adoption could have a material impact on our effective tax rate. It is also possible that jurisdictions in which we do business could react to such IF developments unilaterally by enacting tax legislation that could adversely affect us or our affiliates. There is also general uncertainty regarding the tax policies of the jurisdictions where we operate, and if changes are enacted, there could be a resulting increase in our effective tax rate.

The Internal Revenue Service ("IRS") may not agree that we should be treated as a non-U.S. corporation for U.S. federal tax purposes.

Under current U.S. federal tax law, a corporation is generally considered to be a tax resident in the jurisdiction of its organization or incorporation. Because Johnson Controls International plc is an Irish incorporated entity, it would generally be classified as a non-U.S. corporation (and, therefore, a non-U.S. tax resident) under these rules. However, Section 7874 of the Code ("Section 7874") provides an exception to this general rule under which a non-U.S. incorporated entity may, in certain circumstances, be treated as a U.S. corporation for U.S. federal tax purposes.

Under Section 7874, if (1) former Johnson Controls, Inc. shareholders owned (within the meaning of Section 7874) 80% or more (by vote or value) of our ordinary shares after the Merger by reason of holding Johnson Controls, Inc. common stock (such ownership percentage the "Section 7874 ownership percentage"), and (2) our "expanded affiliated group" did not have "substantial business activities" in Ireland ("the substantial business activities test"), we will be treated as a U.S. corporation for U.S. federal tax purposes. If the Section 7874 ownership percentage of the former Johnson Controls, Inc. shareholders after the Merger was less than 80% but at least 60%, and the substantial business activities test was not met, we and our U.S. affiliates (including the U.S. affiliates historically owned by Tyco) may, in some circumstances, be subject to certain adverse U.S. federal

income tax rules (which, among other things, could limit their ability to utilize certain U.S. tax attributes to offset U.S. taxable income or gain resulting from certain transactions). The application of these rules could result in significant additional U.S. tax liability and limit our ability to restructure or access cash earned by certain of our non-U.S. subsidiaries, in each case, without incurring substantial U.S. tax liabilities.

Based on the terms of the Merger, the rules for determining share ownership under Section 7874 and certain factual assumptions, we believe that former Johnson Controls, Inc. shareholders owned (within the meaning of Section 7874) less than 60% (by both vote and value) of our ordinary shares after the Merger by reason of holding shares of Johnson Controls, Inc. common stock. Therefore, under current law, we believe that we should not be treated as a U.S. corporation for U.S. federal tax purposes and that Section 7874 should otherwise not apply to us or our affiliates as a result of the Merger.

However, the determination of the Section 7874 ownership percentage is complex and is subject to factual and legal uncertainties. Thus, there can be no assurance that the IRS will agree with the position that we should not be treated as a U.S. corporation for U.S. federal tax purposes or that Section 7874 does not otherwise apply as a result of the Merger.

Regardless of any application of Section 7874, we are treated as an Irish tax resident for Irish tax purposes. Consequently, if we were to be treated as a U.S. corporation for U.S. federal tax purposes under Section 7874, we could be liable for both U.S. and Irish taxes, which could have a material adverse effect on our financial condition and results of operations.

Changes to the U.S. model income tax treaty could adversely affect us.

On February 17, 2016, the U.S. Treasury released a revised U.S. model income tax convention (the "new model"), which is the baseline text used by the U.S. Treasury to negotiate tax treaties. If any or all of the modifications to the model treaty are adopted in the main jurisdictions in which we do business, they could, among other things, cause double taxation, increase audit risk and substantially increase our worldwide tax liability. We cannot predict the outcome of any specific modifications to the model treaty, and we cannot provide assurance that any such modifications will not apply to us.

Negative or unexpected tax consequences could adversely affect our results of operations.

Adverse changes in the underlying profitability and financial outlook of our operations in several jurisdictions could lead to additional changes in our valuation allowances against deferred tax assets and other tax reserves on our statement of financial position, and the future sale of certain businesses could potentially result in the reversal of outside basis differences that could adversely affect our results of operations and cash flows. Additionally, changes in tax laws in the U.S., Ireland or in other countries where we have significant operations could materially affect deferred tax assets and liabilities on our consolidated statements of financial position and our income tax provision in our consolidated statements of income.

We are also subject to tax audits by governmental authorities. Negative unexpected results from one or more such tax audits could adversely affect our results of operations.

Risks Relating to Our Jurisdiction of Incorporation

Irish law differs from the laws in effect in the U.S. and may afford less protection to holders of our securities.

It may not be possible to enforce court judgments obtained in the U.S. against us in Ireland based on the civil liability provisions of the U.S. federal or state securities laws. In addition, there is some uncertainty as to whether the courts of Ireland would recognize or enforce judgments of U.S. courts obtained against us or our directors or officers based on the civil liabilities provisions of the U.S. federal or state securities laws or hear actions against us or those persons based on those laws. We have been advised that the U.S. currently does not have a treaty with Ireland providing for the reciprocal recognition and enforcement of judgments in civil and commercial matters. Therefore, a final judgment for the payment of money rendered by any U.S. federal or state court based on civil liability, whether or not based solely on U.S. federal or state securities laws, would not automatically be enforceable in Ireland.

As an Irish company, Johnson Controls is governed by the Irish Companies Acts, which differ in some material respects from laws generally applicable to U.S. corporations and shareholders, including, among others, differences relating to interested director and officer transactions and shareholder lawsuits. Likewise, the duties of directors and officers of an Irish company generally are owed to the company only. Shareholders of Irish companies generally do not have a personal right of action against directors or officers of the company and may exercise such rights of action on behalf of the company only in limited circumstances. Accordingly, holders of Johnson Controls International plc securities may have more difficulty protecting their interests than would holders of securities of a corporation incorporated in a jurisdiction of the U.S.

Transfers of Johnson Controls ordinary shares may be subject to Irish stamp duty.

For the majority of transfers of Johnson Controls ordinary shares, there is no Irish stamp duty. However, Irish stamp duty is payable for certain share transfers. A transfer of Johnson Controls ordinary shares from a seller who holds shares beneficially (i.e., through the Depository Trust Company ("DTC")) to a buyer who holds the acquired shares beneficially is not subject to Irish stamp duty (unless the transfer involves a change in the nominee that is the record holder of the transferred shares). A transfer of Johnson Controls ordinary shares by a seller who holds shares directly (i.e., not through DTC) to any buyer, or by a seller who holds the shares beneficially to a buyer who holds the acquired shares directly, may be subject to Irish stamp duty (currently at the rate of 1% of the price paid or the market value of the shares acquired, if higher) payable by the buyer. A shareholder who directly holds shares may transfer those shares into his or her own broker account to be held through DTC without giving rise to Irish stamp duty provided that the shareholder has confirmed to Johnson Controls transfer agent that there is no change in the ultimate beneficial ownership of the shares as a result of the transfer and, at the time of the transfer, there is no agreement in place for a sale of the shares.

We currently intend to pay, or cause one of our affiliates to pay, stamp duty in connection with share transfers made in the ordinary course of trading by a seller who holds shares directly to a buyer who holds the acquired shares beneficially. In other cases, Johnson Controls may, in its absolute discretion, pay or cause one of its affiliates to pay any stamp duty. Johnson Controls Memorandum and Articles of Association provide that, in the event of any such payment, Johnson Controls (i) may seek reimbursement from the buyer, (ii) may have a lien against the Johnson Controls ordinary shares acquired by such buyer and any dividends paid on such shares and (iii) may set-off the amount of the stamp duty against future dividends on such shares. Parties to a share transfer may assume that any stamp duty arising in respect of a transaction in Johnson Controls ordinary shares has been paid unless one or both of such parties is otherwise notified by Johnson Controls.

Dividends paid by us may be subject to Irish dividend withholding tax.

In certain circumstances, as an Irish tax resident company, we will be required to deduct Irish dividend withholding tax (currently at the rate of 25%) from dividends paid to our shareholders. Shareholders that are residents in the U.S., European Union countries (other than Ireland) or other countries with which Ireland has signed a tax treaty (whether the treaty has been ratified or not) generally should not be subject to Irish withholding tax so long as the shareholder has provided certain Irish dividend withholding tax forms. However, some shareholders may be subject to withholding tax, which could adversely affect the price of our ordinary shares.

Dividends received by you could be subject to Irish income tax.

Dividends paid in respect of Johnson Controls ordinary shares generally are not subject to Irish income tax where the beneficial owner of these dividends is exempt from dividend withholding tax, unless the beneficial owner of the dividend has some connection with Ireland other than his or her shareholding in Johnson Controls.

Johnson Controls shareholders who receive their dividends subject to Irish dividend withholding tax generally will have no further liability to Irish income tax on the dividend unless the beneficial owner of the dividend has some connection with Ireland other than his or her shareholding in Johnson Controls.

General Risk Factors**The potential insolvency or financial distress of third parties could adversely impact our business and results of operations.**

We are exposed to the risk that third parties to various arrangements who owe us money or goods and services, or who purchase goods and services from us, will not be able to perform their obligations or continue to place orders due to insolvency or financial distress. If third parties fail to perform their obligations under arrangements with us, we may be forced to replace the underlying commitment at current or above market prices or on other terms that are less favorable to us. In such events, we may incur losses, or our results of operations, financial condition or liquidity could otherwise be adversely affected.

Risks related to our defined benefit retirement plans may adversely impact our results of operations and cash flow.

Significant changes in actual investment return on defined benefit plan assets, discount rates, mortality assumptions and other factors could adversely affect our results of operations and the amounts of contributions we must make to our defined benefit plans in future periods. Because we mark-to-market our defined benefit plan assets and liabilities on an annual basis, large non-

cash gains or losses could be recorded in the fourth quarter of each fiscal year or when a remeasurement event occurs. Generally accepted accounting principles in the U.S. require that we calculate income or expense for the plans using actuarial valuations. These valuations reflect assumptions about financial markets and interest rates, which may change based on economic conditions. Funding requirements for our defined benefit plans are dependent upon, among other factors, interest rates, underlying asset returns and the impact of legislative or regulatory changes related to defined benefit funding obligations.

A downgrade in the ratings of our debt could restrict our ability to access the debt capital markets and increase our interest costs.

Unfavorable changes in the ratings that rating agencies assign to our debt may ultimately negatively impact our access to the debt capital markets and increase the costs we incur to borrow funds in the market or under our existing credit agreements. If ratings for our debt fall below investment grade, our access to the debt capital markets would become restricted and the price we pay to issue debt could increase. Historically, we have relied on our ability to issue commercial paper rather than to draw on our credit facility to support our daily operations, which means that a downgrade in our ratings or volatility in the financial markets causing limitations to the debt capital markets could have an adverse effect on our business or our ability to meet our liquidity needs.

Further, an increase in the level of our indebtedness may increase our vulnerability to adverse general economic and industry conditions and may affect our ability to obtain additional financing.

A variety of other factors could adversely affect the results of operations of our business.

Any of the following could materially and adversely impact the results of operations of our business: loss of, changes in, or failure to perform under guaranteed performance contracts with our major customers; cancellation of, or significant delays in, projects in our backlog; delays or difficulties in new product development; our ability to recognize the expected benefits of our restructuring actions, products and services that we are unable to pass on to the market; changes in energy costs or governmental regulations that would decrease the incentive for customers to update or improve their building control systems; and natural or man-made disasters or losses that impact our ability to deliver products and services to our customers.

ITEM 1B UNRESOLVED STAFF COMMENTS

The Company has no unresolved written comments regarding its periodic or current reports from the staff of the SEC.

ITEM 2 PROPERTIES

The Company has properties in over 60 countries throughout the world, with its world headquarters located in Cork, Ireland and its North American operational headquarters located in Milwaukee, Wisconsin USA. The Company's wholly- and majority-owned facilities primarily consist of manufacturing, sales and service offices, research and development facilities, monitoring centers, and assembly and/or warehouse centers. At September 30, 2022, these properties totaled approximately 40 million square feet of floor space of which 12 million square feet are owned and 28 million square feet are leased. The Company considers its facilities to be suitable for their current uses and adequate for current needs. The majority of the facilities are operating at normal levels based on capacity. The Company does not anticipate difficulty in renewing existing leases as they expire or in finding alternative facilities.

ITEM 3 LEGAL PROCEEDINGS

Gumm v. Molinaroli, et al.

On August 16, 2016, a putative class action lawsuit, Gumm v. Molinaroli, et al., Case No. 16-cv-1093, was filed in the United States District Court for the Eastern District of Wisconsin, naming Johnson Controls, Inc., the individual members of its board of directors at the time of the merger with the Company's merger subsidiary and certain of its officers, the Company and the Company's merger subsidiary as defendants. The complaint asserted various causes of action under the federal securities laws, state law and the Taxpayer Bill of Rights, including that the individual defendants allegedly breached their fiduciary duties and unjustly enriched themselves by structuring the merger among the Company, Tyco and the merger subsidiary in a manner that would result in a United States federal income tax realization event for the putative class of certain Johnson Controls, Inc. shareholders and allegedly result in certain benefits to the defendants, as well as related claims regarding alleged misstatements in the proxy statement/prospectus distributed to the Johnson Controls, Inc. shareholders, conversion and breach of contract. The complaint also asserted that Johnson Controls, Inc., the Company and the Company's merger subsidiary aided and abetted the individual defendants in their breach of fiduciary duties and unjust enrichment. The complaint seeks, among other things,

disgorgement of profits and damages. On September 30, 2016, approximately one month after the closing of the merger, plaintiffs filed a preliminary injunction motion seeking, among other items, to compel Johnson Controls, Inc. to make certain intercompany payments that plaintiffs contend will impact the United States federal income tax consequences of the merger to the putative class of certain Johnson Controls, Inc. shareholders and to enjoin Johnson Controls, Inc. from reporting to the Internal Revenue Service the capital gains taxes payable by this putative class as a result of the closing of the merger. The court held a hearing on the preliminary injunction motion on January 4, 2017, and on January 25, 2017, the judge denied the plaintiffs' motion. Plaintiffs filed an amended complaint on February 15, 2017, and the Company filed a motion to dismiss on April 3, 2017. On October 17, 2019, the court heard oral arguments on the motion to dismiss and took the matter under advisement. On November 3, 2021, the court granted the Company's motion to dismiss the amended complaint. Plaintiffs appealed to the United States Court of Appeals for the Seventh Circuit. Briefing and oral argument has been completed. The court has yet to issue a ruling.

Refer to Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for discussion of environmental, asbestos, insurable liabilities and other litigation matters, which is incorporated by reference herein and is considered an integral part of Part I, Item 3, "Legal Proceedings."

ITEM 4 **MINE SAFETY DISCLOSURES**

Not applicable.

EXECUTIVE OFFICERS OF THE REGISTRANT

Pursuant to General Instruction G(3) of Form 10-K, the following list of executive officers of the Company as of November 15, 2022 is included as an unnumbered Item in Part I of this report in lieu of being included in the Company's Proxy Statement relating to the annual general meeting of shareholders to be held on March 8, 2023.

Tomas Brannemo, 51, has served as Vice President and President, Building Solutions, Europe, Middle East, Africa and Latin America since September 2019. He previously served as Senior Vice President and President, Water Infrastructure and Europe Commercial Team of Xylem Inc., a leading global water technology company. At Xylem, he also served as Senior Vice President and President, Transport and Treatment, from 2017 to 2019 and other roles from 2010 to 2017. Between 2006 and 2010, he held various marketing, sales and engineering positions at Volvo Construction Company.

Rodney Clark, 53, has served as the Company's Chief Commercial Officer since June 2022. Prior to joining Johnson Controls, Mr. Clark served in various management roles at Microsoft Corporation, a global technology company, including as Corporate Vice President, Global Channel Sales and Channel Chief, from March 2021 to May 2022, Corporate Vice President, IoT and Mixed Reality Sales, from August 2020 to March 2021, Vice President, IoT and Mixed Reality Sales, from 2017 to August 2020, General Manager, IoT from 2013 to 2017 and other positions of increasing responsibility from 1998 through 2013. Mr. Clark also serves as a director on the board of Entegris, Inc., a supplier of advanced materials and process solutions for the semiconductor and other high-technology industries.

John Donofrio, 60, has served as Executive Vice President and General Counsel of the Company since November 2017. He previously served as Vice President, General Counsel and Secretary of Mars, Incorporated, a global food manufacturer from October 2013 to November 2017. Before joining Mars in October 2013, Mr. Donofrio was Executive Vice President, General Counsel and Secretary for The Shaw Group Inc., a global engineering and construction company, from October 2009 until February 2013. Prior to joining Shaw, Mr. Donofrio was Senior Vice President, General Counsel and Chief Compliance Officer at Visteon Corporation, a global automotive supplier, a position he held from 2005 until October 2009. Mr. Donofrio has been a Director of FARO Technologies, Inc., a designer, developer, manufacturer and marketer of software driven, 3D measurement, imaging and realization systems, since 2008.

Michael J. Ellis, 66, has served as Executive Vice President and Chief Customer & Digital Officer since October 2019. From May 2018 to October 2019, he served as a Managing Director at Accenture, a global provider of professional services in strategy, consulting, digital, technology and operations. He previously served as Chairman and CEO of ForgeRock, a global digital security software company, from 2012 to 2018. Prior to joining ForgeRock, from 2008 to 2012, he held various senior executive roles at SAP SE, a global provider of enterprise software solutions. Previously, he also served as Chief Executive Officer of Univa, a leading innovator in enterprise-grade workload management and optimization solutions, and as Senior Vice President Business Development at i2 Technologies, a provider of supply chain solutions. Mr. Ellis also served as a director on the board of CBRE Acquisition Holdings Inc. from 2021 to 2022.

Olivier Leonetti, 57, has served as Chief Financial Officer since November 2020. Prior to joining Johnson Controls, Mr. Leonetti served as the Senior Vice President and Chief Financial Officer of Zebra Technologies, a provider of enterprise-level data capture and automatic identification solutions, a position he had held since November 2016. Prior to joining Zebra, Mr. Leonetti was the Executive Vice President and Chief Financial Officer of Western Digital, a provider of data infrastructure solutions from 2014 to 2016. Prior to joining Western Digital, Mr. Leonetti served as Vice President of Finance – Global Commercial Organization at Amgen, Inc. from 2011 to 2014. From 1997 to 2011, Mr. Leonetti served in various senior finance positions with increasing responsibility at Dell Inc., including most recently as Vice President of Finance. Prior to joining Dell Inc., Mr. Leonetti served in various worldwide finance capacities with Lex Rac Service plc and the Gillette Company. Mr. Leonetti also serves as a director on the board of Eaton Corporation plc, a provider of power management technologies and services.

Nathan Manning, 46, has served as Vice President and President, Building Solutions, North America since October 2020. He previously served as Vice President and General Manager, Field Operations, from March 2020 to October 2020 and Vice President and General Manager, HVAC and Controls Building Solutions North America, from January 2019 to March 2020. Prior to joining Johnson Controls, he served in various roles at General Electric, a diversified industrial and technology company, where he held the position of General Manager, Operational Excellence for General Electric's GE Power segment from August 2017 until December 2018 and the position of General Manager, Services of GE Energy Connections, a division of GE Power, from November 2015 until August 2017. Prior to joining General Electric, Mr. Manning served as Vice President, General Manager of Eaton Aerospace, a segment of Eaton Corporation plc, a provider of power management technologies and services, from February 2014 until November 2015. Prior to joining Eaton, Mr. Manning served in a number of roles with increasing responsibility in General Electric from his hire in January 2000, including as President and Chief Executive Officer of Aviage Systems, a joint venture between General Electric and Aviation Industry Corporation of China, from July 2012 until February 2014.

Daniel C. "Skip" McConeghy, 56, has served as Vice President, Chief Accounting and Tax Officer since June 2022. Mr. McConeghy previously served as Vice President, Global Tax since October 2020 and as interim Controller since February 2022. He also served as Vice President, Corporate Tax Planning, from July 2012 through October 2020. Prior to joining Johnson Controls, Mr. McConeghy was a Tax Partner at PricewaterhouseCoopers, from July 1999 through June 2012.

George R. Oliver, 63, has served as Chief Executive Officer and Chairman of the Board since September 2017. He previously served as our President and Chief Operating Officer following the completion of the merger of Johnson Controls and Tyco in September 2016. Prior to that, Mr. Oliver was Tyco's Chief Executive Officer, a position he held since September 2012. He joined Tyco in July 2006, and served as President of a number of operating segments from 2007 through 2011. Before joining Tyco, he served in operational leadership roles of increasing responsibility at several General Electric divisions. Mr. Oliver also serves as a director on the board of Raytheon Technologies, an aerospace and defense company.

Ganesh Ramaswamy, 54, has served as Vice President and President, Global Services for Johnson Controls since December 2019. From 2015 to 2019, Mr. Ramaswamy served in various executive leadership roles at Danaher Corporation, a diversified manufacturer of life sciences, diagnostics, and industrial products and services, including Senior Vice President, High Growth markets—Beckman Coulter, President, Videojet Technologies, and, most recently, as Danaher Vice President & Group Executive, Marking & Coding. From 2011 to 2015, Mr. Ramaswamy served in various executive roles at Pentax Medical, a provider of endoscopic imaging devices and solutions, including as President of Pentax Medical from 2013 to 2015. Earlier in his career, Mr. Ramaswamy served in various roles of increasing responsibility with the General Electric Company across product development, service operations, and general management. Mr. Ramaswamy also serves as a director on the board of PACCAR, a global manufacturer of heavy-duty and medium-duty trucks.

Anu Rathninde, 52, has served as Vice President and President, Building Solutions, Asia Pacific since May 2022. Prior to joining Johnson Controls, Mr. Rathninde served as President, Electrical Distribution Systems and Advanced Safety & User Experience, Asia Pacific at Aptiv plc, and mobility architecture company primarily serving the automotive sector, from November 2021 until May 2022 and as President, Electrical Distribution Systems from May 2016 until November 2021. Prior to joining Aptiv, Mr. Rathninde served as Vice President of the Automotive Products Group at Johnson Electric, manufacturer of electric motors, actuators, motion subsystems and related electro-mechanical components. Earlier in his career, Mr. Rathninde held progressive leadership positions at Aptiv in general management, engineering, business development, strategy and business planning.

Lei Zhang Schlitz, 56, was appointed Vice President and President, Global Products, in November 2022. Prior to joining Johnson Controls, Ms. Schlitz served as Executive Vice President, Automotive OEM of Illinois Tool Works Inc. ("ITW"), a global manufacturer of a diversified range of industrial products and equipment, from 2019 until October 2022. Prior to serving as Vice President, Automotive OEM, Ms. Schlitz served in various leadership roles at ITW, including Executive Vice President, ITW Food Equipment Segment, from September 2015 until January 2020, Group President, Global Ware-Wash and Refrigeration Businesses and Food Equipment Asia Pacific, from January 2014 until August 2015, Group President, Worldwide Refrigeration & Weigh Wrap Business, from May 2011 until December 2013 and as Vice President, ITW Technology Center from October 2008 until April 2011. Prior to joining ITW, Ms. Schlitz served in roles of increasing responsibility at Siemens Energy & Automation from September 2001 until September 2008 and General Electric from 1998 until September 2001. Ms. Schlitz serves on the Board of Directors for Archer Daniels Midland Company, a leader in human and animal nutrition and agricultural origination and processing.

Marlon Sullivan, 48, became Executive Vice President and Chief Human Resources Officer in September 2021. Prior to joining Johnson Controls, he served as the Senior Vice President of Human Resources at Delta Airlines from January 2021 to September 2021. Prior to joining Delta, Mr. Sullivan served in various human resources and talent development leadership roles at Abbott Laboratories from December 2007 through December 2020. Earlier in his career, Mr. Sullivan held a variety of human resources roles at The Home Depot.

There are no family relationships, as defined by the instructions to this item, among the Company's executive officers.

PART II

ITEM 5 MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

The shares of the Company's ordinary shares are traded on the New York Stock Exchange under the symbol "JCI."

<u>Title of Class</u>	<u>Number of Record Holders as of October 31, 2022</u>
Ordinary Shares, \$0.01 par value	29,935

In March 2021, the Company's Board of Directors approved a \$4.0 billion increase to the Company's share repurchase authorization, adding to the \$2.0 billion remaining as of December 31, 2020 under the prior share repurchase authorization approved in 2019. The share repurchase authorization does not have an expiration date and may be amended or terminated by the Board of Directors at any time without prior notice. During fiscal 2022, the Company repurchased approximately \$1.4 billion of its ordinary shares on an open market. As of September 30, 2022, approximately \$3.6 billion remains available under the share repurchase authorization.

The following table presents information regarding the repurchase of the Company's ordinary shares by the Company as part of the publicly announced program during the three months ended September 30, 2022.

<u>Period</u>	<u>Total Number of Shares Purchased</u>	<u>Average Price Paid per Share</u>	<u>Total Number of Shares Purchased as Part of the Publicly Announced Program</u>	<u>Approximate Dollar Value of Shares that May Yet be Purchased under the Programs</u>
7/1/22 - 7/31/22				
Purchases by Company	278,285	\$ 48.31	278,285	\$ 3,614,400,337
8/1/22 - 8/31/22				
Purchases by Company	—	—	—	—
9/1/22 - 9/30/22				
Purchases by Company	—	—	—	—

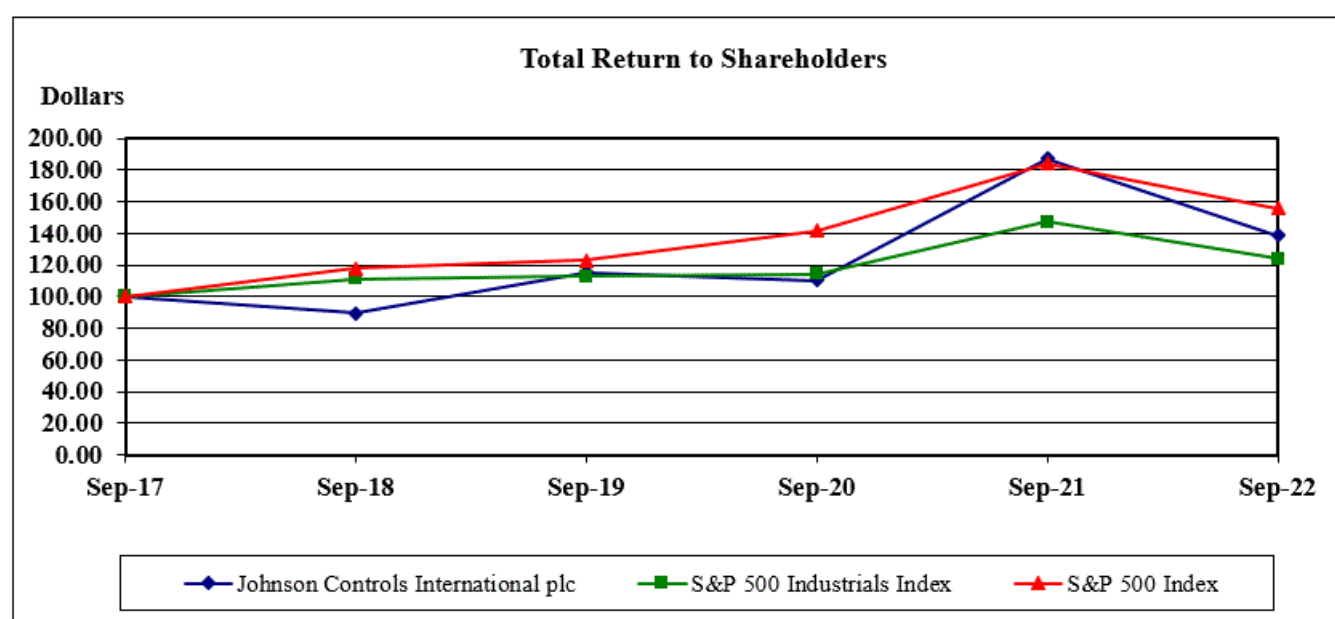
During the three months ended September 30, 2022, acquisitions of shares by the Company from certain employees in order to satisfy employee tax withholding requirements in connection with the vesting of restricted shares were not material.

Equity compensation plan information is incorporated by reference from Part III, Item 12, "Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters," of this document and should be considered an integral part of this Item 5.

The following information in Item 5 is not deemed to be "soliciting material" or to be "filed" with the SEC or subject to Regulation 14A or 14C under the Securities Exchange Act of 1934 ("Exchange Act") or to the liabilities of Section 18 of the Exchange Act, and will not be deemed to be incorporated by reference into any filing under the Securities Act of 1933 or the Exchange Act, except to the extent the Company specifically incorporates it by reference into such a filing.

The line graph below compares the cumulative total shareholder return on the Company's ordinary shares with the cumulative total return of companies on the Standard & Poor's ("S&P's") 500 Stock Index and the companies on the S&P 500 Industrials Index. This graph assumes the investment of \$100 on September 30, 2017 and the reinvestment of all dividends since that date.

COMPANY/INDEX	Sep17	Sep18	Sep19	Sep20	Sep21	Sep22
Johnson Controls International plc	100.00	89.39	115.25	110.34	187.22	138.73
S&P 500 Industrials Index	100.00	111.16	112.66	114.12	147.15	123.75
S&P 500 Index	100.00	117.91	122.93	141.55	184.02	155.86



ITEM 6 **[RESERVED]**

ITEM 7 **MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS**

General

Johnson Controls International plc, headquartered in Cork, Ireland, is a global leader in smart, healthy and sustainable buildings, serving a wide range of customers in more than 150 countries. The Company's products, services, systems and solutions advance the safety, comfort and intelligence of spaces to serve people, places and the planet. The Company is committed to helping its customers win and creating greater value for all of its stakeholders through its strategic focus on buildings.

The Company is a global leader in engineering, manufacturing and commissioning building products and systems, including residential and commercial HVAC equipment, industrial refrigeration systems, controls, security systems, fire-detection systems and fire-suppression solutions. The Company further serves customers by providing technical services, including maintenance, management, repair, retrofit and replacement of equipment (in the HVAC, industrial refrigeration, security and fire-protection space), energy-management consulting and data-driven "smart building" services and solutions. The Company partners with customers by leveraging its broad product portfolio and digital capabilities, including its OpenBlue platform,

together with its direct channel service and solutions capabilities, to deliver outcome-based solutions across the lifecycle of a building that address customers' needs to improve energy efficiency, enhance security, create healthy environments and reduce greenhouse gas emissions.

The Company's fiscal year ends on September 30. Unless otherwise stated, references to years in this report relate to fiscal years rather than calendar years. This discussion summarizes the significant factors affecting the consolidated operating results, financial condition and liquidity of the Company for the year ended September 30, 2022. This discussion should be read in conjunction with Item 8, the consolidated financial statements and the notes to consolidated financial statements. A detailed discussion of the 2021 to 2020 year-over-year changes are not included herein and can be found in [the Management's Discussion and Analysis section in the Company's 2021 Annual Report on Form 10-K filed November 15, 2021 under the heading "Fiscal year 2021 compared to fiscal year 2020"](#) which is incorporated herein by reference.

Macroeconomic Trends

Much of the demand for installation of the Company's products and solutions is driven by commercial and residential construction and industrial facility expansion and maintenance projects. Commercial and residential construction projects are heavily dependent on general economic conditions, localized demand for commercial and residential real estate and availability of credit. Positive or negative fluctuations in commercial and residential construction, industrial facility expansion and maintenance projects and other capital investments in buildings could have a corresponding impact on the Company's financial condition, results of operations and cash flows.

As a result of the Company's global presence, a significant portion of its revenues and expenses is denominated in currencies other than the U.S. dollar. The Company is therefore subject to non-U.S. currency risks and non-U.S. exchange exposure. While the Company employs financial instruments to hedge some of its transactional foreign exchange exposure, these activities do not insulate it completely from those exposures. In addition, the currency exposure from the translation of non-U.S. dollar functional currency subsidiaries are not able to be hedged. Exchange rates can be volatile and a substantial weakening or strengthening of foreign currencies against the U.S. dollar could increase or reduce the Company's profit margin, respectively, and impact the comparability of results from period to period. During fiscal 2022, revenue and profits were adversely impacted due to the significant strengthening of the U.S. dollar against foreign currencies. The continued strength of the U.S. dollar could continue to adversely impact the Company's results.

The Company continues to observe trends demonstrating increased interest and demand for its products and services that enable smart, safe, efficient and sustainable buildings. This demand is driven in part by government tax incentives, building performance standards and other regulations designed to limit emissions and combat climate change. In particular, legislative and regulatory initiatives such as the U.S. Climate Smart Buildings Initiative, U.S. Inflation Reduction Act and EU Energy Performance of Buildings Directive include provisions designed to fund and encourage investment in decarbonization and digital technologies for buildings. This demand is supplemented by an increase in commitments in both the public and private sectors to reduce emissions and/or achieve net zero emissions. The Company seeks to capitalize on these trends to drive growth by developing and delivering technologies and solutions to create smart, sustainable and healthy buildings. The Company is investing in new digital and product capabilities, including its OpenBlue platform, to enable it to deliver sustainable, high-efficiency products and tailored services to enable customers to achieve their sustainability goals. The Company is leveraging its install base, together with data-driven products and services to offer outcome-based solutions to customers with a focus on generating accelerated growth in services and recurring revenue.

The Company has experienced, and expects to continue to experience, increased input material cost inflation and component shortages, as well as disruptions and delays in its supply chain, as a result of global macroeconomic trends, including increased global demand, the conflict between Russia and Ukraine, government-mandated actions in response to COVID-19, particularly in China, and labor shortages. Actions taken by the Company to mitigate supply chain disruptions and inflation, including expanding and redistributing its supplier network, supplier financing, price increases and productivity improvements, have generally been successful in offsetting some, but not all, of the impact of these trends. The collective impact of these trends has been to positively impact revenue due to increased demand and price increases to offset inflation, while negatively impacting margins due to supply chain disruptions and cost pressures. The Company has also experienced delays in converting its backlog due to continued supply chain disruptions, negatively impacting both revenues and margins. Although the Company has experienced recent improvement in its supply chain, the Company expects that these trends will continue to impact its results into fiscal 2023. Therefore, the Company could experience further disruptions, shortages and cost increases in the future, the effect of which will depend on the Company's ability to successfully mitigate and offset the impact of these events.

During the second quarter of fiscal 2022, the Company suspended its operations in Russia in response to the conflict between Russia and Ukraine. Although this decision has not had and is not expected to have a material impact on the Company's

operating results, the broader consequences of this conflict, including heightened supply chain disruption, inflation, economic instability and other factors have and could continue to adversely impact the Company's results of operations.

Impact of COVID-19 Pandemic

The COVID-19 pandemic continues to impact aspects of the Company's operations and results. During fiscal 2022, the Company's facilities generally operated at normal levels, however, the Company has experienced some disruptions to its business in China due to government-mandated lockdowns in several major cities.

The Company has experienced increases in demand as governments have distributed vaccines and lifted COVID-19-related restrictions, leading to increases in retrofit activity and commercial building construction. As a result of the pandemic, the Company has seen an increase in demand for its products and solutions that promote building health and optimize customers' infrastructure.

However, the Company continues to be influenced by COVID-19-related trends impacting site access and the labor force, which have and may continue to negatively impact the Company's revenues and margins. Challenges in reaching sufficient vaccination levels and the introduction of new variants of COVID-19 have caused some governments to extend or reinstitute lockdowns and similar restrictive measures, which, in some cases, have limited the Company's ability to access customer sites to install and maintain its products and deliver services. In addition, the Company has experienced and continues to experience labor shortages at certain facilities as the Company expands its production capacity to meet increased customer demand. Although the Company is mitigating these shortages through focused recruitment efforts and competitive compensation packages, the Company could continue to experience such shortages in the future.

The extent to which the COVID-19 pandemic continues to impact the Company's results of operations and financial condition will depend on future developments that are highly uncertain and cannot be predicted. See Part I, Item 1A, of this Annual Report on Form 10-K for an additional discussion of risks related to COVID-19.

Restructuring and Cost Optimization Initiatives

To better align its resources with its growth strategies and reduce the cost structure of its global operations in certain underlying markets, the Company commits to restructuring plans as necessary. In fiscal 2021, the Company announced its plans to optimize its cost structure through broad-based SG&A actions focused on simplification, standardization and centralization, with the intent to deliver annualized savings of \$300 million by fiscal 2023 (the "2021 Plan"). Additionally, the Company announced cost of sales actions to drive \$250 million in annual run rate savings by fiscal 2023. The Company believes it is on track to deliver and exceed the productivity savings by fiscal 2023. For more information on the Company's restructuring plans, see "Liquidity and Capital Resources—Restructuring."

FISCAL YEAR 2022 COMPARED TO FISCAL YEAR 2021

Net Sales

(in millions)	Year Ended September 30,		Change
	2022	2021	
Net sales	\$ 25,299	\$ 23,668	7%

The increase in net sales was due to higher organic sales (\$2,033 million), incremental sales from acquisitions (\$356 million) and the impact of prior year nonrecurring purchase accounting adjustments (\$6 million), partially offset by the unfavorable impact of foreign currency translation (\$741 million) and lower sales due to business divestitures (\$23 million). Excluding the impact of foreign currency translation, business acquisitions and divestitures and nonrecurring adjustments, consolidated net sales increased 9% as compared to the prior year, attributable to higher volumes and increased pricing in response to inflation pressures. Refer to the "Segment Analysis" below within Item 7 for a discussion of net sales by segment.

Cost of Sales / Gross Profit

(in millions)	Year Ended September 30,		Change
	2022	2021	
Cost of sales	\$ 16,956	\$ 15,609	9%
Gross profit	8,343	8,059	4%
% of sales	33.0%	34.1%	

Cost of sales and gross profit both increased and gross profit as a percentage of sales decreased by 110 basis points. Gross profit increased due to organic sales growth and business acquisitions, partially offset by the unfavorable impact of foreign currency translation (\$229 million), supply chain inefficiencies, price/cost pressures and the unfavorable year-over-year impact of net pension mark-to-market adjustments (\$121 million). Gross profit as a percentage of sales decreased as the benefit of volume leverage was more than offset by supply chain inefficiencies and price/cost pressures. Refer to the "Segment Analysis" below within Item 7 for a discussion of segment earnings before interest, taxes and amortization ("EBITA").

Selling, General and Administrative Expenses

(in millions)	Year Ended September 30,		Change
	2022	2021	
Selling, general and administrative expenses	\$ 5,945	\$ 5,258	13%
% of sales	23.5%	22.2%	

Selling, general and administrative expenses ("SG&A") increased by \$687 million, and SG&A as a percentage of sales increased by 130 basis points. The increase in SG&A on a percentage basis was primarily due to the current year environmental remediation charge and related reserves (\$255 million), the unfavorable year-over-year impact of net mark-to-market adjustments on pension plans (\$154 million), the unfavorable year-over-year impact of net mark-to-market adjustments on restricted asbestos investments (\$93 million), the absence of certain one-time cost mitigation actions and current year business acquisitions, partially offset by a favorable earn-out liability adjustment (\$43 million) and favorable foreign currency translation (\$141 million). Refer to the "Segment Analysis" below within Item 7 for a discussion of segment EBITA.

Restructuring and Impairment Costs

(in millions)	Year Ended September 30,		Change
	2022	2021	
Restructuring and impairment costs	\$ 721	\$ 242	*

* Measure not meaningful

Restructuring and impairment costs in fiscal 2022 included \$419 million impairment costs related to businesses classified as held-for-sale, \$75 million impairment of goodwill attributable to the Silent-Aire reporting unit, \$45 million impairment of long-lived assets in the Building Solutions Asia Pacific segment reclassified from held for sale and \$182 million in severance, long-lived asset impairments and other costs associated with the 2021 Plan. All of the fiscal 2021 restructuring and impairment costs were related to the 2021 Plan.

Refer to "Note 3, "Assets and Liabilities Held for Sale & Discontinued Operations," Note 8, "Goodwill and Other Intangible Assets," and Note 17, "Significant Restructuring and Impairment Costs," of the notes to consolidated financial statements for further disclosure related to the Company's restructuring plans and impairment costs.

Net Financing Charges

(in millions)	Year Ended September 30,		Change
	2022	2021	
Net financing charges	\$ 213	\$ 206	3%

Refer to Note 10, "Debt and Financing Arrangements," of the notes to consolidated financial statements for further disclosure related to the Company's net financing charges.

Equity Income

(in millions)	Year Ended September 30,		Change
	2022	2021	
Equity income	\$ 246	\$ 261	-6%

The decrease in equity income was primarily due to lower income at certain partially-owned affiliates of the Johnson Controls - Hitachi joint venture and at certain partially-owned affiliates within the Building Solutions North America segment. Refer to the "Segment Analysis" below within Item 7 for a discussion of segment EBITA.

Income Tax Provision

(in millions)	Year Ended September 30,		Change
	2022	2021	
Income tax provision (benefit)	\$ (13)	\$ 868	*
Effective tax rate	(1)%	33%	

* Measure not meaningful

The statutory tax rate in Ireland of 12.5% is being used as a comparison since the Company is domiciled in Ireland.

For fiscal 2022, the effective tax rate for continuing operations was (1)% and was lower than the statutory tax rate primarily due to tax reserve adjustments as the result of expired statute of limitations for certain tax years and the benefits of continuing global tax planning initiatives, partially offset by the income tax effects of impairment and restructuring charges, valuation allowance adjustments, the establishment of a deferred tax liability on the outside basis difference of the Company's investment in certain subsidiaries as a result of the planned divestitures and tax rate differentials.

For fiscal 2021, the effective tax rate for continuing operations was 33% and was higher than the statutory tax rate primarily due to the tax impacts of an intercompany transfer of certain of the Company's intellectual property rights, valuation allowance adjustments, the income tax effects of mark-to-market adjustments and tax rate differentials, partially offset by the benefits of continuing global tax planning initiatives.

The fiscal 2022 effective tax rate decreased as compared to fiscal 2021 primarily due to the income tax effects of mark-to-market adjustments, tax reserve adjustments as the result of expired statute of limitations for certain tax years and the benefits of continuing global tax planning initiatives, partially offset by valuation allowance adjustments, the establishment of a deferred tax liability on the outside basis difference of the Company's investment in certain subsidiaries as a result of the planned divestitures, impairment and restructuring charges and tax rate differentials. Refer to Note 18, "Income Taxes," of the notes to consolidated financial statements for further details.

The U.S. enacted the Inflation Reduction Act of 2022 ("IRA") in August 2022, which, among other sections, creates a new book minimum tax of at least 15% of consolidated GAAP pre-tax income for corporations with average book income in excess of \$1 billion. The book minimum tax will first apply to us in fiscal 2024. We do not expect the IRA to have a material impact on our effective tax rate. In addition, in October 2021, 136 out of 140 countries in the Organization for Economic Co-operation and Development ("OECD") Inclusive Framework on Base Erosion and Profit Shifting ("IF"), including Ireland, politically committed to potentially fundamental changes to the international corporate tax system, including the potential implementation of a global minimum corporate tax rate. While the details of these pronouncements presently remain unclear and timing of implementation uncertain, the impact of local country IF adoption could have a material impact on the Company's effective tax

rate in future periods. It is also possible that jurisdictions in which the Company does business could react to such IF developments unilaterally by enacting tax legislation that could adversely affect the Company or its affiliates.

Income From Discontinued Operations, Net of Tax

(in millions)	Year Ended September 30,		Change
	2022	2021	
Income from discontinued operations, net of tax	\$ —	\$ 124	*

* Measure not meaningful

Refer to Note 3, "Assets and Liabilities Held for Sale & Discontinued Operations," of the notes to consolidated financial statements for further information.

Income Attributable to Noncontrolling Interests

(in millions)	Year Ended September 30,		Change
	2022	2021	
Income from continuing operations attributable to noncontrolling interests	\$ 191	\$ 233	-18%

The decrease in income from continuing operations attributable to noncontrolling interests was primarily due to lower net income at certain partially-owned affiliates of the Johnson Controls - Hitachi joint venture.

Net Income Attributable to Johnson Controls

(in millions)	Year Ended September 30,		Change
	2022	2021	
Net income attributable to Johnson Controls	\$ 1,532	\$ 1,637	-6%

The decrease in net income attributable to Johnson Controls was primarily due to higher SG&A, higher restructuring and impairment costs and the non-recurrence of prior year income from discontinued operations, partially offset by lower income tax provision and higher gross profit. Diluted earnings per share attributable to Johnson Controls was \$2.19 for the year ended September 30, 2022 compared to \$2.27 for the year ended September 30, 2021.

Comprehensive Income Attributable to Johnson Controls

(in millions)	Year Ended September 30,		Change
	2022	2021	
Comprehensive income attributable to Johnson Controls	\$ 1,055	\$ 1,979	-47%

The decrease in comprehensive income attributable to Johnson Controls was due to a decrease in other comprehensive income attributable to Johnson Controls (\$819 million) resulting primarily from foreign currency translation adjustments and lower net income attributable to Johnson Controls (\$105 million). The year-over-year unfavorable foreign currency translation adjustments were primarily driven by the weakening of the British pound, euro and Canadian dollar in the current year compared to strengthening of the British pound, Canadian dollar and Mexican peso against the U.S. dollar in the prior year.

SEGMENT ANALYSIS

Management evaluates the performance of its business units based primarily on segment EBITA, which represents income from continuing operations before income taxes and noncontrolling interests, excluding general corporate expenses, intangible asset amortization, net financing charges, restructuring and impairment costs, and net mark-to-market adjustments related to pension and postretirement plans and restricted asbestos investments.

Effective October 1, 2021, the Company's marine businesses previously included in the Building Solutions Asia Pacific and Global Products reportable segments are now part of the Building Solutions EMEA/LA reportable segment. Historical

information has been re-cast to present the comparative periods on a consistent basis. This change was not material to the segment presentation. Refer to Note 19, “Segment Information,” of the notes to the consolidated financial statements for further information.

Beginning on October 1, 2021, the Company began reporting certain retrofit projects in the Building Solutions EMEA/LA and Building Solutions Asia Pacific segments as products and systems revenue on a prospective basis as they have evolved to be more aligned with other install offerings.

(in millions)	Net Sales for the Year Ended September 30,			Segment EBITA for the Year Ended September 30,		
	2022	2021	Change	2022	2021	Change
Building Solutions North America	\$ 9,367	\$ 8,685	8%	\$ 1,122	\$ 1,204	-7%
Building Solutions EMEA/LA	3,845	3,884	-1%	358	401	-11%
Building Solutions Asia Pacific	2,714	2,616	4%	332	344	-3%
Global Products	9,373	8,483	10%	1,594	1,436	11%
	<u>\$ 25,299</u>	<u>\$ 23,668</u>	<u>7%</u>	<u>\$ 3,406</u>	<u>\$ 3,385</u>	<u>1%</u>

Net Sales:

- The increase in Building Solutions North America was due to higher volumes and prices (\$672 million) and incremental sales related to business acquisitions (\$22 million), partially offset by the unfavorable impact of foreign currency translation (\$12 million). The sales increase was led by strong growth in the HVAC & Controls platform.
- The decrease in Building Solutions EMEA/LA was due to the unfavorable impact of foreign currency translation (\$269 million) and business divestitures (\$22 million), partially offset by higher volumes and prices (\$214 million) and incremental sales related to business acquisitions (\$38 million). Excluding the impacts of foreign currency translation and business acquisitions and divestitures, sales increased, driven by growth in the Fire & Security platforms and the HVAC & Controls platform. By region, strong growth in Europe and single digit growth in Latin America was partially offset by growth decline in the Middle East.
- The increase in Building Solutions Asia Pacific was due to the net impact of higher prices and lower volumes (\$178 million) and incremental sales related to business acquisitions (\$42 million), partially offset by the unfavorable impact of foreign currency translation (\$121 million) and business divestitures (\$1 million). The increase in sales was led by strong demand for HVAC & Controls and Industrial Refrigeration equipment. By region, the sales growth was driven by sales in China.
- The increase in Global Products was due to higher volumes and prices (\$975 million) and incremental sales related to business acquisitions (\$254 million), partially offset by the unfavorable impact of foreign currency translation (\$339 million). Sales growth was driven by broad-based demand for Commercial and Residential HVAC and Fire & Security products and strong price realization.

Segment EBITA:

- The decrease in Building Solutions North America was primarily due to lower absorption related to supply chain disruptions and labor constraints and the unfavorable impact of foreign currency translations, partially offset by productivity savings.
- The decrease in Building Solutions EMEA/LA was primarily due to supply chain disruptions, the suspension of operations in Russia (\$11 million), and the unfavorable impact of foreign currency translation (\$29 million), partially offset by favorable price/cost and productivity savings.
- The decrease in Building Solutions Asia Pacific was primarily due to supply chain disruptions, unfavorable mix and the unfavorable impact of foreign currency translation (\$23 million), partially offset by favorable price/cost and productivity savings.

- The increase in Global Products was primarily due to favorable volumes and mix, productivity savings and a favorable earn-out liability adjustment (\$43 million), partially offset by the current year environmental remediation charge (\$222 million), the unfavorable impact of foreign currency translation (\$37 million) and lower equity income driven primarily by certain partially-owned affiliates of the Johnson Controls - Hitachi joint venture (\$13 million).

LIQUIDITY AND CAPITAL RESOURCES

Working Capital

(in millions)	September 30,		Change
	2022	2021	
Current assets	\$ 11,685	\$ 9,998	
Current liabilities	(11,239)	(9,098)	
	446	900	-50%
Less: Cash and cash equivalents	(2,031)	(1,336)	
Add: Short-term debt	669	8	
Add: Current portion of long-term debt	865	226	
Less: Current assets held for sale	(387)	—	
Add: Current liabilities held for sale	236	—	
Working capital (as defined)	\$ (202)	\$ (202)	—%
Accounts receivable - net	\$ 5,528	\$ 5,613	-2%
Inventories	2,510	2,057	22%
Accounts payable	4,241	3,746	13%

- The Company defines working capital as current assets less current liabilities, excluding cash and cash equivalents, short-term debt, the current portion of long-term debt, and current assets and liabilities held for sale. Management believes that this measure of working capital, which excludes financing-related items and businesses to be divested, provides a more useful measurement of the Company's operating performance.
- Working capital at September 30, 2022 remained consistent as compared to September 30, 2021 as an increase in inventory due to supply chain disruptions was offset by an increase in accounts payable.
- The Company's days sales in accounts receivable at September 30, 2022 were 51, a decrease from 58 at September 30, 2021, primarily due to collection efforts and increased use of receivables factoring programs. There has been no significant adverse change in the level of overdue receivables or significant changes in revenue recognition methods.
- The Company's inventory turns for the year ended September 30, 2022 were lower than the comparable period ended September 30, 2021 primarily due to supply chain disruptions.
- Days in accounts payable at September 30, 2022 were 85 days, higher from 76 days for the comparable period ended September 30, 2021, primarily due to timing of payments.

Cash Flows From Continuing Operations

(in millions)	Year Ended September 30,	
	2022	2021
Cash provided by operating activities	\$ 1,990	\$ 2,551
Cash used by investing activities	(693)	(1,090)
Cash used by financing activities	(516)	(2,131)

- The decrease in cash provided by operating activities was primarily due to the unfavorable impacts driven by supply chain disruptions. This resulted in increases in inventory and higher unbilled receivables due to shipment delays, which

were partially offset by the benefit of receivables factoring activity and an increase in accounts payable due to timing of payments.

- The decrease in cash used by investing activities was primarily due to lower cash payments made for acquisitions.
- The increase in cash provided by financing activities was primarily due to higher short-term and long-term debt borrowings.

Capitalization

(in millions)	September 30,		Change
	2022	2021	
Short-term debt	\$ 669	\$ 8	
Current portion of long-term debt	865	226	
Long-term debt	7,426	7,506	
Total debt	8,960	7,740	16%
Less: Cash and cash equivalents	2,031	1,336	
Total net debt	6,929	6,404	8%
Shareholders' equity attributable to Johnson Controls	16,268	17,562	-7%
Total capitalization	<u>\$ 23,197</u>	<u>\$ 23,966</u>	-3%
Total net debt as a % of total capitalization	<u>29.9%</u>	<u>26.7%</u>	

- Net debt and net debt as a percentage of total capitalization are non-GAAP financial measures. The Company believes the percentage of total net debt to total capitalization is useful to understanding the Company's financial condition as it provides a view of the extent to which the Company relies on external debt financing for its funding and is a measure of risk to its shareholders.
- The Company's material cash requirements primarily consist of working capital requirements, repayments of long-term debt and related interest, operating leases, dividends, capital expenditures, potential acquisitions and share repurchases.
- Refer to Note 10, "Debt and Financing Arrangements," of the notes to consolidated financial statements for additional information on debt obligations and maturities. Interest payable on long-term debt is \$253 million in the twelve months following September 30, 2022 and \$3.5 billion thereafter.
- Refer to Note 9, "Leases," of the notes to consolidated financial statements for additional information on lease obligations and maturities.
- As of September 30, 2022, purchase obligations are \$1.5 billion payable in the next twelve months and \$284 million payable thereafter. These purchase obligations represent commitments under enforceable and legally binding agreements, and do not represent the entire anticipated purchases in the future.
- As of September 30, 2022, the Company expects to contribute \$41 million and \$193 million to the global pension and postretirement plans in the next twelve months and thereafter, respectively.
- As of September 30, 2022, approximately \$3.6 billion remains available under the Company's share repurchase authorization, which does not have an expiration date and may be amended or terminated by the Board of Directors at any time without prior notice. The Company expects to repurchase outstanding shares from time to time depending on market conditions, alternate uses of capital, liquidity and economic environment.
- The Company declared dividends of \$1.39 per share in fiscal 2022 and intends to continue paying quarterly dividends in fiscal 2023.
- The Company believes its capital resources and liquidity position at September 30, 2022 are adequate to meet projected needs. The Company believes requirements for working capital, capital expenditures, dividends, stock repurchases, minimum pension contributions, debt maturities and any potential acquisitions in fiscal 2023 will continue to be funded

from operations, supplemented by short- and long-term borrowings, if required. The Company currently manages its short-term debt position in the U.S. and euro commercial paper markets and bank loan markets. In the event the Company is unable to issue commercial paper, it would have the ability to draw on its \$2.5 billion revolving credit facility which expires in December 2024 or its \$0.5 billion 364-day revolving credit facility which expires in December 2022. There were no draws on the revolving credit facilities as of September 30, 2022 and 2021. The Company estimates that as of September 30, 2022, it could borrow up to \$2.0 billion based on average borrowing levels during fiscal 2022 on committed credit lines. The Company maintains a shelf registration statement with the SEC under which it may issue additional debt securities, ordinary shares, preferred shares, depository shares, warrants purchase contracts and units that may be offered in one or more offerings on terms to be determined at the time of the offering. The Company anticipates that the proceeds of any offering would be used for general corporate purposes, including repayment of indebtedness, acquisitions, additions to working capital, repurchases of ordinary shares, dividends, capital expenditures and investments in the Company's subsidiaries. In addition, the Company held cash and cash equivalents of \$2.0 billion as of September 30, 2022. As such, the Company believes it has sufficient financial resources to fund operations and meet its obligations for the foreseeable future.

- The Company's ability to access the global capital markets and the related cost of financing is dependent upon, among other factors, the Company's credit ratings. As of September 30, 2022, the Company's credit ratings and outlook were as follows:

Rating Agency	Short-Term Rating	Long-Term Rating	Outlook
S&P	A-2	BBB+	Stable
Moody's	P-2	Baa2	Stable

The security ratings set forth above are issued by unaffiliated third party rating agencies and are not a recommendation to buy, sell or hold securities. The ratings may be subject to revision or withdrawal by the assigning rating organization at any time.

- The Company entered into the following new or modified debt arrangements in fiscal 2022:
 - In November 2021, the Company entered into a €200 million (\$196 million as of September 30, 2022) bank term loan which had an interest rate of EURIBOR plus 0.5% and was due and paid in October 2022.
 - In March 2022, the Company entered into two bank term loans totaling €285 million (\$280 million as of September 30, 2022) which both have an interest rate of EURIBOR plus 0.5% and are due in March 2023.
 - In September 2022, the Company and its wholly owned subsidiary, TFSCA issued €600 million (\$589 million as of September 30, 2022) of bonds with an interest rate of 3.0%, which are due in September 2028 and \$400 million of bonds with an interest rate of 4.9%, which are due in December 2032.
 - In September 2022, the Company repaid a ¥25 billion (\$181 million) term loan and entered into a ¥30 billion (\$208 million as of September 30, 2022) term loan which is due in September 2027. Both the original and the new debt have an interest rate of LIBOR plus 0.4%.
- Financial covenants in the Company's revolving credit facilities requires a minimum consolidated shareholders' equity attributable to Johnson Controls of at least \$3.5 billion at all times. The revolving credit facility also limits the amount of debt secured by liens that may be incurred to a maximum aggregated amount of 10% of consolidated shareholders' equity attributable to Johnson Controls for liens and pledges. For purposes of calculating these covenants, consolidated shareholders' equity attributable to Johnson Controls is calculated without giving effect to (i) the application of ASC 715-60, "Defined Benefit Plans - Other Postretirement," or (ii) the cumulative foreign currency translation adjustment. As of September 30, 2022, the Company was in compliance with all financial covenants set forth in its credit agreements and the indentures governing its outstanding notes, and expects to remain in compliance for the foreseeable future. None of the Company's debt agreements limit access to stated borrowing levels or require accelerated repayment in the event of a decrease in the Company's credit rating.
- The Company earns a significant amount of its income outside of the parent company. Outside basis differences in these subsidiaries are deemed to be permanently reinvested except in limited circumstances. However, in fiscal 2022, the Company recorded income tax expense related to a change in its assertion over the outside basis differences of its investment in certain subsidiaries as a result of the planned divestitures. The Company currently does not intend nor foresee a need to repatriate undistributed earnings included in the outside basis differences other than in tax efficient

manners. The Company's intent is to reduce basis differences only when it would be tax efficient. The Company expects existing U.S. cash and liquidity to continue to be sufficient to fund the Company's U.S. operating activities and cash commitments for investing and financing activities for at least the next twelve months and thereafter for the foreseeable future. In the U.S., should the Company require more capital than is generated by its operations, the Company could elect to raise capital in the U.S. through debt or equity issuances. The Company has borrowed funds in the U.S. and continues to have the ability to borrow funds in the U.S. at reasonable interest rates. In addition, the Company expects existing non-U.S. cash, cash equivalents, short-term investments and cash flows from operations to continue to be sufficient to fund the Company's non-U.S. operating activities and cash commitments for investing activities, such as material capital expenditures, for at least the next twelve months and thereafter for the foreseeable future. Should the Company require more capital at the Luxembourg and Ireland holding and financing entities, other than amounts that can be provided in tax efficient methods, the Company could also elect to raise capital through debt or equity issuances. These alternatives could result in increased interest expense or other dilution of the Company's earnings.

- The Company may from time to time purchase its outstanding debt through open market purchases, privately negotiated transactions or otherwise. Purchases or retirement of debt, if any, will depend on prevailing market conditions, liquidity requirements, contractual restrictions and other factors. The amounts involved may be material.

Restructuring

To better align its resources with its growth strategies and reduce the cost structure of its global operations in certain underlying markets, the Company commits to restructuring plans as necessary. Restructuring plans generally result in charges for workforce reductions, plant closures, asset impairments and other related costs which are reported as restructuring and impairment costs in the Company's consolidated statements of income. The Company expects the restructuring actions to reduce cost of sales and SG&A due to reduced employee-related costs, depreciation and amortization expense.

In fiscal 2021, the Company announced plans to optimize its cost structure through broad-based SG&A actions focused on simplification, standardization and centralization, with the intent to deliver annualized savings of \$300 million by fiscal 2023. Additionally, the Company announced cost of sales actions intended to drive \$250 million in annual run rate savings by fiscal 2023. The one-time pre-tax costs associated with these actions were originally expected to be approximately \$385 million across all segments and at Corporate through fiscal 2023. The Company has incurred and exceeded these costs during fiscal 2022 due to certain restructuring actions and expenses planned for fiscal 2023 being accelerated into fiscal 2022, which also resulted in incremental savings. During the year ended September 30, 2022, the Company recorded \$182 million and in total, the Company has recorded \$424 million of costs resulting from the 2021 restructuring plan, which is the total amount expected to be incurred for this restructuring plan. The Company has outstanding restructuring reserves of \$82 million at September 30, 2022, all of which is expected to be paid in cash.

Co-Issued Securities: Summarized Financial Information

The following information is provided in compliance with Rule 13-01 of Regulation S-X under the Securities Exchange Act of 1934 with respect to the (i) \$625 million aggregate principal amount of 1.750% Senior Notes due 2030 (the "2030 Notes"), (ii) €500 million aggregate principal amount of 0.375% Senior Notes due 2027 (the "2027 Notes"), (iii) €500 million aggregate principal amount of 1.000% Senior Notes due 2032 (the "2032 Notes"), (iv) \$500 million aggregate principal amount of 2.000% Sustainability-Linked Senior Notes due 2031 (the "2031 Notes"), (v) €600 million aggregate principal amount of 3.000% Senior Notes due 2028 (the "2028 Notes") and (vi) \$400 million aggregate principal amount of 4.900% Senior Notes due 2032 (the "2032 Notes 2" and together with the 2032 Notes, the 2030 Notes, the 2028 Notes and the 2027 Notes, the "Notes"), each issued by Johnson Controls International plc ("Parent Company") and TFSCA, a corporate partnership limited by shares (*société en commandite par actions*) incorporated and organized under the laws of the Grand Duchy of Luxembourg ("Luxembourg"). Refer to Note 10, "Debt and Financing Arrangements," of the notes to consolidated financial statements for additional information.

TFSCA is a wholly-owned consolidated subsidiary of the Company that is 99.996% owned directly by the Parent Company and 0.004% owned by TFSCA's sole general partner and manager, Tyco Fire & Security S.à r.l., which is itself wholly-owned by the Company. The Notes are the Parent Company's and TFSCA's unsecured, unsubordinated obligations. The Parent Company is incorporated and organized under the laws of Ireland and TFSCA is incorporated and organized under the laws of Luxembourg. The bankruptcy, insolvency, administrative, debtor relief and other laws of Luxembourg or Ireland, as applicable, may be materially different from, or in conflict with, those of the United States, including in the areas of rights of creditors, priority of governmental and other creditors, ability to obtain post-petition interest and duration of the proceeding. The

application of these laws, or any conflict among them, could adversely affect noteholders' ability to enforce their rights under the Notes in those jurisdictions or limit any amounts that they may receive.

The following tables set forth summarized financial information of the Parent Company and TFSCA (collectively, the "Obligor Group") on a combined basis after intercompany transactions have been eliminated, including adjustments to remove the receivable and payable balances, investment in, and equity in earnings from, those subsidiaries of the Parent Company other than TFSCA (collectively, the "Non-Obligor Subsidiaries").

The following table presents summarized income statement information for the year ended September 30, 2022 (in millions):

	<u>September 30, 2022</u>
Net sales	\$ —
Gross profit	—
Loss from continuing operations	(268)
Net loss	(268)
Income attributable to noncontrolling interests	—
Net loss attributable to the entity	(268)

Excluded from the table above are the intercompany transactions between the Obligor Group and Non-Obligor Subsidiaries as follows (in millions):

	<u>September 30, 2022</u>
Net sales	\$ —
Gross profit	—
Income from continuing operations	92
Net income	92
Income attributable to noncontrolling interests	—
Net income attributable to the entity	92

The following table presents summarized balance sheet information (in millions):

	<u>September 30, 2022</u>
Current assets	\$ 1,231
Noncurrent assets	243
Current liabilities	5,463
Noncurrent liabilities	7,176
Noncontrolling interests	—

Excluded from the table above are the intercompany balances between the Obligor Group and Non-Obligor Subsidiaries as follows (in millions):

	<u>September 30, 2022</u>
Current assets	\$ 455
Noncurrent assets	2,952
Current liabilities	2,538
Noncurrent liabilities	6,228
Noncontrolling interests	—

The same accounting policies as described in Note 1, "Summary of Significant Accounting Policies," of the notes to consolidated financial statements are used by the Parent Company and each of its subsidiaries in connection with the summarized financial information presented above.

CRITICAL ACCOUNTING ESTIMATES

The Company prepares its consolidated financial statements in conformity with accounting principles generally accepted in the United States of America ("U.S. GAAP"). This requires management to make estimates and assumptions that affect reported amounts and related disclosures. Actual results could differ from those estimates. The following estimates are considered by management to be the most critical to the understanding of the Company's consolidated financial statements as they require significant judgments that could materially impact the Company's results of operations, financial position and cash flows.

Revenue Recognition

The Company recognizes revenue from certain long-term contracts on an over time basis, with progress towards completion measured using a cost-to-cost input method based on the relationship between actual costs incurred and total estimated costs at completion. Total estimated costs at completion are based primarily on estimated purchase contract terms, historical performance trends and other economic projections. Factors that may result in a change to these estimates include unforeseen engineering problems, construction delays, cost inflation, the performance of subcontractors and major material suppliers, and weather conditions. As a result, changes to the original estimates may be required during the life of the contract. Such estimates are reviewed monthly and any adjustments to the measure of completion are recognized as adjustments to sales and gross profit using the cumulative catch-up method. Estimated losses are recorded when identified.

For agreements with multiple performance obligations, the Company allocates the transaction price of the contract to each performance obligation using the best estimate of the standalone selling price of each distinct good or service in the contract. In order to estimate relative selling price, market data and transfer price studies are utilized. If the standalone selling price is not directly observable, the Company estimates the standalone selling price using an adjusted market assessment approach or expected cost plus margin approach.

The Company considers the contractual consideration payable by the customer and assesses variable consideration that may affect the total transaction price, including discounts, rebates, refunds, credits or other similar sources of variable consideration, when determining the transaction price of each contract. The Company includes variable consideration in the estimated transaction price when it is probable that significant reversal of revenue recognized would not occur when the uncertainty associated with variable consideration is subsequently resolved. These estimates are based on the amount of consideration that the Company expects to be entitled to.

Goodwill and Indefinite-Lived Intangible Assets

The Company reviews goodwill for impairment annually as of July 31 or more frequently if events or changes in circumstances indicate the asset might be impaired. The Company performs impairment reviews for its reporting units, which have been determined to be the Company's reportable segments or one level below the reportable segments in certain instances, using a fair value method based on management's judgments and assumptions or third party valuations. The fair value of a reporting unit refers to the price that would be received to sell the unit as a whole in an orderly transaction between market participants at the measurement date. In estimating the fair value, the Company uses the multiples of earnings approach based on the average of published multiples of earnings of comparable entities with similar operations and economic characteristics that are applied to the Company's average of historical and future financial results. In certain instances, the Company uses discounted cash flow analyses or estimated sales price to further support the fair value estimates. The assumptions included in the impairment tests require judgment, and changes to these inputs could impact the results of the calculations. The key assumptions used in the impairment tests were management's projections of future cash flows, weighted-average cost of capital and long-term growth rates. Although the Company's cash flow forecasts are based on assumptions that are considered reasonable by management and consistent with the plans and estimates management is using to operate the underlying businesses, there are significant judgments in determining the expected future cash flows attributable to a reporting unit.

During its fiscal 2022 annual impairment test, the Company determined that its Silent-Aire reporting unit's goodwill was impaired by \$75 million. No other reporting unit was determined to be at risk of failing the goodwill impairment test.

Indefinite-lived intangible assets are also subject to at least annual impairment testing. Indefinite-lived intangible assets primarily consist of trademarks and trade names and are tested for impairment using a relief-from-royalty method. A considerable amount of management judgment and assumptions are required in performing the impairment tests. The key assumptions used in the impairment tests were long-term revenue growth projections, weighted-average cost of capital, the royalty rate and general industry, market and macro-economic conditions.

The Company continuously monitors for events and circumstances that could negatively impact the key assumptions in determining fair value. While the Company believes the judgments and assumptions used in the goodwill and indefinite-lived intangible impairment tests are reasonable, different assumptions or changes in general industry, market and macro-economic conditions could change the estimated fair values and, therefore, future impairment charges could be required, which could be material to the consolidated financial statements.

Refer to Note 8, "Goodwill and other Intangible Assets," of the notes to consolidated financial statements for information regarding the results of goodwill and indefinite-lived intangible assets impairment testing performed in fiscal 2022 and 2021.

Pension Plans

The Company provides a range of benefits to its employees and retired employees, including pensions. Plan assets and obligations are measured annually, or more frequently if there is a significant remeasurement event, based on the Company's measurement date utilizing various actuarial assumptions such as discount rates, assumed rates of return and compensation increases as of that date. The Company reviews its actuarial assumptions on an annual basis and makes modifications to the assumptions based on current rates and trends when appropriate.

The Company utilizes a mark-to-market approach for recognizing pension expenses, including measuring the market related value of plan assets at fair value and recognizing actuarial gains and losses in the fourth quarter of each fiscal year or at the date of a remeasurement event. Refer to Note 16, "Retirement Plans," of the notes to consolidated financial statements for disclosure of the Company's pension plans.

U.S. GAAP requires that companies recognize in the statement of financial position a liability for plans that are underfunded or unfunded, or an asset for plans that are over funded. U.S. GAAP also requires that companies measure the benefit obligations and fair value of plan assets that determine a benefit plan's funded status as of the date of the employer's fiscal year end.

The Company considers the expected benefit payments on a plan-by-plan basis when setting assumed discount rates. As a result, the Company uses different discount rates for each plan depending on the plan jurisdiction, the demographics of participants and the expected timing of benefit payments. For the U.S. pension plans, the Company uses a discount rate provided by an independent third party calculated based on an appropriate mix of high quality bonds. For the non-U.S. pension plans, the Company consistently uses the relevant country specific benchmark indices for determining the various discount rates. The Company's weighted average discount rate on U.S. pension plans was 5.08% and 2.50% at September 30, 2022 and 2021, respectively. The Company's weighted average discount rate on non-U.S. pension plans was 4.36% and 1.80% at September 30, 2022 and 2021, respectively.

In estimating the expected return on plan assets, the Company considers the historical returns on plan assets, adjusted for forward-looking considerations, inflation assumptions and the impact of the active management of the plans' invested assets. Reflecting the relatively long-term nature of the plans' obligations, approximately 19% of the plans' assets are invested in equity securities and 66% in fixed income securities, with the remainder primarily invested in alternative investments. For the years ended September 30, 2022 and 2021, the Company's expected long-term return on U.S. pension plan assets used to determine net periodic benefit cost was 7.00% and 6.50%, respectively. The actual rate of return on U.S. pension plans was below 7.00% in fiscal 2022 and above 6.50% in fiscal 2021. For the years ended September 30, 2022 and 2021, the Company's weighted average expected long-term return on non-U.S. pension plan assets was 3.70% and 4.90%, respectively. The actual rate of return on non-U.S. pension plans was below 3.70% in fiscal 2022 and above 4.90% in fiscal 2021.

Beginning in fiscal 2023, the Company believes the long-term rate of return will approximate 8.25% for U.S. pension plans and 3.70% for non-U.S. pension plans. Any differences between actual investment results and the expected long-term asset returns will be reflected in net periodic benefit costs in the fourth quarter of each fiscal year or at the date of a significant remeasurement event. If the Company's actual returns on plan assets are less than the Company's expectations, additional contributions may be required.

In fiscal 2022, total employer contributions to the defined benefit pension plans were \$93 million, none of which were voluntary contributions made by the Company. The Company expects to contribute approximately \$38 million in cash to its defined benefit pension plans in fiscal 2023.

Based on information provided by its independent actuaries and other relevant sources, the Company believes that the assumptions used are reasonable; however, changes in these assumptions could impact the Company's financial position, results of operations or cash flows.

Mark-to-market adjustments represent actuarial gains (losses) arising from changes in actuarial assumptions and actuarial experiences different from those assumed that are used to value the plan assets and the benefit obligations. The primary factors contributing to actuarial gains (losses) are changes in the discount rate used to value benefit obligations and the difference between expected and actual returns on plan assets. Mark-to-market adjustments are highly volatile and are difficult to forecast. Refer to Note 16, "Retirement Plans," of the notes to consolidated financial statements for further details.

The following chart illustrates the estimated increases (decreases) in projected benefit obligation and future ongoing pension expense, which excludes any potential mark-to-market adjustments, assuming an increase of 25 basis points in the key assumptions for the Company's pension plans (in millions):

	Pension Benefits			
	U.S. Plans		Non-U.S. Plans	
	Change in Projected Benefit Obligation	Change in Ongoing Pension Expense	Change in Projected Benefit Obligation	Change in Ongoing Pension Expense
Discount rate	\$ (31)	\$ 3	\$ (39)	\$ 1
Expected return on plan assets	—	(4)	—	(3)

Loss Contingencies

Accruals are recorded for various contingencies including legal proceedings, environmental matters, self-insurance and other claims that arise in the normal course of business. The accruals are based on judgment, the probability of losses and, where applicable, the consideration of opinions of internal and/or external legal counsel and actuarially determined estimates. Additionally, the Company records receivables from third party insurers when recovery has been determined to be probable.

The Company is subject to laws and regulations relating to protecting the environment. It is difficult to estimate the Company's ultimate level of liability at many remediation sites due to the large number of other parties that may be involved, the complexity of determining the relative liability among those parties, the uncertainty as to the nature and scope of the investigations and remediation to be conducted, the uncertainty in the application of law and risk assessment, the various choices and costs associated with diverse technologies that may be used in corrective actions at the sites, and the often quite lengthy periods over which eventual remediation may occur. It is possible that technological, regulatory or enforcement developments, the results of additional environmental studies or other factors could change the Company's expectations with respect to future charges and cash outlays, and such changes could be material to the Company's future results of operations, financial condition or cash flows. Nevertheless, the Company does not currently believe that any claims, penalties or costs in addition to the amounts accrued will have a material adverse effect on the Company's financial position, results of operations or cash flows. The Company provides for expenses associated with environmental remediation obligations when such amounts are probable and can be reasonably estimated. During fiscal 2022, the Company increased its accrual for environmental remediation liabilities by \$228 million. Refer to Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements.

The Company records liabilities for its workers' compensation, product, general and auto liabilities. The determination of these liabilities and related expenses is dependent on claims experience. For most of these liabilities, claims incurred but not yet reported are estimated by utilizing actuarial valuations based upon historical claims experience. The Company records receivables from third party insurers when recovery has been determined to be probable. The Company maintains captive insurance companies to manage its insurable liabilities.

Asbestos-Related Contingencies and Insurance Receivables

The Company and certain of its subsidiaries along with numerous other companies are named as defendants in personal injury lawsuits based on alleged exposure to asbestos-containing materials. The Company's estimate of the liability and corresponding insurance recovery for pending and future claims and defense costs is based on the Company's historical claim experience, and estimates of the number and resolution cost of potential future claims that may be filed and is discounted to present value from 2068 (which is the Company's reasonable best estimate of the actuarially determined time period through which asbestos-related claims will be filed against Company affiliates). Estimated asbestos-related defense costs are included in the asbestos liability. The Company's legal strategy for resolving claims also impacts these estimates. The Company considers various trends and developments in evaluating the period of time (the look-back period) over which historical claim and settlement experience is used to estimate and value claims reasonably projected to be made through 2068. Annually, the Company assesses the

sufficiency of its estimated liability for pending and future claims and defense costs by evaluating actual experience regarding claims filed, settled and dismissed, and amounts paid in settlements. In addition to claims and settlement experience, the Company considers additional quantitative and qualitative factors such as changes in legislation, the legal environment, and the Company's defense strategy. The Company also evaluates the recoverability of its insurance receivable on an annual basis. The Company evaluates all of these factors and determines whether a change in the estimate of its liability for pending and future claims and defense costs or insurance receivable is warranted.

In connection with the recognition of liabilities for asbestos-related matters, the Company records asbestos-related insurance recoveries that are probable. The Company's estimate of asbestos-related insurance recoveries represents estimated amounts due to the Company for previously paid and settled claims and the probable reimbursements relating to its estimated liability for pending and future claims discounted to present value. In determining the amount of insurance recoverable, the Company considers available insurance, allocation methodologies, solvency and creditworthiness of the insurers. Refer to Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for a discussion on management's judgments applied in the recognition and measurement of asbestos-related assets and liabilities.

Income Taxes

Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between financial statement carrying amounts of existing assets and liabilities and their respective tax bases and operating loss and other loss carryforwards. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The Company records a valuation allowance that primarily represents non-U.S. operating and other loss carryforwards for which realization is uncertain. Management judgment is required in determining the Company's provision for income taxes, deferred tax assets and liabilities, and the valuation allowance recorded against the Company's net deferred tax assets.

The Company reviews the realizability of its deferred tax assets and related valuation allowances on a quarterly basis, or whenever events or changes in circumstances indicate that a review is required. In determining the requirement for a valuation allowance, the historical and projected financial results of the legal entity or consolidated group recording the net deferred tax asset are considered, along with any other positive or negative evidence. Since future financial results may differ from previous estimates, periodic adjustments to the Company's valuation allowances may be necessary. At September 30, 2022, the Company had a valuation allowance of \$6.0 billion for continuing operations, of which \$5.5 billion relates to net operating loss carryforwards primarily in France, Germany, Ireland, Luxembourg, Mexico, Spain, United Kingdom and the U.S. for which sustainable taxable income has not been demonstrated; and \$0.5 billion for other deferred tax assets.

The Company's federal income tax returns and certain non-U.S. income tax returns for various fiscal years remain under various stages of audit by the IRS and respective non-U.S. tax authorities. Although the outcome of tax audits is always uncertain, management believes that it has appropriate support for the positions taken on its tax returns and that its annual tax provisions included amounts sufficient to pay assessments, if any, which may be proposed by the taxing authorities. At September 30, 2022, the Company had recorded a liability of \$2.5 billion for its best estimate of the probable loss on certain of its tax positions, the majority of which is included in other noncurrent liabilities in the consolidated statements of financial position. Nonetheless, the amounts ultimately paid, if any, upon resolution of the issues raised by the taxing authorities may differ materially from the amounts accrued for each year.

The Company does not generally provide additional U.S. or non-U.S. income taxes on outside basis differences of consolidated subsidiaries included in shareholders' equity attributable to Johnson Controls International plc, except in limited circumstances including anticipated taxation on planned divestitures. The reduction of the outside basis differences via the sale or liquidation of these subsidiaries and/or distributions could create taxable income. The Company's intent is to reduce the outside basis differences only when it would be tax efficient. Refer to "Capitalization" within the "Liquidity and Capital Resources" section for discussion of U.S. and non-U.S. cash projections.

Refer to Note 18, "Income Taxes," of the notes to consolidated financial statements for the Company's income tax disclosures.

NEW ACCOUNTING PRONOUNCEMENTS

Refer to the "New Accounting Pronouncements" section within Note 1, "Summary of Significant Accounting Policies," of the notes to consolidated financial statements.

RISK MANAGEMENT

The Company selectively uses derivative instruments to reduce market risk associated with changes in foreign currency, commodities, stock-based compensation and interest rates. All hedging transactions are authorized and executed pursuant to clearly defined policies and procedures, which strictly prohibit the use of financial instruments for speculative purposes. At the inception of the hedge, the Company assesses the effectiveness of the hedge instrument and designates the hedge instrument as either (1) a hedge of a recognized asset or liability or of a recognized firm commitment (a fair value hedge), (2) a hedge of a forecasted transaction or of the variability of cash flows to be received or paid related to an unrecognized asset or liability (a cash flow hedge) or (3) a hedge of a net investment in a non-U.S. operation (a net investment hedge). The Company performs hedge effectiveness testing on an ongoing basis depending on the type of hedging instrument used. All other derivatives not designated as hedging instruments under ASC 815, "Derivatives and Hedging," are revalued in the consolidated statements of income.

For all foreign currency derivative instruments designated as cash flow hedges, retrospective effectiveness is tested on a monthly basis using a cumulative dollar offset test. The fair value of the hedged exposures and the fair value of the hedge instruments are revalued, and the ratio of the cumulative sum of the periodic changes in the value of the hedge instruments to the cumulative sum of the periodic changes in the value of the hedge is calculated. The hedge is deemed as highly effective if the ratio is between 80% and 125%. For commodity derivative contracts designated as cash flow hedges, effectiveness is tested using a regression calculation. Ineffectiveness is minimal as the Company aligns most of the critical terms of its derivatives with the supply contracts.

For net investment hedges, the Company assesses its net investment positions in the non-U.S. operations and compares it with the outstanding net investment hedges on a quarterly basis. The hedge is deemed effective if the aggregate outstanding principal of the hedge instruments designated as the net investment hedge in a non-U.S. operation does not exceed the Company's net investment positions in the respective non-U.S. operation.

Equity swaps and any other derivative instruments not designated as hedging instruments under ASC 815 require no assessment of effectiveness.

A discussion of the Company's accounting policies for derivative financial instruments is included in Note 1, "Summary of Significant Accounting Policies," of the notes to consolidated financial statements, and further disclosure relating to derivatives and hedging activities is included in Note 11, "Derivative Instruments and Hedging Activities," and Note 12, "Fair Value Measurements," of the notes to consolidated financial statements.

Foreign Exchange

The Company has manufacturing, sales and distribution facilities around the world and thus makes investments and enters into transactions denominated in various foreign currencies. In order to maintain strict control and achieve the benefits of the Company's global diversification, foreign exchange exposures for each currency are netted internally so that only its net foreign exchange exposures are, as appropriate, hedged with financial instruments.

The Company hedges 70% to 90% of the nominal amount of each of its known foreign exchange transactional exposures. The Company primarily enters into foreign currency exchange contracts to reduce the earnings and cash flow impact of the variation of non-functional currency denominated receivables and payables. Gains and losses resulting from hedging instruments offset the foreign exchange gains or losses on the underlying assets and liabilities being hedged. The maturities of the forward exchange contracts generally coincide with the settlement dates of the related transactions. Realized and unrealized gains and losses on these contracts are recognized in the same period as gains and losses on the hedged items. The Company also selectively hedges anticipated transactions that are subject to foreign exchange exposure, primarily with foreign currency exchange contracts, which are designated as cash flow hedges in accordance with ASC 815.

The Company has entered into foreign currency denominated debt obligations to selectively hedge portions of its net investment in non-U.S. subsidiaries. The currency effects of debt obligations are reflected in the accumulated other comprehensive income ("AOI") account within shareholders' equity attributable to Johnson Controls ordinary shareholders where they offset gains and losses recorded on the Company's net investments globally.

At September 30, 2022 and 2021, the Company estimates that an unfavorable 10% change in the exchange rates would have decreased net unrealized gains by approximately \$133 million and \$213 million, respectively.

Interest Rates

Substantially all of the Company's outstanding debt has fixed interest rates, and, therefore, any fluctuation in market interest rates is not expected to have a material effect on the Company's results of operations. A 20 basis point increase/decrease in the average interest rate on the Company's variable rate debt would have an immaterial impact on interest expense.

Commodities

The Company uses commodity hedge contracts in the financial derivatives market in cases where commodity price risk cannot be naturally offset or hedged through supply base fixed price contracts. Commodity risks are systematically managed pursuant to policy guidelines. As a cash flow hedge, gains and losses resulting from the hedging instruments offset the gains or losses on purchases of the underlying commodities that will be used in the business. The maturities of the commodity hedge contracts coincide with the expected purchase of the commodities.

ENVIRONMENTAL, HEALTH AND SAFETY AND OTHER MATTERS

The Company's global operations are governed by environmental laws and worker safety laws. Under various circumstances, these laws impose civil and criminal penalties and fines, as well as injunctive and remedial relief, for noncompliance and require remediation at sites where Company-related substances have been released into the environment.

The Company has expended substantial resources globally, both financial and managerial, to comply with applicable environmental laws and worker safety laws and to protect the environment and workers. The Company believes it is in substantial compliance with such laws and maintains procedures designed to foster and ensure compliance. However, the Company has been, and in the future may become, the subject of formal or informal enforcement actions or proceedings regarding noncompliance with such laws or the remediation of Company-related substances released into the environment. Such matters typically are resolved with regulatory authorities through commitments to compliance, abatement or remediation programs and in some cases payment of penalties. Historically, neither such commitments nor penalties imposed on the Company have been material.

Refer to Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for additional information.

ITEM 7A QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

See "Risk Management" included in Item 7 - Management's Discussion and Analysis of Financial Condition and Results of Operations.

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Johnson Controls International plc

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated statements of financial position of Johnson Controls International plc and its subsidiaries (the “Company”) as of September 30, 2022 and 2021, and the related consolidated statements of income, of comprehensive income, of shareholders' equity, and of cash flows for each of the three years in the period ended September 30, 2022, including the related notes and financial statement schedule listed in the accompanying index (collectively referred to as the “consolidated financial statements”). We also have audited the Company's internal control over financial reporting as of September 30, 2022, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of September 30, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended September 30, 2022 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of September 30, 2022, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO.

Change in Accounting Principle

As discussed in Note 1 to the consolidated financial statements, the Company changed the manner in which it accounts for leases as of October 1, 2019.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in Management's Report on Internal Control Over Financial Reporting appearing under Item 9A. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal

control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Uncertain Tax Positions

As described in Note 18 to the consolidated financial statements, the Company has recorded liabilities for uncertain tax positions totaling \$2,537 million, primarily as a non-current liability, as of September 30, 2022. The Company is subject to income taxes in the U.S. and numerous non-U.S. jurisdictions. Judgment is required by management in determining the Company's worldwide provision for income taxes and recording the related income tax assets and liabilities. In the ordinary course of the Company's business, there are many transactions and calculations where the ultimate tax determination is uncertain. As disclosed by management, a liability for the best estimate of the probable loss on certain of the Company's tax positions has been recorded by management. The Company's income tax filings for various fiscal years remain under various stages of audit by the IRS and respective non-U.S. tax authorities. The amounts ultimately paid, if any, upon resolution of the issues raised by the taxing authorities may differ materially from the amounts accrued for each year.

The principal considerations for our determination that performing procedures relating to uncertain tax positions is a critical audit matter are (i) the significant judgment by management in identifying and recording the estimated probable loss for each uncertain tax position; (ii) a high degree of auditor judgment, subjectivity, and effort in performing procedures to evaluate the identification and accurate measurement of uncertain tax positions, (iii) the evaluation of audit evidence available to support the tax liabilities for uncertain tax positions is complex and resulted in significant auditor judgment as the nature of the evidence is often highly subjective, and (iv) the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to management's assessment of uncertain tax positions, including controls over the identification and estimate of probable loss for uncertain tax positions. These procedures also included, among others (i) for a sample of uncertain tax positions by jurisdiction, testing the information used in the calculation of the estimate of probable loss and testing the calculation of the estimate of probable loss; (ii) testing the completeness of management's assessment of the identification of uncertain tax positions; and (iii) evaluating the status and results of income tax audits with the relevant tax authorities, as applicable. Professionals with specialized skill and knowledge were used to assist in the evaluation of the completeness and measurement of the Company's

uncertain tax positions, including evaluating the reasonableness of management's assessment of whether tax positions are more-likely-than-not of being sustained and the amount of potential benefit to be realized, and the application of relevant tax laws.

/s/ PricewaterhouseCoopers LLP
Milwaukee, Wisconsin
November 15, 2022

We have served as the Company's auditor since 1957.

Johnson Controls International plc
Consolidated Statements of Income

(in millions, except per share data)	Year Ended September 30,		
	2022	2021	2020
Net sales			
Products and systems	\$ 19,274	\$ 17,202	\$ 16,253
Services	6,025	6,466	6,064
	<u>25,299</u>	<u>23,668</u>	<u>22,317</u>
Cost of sales			
Products and systems	13,533	11,848	11,401
Services	3,423	3,761	3,505
	<u>16,956</u>	<u>15,609</u>	<u>14,906</u>
Gross profit	8,343	8,059	7,411
Selling, general and administrative expenses	(5,945)	(5,258)	(5,665)
Restructuring and impairment costs	(721)	(242)	(783)
Net financing charges	(213)	(206)	(231)
Equity income	246	261	171
	<u>1,710</u>	<u>2,614</u>	<u>903</u>
Income from continuing operations before income taxes	1,710	2,614	903
Income tax provision (benefit)	(13)	868	108
	<u>1,723</u>	<u>1,746</u>	<u>795</u>
Income from continuing operations	1,723	1,746	795
Income from discontinued operations, net of tax (Note 3)	—	124	—
	<u>—</u>	<u>124</u>	<u>—</u>
Net income	1,723	1,870	795
Income from continuing operations attributable to noncontrolling interests	191	233	164
	<u>191</u>	<u>233</u>	<u>164</u>
Net income attributable to Johnson Controls	<u>\$ 1,532</u>	<u>\$ 1,637</u>	<u>\$ 631</u>
Amounts attributable to Johnson Controls ordinary shareholders:			
Income from continuing operations	\$ 1,532	\$ 1,513	\$ 631
Income from discontinued operations	—	124	—
Net income	<u>\$ 1,532</u>	<u>\$ 1,637</u>	<u>\$ 631</u>
Basic earnings per share attributable to Johnson Controls			
Continuing operations	\$ 2.20	\$ 2.11	\$ 0.84
Discontinued operations	—	0.17	—
Net income	<u>\$ 2.20</u>	<u>\$ 2.28</u>	<u>\$ 0.84</u>
Diluted earnings per share attributable to Johnson Controls			
Continuing operations	\$ 2.19	\$ 2.10	\$ 0.84
Discontinued operations	—	0.17	—
Net income	<u>\$ 2.19</u>	<u>\$ 2.27</u>	<u>\$ 0.84</u>

The accompanying notes are an integral part of the consolidated financial statements.

Johnson Controls International plc
Consolidated Statements of Comprehensive Income

(in millions)	Year Ended September 30,		
	2022	2021	2020
Net income	\$ 1,723	\$ 1,870	\$ 795
Other comprehensive income (loss), net of tax:			
Foreign currency translation adjustments	(603)	376	25
Realized and unrealized gains (losses) on derivatives	7	(18)	8
Pension and postretirement plans	(3)	4	8
Other comprehensive income (loss)	(599)	362	41
Total comprehensive income	1,124	2,232	836
Comprehensive income attributable to noncontrolling interests:			
Net income	191	233	164
Other comprehensive income (loss), net of tax:			
Foreign currency translation adjustments	(123)	19	18
Realized and unrealized gains on derivatives	1	1	4
Other comprehensive income (loss)	(122)	20	22
Comprehensive income attributable to noncontrolling interests	69	253	186
Comprehensive income attributable to Johnson Controls	<u>\$ 1,055</u>	<u>\$ 1,979</u>	<u>\$ 650</u>

The accompanying notes are an integral part of the consolidated financial statements.

Johnson Controls International plc
Consolidated Statements of Financial Position

(in millions, except par value and share data)	September 30,	
	2022	2021
Assets		
Cash and cash equivalents	\$ 2,031	\$ 1,336
Accounts receivable - net	5,528	5,613
Inventories	2,510	2,057
Current assets held for sale	387	—
Other current assets	1,229	992
Current assets	11,685	9,998
Property, plant and equipment - net	3,042	3,228
Goodwill	17,328	18,335
Other intangible assets - net	4,641	5,549
Investments in partially-owned affiliates	963	1,066
Noncurrent assets held for sale	751	156
Other noncurrent assets	3,748	3,558
Total assets	<u>\$ 42,158</u>	<u>\$ 41,890</u>
Liabilities and Equity		
Short-term debt	\$ 669	\$ 8
Current portion of long-term debt	865	226
Accounts payable	4,241	3,746
Accrued compensation and benefits	978	1,008
Deferred revenue	1,768	1,637
Current liabilities held for sale	236	—
Other current liabilities	2,482	2,473
Current liabilities	11,239	9,098
Long-term debt	7,426	7,506
Pension and postretirement benefit obligations	358	628
Noncurrent liabilities held for sale	62	—
Other noncurrent liabilities	5,671	5,905
Noncurrent liabilities	13,517	14,039
Commitments and contingencies (Note 21)		
Ordinary shares (par value \$0.01; 2.0 billion shares authorized; shares issued: 2022 - 717,726,243; 2021 - 737,090,363)	7	7
Ordinary A shares (par value €1.00; 40,000 shares authorized, none outstanding as of September 30, 2022 and 2021)	—	—
Preferred shares (par value \$0.01; 200,000,000 shares authorized, none outstanding as of September 30, 2022 and 2021)	—	—
Ordinary shares held in treasury, at cost (shares held: 2022 - 29,029,475; 2021 - 28,356,889)	(1,203)	(1,152)
Capital in excess of par value	17,224	17,116
Retained earnings	1,151	2,025
Accumulated other comprehensive loss	(911)	(434)
Shareholders' equity attributable to Johnson Controls	16,268	17,562
Noncontrolling interests	1,134	1,191
Total equity	17,402	18,753
Total liabilities and equity	<u>\$ 42,158</u>	<u>\$ 41,890</u>

The accompanying notes are an integral part of the consolidated financial statements.

Johnson Controls International plc
Consolidated Statements of Cash Flows

(in millions)	Year Ended September 30,		
	2022	2021	2020
Operating Activities of Continuing Operations			
Net income from continuing operations attributable to Johnson Controls	\$ 1,532	\$ 1,513	\$ 631
Income from continuing operations attributable to noncontrolling interests	191	233	164
Net income from continuing operations	1,723	1,746	795
Adjustments to reconcile net income from continuing operations to cash provided by operating activities:			
Depreciation and amortization	830	845	822
Pension and postretirement benefit expense (income)	(216)	(551)	118
Pension and postretirement contributions	(96)	(68)	(61)
Equity in earnings of partially-owned affiliates, net of dividends received	30	(117)	(36)
Deferred income taxes	(141)	36	(537)
Non-cash restructuring and impairment charges	555	98	582
Equity-based compensation expense	102	76	74
Other - net	(58)	(85)	(90)
Changes in assets and liabilities, excluding acquisitions and divestitures:			
Accounts receivable	(427)	(143)	534
Inventories	(773)	(219)	45
Other assets	(362)	(164)	(52)
Restructuring reserves	(7)	(44)	(29)
Accounts payable and accrued liabilities	1,270	813	(717)
Accrued income taxes	(440)	328	1,031
Cash provided by operating activities from continuing operations	1,990	2,551	2,479
Investing Activities of Continuing Operations			
Capital expenditures	(592)	(552)	(443)
Sale of property, plant and equipment	127	124	127
Acquisition of businesses, net of cash acquired	(269)	(725)	(77)
Business divestitures, net of cash divested	16	19	135
Other - net	25	44	—
Cash used by investing activities from continuing operations	(693)	(1,090)	(258)
Financing Activities of Continuing Operations			
Increase (decrease) in short-term debt - net	923	(17)	(33)
Increase in long-term debt	1,227	496	1,804
Repayment of long-term debt	(184)	(507)	(1,386)
Stock repurchases and retirements	(1,441)	(1,307)	(2,204)
Payment of cash dividends	(916)	(762)	(790)
Proceeds from the exercise of stock options	17	178	75
Dividends paid to noncontrolling interests	(121)	(142)	(114)
Employee equity-based compensation withholding taxes	(51)	(33)	(34)
Cash paid to acquire a noncontrolling interest	(1)	(14)	(132)
Other - net	31	(23)	(10)
Cash used by financing activities from continuing operations	(516)	(2,131)	(2,824)
Discontinued Operations			
Cash used by operating activities	(4)	(64)	(260)
Cash used by financing activities	—	—	(113)
Cash used by discontinued operations	(4)	(64)	(373)
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(53)	116	115
Increase (decrease) in cash, cash equivalents and restricted cash	724	(618)	(861)
Cash, cash equivalents and restricted cash at beginning of period	1,342	1,960	2,821
Cash, cash equivalents and restricted cash at end of period	2,066	1,342	1,960
Less: Restricted cash	35	6	9
Cash and cash equivalents at end of period	\$ 2,031	\$ 1,336	\$ 1,951

The accompanying notes are an integral part of the consolidated financial statements.

Johnson Controls International plc
Consolidated Statements of Shareholders' Equity

(in millions)	Year Ended September 30,		
	2022	2021	2020
Shareholders' Equity Attributable to Johnson Controls			
Beginning Balance	\$ 17,562	\$ 17,447	\$ 19,766
Ordinary Shares			
Beginning balance	7	8	8
Repurchases and retirements of ordinary shares	—	(1)	—
Ending balance	7	7	8
Ordinary Shares Held in Treasury, at Cost			
Beginning balance	(1,152)	(1,119)	(1,086)
Employee equity-based compensation withholding taxes	(51)	(33)	(33)
Ending balance	(1,203)	(1,152)	(1,119)
Capital in Excess of Par Value			
Beginning balance	17,116	16,865	16,812
Change in noncontrolling interest share	—	(8)	(83)
Share-based compensation expense	88	76	61
Other, including options exercised	20	183	75
Ending balance	17,224	17,116	16,865
Retained Earnings			
Beginning balance	2,025	2,469	4,827
Net income attributable to Johnson Controls	1,532	1,637	631
Cash dividends declared	(965)	(771)	(780)
Repurchases and retirements of ordinary shares	(1,441)	(1,306)	(2,204)
Adoption of ASC 842	—	—	(5)
Adoption of ASU 2016-13	—	(4)	—
Ending balance	1,151	2,025	2,469
Accumulated Other Comprehensive Income (Loss)			
Beginning balance	(434)	(776)	(795)
Other comprehensive income (loss)	(477)	342	19
Ending balance	(911)	(434)	(776)
Ending Balance	16,268	17,562	17,447
Shareholders' Equity Attributable to Noncontrolling Interests			
Beginning Balance	1,191	1,086	1,063
Comprehensive income attributable to noncontrolling interests	69	253	186
Dividends attributable to noncontrolling interests	(131)	(142)	(114)
Change in noncontrolling interest share	5	(6)	(49)
Ending Balance	1,134	1,191	1,086
Total Shareholders' Equity	<u>\$ 17,402</u>	<u>\$ 18,753</u>	<u>\$ 18,533</u>
Cash Dividends Declared per Ordinary Share	<u>\$ 1.39</u>	<u>\$ 1.07</u>	<u>\$ 1.04</u>

The accompanying notes are an integral part of the consolidated financial statements.

Johnson Controls International plc
Notes to Consolidated Financial Statements

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The consolidated financial statements include the consolidated accounts of Johnson Controls International plc, a public limited company organized under the laws of Ireland, and its subsidiaries (Johnson Controls International plc and all its subsidiaries, hereinafter collectively referred to as the "Company," "Johnson Controls" or "JCI plc").

The Company's fiscal year ends on September 30. Unless otherwise stated, references to years in this report relate to fiscal years rather than calendar years.

Nature of Operations

Johnson Controls International plc, headquartered in Cork, Ireland, is a global leader in smart, healthy and sustainable buildings, serving a wide range of customers in more than 150 countries. The Company's products, services, systems and solutions advance the safety, comfort and intelligence of spaces to serve people, places and the planet. The Company is committed to helping its customers win and creating greater value for all of its stakeholders through its strategic focus on buildings.

The Company is a global leader in engineering, manufacturing, commissioning and retrofitting building products and systems, including residential and commercial heating, ventilating, air-conditioning ("HVAC") equipment, industrial refrigeration systems, controls, security systems, fire-detection systems and fire-suppression solutions. The Company further serves customers by providing technical services, including maintenance, management and repair of equipment (in the HVAC, industrial refrigeration, controls, security and fire-protection space), energy-management consulting and data-driven "smart building" services and solutions powered by its OpenBlue software platform and capabilities. The Company partners with customers by leveraging its broad product portfolio and digital capabilities powered by OpenBlue, together with its direct channel service and solutions capabilities, to deliver outcome-based solutions across the lifecycle of a building that address customers' needs to improve energy efficiency, enhance security, create healthy environments and reduce greenhouse gas emissions.

Principles of Consolidation

The consolidated financial statements include the consolidated accounts of Johnson Controls International plc and its subsidiaries that are consolidated in conformity with accounting principles generally accepted in the United States of America ("U.S. GAAP"). All significant intercompany transactions have been eliminated. The results of companies acquired or disposed of during the year are included in the consolidated financial statements from the effective date of acquisition or up to the date of disposal. Investments in partially-owned affiliates are accounted for by the equity method when the Company exercises significant influence, which typically occurs when its ownership interest exceeds 20%, and the Company does not have a controlling interest.

The Company consolidates variable interest entities ("VIE") when it has the power to direct the significant activities of the entity and the obligation to absorb losses or receive benefits from the entity that may be significant. The Company did not have any material consolidated or nonconsolidated VIEs in its continuing operations for the presented reporting periods.

Use of Estimates

The preparation of consolidated financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Fair Value of Financial Instruments

ASC 820, "Fair Value Measurement," defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. ASC 820 also establishes a three-level fair value hierarchy that prioritizes information used in developing assumptions when pricing an asset or liability as follows:

Level 1: Observable inputs such as quoted prices in active markets for identical assets or liabilities;

Level 2: Quoted prices in active markets for similar assets or liabilities, quoted prices for identical or similar assets or liabilities in markets that are not active, or inputs, other than quoted prices in active markets, that are observable either directly or indirectly; and

Level 3: Unobservable inputs where there is little or no market data, which requires the reporting entity to develop its own assumptions.

ASC 820 requires the use of observable market data, when available, in making fair value measurements. When inputs used to measure fair value fall within different levels of the hierarchy, the level within which the fair value measurement is categorized is based on the lowest level input that is significant to the fair value measurement.

The fair values of cash and cash equivalents, accounts receivable, short-term debt and accounts payable approximate their carrying values.

Assets and Liabilities Held for Sale

Assets and liabilities (disposal groups) to be sold are classified as held for sale in the period in which all of the following criteria are met:

- Management, having the authority to approve the action, commits to a plan to sell the disposal group;
- The disposal group is available for immediate sale in its present condition subject only to terms that are usual and customary for sales of such disposal groups;
- An active program to locate a buyer and other actions required to complete the plan to sell the disposal group have been initiated;
- Sale of the disposal group is probable and transfer of the disposal group is expected to qualify for recognition as a completed sale within one year, except if events or circumstances beyond the Company's control extend the period of time required to sell the disposal group beyond one year;
- The disposal group is being actively marketed for sale at a price that is reasonable in relation to its current fair value; and
- Actions required to complete the plan indicate that it is unlikely that significant changes to the plan will be made or that the plan will be withdrawn.

The Company initially measures a disposal group that is classified as held for sale at the lower of its carrying value or fair value less any costs to sell. Any loss resulting from this measurement is recognized in the period in which the held for sale criteria are met. Conversely, gains are not recognized on the sale of a disposal group until the date of sale. The Company assesses the fair value of a disposal group, less any costs to sell, each reporting period it remains classified as held for sale and reports any subsequent changes as an adjustment to the carrying value of the disposal group, as long as the new carrying value does not exceed the carrying value of the disposal group at the time it was initially classified as held for sale.

Upon determining that a disposal group meets the criteria to be classified as held for sale, the Company reports the assets and liabilities of the disposal group, if material, in the line items assets held for sale and liabilities held for sale in the consolidated statements of financial position.

Cash and Cash Equivalents

Cash equivalents include all highly liquid investments with an original maturity of three months or less when purchased.

Restricted Cash

Restricted cash relates to amounts restricted for payment of asbestos liabilities and certain litigation and environmental matters. Restricted cash is recorded within other current assets in the consolidated statements of financial position and totaled \$35 million and \$6 million at September 30, 2022 and 2021, respectively.

Receivables

Receivables consist of amounts billed and currently due from customers and unbilled costs and accrued profits related to revenues on long-term contracts that have been recognized for accounting purposes but not yet billed to customers. The Company extends credit to customers in the normal course of business and maintains an allowance for expected credit losses resulting from the inability or unwillingness of customers to make required payments. The allowance for expected credit losses is based on historical experience, existing economic conditions, reasonable and supportable forecasts, and any specific customer collection issues the Company has identified. The Company evaluates the reasonableness of the allowance for expected credit losses on a quarterly basis.

The Company enters into various factoring agreements to sell certain accounts receivable to third-party financial institutions. For the majority of these agreements, for ease of administration, the Company collects customer payments related to the factored receivables on behalf of the financial institutions but otherwise maintains no continuing involvement with respect to the factored receivables. Sales of accounts receivable are reflected as a reduction of accounts receivable in the consolidated statements of financial position and the proceeds are included in cash flows from operating activities in the consolidated statements of cash flows.

Inventories

Inventories are stated at the lower of cost or net realizable value using the first-in, first-out ("FIFO") method. Finished goods and work-in-process inventories include material, labor and manufacturing overhead costs.

Property, Plant and Equipment

Property, plant and equipment are recorded at cost. Depreciation is provided over the estimated useful lives of the respective assets using the straight-line method for financial reporting purposes and accelerated methods for income tax purposes. The estimated useful lives generally range from 3 to 40 years for buildings and improvements, up to 15 years for subscriber systems, and from 3 to 15 years for machinery and equipment. Interest on borrowings is capitalized during the active construction period of major capital projects, added to the cost of the underlying assets and amortized over the useful lives of the assets.

Goodwill and Indefinite-Lived Intangible Assets

Goodwill reflects the cost of an acquisition in excess of the fair values assigned to identifiable net assets acquired. Goodwill is reviewed for impairment during the fourth fiscal quarter or more frequently if events or changes in circumstances indicate the asset might be impaired. The Company performs impairment reviews for its reporting units, which have been determined to be the Company's reportable segments or one level below the reportable segments in certain instances, using a fair value method based on management's judgments and assumptions or third party valuations. The fair value of a reporting unit refers to the price that would be received to sell the unit as a whole in an orderly transaction between market participants at the measurement date. In estimating the fair value, the Company uses the multiples of earnings approach based on the average of published multiples of earnings of comparable entities with similar operations and economic characteristics and applies the multiples to the Company's average of historical and future financial results for each reporting unit. In certain instances, the Company uses discounted cash flow analyses or estimated sales price to further support the fair value estimates. The inputs utilized in the analyses are classified as Level 3 inputs within the fair value hierarchy as defined in ASC 820, "Fair Value Measurement." The estimated fair value is then compared to the carrying amount of the reporting unit, including recorded goodwill. The Company is subject to financial statement risk to the extent that the carrying amount exceeds the estimated fair value.

Indefinite-lived intangible assets are also subject to at least annual impairment testing. Indefinite-lived intangible assets primarily consist of trademarks and trade names and are tested for impairment using a relief-from-royalty method. A considerable amount of management judgment and assumptions are required in performing the impairment tests.

Leases

Lessee arrangements

The Company leases certain administrative, production and other facilities, fleet vehicles, information technology equipment and other equipment under arrangements that are accounted for as operating leases. The Company determines whether an arrangement contains a lease at contract inception based on whether the arrangement involves the use of a physically distinct identified asset and whether the Company has the right to obtain substantially all of the economic benefits from the use of the asset throughout the period as well as the right to direct the use of the asset.

The Company adopted ASU 2016-02, "Leases (Topic 842)" and the related amendments using a modified-retrospective approach as of October 1, 2019.

Right-of-use assets represent the Company's right to use an underlying asset for the lease term and lease liabilities represent its obligation to make lease payments arising from the lease. Right-of-use assets and the corresponding lease liabilities are recognized at commencement date based on the present value of lease payments for all leases with terms longer than twelve months. The majority of the Company's leases do not provide an implicit interest rate. To determine the present value of lease payments, the Company uses its incremental borrowing rate based on information available on the lease commencement date or the implicit rate if it is readily determinable. The Company determines its incremental borrowing rate based on a comparable market yield curve consistent with its credit rating, term of the lease and relative economic environment. The Company has elected to combine lease and nonlease components for its leases.

Most leases contain options to renew or terminate the lease. Right-of-use assets and lease liabilities reflect only the options which the Company is reasonably certain to exercise.

The Company has certain real estate leases that contain variable lease payments which are based on changes in the Consumer Price Index (CPI). Additionally, the Company's leases generally require it to pay for fuel, maintenance, repair, insurance and taxes. These payments are not included in the right-of-use asset or lease liability and are expensed as incurred.

Lease expense is recognized on a straight-line basis over the lease term.

Lessor arrangements

The Company has monitoring services and maintenance agreements within its security business that include subscriber system assets for which the Company retains ownership. These agreements contain both lease and nonlease components. The Company has elected to combine lease and nonlease components for these arrangements where the timing and pattern of transfer of the lease and nonlease components are the same and the lease component would be classified as an operating lease if accounted for separately. The Company has concluded that in these arrangements the nonlease components are the predominant characteristic, and as a result, the combined component is accounted for under the revenue guidance.

Impairment of Long-Lived Assets

Long-lived assets, including right-of-use assets under operating leases, other tangible assets and intangible assets with definitive lives, are reviewed for impairment whenever events or changes in circumstances indicate that the asset's carrying amount may not be recoverable. The Company conducts its long-lived asset impairment analyses in accordance with ASC 360-10-15, "Impairment or Disposal of Long-Lived Assets," ASC 350-30, "General Intangibles Other than Goodwill" and ASC 985-20, "Costs of Software to be Sold, Leased, or Marketed."

Assets and liabilities are grouped at the lowest level for which identifiable cash flows are largely independent of the cash flows of other assets and liabilities and evaluates the asset group against the sum of the undiscounted future cash flows. If the undiscounted cash flows do not indicate the carrying amount of the asset group is recoverable, an impairment charge is measured as the amount by which the carrying amount of the asset group exceeds its fair value based on discounted cash flow analysis or appraisals. Intangible assets acquired in a business combination that are used in research and development activities are considered indefinite-lived until the completion or abandonment of the associated research and development efforts. During the period that those assets are considered indefinite lived, they are not amortized but are tested for impairment annually and more frequently if events or changes in circumstances indicate that it is more likely than not that the asset is impaired. If the carrying amount of an intangible asset exceeds its fair value, the Company recognizes an impairment loss in an amount equal to that excess. Unamortized capitalized costs of a computer software product are compared to the net realizable value of the product. The amount by which the unamortized capitalized costs of a computer software product exceed the net realizable value of that asset is written off.

Revenue Recognition

Revenue from certain long-term contracts to design, manufacture and install building products and systems as well as unscheduled repair or replacement services is recognized on an over time basis, with progress towards completion measured using a cost-to-cost input method based on the relationship between actual costs incurred and total estimated costs at completion. The cost-to-cost input method is used as it best depicts the transfer of control to the customer that occurs as the Company incurs costs. Changes to the original estimates may be required during the life of the contract and such estimates are

reviewed monthly. If contract modifications result in additional goods or services that are distinct from those transferred before the modification, they are accounted for prospectively as if the Company entered into a new contract. If the goods or services in the modification are not distinct from those in the original contract, sales and gross profit are adjusted using the cumulative catch-up method for revisions in estimated total contract costs and contract values. Estimated losses are recorded when identified. The Company does not adjust the promised amount of consideration for the effects of a significant financing component as at contract inception the Company expects to receive the payment within twelve months of transfer of goods or services.

The Company enters into extended warranties and long-term service and maintenance agreements with certain customers. For these arrangements, revenue is recognized over time on a straight-line basis over the respective contract term.

The Company also sells certain HVAC and refrigeration products and services in bundled arrangements with multiple performance obligations, such as equipment, commissioning, service labor and extended warranties. Approximately four to twelve months separate the timing of the first deliverable until the last piece of equipment is delivered, and there may be extended warranty arrangements with duration of one to five years commencing upon the end of the standard warranty period. In addition, the Company sells security monitoring systems that may have multiple performance obligations, including equipment, installation, monitoring services and maintenance agreements. Revenues associated with the sale of equipment and related installations are recognized over time on a cost-to-cost input method, while the revenue for monitoring and maintenance services are recognized over time as services are rendered. The transaction price is allocated to each performance obligation based on the relative selling price method. In order to estimate relative selling price, market data and transfer price studies are utilized. If the standalone selling price is not directly observable, the Company estimates the standalone selling price using an adjusted market assessment approach or expected cost plus margin approach. For transactions in which the Company retains ownership of the subscriber system asset, fees for monitoring and maintenance services are recognized over time on a straight-line basis over the contract term. Non-refundable fees received in connection with the initiation of a monitoring contract, along with associated direct and incremental selling costs, are deferred and amortized over the estimated life of the contract.

In all other cases, the Company recognizes revenue at the point in time when control over the goods or services transfers to the customer.

The Company considers the contractual consideration payable by the customer and assesses variable consideration that may affect the total transaction price, including discounts, rebates, refunds, credits or other similar sources of variable consideration, when determining the transaction price of each contract. The Company includes variable consideration in the estimated transaction price when it is probable that significant reversal of revenue recognized would not occur when the uncertainty associated with variable consideration is subsequently resolved. These estimates are based on the amount of consideration that the Company expects to be entitled to.

Shipping and handling costs billed to customers are included in sales and the related costs are included in cost of sales when control transfers to the customer. The Company presents amounts collected from customers for sales and other taxes net of the related amounts remitted.

Subscriber System Assets, Dealer Intangibles and Related Deferred Revenue Accounts

The Company considers assets related to the acquisition of new customers in its electronic security business in three asset categories:

- Internally generated residential subscriber systems outside of North America
- Internally generated commercial subscriber systems (collectively referred to as subscriber system assets)
- Customer accounts acquired through the ADT dealer program, primarily outside of North America (referred to as dealer intangibles)

Subscriber system assets include installed property, plant and equipment for which the Company retains ownership and deferred costs directly related to the customer acquisition and system installation. Subscriber system assets represent capitalized equipment (e.g. security control panels, touch pad, motion detectors, window sensors, and other equipment) and installation costs associated with electronic security monitoring arrangements under which the Company retains ownership of the security system assets in a customer's place of business, or outside of North America, residence. Installation costs represent costs incurred to prepare the asset for its intended use. The Company pays property taxes on the subscriber system assets and upon

customer termination, may retrieve such assets. These assets embody a probable future economic benefit as they generate future monitoring revenue for the Company.

Costs related to the subscriber system equipment and installation are categorized as property, plant and equipment rather than deferred costs. Deferred costs associated with subscriber system assets represent direct and incremental selling expenses (such as commissions) related to acquiring the customer. Commissions related to up-front consideration paid by customers in connection with the establishment of the monitoring arrangement are determined based on a percentage of the up-front fees and do not exceed deferred revenue. Such deferred costs are recorded as other current and noncurrent assets within the consolidated statements of financial position.

Subscriber system assets and any deferred revenue resulting from the customer acquisition are accounted for over the expected life of the subscriber. In certain geographical areas where the Company has a large number of customers that behave in a similar manner over time, the Company accounts for subscriber system assets and related deferred revenue using pools, with separate pools for the components of subscriber system assets and any related deferred revenue based on the same month and year of acquisition. Pooled subscriber system assets and related deferred revenue are depreciated using a straight-line method with lives up to 12 years and considering customer attrition. Non-pooled subscriber systems (primarily in Europe, Latin America and Asia) and related deferred revenue are depreciated using a straight-line method with a 15-year life, with remaining balances written off upon customer termination.

Certain contracts and related customer relationships result from purchasing residential security monitoring contracts from an external network of independent dealers who operate under the ADT dealer program, primarily outside of North America. Acquired contracts and related customer relationships are recorded at their contractually determined purchase price.

During the first 6 months (12 months in certain circumstances) after the purchase of the customer contract, any cancellation of monitoring service, including those that result from customer payment delinquencies, results in a chargeback by the Company to the dealer for the full amount of the contract purchase price. The Company records the amount charged back to the dealer as a reduction of the previously recorded intangible asset.

Intangible assets arising from the ADT dealer program described above are amortized in pools determined by the same month and year of contract acquisition on a straight-line basis over the period of the customer relationship. The estimated useful life of dealer intangibles ranges from 12 to 15 years.

Research and Development Costs

Expenditures for research activities relating to product development and improvement are charged against income as incurred and included within selling, general and administrative expenses in the consolidated statements of income. Such expenditures for the years ended September 30, 2022, 2021 and 2020 were \$295 million, \$275 million and \$274 million, respectively.

Stock-Based Compensation

Restricted (Non-vested) Stock /Units

Restricted stock and restricted stock units are typically settled in shares for employees in the U.S. and in cash for employees not in the U.S. Restricted awards typically vest over a period of three years from the grant date. The Company's Compensation and Talent Development Committee may approve different vesting terms on specific grants. The fair value of each share-settled restricted award is based on the closing market value of the Company's ordinary shares on the date of grant. The fair value of each cash-settled restricted award is recalculated at the end of each reporting period based on the closing market value of the Company's ordinary shares at the end of the reporting period, and the liability and expense are adjusted based on the new fair value.

Performance Share Awards

Performance-based share unit ("PSU") awards are generally contingent on the achievement of predetermined performance goals over a performance period of one to three years and on the award holder's continuous employment until the vesting date. The majority of PSUs are also indexed to the achievement of specified levels of total shareholder return versus a peer group over the performance period.

Upon completion of the performance period, earned PSUs are typically settled with shares of the Company's ordinary shares for employees in the U.S. and in cash for employees not in the U.S.

The fair value of the portion of the PSU which is linked to the achievement of performance goals is based on the closing market value of the Company's ordinary shares on the date of grant. Share-based compensation expense for these PSUs is recognized over the performance period based on the probability of achieving the performance targets.

The fair value of the portion of the PSU that is indexed to total shareholder return is estimated on the date of grant using a Monte Carlo simulation that uses the following assumptions:

- The risk-free interest rate for periods during the contractual life of the PSU is based on the U.S. Treasury yield curve in effect at the time of grant.
- The expected volatility is based on the historical volatility of the Company's stock over the most recent three-year period as of the grant date.

Share-based compensation expense for PSUs which are indexed to total shareholder return is not adjusted for changes in performance subsequent to the grant date because the likelihood of achieving the market condition is incorporated in the grant date fair value of the award.

Stock Options

Stock options are granted with an exercise price equal to the market price of the Company's stock at the date of grant. Stock option awards typically vest between two and three years after the grant date and expire ten years from the grant date.

The fair value of each option is estimated on the date of grant using a Black-Scholes option valuation model that uses the following assumptions:

- The expected life of options represents the period of time that options granted are expected to be outstanding.
- The risk-free interest rate for periods during the contractual life of the option is based on the U.S. Treasury yield curve in effect at the time of grant.
- Expected volatility is based on the historical volatility of the Company's stock since October 2016 blended with the historical volatility of certain peer companies' stock prior to October 2016 over the most recent period corresponding to the expected life as of the grant date.
- The expected dividend yield is based on the expected annual dividend as a percentage of the market value of the Company's ordinary shares as of the grant date.

The Company uses historical data to estimate option exercises and employee terminations within the valuation model.

Stock Appreciation Rights

SARs vest under the same terms and conditions as stock option awards, but are settled in cash for the difference between the market price on the date of exercise and the exercise price. As a result, SARs are recorded in the Company's consolidated statements of financial position as a liability until the date of exercise.

The fair value of each SAR award is estimated using a similar method to that used for stock options. The fair value of each SAR award is recalculated at the end of each reporting period and the liability and expense are adjusted based on the new fair value.

Amounts related to SARs are not material.

Earnings Per Share

The Company presents both basic and diluted earnings per share ("EPS") amounts. Basic EPS is calculated by dividing net income attributable to Johnson Controls by the weighted average number of ordinary shares outstanding during the reporting period. Diluted EPS is calculated by dividing net income attributable to Johnson Controls by the weighted average number of ordinary shares and ordinary equivalent shares outstanding during the reporting period that are calculated using the treasury stock method for stock options, unvested restricted stock and unvested performance share awards. The treasury stock method

assumes that the Company uses the proceeds from the exercise of stock option awards to repurchase ordinary shares at the average market price during the period. The assumed proceeds under the treasury stock method include the purchase price that the grantee will pay in the future and compensation cost for future service that the Company has not yet recognized. For unvested restricted stock and unvested performance share awards, assumed proceeds under the treasury stock method include unamortized compensation cost.

Foreign Currency Translation

Substantially all of the Company's international operations use the respective local currency as the functional currency. Assets and liabilities of international entities have been translated at period-end exchange rates, and income and expenses have been translated using average exchange rates for the period. Monetary assets and liabilities denominated in non-functional currencies are adjusted to reflect period-end exchange rates. Aggregate transaction gains (losses), net of the impact of foreign currency hedges, for the years ended September 30, 2022, 2021 and 2020 were \$49 million, \$56 million and \$(32) million, respectively.

Derivative Financial Instruments

The Company has written policies and procedures that place all financial instruments under the direction of Corporate treasury and restrict all derivative transactions to those intended for hedging purposes. The use of financial instruments for speculative purposes is strictly prohibited. The Company selectively uses financial instruments to manage the market risk from changes in foreign exchange rates, commodity prices, stock-based compensation liabilities and interest rates.

The fair values of all derivatives are recorded in the consolidated statements of financial position. The change in a derivative's fair value is recorded each period in current earnings or accumulated other comprehensive income ("AOCI"), depending on whether the derivative is designated as part of a hedge transaction and if so, the type of hedge transaction.

Investments

Investments in debt and equity securities are marked to market at the end of each accounting period. Unrealized gains and losses on these securities are recognized in the Company's consolidated statements of income. The deferred compensation plan assets are marked to market at the end of each accounting period and all unrealized gains and losses are recorded in the consolidated statements of income.

Pension and Postretirement Benefits

The Company utilizes a mark-to-market approach for recognizing pension and postretirement benefit expenses, including measuring the market related value of plan assets at fair value and recognizing actuarial gains and losses in the fourth quarter of each fiscal year or at the date of a remeasurement event.

Loss Contingencies

Accruals are recorded for various contingencies including legal proceedings, environmental matters, self-insurance and other claims that arise in the normal course of business. The accruals are based on judgment, the probability of losses and, where applicable, the consideration of opinions of internal and/or external legal counsel and actuarially determined estimates. Additionally, the Company records receivables from third party insurers when recovery has been determined to be probable.

The Company is subject to laws and regulations relating to protecting the environment. Expenses associated with environmental remediation obligations are recognized when such amounts are probable and can be reasonably estimated.

Liabilities and expenses for workers' compensation, product, general and auto liabilities is dependent on claims experience. For most of these liabilities, claims incurred but not yet reported are estimated by utilizing actuarial valuations based upon historical claims experience. Receivables from third party insurers are recorded when recovery has been determined to be probable. The Company maintains captive insurance companies to manage its insurable liabilities.

Asbestos-Related Contingencies and Insurance Receivables

The Company and certain of its subsidiaries, along with numerous other companies, are named as defendants in personal injury lawsuits based on alleged exposure to asbestos-containing materials. The estimated liability and corresponding insurance recovery for pending and future claims and defense costs is based on the Company's historical claim experience, and estimates of the number and resolution cost of potential future claims that may be filed and is discounted to present value from 2068

(which is the Company's reasonable best estimate of the actuarially determined time period through which asbestos-related claims will be filed against its affiliates). Estimated asbestos-related defense costs are included in the asbestos liability. The Company's legal strategy for resolving claims also impacts these estimates. The Company considers various trends and developments in evaluating the period of time (the look-back period) over which historical claim and settlement experience is used to estimate and value claims reasonably projected to be made through 2068. At least annually, the Company assesses the sufficiency of its estimated liability for pending and future claims and defense costs by evaluating actual experience regarding claims filed, settled and dismissed, and amounts paid in settlements. In addition to claims and settlement experience, the Company considers additional quantitative and qualitative factors such as changes in legislation, the legal environment, and the Company's defense strategy. The Company also evaluates the recoverability of its insurance receivable on an annual basis. The Company evaluates all of these factors and determines whether a change in the estimate of its liability for pending and future claims and defense costs or insurance receivable is warranted.

In connection with the recognition of liabilities for asbestos-related matters, the Company records asbestos-related insurance recoveries that are probable. Estimated asbestos-related insurance recoveries represents estimated amounts due to the Company for previously paid and settled claims and the probable reimbursements relating to its estimated liability for pending and future claims discounted to present value. In determining the amount of insurance recoverable, the Company considers available insurance, allocation methodologies, solvency and creditworthiness of the insurers.

Income Taxes

Deferred tax liabilities and assets are recognized for the expected future tax consequences of events that have been reflected in the consolidated financial statements. Deferred tax liabilities and assets are determined based on the differences between the book and tax basis of particular assets and liabilities and operating loss carryforwards, using tax rates in effect for the years in which the differences are expected to reverse. A valuation allowance is provided to reduce the carrying or book value of deferred tax assets if, based upon the available evidence, including consideration of tax planning strategies, it is more-likely-than-not that some or all of the deferred tax assets will not be realized.

Retrospective Changes

Effective October 1, 2021, the Company's marine businesses, which were previously included in the Building Solutions Asia Pacific and Global Products segments, became part of the Building Solutions EMEA/LA segment. Historical information has been re-cast to present the comparative periods on a consistent basis. This change was not material to the segment presentation.

New Accounting Pronouncements

Recently Adopted Accounting Pronouncements

In October 2021, the FASB issued ASU No. 2021-08, "Business Combinations (Topic 805), Accounting for Contract Assets and Contract Liabilities from Contracts with Customers," which requires contract assets and contract liabilities (e.g. deferred revenue) acquired in a business combination to be recognized and measured by the acquirer on the acquisition date in accordance with ASC 606, "Revenue from Contracts with Customers." Generally, this new guidance will result in the acquirer recognizing contract assets and contract liabilities at the same amounts recorded by the acquiree. Historically, such amounts were recognized by the acquirer at fair value in acquisition accounting. The guidance is applied prospectively to acquisitions occurring on or after the effective date. The Company early adopted ASU No. 2021-08 at the beginning of fiscal 2022. The adoption of the new standard did not have a material impact on the Company's consolidated financial statements.

Recently Issued Accounting Pronouncements

In September 2022, the FASB issued ASU 2022-04, "Disclosure of Supplier Finance Program Obligations", which is intended to enhance the transparency surrounding the use of supplier finance programs. Supplier finance programs may also be referred to as reverse factoring, payables finance, or structured payables arrangements. The amendments require a buyer that uses supplier finance programs to make annual disclosures about the program's key terms, the balance sheet presentation of related amounts, the confirmed amount outstanding at the end of the period, and associated rollforward information. Only the amount outstanding at the end of the period must be disclosed in interim periods. The Company expects to adopt the new disclosures, other than the rollforward disclosure, as required at the beginning of fiscal 2024. The rollforward disclosures will be adopted as required at the beginning of fiscal 2025.

Other recently issued accounting pronouncements are not expected to have a material impact on the Company's consolidated financial statements.

2. ACQUISITIONS AND DIVESTITURES

During fiscal 2022, the Company acquired several businesses for a combined purchase price, net of cash acquired, of \$323 million, of which \$269 million was paid as of September 30, 2022. Intangible assets associated with these acquisitions totaled \$123 million and primarily relate to customer relationships and technology. In connection with these acquisitions, the Company recorded goodwill of \$194 million, of which \$68 million was assigned to the Building Solutions EMEA/LA segment, \$45 million was assigned to the Global Products segment, \$44 million was assigned to the Building Solutions APAC segment and \$36 million was assigned to the Building Solutions North America segment.

Silent-Aire Acquisition

In May 2021, the Company completed its acquisition of Silent-Aire, a global leader in hyperscale data center cooling and modular critical infrastructure solutions, for approximately \$755 million, net of cash acquired, which was comprised of an upfront net cash payment of approximately \$661 million, the estimated fair value at the acquisition date of contingent earn-out liabilities of approximately \$86 million and a working capital adjustment of \$8 million. The contingent earn-out liabilities are based upon the achievement of certain defined operating results in each of the three years following the acquisition, with a maximum payout of approximately \$250 million. The fair value of contingent earn-out liabilities is reassessed on a quarterly basis and could differ materially from the initial estimates. Subsequent changes in the estimated fair value of contingent earn-out liabilities are recorded in the consolidated statements of income when incurred. Earn-out payments that are less than or equal to the contingent earn-out liabilities on the acquisition date are reflected as financing cash outflows and amounts paid in excess of the contingent earn-out liabilities on the acquisition date are reflected as operating cash outflows. During the year ended September 30, 2022, the Company recorded a reduction in the fair value of the contingent earn-out liability of \$43 million. No earn-out payments were made for the first twelve-month earn-out period ended April 30, 2022 as the performance measures for the period were not achieved.

In connection with the acquisition, the Company recorded goodwill of \$244 million in the Global Products segment. Goodwill is attributable primarily to expected synergies, expanded market opportunities and other benefits that the Company believes will result from combining its operations with the operations of Silent-Aire. The goodwill created in the acquisition is not deductible for tax purposes.

The original fair values of the assets acquired and liabilities assumed related to Silent-Aire are as follows (in millions):

Cash and cash equivalents	\$	5
Accounts receivable		141
Inventories		60
Other current assets		4
Property, plant, and equipment - net		33
Goodwill		244
Intangible assets - net		497
Other noncurrent assets		84
Total assets acquired		<u>1,068</u>
Accounts payable		62
Accrued compensation and benefits		6
Deferred revenue		32
Other current liabilities		12
Other noncurrent liabilities		196
Total liabilities acquired		<u>308</u>
Net assets acquired	\$	<u>760</u>

The purchase price allocation to identifiable intangible assets acquired related to Silent-Aire is as follows:

	Fair Value (in millions)	Weighted Average Life (in years)
Customer relationships	\$ 291	19
Technology	116	13
Other definite-lived intangibles	23	1
Indefinite-lived trademarks	67	
Total identifiable intangible assets	<u>\$ 497</u>	

Other acquisitions and divestitures were not material individually or in the aggregate in fiscal 2021 and 2020.

3. ASSETS AND LIABILITIES HELD FOR SALE & DISCONTINUED OPERATIONS

Assets and Liabilities Held for Sale

During fiscal 2022, the Company determined that its Global Retail business within its Building Solutions North America, Building Solutions Asia Pacific and Building Solutions EMEA/LA segments and a business within the Building Solutions Asia Pacific segment both met the criteria to be classified as held for sale. The assets and liabilities of both businesses are presented as held for sale in the consolidated statements of financial position as of September 30, 2022. Assets and liabilities held for sale are recorded at the lower of carrying value or fair value, less costs to sell in accordance with ASC 360-10-15, "Impairment or Disposal of Long-Lived Assets". The carrying amount of any assets, including goodwill, that are part of the disposal group, but not in the scope of ASC 360-10, are tested for impairment under the relevant guidance prior to measuring the disposal group at fair value, less cost to sell.

As a result of classifying the Global Retail business as held for sale, during the year ended September 30, 2022, the Company recorded impairment charges of \$235 million to write down goodwill related to its North America Retail reporting unit and \$86 million to write down the disposal group to its estimated fair value, less costs to sell. The Company also fully impaired \$38 million of internal-use software projects that were no longer probable of being completed. Refer to Note 8, "Goodwill and Other Intangible Assets," of the notes to the consolidated financial statements for further information regarding the goodwill impairment charge.

An additional \$60 million was recorded in the year ended September 30, 2022 to write down the business classified as held for sale in the Building Solutions Asia Pacific segment to its estimated fair value, less costs to sell.

All of the impairments were recorded within restructuring and impairment costs in the consolidated statements of income. The divestiture of the businesses held for sale could result in a gain or loss on sale to the extent the ultimate selling prices differ from the current carrying value of the net assets recorded, which could be material. The businesses did not meet the criteria to be classified as discontinued operations as neither divestiture represents a strategic shift that will have a major effect on the Company's operations and financial results.

The following table summarizes the carrying value of the Global Retail assets and liabilities held for sale (in millions):

	September 30, 2022
Accounts receivable - net	\$ 199
Inventories	155
Other current assets	21
Current assets held for sale	<u>\$ 375</u>
Property, plant and equipment - net	\$ 89
Goodwill	22
Other intangible assets - net	514
Other noncurrent assets	72
Noncurrent assets held for sale	<u>\$ 697</u>
Accounts payable	\$ 127
Accrued compensation and benefits	25
Deferred revenue	36
Other current liabilities	33
Current liabilities held for sale	<u>\$ 221</u>
Other noncurrent liabilities	\$ 61
Noncurrent liabilities held for sale	<u>\$ 61</u>

During the third quarter of fiscal 2020, the Company determined that certain assets of the Building Solutions Asia Pacific segment met the criteria to be classified as held for sale. During the fourth quarter of fiscal 2022, the Company determined that these assets no longer met the criteria to be classified as held for sale as the Company can no longer assert that the sale of the assets is probable within a year due to the real estate market downturn in China that has worsened in the period after the COVID-19 lockdowns. As a result, the Company reclassified the held for sale assets to held and used as of September 30, 2022. Upon reclassification, an impairment of \$45 million was recorded within restructuring and impairment costs in the consolidated statements of income to adjust the asset to the lower of its carrying value adjusted for depreciation and the fair value of the asset as of September 30, 2022.

Discontinued Operations

The Company completed the sale of its Power Solutions business on April 30, 2019. In December 2020, the favorable resolution of certain post-closing working capital and net debt adjustments resulted in income from discontinued operations of \$124 million, net of tax of \$26 million, due to a reversal of a reserve established in connection with the sale.

There was no Power Solutions related activity in fiscal 2022 and 2020.

4. REVENUE RECOGNITION

Disaggregated Revenue

The following table presents the Company's revenues disaggregated by segment and by products and systems versus services revenue (in millions):

	Year Ended September 30,					
	2022			2021		
	Products & Systems	Services	Total	Products & Systems	Services	Total
Building Solutions North America	\$ 5,708	\$ 3,659	\$ 9,367	\$ 5,312	\$ 3,373	\$ 8,685
Building Solutions EMEA/LA	2,188	1,657	3,845	1,929	1,955	3,884
Building Solutions Asia Pacific	2,005	709	2,714	1,478	1,138	2,616
Global Products	9,373	—	9,373	8,483	—	8,483
Total	<u>\$ 19,274</u>	<u>\$ 6,025</u>	<u>\$ 25,299</u>	<u>\$ 17,202</u>	<u>\$ 6,466</u>	<u>\$ 23,668</u>

The following table presents further disaggregation of Global Products revenues by product type (in millions):

	Year Ended September 30,	
	2022	2021
HVAC	\$ 6,756	\$ 6,054
Fire & Security	2,367	2,192
Industrial Refrigeration	250	237
Total	<u>\$ 9,373</u>	<u>\$ 8,483</u>

Contract Balances

Contract assets relate to the Company's right to consideration for performance obligations satisfied but not billed and consist of unbilled receivables and costs in excess of billings. Contract liabilities relate to customer payments received in advance of satisfaction of performance obligations under the contract. Contract balances are classified as assets or liabilities on a contract-by-contract basis at the end of each reporting period.

The following table presents the location and amount of contract balances in the Company's consolidated statements of financial position (in millions):

	Location of contract balances	September 30,	
		2022	2021
Contract assets - current	Accounts receivable - net	\$ 2,020	\$ 1,718
Contract assets - noncurrent	Other noncurrent assets	79	99
Contract liabilities - current	Deferred revenue	(1,768)	(1,637)
Contract liabilities - noncurrent	Other noncurrent liabilities	(282)	(269)

The Company recognized revenue that was included in the beginning of period contract liability balance of approximately \$1.5 billion and \$1.2 billion for the years ended September 30, 2022 and 2021, respectively.

Performance Obligations

A performance obligation is a distinct good, service, or bundle of goods and services promised in a contract. A contract's transaction price is allocated to each distinct performance obligation and recognized as revenue when, or as, the performance obligation is satisfied. When contracts with customers require significant and complex integration, contain goods or services which are highly interdependent or interrelated, or are goods or services which significantly modify or customize other promises in the contracts and, therefore, are not distinct, then the entire contract is accounted for as a single performance obligation. For any contracts with multiple performance obligations, the contract's transaction price is allocated to each performance obligation based on the estimated relative standalone selling price of each distinct good or service in the contract. For product sales, each product sold to a customer typically represents a distinct performance obligation.

Performance obligations are satisfied as of a point in time or over time. The timing of satisfying the performance obligation is typically indicated by the terms of the contract. As of September 30, 2022, the aggregate amount of the transaction price allocated to remaining performance obligations was approximately \$17.5 billion, of which approximately 65% is expected to be recognized as revenue over the next two years. The remaining performance obligations expected to be recognized in revenue beyond two years primarily relate to large, multi-purpose contracts to construct hospitals, schools and other governmental buildings, which include services to be performed over the building's lifetime, with average initial contract terms of 25 to 35 years. Future contract modifications could affect both the timing and the amount of the remaining performance obligations. The Company excludes the value of remaining performance obligations for contracts with an original expected duration of one year or less.

Costs to Obtain or Fulfill a Contract

The Company recognizes the incremental costs incurred to obtain or fulfill a contract with a customer as an asset when these costs are recoverable. These costs consist primarily of sales commissions and bid/proposal costs. Costs to obtain or fulfill a contract are capitalized and amortized to revenue over the period of contract performance.

The following table presents the location and amount of costs to obtain or fulfill a contract recorded in the Company's consolidated statements of financial position (in millions):

	September 30,	
	2022	2021
Other current assets	\$ 139	\$ 149
Other noncurrent assets	174	117
Total	<u>\$ 313</u>	<u>\$ 266</u>

Amortization related to costs to obtain or fulfill a contract were \$191 million and \$173 million during the years ended September 30, 2022 and 2021, respectively. There were no impairment losses recognized in the year ended September 30, 2022 or 2021.

5. ACCOUNTS RECEIVABLE

Accounts receivable, net consisted of the following (in millions):

	September 30,	
	2022	2021
Accounts receivable	\$ 5,590	\$ 5,723
Less: Allowance for expected credit losses	(62)	(110)
Accounts receivable, net	<u>\$ 5,528</u>	<u>\$ 5,613</u>

The changes in the allowance for expected credit losses related to accounts receivable were as follows (in millions):

	Year Ended September 30, 2022	
	2022	2021
Balance at beginning of period	\$ 110	\$ 173
Benefit for expected credit losses	(2)	(3)
Write-offs charged against the allowance for expected credit losses	(38)	(65)
Currency translation	(3)	1
Other	(5)	4
Balance at end of period	<u>\$ 62</u>	<u>\$ 110</u>

The Company sold receivables where it collected customer payments related to the factored receivables on behalf of the financial institution but otherwise maintained no continuing involvement totaling \$1,115 million and \$129 million during the years ended September 30, 2022 and 2021, respectively. The costs of factoring such receivables were not material. Outstanding

receivables sold under the factoring agreements were \$476 million as of September 30, 2022 and \$127 million as of September 30, 2021.

6. INVENTORIES

Inventories consisted of the following (in millions):

	September 30,	
	2022	2021
Raw materials and supplies	\$ 1,009	\$ 769
Work-in-process	196	166
Finished goods	1,305	1,122
Inventories	<u>\$ 2,510</u>	<u>\$ 2,057</u>

7. PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment consisted of the following (in millions):

	September 30,	
	2022	2021
Buildings and improvements	\$ 1,300	\$ 1,313
Subscriber systems	733	802
Machinery and equipment	3,550	3,669
Construction in progress	512	500
Land	196	231
Total property, plant and equipment	6,291	6,515
Less: Accumulated depreciation	(3,249)	(3,287)
Property, plant and equipment - net	<u>\$ 3,042</u>	<u>\$ 3,228</u>

8. GOODWILL AND OTHER INTANGIBLE ASSETS

Effective October 1, 2021, the Company's marine businesses previously included in the Building Solutions Asia Pacific and Global Products reportable segments became part of the Building Solutions EMEA/LA reportable segment. Historical information has been re-cast to present the comparative periods on a consistent basis. This change was not material to the segment presentation or the allocation of goodwill.

The changes in the carrying amount of goodwill in each of the Company's reportable segments were as follows (in millions):

	September 30, 2020	Business Acquisitions	Business Divestitures	Impairments	Currency Translation and Other	September 30, 2021
Building Solutions North America	\$ 9,160	\$ 21	\$ —	\$ —	\$ 34	\$ 9,215
Building Solutions EMEA/LA	1,987	35	—	—	19	2,041
Building Solutions Asia Pacific	1,223	—	(7)	—	21	1,237
Global Products	5,562	244	—	—	36	5,842
Total	<u>\$ 17,932</u>	<u>\$ 300</u>	<u>\$ (7)</u>	<u>\$ —</u>	<u>\$ 110</u>	<u>\$ 18,335</u>

	September 30, 2021	Business Acquisitions	Business Divestitures ⁽¹⁾	Impairments	Currency Translation and Other	September 30, 2022
Building Solutions North America	\$ 9,215	\$ 37	\$ —	\$ (235)	\$ (46)	\$ 8,971
Building Solutions EMEA/LA	2,041	78	(98)	—	(296)	1,725
Building Solutions Asia Pacific	1,237	44	(29)	—	(136)	1,116
Global Products	5,842	60	—	(75)	(311)	5,516
Total	<u>\$ 18,335</u>	<u>\$ 219</u>	<u>\$ (127)</u>	<u>\$ (310)</u>	<u>\$ (789)</u>	<u>\$ 17,328</u>

⁽¹⁾ Business divestitures include \$93 million and \$29 million of goodwill within the Building Solutions EMEA/LA and Building Solutions Asia Pacific reportable segments, respectively, transferred to noncurrent assets held for sale on the consolidated statements of financial position.

As of September 30, 2022, the accumulated impairment loss totaled \$781 million, of which \$659 million related to the Building Solutions North America segment, \$75 million related to the Global Products segment and \$47 million related to the Building Solutions EMEA/LA segment.

As of September 30, 2021 and 2020, the accumulated impairment loss totaled \$471 million, of which \$424 million related to the Building Solutions North America segment and \$47 million related to the Building Solutions EMEA/LA segment.

The Company reviews goodwill for impairment annually as of July 31 or more frequently if events or changes in circumstances indicate the asset might be impaired. During its fiscal 2022 annual impairment test, the Company determined that its Silent-Aire reporting unit's goodwill was impaired. As a result, the Company recorded a non-cash impairment charge of \$75 million within restructuring and impairment costs in the consolidated statements of income in the fourth quarter of fiscal 2022, which was determined by comparing the carrying amount of the reporting unit to its fair value. The Silent-Aire reporting unit has a remaining goodwill balance of \$183 million at September 30, 2022. The Company used a discounted cash flow model to estimate the fair value of the reporting unit. The primary assumptions used in the model were management's internal projections of future cash flows, the weighted-average cost of capital and long-term growth rates, which are classified as Level 3 inputs within the fair value hierarchy as defined in ASC 820, "Fair Value Measurement." Although the Company's cash flow forecasts are based on assumptions that are considered reasonable by management and consistent with the plans and estimates management is using to operate the underlying business, there was significant judgment in determining the expected future cash flows attributable to the Silent-Aire reporting unit. Other than the Silent-Aire reporting unit that is recorded at fair value, no other reporting unit was determined to be at risk of failing the goodwill impairment test.

In the second quarter of fiscal 2022, the Company concluded it had a triggering event requiring assessment of goodwill impairment for its North America Retail reporting unit in conjunction with classifying its Global Retail business as held for sale. Refer to Note 3, "Discontinued Operations & Assets and Liabilities Held for Sale," of the notes to the consolidated financial statements for further disclosure related to the Global Retail assets held for sale. As a result, the Company recorded a non-cash impairment charge of \$235 million within restructuring and impairment costs in the consolidated statements of

income in the second quarter of fiscal 2022. The North America Retail reporting unit has no remaining goodwill balance as of September 30, 2022. The Company used the market approach to estimate the fair value of the reporting unit based on the relative estimated sales proceeds for the planned disposal of the Global Retail business attributable to the North America Retail reporting unit. The inputs utilized in the analysis are classified as Level 3 inputs within the fair value hierarchy as defined in ASC 820, "Fair Value Measurement."

There were no other triggering events requiring that an impairment assessment be conducted in fiscal 2022.

There were no goodwill impairments resulting from the fiscal 2021 and the fiscal 2020 annual impairment test and no reporting unit was determined to be at risk of failing the goodwill impairment test as of September 30, 2021.

During fiscal 2020, the Company considered the deterioration in general economic and market conditions due to the COVID-19 pandemic and its impact on each of the Company's reporting units' performance. Due to declines in cash flow projections of the North America Retail reporting unit in the third quarter of fiscal 2020 as a result of the COVID-19 pandemic, the Company concluded a triggering event occurred requiring assessment of impairment for its North America Retail reporting unit. As a result, the Company recorded a non-cash impairment charge of \$424 million within restructuring and impairment costs in the consolidated statements of income in the third quarter of fiscal 2020. The North America Retail reporting unit had a remaining goodwill balance of \$235 million at September 30, 2021. The Company used a discounted cash flow model to estimate the fair value of the reporting unit. The primary assumptions used in the model were management's internal projections of future cash flows, the weighted-average cost of capital and long-term growth rates, which are classified as Level 3 inputs within the fair value hierarchy as defined in ASC 820, "Fair Value Measurement."

The Company's other intangible assets, primarily from business acquisitions, consisted of (in millions):

	September 30,					
	2022			2021		
	Gross Carrying Amount	Accumulated Amortization	Net	Gross Carrying Amount	Accumulated Amortization	Net
Definite-lived intangible assets						
Technology	\$ 1,353	\$ (658)	\$ 695	\$ 1,464	\$ (629)	\$ 835
Customer relationships	2,742	(1,254)	1,488	3,097	(1,191)	1,906
Miscellaneous	756	(386)	370	750	(354)	396
	<u>4,851</u>	<u>(2,298)</u>	<u>2,553</u>	<u>5,311</u>	<u>(2,174)</u>	<u>3,137</u>
Indefinite-lived intangible assets						
Trademarks/tradenames	2,088	—	2,088	2,332	—	2,332
Miscellaneous	—	—	—	80	—	80
	<u>2,088</u>	<u>—</u>	<u>2,088</u>	<u>2,412</u>	<u>—</u>	<u>2,412</u>
Total intangible assets	<u>\$ 6,939</u>	<u>\$ (2,298)</u>	<u>\$ 4,641</u>	<u>\$ 7,723</u>	<u>\$ (2,174)</u>	<u>\$ 5,549</u>

The Company reviews indefinite-lived intangible assets for impairment during the fourth fiscal quarter or more frequently if events or changes in circumstances indicate the asset might be impaired.

There were no indefinite-lived intangible asset impairments resulting from the fiscal 2022, 2021 and 2020 annual impairment tests. However, it is possible that future changes in circumstances would require the Company to record non-cash impairment charges. For fiscal 2022, the estimated fair values of all indefinite-lived intangibles substantially exceeded their carrying values, with the exception of the indefinite-lived trademarks related to the Company's Asia Pacific subscriber business. The estimated fair value for the Asia Pacific indefinite-lived trademark was consistent with its carrying value of \$54 million.

During the second and third quarters of fiscal 2020, the Company determined that it had a triggering event at each reporting period end requiring assessment of impairment for certain of its indefinite-lived intangible assets due to declines in revenue directly attributable to the COVID-19 pandemic. As a result, the Company recorded an impairment charge of \$62 million related primarily to the Company's retail business indefinite-lived intangible assets within restructuring and impairment costs in the consolidated statements of income in the second quarter of fiscal 2020. No further impairment was required to be recorded in the third quarter of fiscal 2020 as a result of the completed impairment assessment.

Amortization of other intangible assets included within continuing operations for the years ended September 30, 2022, 2021 and 2020 was \$427 million, \$435 million and \$386 million, respectively.

The following table summarizes the expected amortization of definite-lived intangible assets, excluding the impact of future acquisitions, by year (in millions):

2023	\$ 414
2024	406
2025	382
2026	317
2027	282

9. LEASES

The following table presents the Company's lease costs (in millions):

	Year Ended September 30,		
	2022	2021	2020
Operating lease cost	\$ 352	\$ 384	\$ 399
Variable lease cost	165	130	145
Total lease costs	<u>\$ 517</u>	<u>\$ 514</u>	<u>\$ 544</u>

The following table presents supplemental consolidated statement of financial position information (in millions):

	Location of lease balances	September 30,	
		2022	2021
Operating lease right-of-use assets	Other noncurrent assets	\$ 1,271	\$ 1,376
Operating lease liabilities - current	Other current liabilities	280	319
Operating lease liabilities - noncurrent	Other noncurrent liabilities	987	1,055
Weighted-average remaining lease term		7 years	7 years
Weighted-average discount rate		2.1 %	1.8 %

The following table presents supplemental cash flow information related to operating leases (in millions):

	Year Ended September 30,		
	2022	2021	2020
Cash paid for amounts included in the measurement of lease liability:			
Operating cash outflows from operating leases	\$ 367	\$ 398	\$ 397
Noncash operating lease activity:			
Right-of-use assets obtained in exchange for operating lease liabilities	369	515	467

The following table presents maturities of operating lease liabilities (in millions):

	September 30, 2022
2023	\$ 301
2024	269
2025	203
2026	149
2027	109
After 2027	345
Total operating lease payments	1,376
Less: Interest	(109)
Present value of lease payments	\$ 1,267

10. DEBT AND FINANCING ARRANGEMENTS

Short-term debt consisted of the following (in millions):

	September 30,	
	2022	2021
Bank borrowings	\$ 10	\$ 8
Commercial paper	172	—
Term loans	487	—
	\$ 669	\$ 8
Weighted average interest rate on short-term debt outstanding	0.5 %	0.2 %

As of September 30, 2022, the Company had a syndicated \$2.5 billion committed revolving credit facility, which is scheduled to expire in December 2024, and a syndicated \$500 million committed revolving credit facility, which is scheduled to expire in December 2022. There were no draws on the facilities as of September 30, 2022.

Long-term debt consisted of the following (in millions; due dates by fiscal year):

	September 30,	
	2022	2021
Unsecured notes		
JCI plc - Term Loan -¥25 billion; LIBOR JPY plus 0.40% due in 2022	\$ —	\$ 223
JCI plc - 4.625% due in 2023 (\$25 million par value)	25	25
Tyco International Finance S.A. ("TIFSA") - 4.625% due in 2023 (\$7 million par value)	7	7
JCI plc - 1.00% due in 2023 (€846 million par value)	830	980
JCI plc - 3.625% due in 2024 (\$453 million par value)	453	453
JCI Inc. - 3.625% due in 2024 (\$31 million par value)	31	31
JCI plc - 1.375% due in 2025 (€423 million par value)	419	496
TIFSA - 1.375% due in 2025 (€54 million par value)	53	63
JCI plc - 3.90% due in 2026 (\$487 million par value)	505	510
TIFSA - 3.90% due in 2026 (\$51 million par value)	51	51
JCI plc - Term Loan - ¥30 billion; TORF plus 0.40% due in 2027	208	—
JCI plc and Tyco Fire & Security Finance S.C.A. ("TFSCA") - 0.375% due in 2027 (€500 million par value)	488	577
JCI plc and TFSCA - 3.00% due in 2028 (€600 million par value)	586	—
JCI plc and TFSCA - 1.75% due in 2030 (\$625 million par value)	623	623
JCI plc and TFSCA - 2.00% due in 2031 (\$500 million par value)	496	496
JCI plc and TFSCA - 1.00% due in 2032 (€500 million par value)	489	578
JCI plc and TFSCA - 4.90% due in 2032 (\$400 million par value)	394	—
JCI plc - 6.00% due in 2036 (\$342 million par value)	339	339
JCI Inc. - 6.00% due in 2036 (\$8 million par value)	8	8
JCI plc - 5.70% due in 2041 (\$190 million par value)	189	189
JCI Inc. - 5.70% due in 2041 (\$30 million par value)	30	30
JCI plc - 5.25% due in 2042 (\$155 million par value)	155	155
JCI Inc. - 5.25% due in 2042 (\$6 million par value)	6	6
JCI plc - 4.625% due in 2044 (\$444 million par value)	441	441
JCI Inc. - 4.625% due in 2044 (\$6 million par value)	6	6
JCI plc - 5.125% due in 2045 (\$477 million par value)	557	560
TIFSA - 5.125% due in 2045 (\$23 million par value)	23	22
JCI plc - 6.95% due in 2046 (\$32 million par value)	32	32
JCI Inc. - 6.95% due in 2046 (\$4 million par value)	4	4
JCI plc - 4.50% due in 2047 (\$500 million par value)	496	496
JCI plc - 4.95% due in 2064 (\$341 million par value)	340	340
JCI Inc. - 4.95% due in 2064 (\$15 million par value)	15	15
Other	25	8
Gross long-term debt	8,324	7,764
Less: current portion	865	226
Less: debt issuance costs	33	32
Long-term debt	\$ 7,426	\$ 7,506

The following table presents maturities of long-term debt as of September 30, 2022 (in millions):

2023	\$	865
2024		485
2025		473
2026		557
2027		697
After 2027		5,247
Total	\$	<u>8,324</u>

As of September 30, 2022, the Company was in compliance with all financial covenants set forth in its credit agreements and the indentures governing its outstanding notes, and expects to remain in compliance for the foreseeable future.

Total interest paid on both short and long-term debt for the years ended September 30, 2022, 2021 and 2020 was \$226 million, \$242 million and \$247 million, respectively.

Financing Arrangements

In November 2021, the Company entered into a €200 million (\$196 million as of September 30, 2022) bank term loan which had an interest rate of EURIBOR plus 0.5% and was due in October 2022.

In March 2022, the Company entered into two bank term loans totaling €285 million (\$280 million as of September 30, 2022) which both have an interest rate of EURIBOR plus 0.5% and are due in March 2023.

In September 2022, the Company and its wholly owned subsidiary, TFSCA issued €600 million (\$589 million as of September 30, 2022) of bonds with an interest rate of 3.0%, which are due in September 2028 and \$400 million of bonds with an interest rate of 4.9%, which are due in December 2032.

In September 2022, the Company repaid a ¥25 billion (\$181 million) term loan and entered into a ¥30 billion (\$208 million as of September 30, 2022) term loan which is due in September 2027. The new ¥30 billion loan has an interest rate of TORF plus 0.4%. The original ¥25 billion loan had an interest rate of LIBOR JPY plus 0.4%.

Net Financing Charges

The Company's net financing charges line item in the consolidated statements of income contained the following components (in millions):

	Year Ended September 30,		
	2022	2021	2020
Interest expense, net of capitalized interest costs	\$ 225	\$ 219	\$ 240
Other financing charges	27	25	26
Interest income	(6)	(9)	(23)
Net foreign exchange results for financing activities	(33)	(29)	(12)
Net financing charges	<u>\$ 213</u>	<u>\$ 206</u>	<u>\$ 231</u>

11. DERIVATIVE INSTRUMENTS AND HEDGING ACTIVITIES

Cash Flow Hedges

The Company has global operations and participates in foreign exchange markets to minimize its risk of loss from fluctuations in foreign currency exchange rates. The Company selectively hedges anticipated transactions that are subject to foreign exchange rate risk primarily using foreign currency exchange forward contracts. The Company hedges 70% to 90% of the notional amount of each of its known foreign exchange transactional exposures.

The Company selectively hedges anticipated transactions that are subject to commodity price risk, primarily using commodity hedge contracts, to minimize overall price risk associated with the Company's purchases of copper and aluminum in cases where commodity price risk cannot be naturally offset or hedged through supply base fixed price contracts. Commodity risks are systematically managed pursuant to policy guidelines. The maturities of the commodity hedge contracts coincide with the expected purchase of the commodities.

As cash flow hedges under ASC 815, "Derivatives and Hedging," the hedge gains or losses due to changes in fair value are initially recorded as a component of AOCI and are subsequently reclassified into earnings when the hedged transactions occur and affect earnings. These contracts were highly effective in hedging the variability in future cash flows attributable to changes in currency exchange rates during the years ended September 30, 2022 and 2021.

The Company had the following outstanding contracts to hedge forecasted commodity purchases (in metric tons):

Commodity	Volume Outstanding as of September 30,	
	2022	2021
Copper	3,629	2,656
Aluminum	6,758	5,159

The Company enters into forward-starting interest rate swaps in conjunction with anticipated note issuances. The following table summarizes forward-starting interest rate swaps and the related anticipated note issuances (in millions):

	Year Ended September 30,	
	2022	2021
US dollar denominated		
Forward-starting interest swaps	\$ 300	\$ 500
Anticipated note issuance	400	500
Euro denominated		
Forward-starting interest swap	€ 200	—
Anticipated note issuance	600	—

All of the forward-starting interest swaps were terminated when the anticipated notes were issued and none were outstanding at September 30, 2022. Accumulated amounts recorded in AOCI as of the date of the note issuance are amortized to interest expense over the life of the related note to reflect the difference between the swap's reference rate and the fixed rate of the note.

Net Investment Hedges

The Company enters into foreign currency denominated debt obligations to selectively hedge portions of its net investment in non-U.S. subsidiaries. The currency effects of the debt obligations are reflected in the AOCI account within shareholders' equity attributable to Johnson Controls ordinary shareholders where they offset currency gains and losses recorded on the Company's net investments globally.

The following table summarizes net investment hedges (in billions):

	September 30,	
	2022	2021
Euro-denominated bonds designated as net investment hedges in Europe	€ 2.9	€ 2.3
Yen-denominated debt designated as a net investment hedge in Japan	¥ 30	¥ 25

Derivatives Not Designated as Hedging Instruments

The Company selectively uses equity swaps to reduce market risk associated with certain of its stock-based compensation plans, such as its deferred compensation plans. These equity compensation liabilities increase as the Company's stock price increases and decrease as the Company's stock price decreases. In contrast, the value of the swap agreement moves in the opposite direction of these liabilities, allowing the Company to fix a portion of the liabilities at a stated amount. The Company hedged approximately 0.3 million ordinary shares, which had a cost basis of \$23 million, as of September 30, 2021. No shares were hedged as of September 30, 2022.

The Company also holds certain foreign currency forward contracts not designated as hedging instruments under ASC 815 to hedge foreign currency exposure resulting from monetary assets and liabilities denominated in nonfunctional currencies. The changes in fair value of these foreign currency exchange derivatives are recorded in the consolidated statements of income where they offset foreign currency transactional gains and losses on the nonfunctional currency denominated assets and liabilities being hedged.

Fair Value of Derivative Instruments

The following table presents the location and fair values of derivative instruments and hedging activities included in the Company's consolidated statements of financial position (in millions):

	Designated as Hedging Instruments		Not Designated as Hedging Instruments	
	September 30, 2022	September 30, 2021	September 30, 2022	September 30, 2021
Other current assets				
Foreign currency exchange derivatives	\$ 30	\$ 15	\$ 24	\$ 17
Commodity derivatives	—	2	—	—
Other noncurrent assets				
Equity swap	—	—	—	23
Total assets	<u>\$ 30</u>	<u>\$ 17</u>	<u>\$ 24</u>	<u>\$ 40</u>
Other current liabilities				
Foreign currency exchange derivatives	\$ 24	\$ 11	\$ 27	\$ 6
Commodity derivatives	10	1	—	—
Long-term debt				
Foreign currency denominated debt	3,077	2,918	—	—
Total liabilities	<u>\$ 3,111</u>	<u>\$ 2,930</u>	<u>\$ 27</u>	<u>\$ 6</u>

Counterparty Credit Risk

The use of derivative financial instruments exposes the Company to counterparty credit risk. The Company has established policies and procedures to limit the potential for counterparty credit risk, including establishing limits for credit exposure and continually assessing the creditworthiness of counterparties. As a matter of practice, the Company deals with major banks worldwide having strong investment grade long-term credit ratings. To further reduce the risk of loss, the Company generally enters into International Swaps and Derivatives Association ("ISDA") master netting agreements with substantially all of its counterparties. The Company enters into ISDA master netting agreements with counterparties that permit the net settlement of amounts owed under the derivative contracts. The master netting agreements generally provide for net settlement of all outstanding contracts with a counterparty in the case of an event of default or a termination event. The Company has not elected to offset the fair value positions of the derivative contracts recorded in the consolidated statements of financial position.

The Company's derivative contracts do not contain any credit risk related contingent features and do not require collateral or other security to be furnished by the Company or the counterparties. The Company's exposure to credit risk associated with its derivative instruments is measured on an individual counterparty basis, as well as by groups of counterparties that share similar attributes. The Company does not anticipate any non-performance by any of its counterparties, and the concentration of risk with financial institutions does not present significant credit risk to the Company.

The gross and net amounts of derivative assets and liabilities were as follows (in millions):

	Fair Value of Assets		Fair Value of Liabilities	
	September 30, 2022	September 30, 2021	September 30, 2022	September 30, 2021
Gross amount recognized	\$ 54	\$ 57	\$ 3,138	\$ 2,936
Gross amount eligible for offsetting	(42)	(16)	(42)	(16)
Net amount	<u>\$ 12</u>	<u>\$ 41</u>	<u>\$ 3,096</u>	<u>\$ 2,920</u>

Derivatives Impact on the Statements of Income and Statements of Comprehensive Income

The following table presents the pre-tax gains (losses) recorded in other comprehensive income (loss) related to cash flow hedges (in millions):

Derivatives in Cash Flow Hedging Relationships	Year Ended September 30,		
	2022	2021	2020
Foreign currency exchange derivatives	\$ 26	\$ 15	\$ 1
Commodity derivatives	(21)	4	6
Interest rate swaps	16	(21)	—
Total	<u>\$ 21</u>	<u>\$ (2)</u>	<u>\$ 7</u>

The following table presents the location and amount of the pre-tax gains (losses) on cash flow hedges reclassified from AOCI into the Company's consolidated statements of income (in millions):

Derivatives in Cash Flow Hedging Relationships	Location of Gain (Loss) Reclassified from AOCI into Income	Year Ended September 30,		
		2022	2021	2020
Foreign currency exchange derivatives	Cost of sales	\$ 25	\$ 11	\$ (5)
Commodity derivatives	Cost of sales	(7)	3	2
Interest rate swaps	Net financing charges	(2)	—	—
Total		<u>\$ 16</u>	<u>\$ 14</u>	<u>\$ (3)</u>

The following table presents the location and amount of pre-tax gains (losses) on derivatives not designated as hedging instruments recognized in the Company's consolidated statements of income (in millions):

Derivatives Not Designated as Hedging Instruments	Location of Gain (Loss) Recognized in Income on Derivative	Year Ended September 30,		
		2022	2021	2020
Foreign currency exchange derivatives	Cost of sales	\$ 10	\$ (6)	\$ (1)
Foreign currency exchange derivatives	Net financing charges	85	174	87
Foreign currency exchange derivatives	Selling, general and administrative	—	(2)	—
Foreign currency exchange derivatives	Income tax provision	—	(1)	—
Equity swap	Selling, general and administrative	(5)	28	(4)
Total		<u>\$ 90</u>	<u>\$ 193</u>	<u>\$ 82</u>

Pre-tax gains (losses) on net investment hedges recorded as foreign currency translation adjustment ("CTA") within other comprehensive income (loss) were \$470 million, \$42 million and \$(172) million for the years ended September 30, 2022, 2021 and 2020, respectively. No gains or losses were reclassified from CTA into income for the years ended September 30, 2022, 2021 and 2020.

12. FAIR VALUE MEASUREMENTS

The following tables present the Company's fair value hierarchy for those assets and liabilities measured at fair value (in millions):

	Fair Value Measurements Using:			
	Total as of September 30, 2022	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Other current assets				
Foreign currency exchange derivatives	\$ 54	\$ —	\$ 54	\$ —
Exchange traded funds (fixed income) ¹	22	22	—	—
Other noncurrent assets				
Deferred compensation plan assets	46	46	—	—
Exchange traded funds (fixed income) ¹	86	86	—	—
Exchange traded funds (equity) ¹	131	131	—	—
Total assets	<u>\$ 339</u>	<u>\$ 285</u>	<u>\$ 54</u>	<u>\$ —</u>
Other current liabilities				
Foreign currency exchange derivatives	\$ 51	\$ —	\$ 51	\$ —
Commodity derivatives	10	—	10	—
Contingent earn-out liabilities	30	—	—	30
Other noncurrent liabilities				
Contingent earn-out liabilities	30	—	—	30
Total liabilities	<u>\$ 121</u>	<u>\$ —</u>	<u>\$ 61</u>	<u>\$ 60</u>

	Fair Value Measurements Using:			
	Total as of September 30, 2021	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Other current assets				
Foreign currency exchange derivatives	\$ 32	\$ —	\$ 32	\$ —
Commodity derivatives	2	—	2	—
Other noncurrent assets				
Deferred compensation plan assets	63	63	—	—
Exchange traded funds (fixed income) ¹	146	146	—	—
Exchange traded funds (equity) ¹	168	168	—	—
Equity swap	23	—	23	—
Total assets	<u>\$ 434</u>	<u>\$ 377</u>	<u>\$ 57</u>	<u>\$ —</u>
Other current liabilities				
Foreign currency exchange derivatives	\$ 17	\$ —	\$ 17	\$ —
Commodity derivatives	1	—	1	—
Contingent earn-out liabilities	32	—	—	32
Other noncurrent liabilities				
Contingent earn-out liabilities	50	—	—	50
Total liabilities	<u>\$ 100</u>	<u>\$ —</u>	<u>\$ 18</u>	<u>\$ 82</u>

¹Classified as restricted investments for payment of asbestos liabilities. Refer to Note 21, "Commitments and Contingencies" of the notes to consolidated financial statements for further details.

The following table summarizes the changes in contingent earn-out liabilities, which are valued using significant unobservable inputs (Level 3) (in millions):

Balance at September 30, 2021	\$	82
Acquisitions		29
Payments		(5)
Reduction for change in estimates		(43)
Currency translation		(3)
Balance at September 30, 2022	\$	<u>60</u>

Valuation Methods

Foreign currency exchange derivatives: The foreign currency exchange derivatives are valued under a market approach using publicized spot and forward prices.

Commodity derivatives: The commodity derivatives are valued under a market approach using publicized prices, where available, or dealer quotes.

Equity swaps: The equity swaps are valued under a market approach as the fair value of the swaps is equal to the Company's stock price at the reporting period date.

Deferred compensation plan assets: Assets held in the deferred compensation plans will be used to pay benefits under certain of the Company's non-qualified deferred compensation plans. The investments primarily consist of mutual funds which are publicly traded on stock exchanges and are valued using a market approach based on the quoted market prices. Unrealized gains (losses) on the deferred compensation plan assets are recognized in the consolidated statements of income where they offset unrealized gains and losses on the related deferred compensation plan liability.

Investments in exchange traded funds: Investments in exchange traded funds are valued using a market approach based on quoted market prices, where available, or broker/dealer quotes of identical or comparable instruments. Refer to Note 21, "Commitments and Contingencies," of the notes to consolidated financial statements for further information.

Contingent earn-out liabilities: The contingent earn-out liabilities are typically established using a Monte Carlo simulation based on the forecasted operating results and the earn-out formulas specified in the purchase agreements.

The following table presents the portion of unrealized gains (losses) recognized in the consolidated statements of income that relate to equity securities still held at September 30, 2022 and 2021 (in millions):

	Year Ended September 30,	
	2022	2021
Deferred compensation plan assets	\$ (10)	\$ 7
Investments in exchange traded funds	(55)	37

All of the gains and losses on investments in exchange traded funds related to restricted investments.

The fair values of cash and cash equivalents, accounts receivable, short-term debt and accounts payable approximate their carrying values. At September 30, 2022, the fair value of long-term debt was \$7.3 billion, including public debt of \$7.1 billion and other long-term debt of \$0.2 billion. At September 30, 2021, the fair value of long-term debt was \$8.5 billion, including public debt of \$8.3 billion and other long-term debt of \$0.2 billion. The fair value of public debt was determined primarily using market quotes which are classified as Level 1 inputs within the ASC 820 fair value hierarchy. The fair value of other long-term debt was determined using quoted market prices for similar instruments and are classified as Level 2 inputs within the ASC 820 fair value hierarchy.

13. STOCK-BASED COMPENSATION

On March 10, 2021, the shareholders of the Company approved the Johnson Controls International plc 2021 Equity and Incentive Plan, which terminated the Johnson Controls International plc 2012 Share and Incentive Plan, as amended in September 2016 (collectively, the "Plans"). Both Plans authorize stock options, stock appreciation rights, restricted (non-vested) stock/units, performance shares, performance units and other stock-based awards. The Compensation and Talent Development Committee of the Company's Board of Directors determines the types of awards to be granted to individual participants and the terms and conditions of the awards. As of September 30, 2022, there were 55 million shares of the Company's common stock reserved and 54 million shares available for issuance under the 2021 Equity and Incentive Plan.

The following table summarizes stock-based compensation related charges and benefits (in millions):

	Year Ended September 30,		
	2022	2021	2020
Compensation expense	\$ 104	\$ 97	\$ 66
Income tax benefit resulting from share-based compensation arrangements	26	24	16
Tax impact from exercise and vesting of equity settled awards	12	12	—

Compensation expense excludes the offsetting impact of equity swaps and is recorded in selling, general and administrative expenses. The Company does not settle stock options granted under share-based payment arrangements in cash.

Restricted (Non-vested) Stock / Units

A summary of non-vested restricted stock awards at September 30, 2022, and changes for the year then ended, is presented below:

	Weighted Average Price	Shares/Units Subject to Restriction
Non-vested, September 30, 2021	\$ 44.06	3,334,437
Granted	74.63	1,508,550
Vested	42.52	(1,497,497)
Forfeited	56.58	(396,296)
Non-vested, September 30, 2022	<u>\$ 58.78</u>	<u>2,949,194</u>

At September 30, 2022, the Company had approximately \$107 million of total unrecognized compensation cost related to non-vested restricted stock arrangements granted for continuing operations which is expected to be recognized over a weighted-average period of 2.0 years.

Performance Share Awards

The following table summarizes the assumptions used in determining the fair value of stock options granted:

	Year Ended September 30,		
	2022	2021	2020
Risk-free interest rate	0.99%	0.20%	1.60%
Expected volatility of the Company's stock	30.00%	30.90%	21.80%

A summary of the status of the Company's non-vested PSUs at September 30, 2022, and changes for the year then ended, is presented below:

	Weighted Average Price	Shares/Units Subject to PSU
Non-vested, September 30, 2021	\$ 43.11	1,196,318
Granted	82.88	482,030
Vested	36.35	(402,465)
Forfeited	60.02	(132,812)
Non-vested, September 30, 2022	<u>\$ 60.30</u>	<u>1,143,071</u>

At September 30, 2022, the Company had approximately \$37 million of total unrecognized compensation cost related to non-vested performance-based share unit awards granted for continuing operations which is expected to be recognized over a weighted-average period of 1.7 years.

Stock Options

The following table summarizes the assumptions used in determining the fair value of stock options granted:

	Year Ended September 30,		
	2022	2021	2020
Expected life of option (years)	6.0	6.5	6.5
Risk-free interest rate	1.35%	0.60%	1.67%
Expected volatility of the Company's stock	27.80%	27.60%	22.40%
Expected dividend yield on the Company's stock	1.71%	2.28%	2.49%

A summary of stock option activity at September 30, 2022, and changes for the year then ended, is presented below:

	Weighted Average Option Price	Shares Subject to Option	Weighted Average Remaining Contractual Life (years)	Aggregate Intrinsic Value (in millions)
Outstanding, September 30, 2021	\$ 38.84	5,951,011		
Granted	79.54	548,398		
Exercised	33.77	(542,903)		
Forfeited or expired	50.97	(272,659)		
Outstanding, September 30, 2022	<u>\$ 42.46</u>	<u>5,683,847</u>	<u>5.7</u>	<u>\$ 52</u>
Exercisable, September 30, 2022	<u>\$ 37.86</u>	<u>4,082,897</u>	<u>4.1</u>	<u>\$ 47</u>

The following table summarizes additional stock option information:

	Year Ended September 30,		
	2022	2021	2020
Weighted-average grant-date fair value of options granted	\$ 18.59	\$ 9.36	\$ 7.29
Intrinsic value of options exercised (in millions)	19	94	30

At September 30, 2022, the Company had approximately \$10 million of total unrecognized compensation cost related to non-vested stock options granted for continuing operations which is expected to be recognized over a weighted-average period of 1.6 years.

14. EARNINGS PER SHARE

The following table reconciles the numerators and denominators used to calculate basic and diluted earnings per share (in millions):

	Year Ended September 30,		
	2022	2021	2020
Income Available to Ordinary Shareholders			
Income from continuing operations	\$ 1,532	\$ 1,513	\$ 631
Income from discontinued operations	—	124	—
Basic and diluted income available to shareholders	<u>\$ 1,532</u>	<u>\$ 1,637</u>	<u>\$ 631</u>
Weighted Average Shares Outstanding			
Basic weighted average shares outstanding	696.1	716.6	751.0
Effect of dilutive securities:			
Stock options, unvested restricted stock and unvested performance share awards	3.5	4.5	2.6
Diluted weighted average shares outstanding	<u>699.6</u>	<u>721.1</u>	<u>753.6</u>
Antidilutive Securities			
Stock options and unvested restricted stock	0.4	—	1.4

15. EQUITY

Dividends

The authority to declare and pay dividends is vested in the Board of Directors. The timing, declaration and payment of future dividends to holders of the Company's ordinary shares is determined by the Company's Board of Directors and depends upon many factors, including the Company's financial condition and results of operations, the capital requirements of the Company's businesses, industry practice and any other relevant factors.

Under Irish law, dividends may only be paid (and share repurchases and redemptions must generally be funded) out of "distributable reserves." The creation of distributable reserves was accomplished by way of a capital reduction, which the Irish High Court approved on December 18, 2014 and as acquired in conjunction with the Merger.

Share Repurchase Program

As of September 30, 2022, approximately \$3.6 billion remained available under the share repurchase program which was approved by the Company's Board of Directors in March 2021. The share repurchase program does not have an expiration date and may be amended or terminated by the Board of Directors at any time without prior notice.

The Company repurchased and retired its ordinary shares of approximately \$1,441 million, \$1,307 million and \$2,204 million during the years ended September 30, 2022, 2021 and 2020, respectively.

Accumulated Other Comprehensive Income

The following table includes changes in AOCI attributable to Johnson Controls (in millions, net of tax):

	Year Ended September 30,		
	2022	2021	2020
Foreign currency translation adjustments			
Balance at beginning of period	\$ (421)	\$ (778)	\$ (785)
Aggregate adjustment for the period (net of tax effect of \$0, \$0 and \$1)	(480)	357	7
Balance at end of period	(901)	(421)	(778)
Realized and unrealized gains (losses) on derivatives			
Balance at beginning of period	(17)	2	(2)
Current period changes in fair value (net of tax effect of \$2, \$5 and \$1)	18	(8)	3
Reclassification to income (net of tax effect of \$(4), \$(3) and \$0) ⁽¹⁾	(12)	(11)	1
Balance at end of period	(11)	(17)	2
Pension and postretirement plans			
Balance at beginning of period	4	—	(8)
Reclassification to income (net of tax effect of \$0, \$0 and \$(1))	(3)	(3)	(1)
Other changes (net of tax effect of \$0, \$(1) and \$4)	—	7	9
Balance at end of period	1	4	—
Accumulated other comprehensive loss, end of period	<u>\$ (911)</u>	<u>\$ (434)</u>	<u>\$ (776)</u>

⁽¹⁾ Refer to Note 11, "Derivative Instruments and Hedging Activities," of the notes to consolidated financial statements for disclosure of the line items in the consolidated statements of income affected by reclassifications from AOCI into income related to derivatives.

16. RETIREMENT PLANS

Pension Benefits

The Company has non-contributory defined benefit pension plans covering certain U.S. and non-U.S. employees. The benefits provided are primarily based on years of service and average compensation or a monthly retirement benefit amount. Certain of the Company's U.S. pension plans have been amended to prohibit new participants from entering the plans and no longer accrue benefits. Funding for U.S. pension plans equals or exceeds the minimum requirements of the Employee Retirement Income Security Act of 1974. Funding for non-U.S. plans observes the local legal and regulatory limits. Also, the Company makes contributions to union-trusted pension funds for construction and service personnel.

The following table includes information for pension plans with accumulated benefit obligations ("ABO") in excess of plan assets (in millions):

	September 30,	
	2022	2021
Accumulated benefit obligation	\$ 2,004	\$ 4,402
Fair value of plan assets	1,720	3,841

The following table includes information for pension plans with projected benefit obligations ("PBO") in excess of plan assets (in millions):

	September 30,	
	2022	2021
Projected benefit obligation	\$ 2,013	\$ 4,519
Fair value of plan assets	1,729	3,954

During the year ended September 30, 2022, total employer contributions to the defined benefit pension plans were \$93 million, none of which were voluntary contributions made by the Company. The Company expects to contribute approximately \$38 million in cash to its defined benefit pension plans in the year ended September 30, 2023. Projected benefit payments from the plans as of September 30, 2022 are estimated as follows (in millions):

2023	\$ 266
2024	248
2025	246
2026	245
2027	243
2028 - 2032	1,180

Postretirement Benefits

The Company provides certain health care and life insurance benefits for eligible retirees and their dependents primarily in the U.S. and Canada. Most non-U.S. employees are covered by government sponsored programs. The cost to the Company is not significant.

Eligibility for coverage is based on meeting certain years of service and retirement age qualifications. These benefits may be subject to deductibles, co-payment provisions and other limitations. The Company has reserved the right to modify these benefits.

The health care cost trend assumption does not have a significant effect on the amounts reported.

The following table includes information for postretirement plans with accumulated postretirement benefit obligations ("APBO") in excess of plan assets (in millions):

	September 30,	
	2022	2021
Accumulated postretirement benefit obligation	\$ 68	\$ 96
Fair value of plan assets	28	38

During the year ended September 30, 2022, total employer contributions to the postretirement plans were \$3 million. The Company expects to contribute approximately \$3 million in cash to its postretirement plans in the year ended September 30, 2023. Projected benefit payments from the plans as of September 30, 2022 are estimated as follows (in millions):

2023	\$ 11
2024	10
2025	10
2026	10
2027	9
2028 - 2032	31

Defined Contribution Plans

The Company sponsors various defined contribution savings plans that allow employees to contribute a portion of their pre-tax and/or after-tax income in accordance with plan specified guidelines. Under specified conditions, the Company will contribute to certain savings plans based on predetermined percentages of compensation earned by the employee and/or will match a percentage of the employee contributions up to certain limits. The Company temporarily suspended certain contributions in fiscal 2021 and 2020 in response to the COVID-19 pandemic. Defined contribution plan contributions charged to expense amounted to \$196 million, \$118 million and \$104 million during the years ended September 30, 2022, 2021 and 2020, respectively.

Multiemployer Benefit Plans

The Company contributes to multiemployer benefit plans based on obligations arising from collective bargaining agreements related to certain of its hourly employees in the U.S. These plans provide retirement benefits to participants based on their service to contributing employers. The benefits are paid from assets held in trust for that purpose. The trustees typically are responsible for determining the level of benefits to be provided to participants as well as for such matters as the investment of the assets and the administration of the plans.

The risks of participating in these multiemployer benefit plans are different from single-employer benefit plans in the following aspects:

- Assets contributed to the multiemployer benefit plan by one employer may be used to provide benefits to employees of other participating employers.
- If a participating employer stops contributing to the multiemployer benefit plan, the unfunded obligations of the plan may be borne by the remaining participating employers.
- If the Company stops participating in some of its multiemployer benefit plans, the Company may be required to pay those plans an amount based on its allocable share of the underfunded status of the plan, referred to as a withdrawal liability.

The Company participates in approximately 270 multiemployer benefit plans, none of which are individually significant to the Company. The number of employees covered by the Company's multiemployer benefit plans has remained consistent over the past three years, and there have been no significant changes that affect the comparability of fiscal 2022, 2021 and 2020 contributions. The Company recognizes expense for the contractually-required contribution for each period. The Company contributed \$71 million, \$67 million and \$66 million to multiemployer benefit plans during the years ended September 30, 2022, 2021 and 2020, respectively.

Based on the most recent information available, the Company believes that the present value of actuarial accrued liabilities in certain of these multiemployer benefit plans may exceed the value of the assets held in trust to pay benefits. Currently, the Company is not aware of any significant multiemployer benefit plans for which it is probable or reasonably possible that the Company will be obligated to make up any shortfall in funds. Moreover, if the Company were to exit certain markets or otherwise cease making contributions to these funds, the Company could trigger a withdrawal liability. Currently, the Company is not aware of any multiemployer benefit plans for which it is probable or reasonably possible that the Company will have a significant withdrawal liability. Any accrual for a shortfall or withdrawal liability will be recorded when it is probable that a liability exists and it can be reasonably estimated.

Plan Assets

The Company's investment policies employ an approach whereby a mix of equities, fixed income and alternative investments are used to maximize the long-term return of plan assets for a prudent level of risk. The investment portfolio primarily contains a diversified blend of equity and fixed income investments. Equity investments are diversified across U.S. and non-U.S. stocks, as well as growth, value and small to large capitalization. Fixed income investments include corporate and government issues, with short-, mid- and long-term maturities, with a focus on investment grade when purchased and a target duration close to that of the plan liability. Investment and market risks are measured and monitored on an ongoing basis through regular investment portfolio reviews, annual liability measurements and periodic asset/liability studies. The majority of the real estate component of the portfolio is invested in a diversified portfolio of high-quality, operating properties with cash yields greater than the targeted appreciation. Investments in other alternative asset classes, including hedge funds and commodities, diversify the expected investment returns relative to the equity and fixed income investments. As a result of the Company's diversification strategies, there are no significant concentrations of risk within the portfolio of investments.

The Company's actual asset allocations are in line with target allocations. The Company rebalances asset allocations as appropriate, in order to stay within a range of allocation for each asset category.

The expected return on plan assets is based on the Company's expectation of the long-term average rate of return of the capital markets in which the plans invest. The average market returns are adjusted, where appropriate, for active asset management returns. The expected return reflects the investment policy target asset mix and considers the historical returns earned for each asset category.

The Company's plan assets at September 30, 2022 and 2021, by asset category, are as follows (in millions):

Asset Category	Fair Value Measurements Using:			
	Total as of September 30, 2022	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
<u>U.S. Pension</u>				
Cash and Cash Equivalents	\$ 40	\$ —	\$ 40	\$ —
Equity Securities				
Large-Cap	160	160	—	—
Small-Cap	175	175	—	—
International - Developed	139	139	—	—
International - Emerging	39	39	—	—
Fixed Income Securities				
Government	217	216	1	—
Corporate/Other	804	804	—	—
Total Investments in the Fair Value Hierarchy	1,574	\$ 1,533	\$ 41	\$ —
Real Estate Investments Measured at Net Asset Value⁽¹⁾	322			
Due to Broker	(166)			
Total Plan Assets	\$ 1,730			
<u>Non-U.S. Pension</u>				
Cash and Cash Equivalents	\$ 150	\$ 150	\$ —	\$ —
Equity Securities				
Large-Cap	45	8	37	—
International - Developed	43	12	31	—
International - Emerging	3	—	3	—
Fixed Income Securities				
Government	650	50	600	—
Corporate/Other	418	277	141	—
Hedge Fund	18	—	18	—
Real Estate	9	9	—	—
Total Investments in the Fair Value Hierarchy	1,336	\$ 506	\$ 830	\$ —
Real Estate Investments Measured at Net Asset Value⁽¹⁾	97			
Total Plan Assets	\$ 1,433			
<u>Postretirement</u>				
Cash and Cash Equivalents	\$ 13	\$ 13	\$ —	\$ —
Equity Securities				
Global	66	—	66	—
Total Investments in the Fair Value Hierarchy	79	\$ 13	\$ 66	\$ —
Multi-Credit Strategy Investments Measured at Net Asset Value⁽¹⁾	65			
Total Plan Assets	\$ 144			

Asset Category	Fair Value Measurements Using:			
	Total as of September 30, 2021	Quoted Prices in Active Markets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
<u>U.S. Pension</u>				
Cash and Cash Equivalents	\$ 75	\$ —	\$ 75	\$ —
Equity Securities				
Large-Cap	185	185	—	—
Small-Cap	215	215	—	—
International - Developed	182	182	—	—
International - Emerging	34	34	—	—
Fixed Income Securities				
Government	286	98	188	—
Corporate/Other	1,279	1,279	—	—
Total Investments in the Fair Value Hierarchy	2,256	<u>\$ 1,993</u>	<u>\$ 263</u>	<u>\$ —</u>
Real Estate Investments Measured at Net Asset Value⁽¹⁾	280			
Due to Broker	(77)			
Total Plan Assets	<u>\$ 2,459</u>			
<u>Non-U.S. Pension</u>				
Cash and Cash Equivalents	\$ 151	\$ 151	\$ —	\$ —
Large-Cap	197	23	174	—
International - Developed	128	30	98	—
International - Emerging	2	—	2	—
Fixed Income Securities				
Government	1,123	77	1,046	—
Corporate/Other	597	320	277	—
Hedge Fund	27	—	27	—
Real Estate	14	14	—	—
Total Investments in the Fair Value Hierarchy	2,239	<u>\$ 615</u>	<u>\$ 1,624</u>	<u>\$ —</u>
Real Estate Investments Measured at Net Asset Value⁽¹⁾	105			
Total Plan Assets	<u>\$ 2,344</u>			
<u>Postretirement</u>				
Cash and Cash Equivalents	\$ 5	\$ 5	\$ —	\$ —
Equity Securities				
Large-Cap	24	—	24	—
Small-Cap	8	—	8	—
International - Developed	19	—	19	—
International - Emerging	12	—	12	—
Fixed Income Securities				
Government	20	—	20	—
Corporate/Other	56	—	56	—
Commodities	17	—	17	—
Real Estate	11	—	11	—
Total Plan Assets	<u>\$ 172</u>	<u>\$ 5</u>	<u>\$ 167</u>	<u>\$ —</u>

⁽¹⁾The fair value of certain real estate and multi-credit strategy investments do not have a readily determinable fair value and require the fund managers to independently arrive at fair value by calculating net asset value ("NAV") per share. In order to

calculate NAV per share, the fund managers value the investments using any one, or a combination of, the following methods: independent third party appraisals, discounted cash flow analysis of net cash flows projected to be generated by the investment and recent sales of comparable investments. Assumptions used to revalue the investments are updated every quarter. Due to the fact that the fund managers calculate NAV per share, the Company utilizes a practical expedient for measuring the fair value of its real estate and multi-credit strategy investments, as provided for under ASC 820, "Fair Value Measurement." In applying the practical expedient, the Company is not required to further adjust the NAV provided by the fund manager in order to determine the fair value of its investments as the NAV per share is calculated in a manner consistent with the measurement principles of ASC 946, "Financial Services - Investment Companies," and as of the Company's measurement date. The Company believes this is an appropriate methodology to obtain the fair value of these assets. For the component of the real estate portfolio under development, the investments are carried at cost until they are completed and valued by a third party appraiser. In accordance with ASU No. 2015-07, "Disclosures for Investments in Certain Entities That Calculate Net Asset Value per Share (or Its Equivalent)," investments for which fair value is measured using the net asset value per share practical expedient are disclosed separate from the fair value hierarchy. The fair value amounts presented in these tables are intended to permit reconciliation of total plan assets to the amounts presented in the notes to consolidated financial statements.

The following is a description of the valuation methodologies used for assets measured at fair value. Certain assets are held within commingled funds which are valued at the unitized NAV or percentage of the net asset value as determined by the manager of the fund. These values are based on the fair value of the underlying net assets owned by the fund.

Cash and Cash Equivalents: The fair value of cash and cash equivalents is valued at cost.

Equity Securities: The fair value of equity securities is determined by direct quoted market prices. The underlying holdings are direct quoted market prices on regulated financial exchanges.

Fixed Income Securities: The fair value of fixed income securities is determined by direct or indirect quoted market prices. If indirect quoted market prices are utilized, the value of assets held in separate accounts is not published, but the investment managers report daily the underlying holdings. The underlying holdings are direct quoted market prices on regulated financial exchanges.

Commodities: The fair value of the commodities is determined by quoted market prices of the underlying holdings on regulated financial exchanges.

Hedge Funds: The fair value of hedge funds is accounted for by the custodian. The custodian obtains valuations from underlying managers based on market quotes for the most liquid assets and alternative methods for assets that do not have sufficient trading activity to derive prices. The Company and custodian review the methods used by the underlying managers to value the assets. The Company believes this is an appropriate methodology to obtain the fair value of these assets.

Real Estate: The fair value of real estate is determined by quoted market prices of the underlying Real Estate Investment Trusts ("REITs"), which are securities traded on an open exchange.

The methods described above may produce a fair value calculation that may not be indicative of net realizable value or reflective of future fair values. Furthermore, while the Company believes its valuation methods are appropriate and consistent with other market participants, the use of different methodologies or assumptions to determine the fair value of certain financial instruments could result in a different fair value measurement at the reporting date.

There were no Level 3 assets as of September 30, 2022 or 2021 or any Level 3 asset activity during fiscal 2022 or 2021.

Funded Status

The following table contains the ABO and reconciliations of the changes in the PBO, the changes in plan assets and the funded status (in millions):

September 30,	Pension Benefits				Postretirement Benefits	
	U.S. Plans		Non-U.S. Plans			
	2022	2021	2022	2021	2022	2021
Accumulated Benefit Obligation	<u>\$ 1,822</u>	<u>\$ 2,629</u>	<u>\$ 1,417</u>	<u>\$ 2,540</u>	<u>\$ 89</u>	<u>\$ —</u>
Change in Projected Benefit Obligation						
Projected benefit obligation at beginning of year	\$ 2,629	\$ 3,217	\$ 2,625	\$ 2,726	\$ 123	\$ 146
Service cost	—	—	20	27	1	1
Interest cost	56	47	39	32	2	2
Plan participant contributions	—	—	2	3	3	3
Actuarial gain	(587)	(52)	(651)	(103)	(25)	(13)
Amendments made during the year	—	—	(1)	(6)	—	—
Benefits and settlements paid	(276)	(583)	(166)	(124)	(14)	(17)
Curtailment	—	—	—	(3)	—	—
Other	—	—	(2)	(2)	—	—
Currency translation adjustment	—	—	(395)	75	(1)	1
Projected benefit obligation at end of year	<u>\$ 1,822</u>	<u>\$ 2,629</u>	<u>\$ 1,471</u>	<u>\$ 2,625</u>	<u>\$ 89</u>	<u>\$ 123</u>
Change in Plan Assets						
Fair value of plan assets at beginning of year	\$ 2,459	\$ 2,706	\$ 2,344	\$ 2,213	\$ 172	\$ 153
Actual return on plan assets	(454)	333	(459)	125	(20)	30
Employer and employee contributions	1	3	94	65	6	6
Benefits paid	(85)	(108)	(74)	(79)	(14)	(17)
Settlement payments	(191)	(475)	(92)	(45)	—	—
Other	—	—	(2)	(1)	—	—
Currency translation adjustment	—	—	(378)	66	—	—
Fair value of plan assets at end of year	<u>\$ 1,730</u>	<u>\$ 2,459</u>	<u>\$ 1,433</u>	<u>\$ 2,344</u>	<u>\$ 144</u>	<u>\$ 172</u>
Funded status	<u>\$ (92)</u>	<u>\$ (170)</u>	<u>\$ (38)</u>	<u>\$ (281)</u>	<u>\$ 55</u>	<u>\$ 49</u>
Amounts recognized in the statement of financial position consist of:						
Prepaid benefit cost	\$ 37	\$ 44	\$ 151	\$ 79	\$ 95	\$ 107
Accrued benefit liability	(129)	(214)	(189)	(360)	(40)	(58)
Net amount recognized	<u>\$ (92)</u>	<u>\$ (170)</u>	<u>\$ (38)</u>	<u>\$ (281)</u>	<u>\$ 55</u>	<u>\$ 49</u>
Weighted Average Assumptions⁽¹⁾						
Discount rate ⁽²⁾	5.08 %	2.50 %	4.36 %	1.80 %	4.92 %	2.30 %
Rate of compensation increase	N/A	N/A	3.00 %	2.85 %	N/A	N/A
Interest crediting rate	N/A	N/A	1.69 %	1.45 %	N/A	N/A

⁽¹⁾ Plan assets and obligations are determined based on a September 30 measurement date at September 30, 2022 and 2021.

⁽²⁾ The Company considers the expected benefit payments on a plan-by-plan basis when setting assumed discount rates. As a result, the Company uses different discount rates for each plan depending on the plan jurisdiction, the demographics of participants and the expected timing of benefit payments. For the U.S. pension and postretirement plans, the Company uses a discount rate provided by an independent third party calculated based on an appropriate mix of high quality bonds. For the non-U.S. pension and postretirement plans, the Company consistently uses the relevant country specific benchmark indices for

determining the various discount rates. The Company has elected to utilize a full yield curve approach in the estimation of service and interest components of net periodic benefit cost (credit) for pension and other postretirement for plans that utilize a yield curve approach. The full yield curve approach applies the specific spot rates along the yield curve used in the determination of the benefit obligation to the relevant projected cash flows.

The fiscal 2022 and fiscal 2021 net actuarial gains related to changes in the projected benefit obligation were primarily the result of the increase in discount rates globally.

Net Periodic Benefit Cost

The following table contains the components of net periodic benefit costs, which are primarily recorded in selling, general and administrative expenses in the consolidated statements of income (in millions):

Year ended September 30,	Pension Benefits						Postretirement Benefits		
	U.S. Plans			Non-U.S. Plans					
	2022	2021	2020	2022	2021	2020	2022	2021	2020
Components of Net Periodic Benefit Cost (Credit):									
Service cost	\$ —	\$ —	\$ —	\$ 20	\$ 27	\$ 25	\$ 1	\$ 1	\$ 1
Interest cost	56	47	67	39	32	36	2	2	4
Expected return on plan assets	(150)	(171)	(180)	(81)	(112)	(111)	(9)	(8)	(9)
Net actuarial (gain) loss	16	(214)	244	(116)	(115)	43	4	(35)	2
Amortization of prior service cost (credit)	—	—	—	—	1	1	(4)	(4)	(3)
Curtailment gain	—	—	—	—	(3)	(8)	—	—	—
Settlement (gain) loss	1	—	6	5	(1)	—	—	—	—
Special termination benefit cost	—	—	—	—	2	—	—	—	—
Net periodic benefit cost (credit) included in continuing operations	<u>\$ (77)</u>	<u>\$(338)</u>	<u>\$ 137</u>	<u>\$(133)</u>	<u>\$(169)</u>	<u>\$ (14)</u>	<u>\$ (6)</u>	<u>\$ (44)</u>	<u>\$ (5)</u>
Expense Assumptions:									
Discount rate	2.52 %	2.25 %	2.95 %	1.79 %	1.35 %	1.50 %	2.30 %	1.90 %	2.65 %
Expected return on plan assets	7.00 %	6.50 %	6.90 %	3.70 %	4.90 %	5.20 %	5.29 %	5.30 %	5.70 %
Rate of compensation increase	N/A	N/A	N/A	2.85 %	2.75 %	2.80 %	N/A	N/A	N/A
Interest crediting rate	N/A	N/A	N/A	1.44 %	1.50 %	1.50 %	N/A	N/A	N/A

17. SIGNIFICANT RESTRUCTURING AND IMPAIRMENT COSTS

To better align its resources with its growth strategies and reduce the cost structure of its global operations in certain underlying markets, the Company commits to restructuring plans as necessary. Restructuring plans generally result in charges for workforce reductions, plant closures, asset impairments and other related costs which are reported as restructuring and impairment costs in the Company's consolidated statements of income. The other related costs consist primarily of consulting costs incurred as a direct result of the restructuring initiatives. The Company expects the restructuring actions to reduce cost of sales and SG&A due to reduced employee-related costs, depreciation and amortization expense.

In fiscal 2021, the Company committed to a significant multi-year restructuring plan ("2021 Plan") which is expected to be completed during fiscal 2023. The Company originally expected to incur \$385 million of restructuring costs across all segments and at Corporate through fiscal 2023. The Company has incurred and exceeded these costs during fiscal 2022 due to certain restructuring actions and expenses planned for fiscal 2023 being accelerated into fiscal 2022. In total, the Company recorded \$424 million of restructuring and impairment costs related to the 2021 Plan, which is the total amount expected to be incurred for this restructuring plan.

The following table summarizes restructuring and impairment costs related to the 2021 Plan (in millions):

	Year Ended September 30, 2022	Inception to September 30, 2022
Building Solutions North America	\$ 41	\$ 111
Building Solutions EMEA/LA	33	62
Building Solutions Asia Pacific	21	49
Global Products	75	166
Corporate	12	36
Total	<u>\$ 182</u>	<u>\$ 424</u>

The following table summarizes the changes in the Company's 2021 Plan reserve, included primarily within other current liabilities in the consolidated statements of financial position (in millions):

	Employee Severance and Termination Benefits	Long-Lived Asset Impairments ⁽¹⁾	Other	Total
Original reserve	\$ 68	\$ 98	\$ 76	\$ 242
Utilized—cash	(28)	—	(51)	(79)
Utilized—noncash	—	(98)	—	(98)
Balance at September 30, 2021	40	—	25	65
Additional restructuring costs	116	17	49	182
Utilized—cash	(81)	—	(66)	(147)
Utilized—noncash	—	(17)	—	(17)
Currency translation	(1)	—	—	(1)
Balance at September 30, 2022	<u>\$ 74</u>	<u>\$ —</u>	<u>\$ 8</u>	<u>\$ 82</u>

⁽¹⁾ Of the \$98 million of long-lived asset impairment charges in fiscal 2021, \$50 million related to the Global Products segment, \$33 million related to the Building Solutions North America segment, \$6 million related to Corporate assets, \$5 million related to the Building Solutions EMEA/LA segment and \$4 million related to the Building Solutions Asia Pacific segment. Of the \$17 million of long-lived asset impairment charges in fiscal 2022, \$6 million related to the Building Solutions Asia Pacific segment, \$5 million related to Corporate assets, \$3 million related to the Global Products segment, \$2 million related to the Building Solutions EMEA/LA segment and \$1 million related to the Building Solutions North America segment.

The 2021 Plan included workforce reductions of approximately 6,200 employees. Restructuring charges associated with employee severance and termination benefits are paid over the severance period granted to each employee or on a lump sum basis in accordance with individual severance agreements. As of September 30, 2022, approximately 4,000 of the employees have been separated from the Company pursuant to the restructuring plans.

Company management closely monitors its overall cost structure and continually analyzes each of its businesses for opportunities to consolidate current operations, improve operating efficiencies and locate facilities in close proximity to customers. This ongoing analysis includes a review of its manufacturing, engineering and purchasing operations, as well as the overall global footprint for all its businesses.

18. INCOME TAXES

The more significant components of the Company's income tax provision from continuing operations are as follows (in millions):

	2022	2021	2020
Tax expense at Ireland statutory rate	\$ 214	\$ 327	\$ 113
U.S. state income tax, net of federal benefit	(23)	34	8
Income subject to the U.S. federal tax rate	(95)	3	(92)
Income subject to rates different than the statutory rate	125	30	99
Reserve and valuation allowance adjustments	(274)	66	(70)
Intercompany intellectual property transfer	—	417	—
Restructuring and impairment costs	40	(9)	50
Income tax provision (benefit)	<u>\$ (13)</u>	<u>\$ 868</u>	<u>\$ 108</u>

The statutory tax rate in Ireland of 12.5% is being used as a comparison since the Company is domiciled in Ireland.

For fiscal 2022, the effective tax rate for continuing operations was (1)% and was lower than the statutory tax rate primarily due to tax reserve adjustments as the result of expired statute of limitations for certain tax years and the benefits of continuing global tax planning initiatives, partially offset by the income tax effects of impairment and restructuring charges, valuation allowance adjustments, the establishment of a deferred tax liability on the outside basis difference of the Company's investment in certain subsidiaries as a result of the planned divestitures and tax rate differentials.

For fiscal 2021, the effective tax rate for continuing operations was 33% and was higher than the statutory tax rate primarily due to the tax impacts of an intercompany transfer of certain of the Company's intellectual property rights, valuation allowance adjustments, the income tax effects of mark-to-market adjustments and tax rate differentials, partially offset by the benefits of continuing global tax planning initiatives.

For fiscal 2020, the effective tax rate for continuing operations was 12% and was lower than the statutory tax rate primarily due to tax audit reserve adjustments, the income tax effects of mark-to-market adjustments, valuation allowance adjustments and the benefits of continuing global tax planning initiatives, partially offset by a discrete tax charge related to the remeasurement of deferred tax assets and liabilities as a result of Swiss tax reform, the tax impact of an impairment charge and tax rate differentials.

Valuation Allowances

The Company reviews the realizability of its deferred tax assets and related valuation allowances on a quarterly basis, or whenever events or changes in circumstances indicate that a review is required. In determining the requirement for a valuation allowance, the historical and projected financial results of the legal entity or consolidated group recording the net deferred tax asset are considered, along with any other positive or negative evidence. Since future financial results may differ from previous estimates, periodic adjustments to the Company's valuation allowances may be necessary.

In fiscal 2022, due to changes in forecasted taxable income, the Company determined that it was more likely than not that certain deferred tax assets of Japan would not be realized. The valuation allowance adjustment resulted in a tax charge of \$27 million.

In fiscal 2021, as a result of an intercompany transfer of certain of the Company's intellectual property rights, the Company determined that it is more likely than not that certain deferred tax assets of Switzerland would be realized, and it was more likely than not that certain deferred tax assets of Canada would not be realized. The valuation allowance adjustments resulted in a \$39 million net benefit to income tax expense. Due to changes in forecasted taxable income, the Company also recorded a

discrete tax charge of \$105 million related to valuation allowances on certain Mexico deferred tax assets now considered unrealizable.

In fiscal 2020, the Company performed an analysis related to the realizability of its worldwide deferred tax assets. As a result, and after considering feasible tax planning initiatives and other positive and negative evidence, the Company determined that it was more likely than not that certain deferred tax assets primarily within the U.S. would not be realized, and it is more likely than not that certain deferred tax assets of Canada would be realized. The valuation allowance adjustments resulted in a \$26 million net benefit to income tax expense.

Uncertain Tax Positions

The Company is subject to income taxes in the U.S. and numerous non-U.S. jurisdictions. Judgment is required in determining its worldwide provision for income taxes and recording the related assets and liabilities. In the ordinary course of the Company's business, there are many transactions and calculations where the ultimate tax determination is uncertain. The Company is regularly under audit by tax authorities.

A reconciliation of the beginning and ending amount of unrecognized tax benefits is as follows (in millions):

	2022	2021	2020
Beginning balance, October 1	\$ 2,726	\$ 2,528	\$ 2,451
Additions for tax positions related to the current year	169	240	128
Additions for tax positions of prior years	31	33	129
Reductions for tax positions of prior years	(48)	(6)	(27)
Settlements with taxing authorities	(7)	(24)	(54)
Statute closings and audit resolutions	(334)	(45)	(99)
Ending balance, September 30	<u>\$ 2,537</u>	<u>\$ 2,726</u>	<u>\$ 2,528</u>

The following table summarizes gross tax effected unrecognized tax benefits that, if recognized, would impact the effective tax rate and the related accrued interest, net of tax benefit (in millions):

	September 30,		
	2022	2021	2020
Gross tax effected unrecognized tax benefits	\$ 1,973	\$ 2,268	\$ 2,132
Net accrued interest	284	252	205

In fiscal 2022, the statute of limitations for certain tax years expired, which resulted in a \$301 million benefit to income tax expense.

During fiscal 2020, tax audit resolutions resulted in a \$44 million net benefit to income tax expense.

In the U.S., fiscal years 2017 through 2018 are currently under exam by the Internal Revenue Service ("IRS") for certain legal entities. Additionally, the Company is currently under exam in the following major non-U.S. jurisdictions for continuing operations:

Tax Jurisdiction	Tax Years Covered
Belgium	2015 - 2021
Germany	2007 - 2018
Luxembourg	2017 - 2018
Mexico	2015 - 2017
United Kingdom	2014 - 2015, 2017 - 2018; 2020

It is reasonably possible that certain tax examinations and/or tax litigation will conclude within the next twelve months, which could have a material impact on tax expense. Based upon the circumstances surrounding these examinations, the impact is not currently quantifiable.

Other Tax Matters

During fiscal 2022, 2021 and 2020, the Company incurred charges for restructuring and impairment costs of \$721 million, \$242 million and \$783 million, which generated tax benefits of \$50 million, \$39 million and \$48 million, respectively.

In fiscal 2021, the Company completed an intercompany transfer of certain of the Company's intellectual property rights which resulted in a net tax charge of \$417 million.

Impacts of Tax Legislation and Change in Statutory Tax Rates

On August 16, 2022, the U.S. enacted the Inflation Reduction Act ("IRA") which, among other things, creates a new book minimum tax of at least 15% of consolidated GAAP pre-tax income for corporations with average book income in excess of \$1 billion. The book minimum tax is first applicable in fiscal year 2024. The Company does not expect this provision to have a material impact on its effective tax rate.

In fiscal 2020, the Company recorded a noncash discrete tax charge of \$30 million due to the remeasurement of deferred tax assets and liabilities related to Switzerland and the canton of Schaffhausen. On September 28, 2018, the Swiss Parliament approved the Federal Act on Tax Reform and AHV Financing ("TRAF"), which was subsequently approved by the Swiss electorate on May 19, 2019. During the fourth quarter of fiscal 2019, the Swiss Federal Council enacted TRAF which became effective for the Company on January 1, 2020. The impacts of the federal enactment did not have a material impact to the Company's financial statements. TRAF also provides for parameters which enable the Swiss cantons to adjust tax rates and establish new regulations for companies. As of September 30, 2019, the canton of Schaffhausen had not concluded its public referendum; however, the enactment did occur during the first quarter of fiscal 2020.

During the fiscal years ended 2022, 2021 and 2020, other tax legislation was adopted in various jurisdictions. These law changes did not have a material impact on the Company's consolidated financial statements.

Continuing Operations

Selected income tax data related to continuing operations were as follows (in millions):

	2022	2021	2020
Components of income (loss) from continuing operations before income taxes:			
U.S.	\$ 67	\$ 543	\$ (385)
Non-U.S.	1,643	2,071	1,288
Income from continuing operations before income taxes	<u>\$ 1,710</u>	<u>\$ 2,614</u>	<u>\$ 903</u>
Components of the provision (benefit) for income taxes:			
Current			
U.S. federal	\$ (219)	\$ 459	\$ 309
U.S. state	53	108	72
Non-U.S.	294	265	264
	<u>128</u>	<u>832</u>	<u>645</u>
Deferred			
U.S. federal	(175)	(7)	(382)
U.S. state	(69)	46	(43)
Non-U.S.	103	(3)	(112)
	<u>(141)</u>	<u>36</u>	<u>(537)</u>
Income tax provision (benefit)	<u>\$ (13)</u>	<u>\$ 868</u>	<u>\$ 108</u>
Income taxes paid (refunded)	<u>\$ 568</u>	<u>\$ 504</u>	<u>\$ (386)</u>

At September 30, 2022 and 2021, the Company recorded within the consolidated statements of financial position in other current assets approximately \$253 million and \$120 million, respectively, of income tax assets. At September 30, 2022 and 2021, the Company recorded within the consolidated statements of financial position in other current liabilities approximately \$143 million and \$201 million, respectively, of accrued income tax liabilities.

The Company has not provided U.S. or non-U.S. income taxes on approximately \$23.6 billion of outside basis differences of consolidated subsidiaries of Johnson Controls International plc. The Company is indefinitely reinvested in these basis differences. The reduction of the outside basis differences via the sale or liquidation of these subsidiaries and/or distributions could create taxable income. The Company's intent is to reduce the outside basis differences only when it would be tax efficient. Given the numerous ways in which the basis differences may be reduced, it is not practicable to estimate the amount of unrecognized withholding taxes and deferred tax liability on the outside basis differences.

Deferred taxes were classified in the consolidated statements of financial position as follows (in millions):

	September 30,	
	2022	2021
Other noncurrent assets	\$ 944	\$ 755
Other noncurrent liabilities	(500)	(443)
Net deferred tax asset	<u>\$ 444</u>	<u>\$ 312</u>

Temporary differences and carryforwards which gave rise to deferred tax assets and liabilities included (in millions):

	September 30,	
	2022	2021
Deferred tax assets		
Accrued expenses and reserves	\$ 376	\$ 407
Employee and retiree benefits	77	148
Property, plant and equipment	444	369
Net operating loss and other credit carryforwards	6,472	6,293
Research and development	52	42
Operating lease liabilities	309	334
Other, net	58	28
	7,788	7,621
Valuation allowances	(5,967)	(5,853)
	1,821	1,768
Deferred tax liabilities		
Subsidiaries, joint ventures and partnerships	338	346
Intangible assets	730	776
Operating lease right-of-use assets	309	334
	1,377	1,456
Net deferred tax asset	\$ 444	\$ 312

At September 30, 2022, the Company had available net operating loss carryforwards of approximately \$24.3 billion, of which \$14.0 billion will expire at various dates between 2023 and 2042, and the remainder has an indefinite carryforward period. The Company had available U.S. foreign tax credit carryforwards at September 30, 2022 of \$35 million which will expire in 2029. The valuation allowance, generally, is for loss and credit carryforwards for which realization is uncertain because it is unlikely that the losses and/or credits will be realized given the lack of sustained profitability and/or limited carryforward periods in certain countries.

19. SEGMENT INFORMATION

ASC 280, "Segment Reporting," establishes the standards for reporting information about segments in financial statements. In applying the criteria set forth in ASC 280, the Company has determined that it has four reportable segments for financial reporting purposes.

Building Solutions North America: Building Solutions North America designs, sells, installs and services HVAC, controls, building management, refrigeration, integrated electronic security and integrated fire-detection and suppression systems for commercial, industrial, retail, small business, institutional and governmental customers in the United States and Canada. Building Solutions North America also provides energy efficiency solutions and technical services, including inspection, scheduled maintenance, and repair and replacement of mechanical and controls systems, as well as data-driven "smart building" solutions, to non-residential building and industrial applications in the United States and Canadian marketplace.

Building Solutions EMEA/LA: Building Solutions EMEA/LA designs, sells, installs and services HVAC, controls, building management, refrigeration, integrated electronic security, integrated fire-detection and suppression systems, and provides technical services, including data-driven "smart building" solutions, to markets in Europe, the Middle East, Africa and Latin America.

Building Solutions Asia Pacific: Building Solutions Asia Pacific designs, sells, installs and services HVAC, controls, building management, refrigeration, integrated electronic security, integrated fire-detection and suppression systems, and provides technical services, including data-driven "smart building" solutions, in the Asia Pacific marketplace.

Global Products: Global Products designs, manufactures and sells HVAC equipment, controls software and software services for residential and commercial applications to commercial, industrial, retail, residential, small business, institutional and

governmental customers worldwide. In addition, Global Products designs, manufactures and sells refrigeration equipment and controls globally. The Global Products business also designs, manufactures and sells fire protection, fire suppression and security products, including intrusion security, anti-theft devices, access control, and video surveillance and management systems, for commercial, industrial, retail, residential, small business, institutional and governmental customers worldwide. Global Products includes the Johnson Controls-Hitachi joint venture.

Effective October 1, 2021, the Company's marine businesses previously included in the Building Solutions Asia Pacific and Global Products reportable segments became part of the Building Solutions EMEA/LA reportable segment. Historical information has been re-cast to present the comparative periods on a consistent basis. This change was not material to the segment presentation or the allocation of goodwill.

Management evaluates the performance of its business segments primarily on segment earnings before interest, taxes and amortization ("EBITA"), which represents income from continuing operations before income taxes and noncontrolling interests, excluding general corporate expenses, intangible asset amortization, net financing charges, restructuring and impairment costs, and net mark-to-market adjustments related to pension and postretirement plans and restricted asbestos investments.

Financial information relating to the Company's reportable segments is as follows (in millions):

	Year Ended September 30,		
	2022	2021	2020
<u>Net Sales</u>			
Building Solutions North America	\$ 9,367	\$ 8,685	\$ 8,605
Building Solutions EMEA/LA	3,845	3,884	3,613
Building Solutions Asia Pacific	2,714	2,616	2,368
Global Products	9,373	8,483	7,731
Total net sales	<u>\$ 25,299</u>	<u>\$ 23,668</u>	<u>\$ 22,317</u>
	Year Ended September 30,		
	2022	2021	2020
<u>Segment EBITA ⁽¹⁾</u>			
Building Solutions North America	\$ 1,122	\$ 1,204	\$ 1,157
Building Solutions EMEA/LA	358	401	349
Building Solutions Asia Pacific	332	344	314
Global Products	1,594	1,436	1,128
Total segment EBITA	<u>\$ 3,406</u>	<u>\$ 3,385</u>	<u>\$ 2,948</u>
Amortization of intangible assets	(427)	(435)	(386)
Corporate expenses	(369)	(290)	(371)
Net financing charges	(213)	(206)	(231)
Restructuring and impairment costs	(721)	(242)	(783)
Net mark-to-market adjustments	34	402	(274)
Income from continuing operations before income taxes	<u>\$ 1,710</u>	<u>\$ 2,614</u>	<u>\$ 903</u>

	September 30,		
	2022	2021	2020
<u>Assets</u> ⁽²⁾			
Building Solutions North America	\$ 14,429	\$ 15,317	\$ 15,215
Building Solutions EMEA/LA	4,766	5,397	5,159
Building Solutions Asia Pacific	2,424	2,728	2,662
Global Products	15,185	15,227	13,770
	36,804	38,669	36,806
Assets held for sale	1,138	156	147
Unallocated	4,216	3,065	3,862
Total	<u>\$ 42,158</u>	<u>\$ 41,890</u>	<u>\$ 40,815</u>

	Year Ended September 30,		
	2022	2021	2020
<u>Depreciation/Amortization</u>			
Building Solutions North America	\$ 213	\$ 245	\$ 233
Building Solutions EMEA/LA	96	103	102
Building Solutions Asia Pacific	21	25	24
Global Products	461	432	414
	791	805	773
Corporate	39	40	49
Total	<u>\$ 830</u>	<u>\$ 845</u>	<u>\$ 822</u>

	Year Ended September 30,		
	2022	2021	2020
<u>Capital Expenditures</u>			
Building Solutions North America	\$ 141	\$ 87	\$ 93
Building Solutions EMEA/LA	119	128	99
Building Solutions Asia Pacific	22	31	36
Global Products	257	265	191
	539	511	419
Corporate	53	41	24
Total	<u>\$ 592</u>	<u>\$ 552</u>	<u>\$ 443</u>

(1) For the years ended September 30, 2022, 2021 and 2020, segment EBITA includes \$240 million, \$250 million and \$166 million, respectively, of equity income for the Global Products segment. Equity income for other segments is immaterial.

(2) Building Solutions EMEA/LA assets as of September 30, 2022, 2021 and 2020 include \$115 million, \$111 million and \$108 million, respectively, of investments in partially-owned affiliates. Global Products assets as of September 30, 2022, 2021 and 2020 include \$834 million, \$945 million and \$797 million, respectively, of investments in partially-owned affiliates. Investments in partially-owned affiliates for other segments is immaterial.

In fiscal 2022, 2021 and 2020, no customer exceeded 10% of consolidated net sales.

Geographic Segments

Financial information relating to the Company's operations by geographic area is as follows (in millions):

	Year Ended September 30,		
	2022	2021	2020
<u>Net Sales</u>			
United States	\$ 12,864	\$ 11,577	\$ 11,371
Europe	4,186	4,069	3,523
Asia Pacific	5,791	5,748	5,285
Other Non-U.S.	2,458	2,274	2,138
Total	<u>\$ 25,299</u>	<u>\$ 23,668</u>	<u>\$ 22,317</u>
<u>Long-Lived Assets (Year-end)</u>			
United States	\$ 1,573	\$ 1,638	\$ 1,713
Europe	412	436	278
Asia Pacific	656	727	667
Other Non-U.S.	401	427	401
Total	<u>\$ 3,042</u>	<u>\$ 3,228</u>	<u>\$ 3,059</u>

Net sales attributed to geographic locations are based on the location of where the sale originated. Long-lived assets by geographic location consist of net property, plant and equipment.

20. GUARANTEES

Certain of the Company's subsidiaries at the business segment level have guaranteed the performance of third-parties and provided financial guarantees for uncompleted work and financial commitments. The terms of these guarantees vary with end dates ranging from the current fiscal year through the completion of such transactions and would typically be triggered in the event of nonperformance. Performance under the guarantees, if required, would not have a material effect on the Company's financial position, results of operations or cash flows.

The Company offers warranties to its customers depending upon the specific product and terms of the customer purchase agreement. A typical warranty program requires that the Company replace defective products within a specified time period from the date of sale. The Company records an estimate for future warranty-related costs based on actual historical return rates and other known factors. Based on analysis of return rates and other factors, the Company's warranty provisions are adjusted as necessary. The Company monitors its warranty activity and adjusts its reserve estimates when it is probable that future warranty costs will be different than those estimates.

The Company's product warranty liability is recorded in the consolidated statements of financial position in other current liabilities if the warranty is less than one year and in other noncurrent liabilities if the warranty extends longer than one year.

The changes in the carrying amount of the Company's total product warranty liability were as follows (in millions).

	Year Ended September 30,	
	2022	2021
Balance at beginning of period	\$ 192	\$ 167
Accruals for warranties issued during the period	119	91
Accruals from acquisitions and divestitures	(1)	—
Changes in estimates to pre-existing warranties	(6)	11
Settlements made (in cash or in kind) during the period	(114)	(77)
Currency translation	(11)	—
Balance at end of period	<u>\$ 179</u>	<u>\$ 192</u>

21. COMMITMENTS AND CONTINGENCIES

Environmental Matters

The Company accrues for potential environmental liabilities when it is probable a liability has been incurred and the amount of the liability is reasonably estimable. The following table presents the location and amount of reserves for environmental liabilities in the Company's consolidated statements of financial position (in millions):

	September 30,	
	2022	2021
Other current liabilities	\$ 66	\$ 48
Other noncurrent liabilities	220	54
Total reserves for environmental liabilities	<u>\$ 286</u>	<u>\$ 102</u>

The Company periodically examines whether the contingent liabilities related to the environmental matters described below are probable and reasonably estimable based on experience and ongoing developments in those matters, including continued study and analysis of ongoing remediation obligations. During the three months ended September 30, 2022, with the assistance of independent environmental consultants and taking into consideration investigation and remediation actions previously completed, new information available to the Company during the fourth quarter of 2022 and ongoing discussions with the Wisconsin Department of Natural Resources ("WDNR"), the Company completed a comprehensive long-term analysis and cost assessment related to the Company's ongoing environmental remediation obligations. As a result of this analysis, the Company increased its accrual for environmental liabilities by \$228 million, which are recorded on an undiscounted basis. The Company expects that it will pay the amounts recorded over an estimated period of up to 20 years. The Company is not able to estimate a possible loss or range of loss, if any, in excess of the established accruals for environmental liabilities at this time.

A substantial portion of the increase to the Company's environmental reserves relates to ongoing long-term remediation efforts to address contamination relating to fire-fighting foams containing perfluorooctane sulfonate ("PFOS"), perfluorooctanoic acid ("PFOA"), and/or other per- and poly-fluoroalkyl substances ("PFAS") at or near the Tyco Fire Products L.P. ("Tyco Fire Products") Fire Technology Center ("FTC") located in Marinette, Wisconsin and surrounding areas in the City of Marinette and Town of Peshtigo, Wisconsin, as well as the continued remediation of PFAS, arsenic and other contaminants at the Tyco Fire Products Stanton Street manufacturing facility also located in Marinette, Wisconsin (the "Stanton Street Facility"). The increase in reserves was recorded as a result of several events that occurred in the three months ended September 30, 2022, including the completion and testing of the Groundwater Extraction and Treatment System ("GETS") at the FTC (as further discussed below), the completion of resident surveys in Peshtigo regarding long-term drinking water solutions, correspondence with regulators on planned remediation activities, finalization of cost estimates for system upgrades and related long-term run rate costs in response to new permit requirements at the Stanton Street Facility, and the development of additional information through ongoing investigation and analysis. These events have allowed the Company to develop estimates of costs associated with the long-term remediation actions expected to be performed over an estimated period of up to 20 years, including the continued operation of the GETS, the implementation of long-term drinking water solutions, continued monitoring and testing of the wells, the operation and wind-down of other legacy remediation and treatment systems and the completion of ongoing investigation obligations.

The use of fire-fighting foams at the FTC was primarily for training and testing purposes to ensure that such products sold by the Company's affiliates, Chemguard, Inc. ("Chemguard") and Tyco Fire Products, were effective at suppressing high intensity fires that may occur at military installations, airports or elsewhere. In May 2021, as part of Tyco Fire Products' ongoing investigation and remediation program, the WDNR approved Tyco Fire Products' proposed GETS, a permanent groundwater remediation system that will extract groundwater that contains PFAS, treat it using advanced filtration systems, and return the treated water to the environment. Tyco Fire Products has completed construction of the GETS, which is now in operation. Tyco Fire Products is also in the process of completing the removal and disposal of PFAS-affected soil from the FTC.

Tyco Fire Products has been engaged in remediation activities at the Stanton Street Facility since 1990. Its corporate predecessor, Ansul Incorporated ("Ansul") manufactured arsenic-based agricultural herbicides at the Stanton Street Facility, which resulted in significant arsenic contamination of soil and groundwater on the site and in parts of the adjoining Menominee River. In 2009, Ansul entered into an Administrative Consent Order (the "Consent Order") with the U.S. Environmental Protection Agency ("EPA") to address the presence of arsenic at the site. Under this agreement, Tyco Fire Products' principal obligations are to contain the arsenic contamination on the site, pump and treat on-site groundwater, dredge, treat and properly dispose of contaminated sediments in the adjoining river areas, and monitor contamination levels on an ongoing basis.

Activities completed under the Consent Order since 2009 include the installation of a subsurface barrier wall around the facility to contain contaminated groundwater, the installation of a groundwater extraction and treatment system and the dredging and offsite disposal of treated river sediment. In addition to ongoing remediation activities, the Company is also working with the WDNR to investigate and remediate the presence of PFAS at or near the Stanton Street Facility as part of the evaluation and remediation of PFAS in the Marinette region.

PFOA, PFOS, and other PFAS compounds are being studied by EPA and other environmental and health agencies and researchers. EPA has not issued binding regulatory limits, but had initially stated that it would propose regulatory standards for PFOS and PFOA in drinking water by the end of 2019, in accordance with its PFAS Action Plan released in February 2019, and issued interim recommendations for addressing PFOA and PFOS in groundwater in December 2019. In March 2021, EPA published its final determination to regulate PFOS and PFOA in drinking water. While those studies continue, EPA issued in June 2022 an updated set of interim health advisory levels for PFOA and PFOS in drinking water, as well as final health advisory levels for two other types of PFAS (PFBS and GenX chemicals). In November 2022, EPA added a class definition of PFAS to the final version of EPA's fifth Contaminant Candidate List (CCL 5), which is a list of substances not currently subject to national drinking water regulation, but which EPA believes may require future regulation.

In October 2021, EPA released its "PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024." The 2021-2024 Roadmap sets timelines by which EPA plans to take specific actions, including, among other items, publishing a national PFAS testing strategy, proposing to designate PFOA and PFOS as Comprehensive Environmental Response, Compensation and Liability Act hazardous substances, restricting PFAS discharges from industrial sources through Effluent Limitations Guidelines, publishing the final toxicity assessment for five additional PFAS, requiring water systems to test for 29 PFAS under the Safe Drinking Water Act, and publishing improved analytical methods in eight different environmental matrices to monitor 40 PFAS present in wastewater and stormwater discharges. Both PFOA and PFOS are types of synthetic chemical compounds that have been present in firefighting foam. However, both are also present in many existing consumer products. According to EPA, PFOA and PFOS have been used to make carpets, clothing, fabrics for furniture, paper packaging for food and other materials (e.g., cookware) that are resistant to water, grease or stains. In August 2022, EPA published a proposed rule that would designate PFOA and PFOS as "hazardous substances" under CERCLA.

It is difficult to estimate the Company's ultimate level of liability at many remediation sites due to the large number of other parties that may be involved, the complexity of determining the relative liability among those parties, the financial viability of other potentially responsible parties and third-party indemnitors, the uncertainty as to the nature and scope of the investigations and remediation to be conducted, changes in environmental regulations, changes in permissible levels of specific compounds in drinking water sources, or changes in enforcement theories and policies, including efforts to recover natural resource damages, the uncertainty in the application of law and risk assessment, the various choices and costs associated with diverse technologies that may be used in corrective actions at the sites, and the often quite lengthy periods over which eventual remediation may occur. It is possible that technological, regulatory or enforcement developments, the results of additional environmental studies or other factors could change the Company's expectations with respect to future charges and cash outlays, and such changes could be material to the Company's future results of operations, financial condition or cash flows. Nevertheless, the Company does not currently believe that any claims, penalties or costs in addition to the amounts accrued will have a material adverse effect on the Company's financial position, results of operations or cash flows.

In addition, the Company has identified asset retirement obligations for environmental matters that are expected to be addressed at the retirement, disposal, removal or abandonment of existing owned facilities. Conditional asset retirement obligations were \$17 million and \$29 million at September 30, 2022 and 2021, respectively.

FTC-Related Remediation and Litigation

On June 21, 2019, the WDNR announced that it had received from the Wisconsin Department of Health Services ("WDHS") a recommendation for groundwater quality standards as to, among other compounds, PFOA and PFOS. The WDHS recommended a groundwater enforcement standard for PFOA and PFOS of 20 parts per trillion. Although Wisconsin recently approved final regulatory standards for PFOA and PFOS in drinking water and surface water, the Wisconsin Natural Resources Board did not approve WDNR's proposed standards for PFOA and PFOS in groundwater. In September 2022, the Governor of Wisconsin signed a scope statement setting out parameters for the WDNR to draft a final rule regarding groundwater quality standards for PFOA and PFOS, among other compounds. The WDNR is now in the process of drafting the rule.

In July 2019, the Company received a letter from the WDNR directing the expansion of the evaluation of PFAS in the Marinette region to include (1) biosolids sludge produced by the City of Marinette Waste Water Treatment Plant and spread on certain fields in the area and (2) the Menominee and Peshtigo Rivers. Tyco Fire Products responded to the WDNR's letter by requesting additional necessary information. On October 16, 2019, the WDNR issued a "Notice of Noncompliance" to Tyco

Fire Products and Johnson Controls, Inc. regarding the WDNR's July 3, 2019 letter. The WDNR issued a further letter regarding the issue on November 4, 2019. In February 2020, the WDNR sent a letter to Tyco Fire Products and Johnson Controls, Inc. further directing the expansion of the evaluation of PFAS in the Marinette region to include investigation activities south and west of the previously defined FTC study area. In September 2021, the WDNR sent an additional "Notice of Noncompliance" to Tyco Fire Products and Johnson Controls, Inc. concerning land-applied biosolids, which reviewed and responded to the Company's biosolids investigation conducted to date. Tyco Fire Products responded to the WDNR's September 2021 notice by the December 27, 2021 deadline set by WDNR and submitted a Land Applied Biosolids Interim Site Status Update Report to WDNR on October 25, 2022. Tyco Fire Products and Johnson Controls, Inc. believe that they have complied with all applicable environmental laws and regulations. The Company cannot predict what regulatory or enforcement actions, if any, might result from the WDNR's actions, or the consequences of any such actions.

In March 2022, the Wisconsin Department of Justice ("WDOJ") filed a civil enforcement action against Johnson Controls Inc. and Tyco Fire Products in Wisconsin state court relating to environmental matters at the FTC (*State of Wisconsin v. Tyco Fire Products, LP and Johnson Controls, Inc.*, Case No. 22-CX-1 (filed March 14, 2022 in Circuit Court in Marinette County, Wisconsin)). The WDOJ alleges that the Company failed to timely report the presence of PFAS chemicals at the FTC, and that the Company has not sufficiently investigated or remediated PFAS at or near the FTC. The WDOJ seeks monetary penalties and an injunction ordering these two subsidiaries to complete a site investigation and cleanup of PFAS contamination in accordance with the WDNR's requests. The lawsuit is presently at the beginning stages of litigation. Tyco Fire Products and Johnson Controls, Inc. each filed Answers to the Complaint on April 4, 2022 and the parties are proceeding with initial fact discovery. The Company is vigorously defending this civil enforcement action and believes that it has meritorious defenses, but the Company is presently unable to predict the duration, scope, or outcome of this action.

In October 2022, the Town of Peshtigo filed a tort action in Wisconsin state court against Tyco Fire Products, Johnson Controls Inc., Chemguard, Inc., and ChemDesign, Inc. relating to environmental matters at the FTC (*Town of Peshtigo v. Tyco Fire Products L.P. et al.*, Case No. 2022CV000234 (filed October 18, 2022 in Circuit Court in Marinette County, Wisconsin)). The town alleges that use of AFFF products at the FTC caused contamination of water supplies in Peshtigo. The town seeks monetary penalties and an injunction ordering abatement of PFAS contamination in Peshtigo. The lawsuit is presently at the beginning stages of litigation. The Company was served with the operative complaint on October 21, 2022. The Company plans to vigorously defend against this case and believes that it has meritorious defenses, but the Company is presently unable to predict the duration, scope, or outcome of this action.

Aqueous Film-Forming Foam ("AFFF") Litigation

Two of the Company's subsidiaries, Chemguard and Tyco Fire Products, have been named, along with other defendant manufacturers, suppliers and distributors, and, in some cases, certain subsidiaries of the Company affiliated with Chemguard and Tyco Fire Products, in a number of class action and other lawsuits relating to the use of fire-fighting foam products by the U.S. Department of Defense (the "DOD") and others for fire suppression purposes and related training exercises. Plaintiffs generally allege that the firefighting foam products contain or break down into the chemicals PFOS and PFOA and/or other PFAS compounds and that the use of these products by others at various airbases, airports and other sites resulted in the release of these chemicals into the environment and ultimately into communities' drinking water supplies neighboring those airports, airbases and other sites. Plaintiffs generally seek compensatory damages, including damages for alleged personal injuries, medical monitoring, diminution in property values, investigation and remediation costs, and natural resources damages, and also seek punitive damages and injunctive relief to address remediation of the alleged contamination.

In September 2018, Tyco Fire Products and Chemguard filed a Petition for Multidistrict Litigation with the United States Judicial Panel on Multidistrict Litigation ("JPML") seeking to consolidate all existing and future federal cases into one jurisdiction. On December 7, 2018, the JPML issued an order transferring various AFFF cases to a multi-district litigation ("MDL") before the United States District Court for the District of South Carolina. Additional cases have been identified for transfer to or are being directly filed in the MDL.

AFFF Putative Class Actions

Chemguard and Tyco Fire Products are named in 33 pending putative class actions in federal courts originating from Colorado, Florida, Massachusetts, New York, Pennsylvania, Washington, New Hampshire, South Carolina, the District of Columbia, Guam, West Virginia, Michigan, Texas and South Dakota. All of these cases except one have been direct-filed in or transferred to the MDL, and the remaining action was recently removed to federal court and will be tagged for transfer to the MDL shortly.

AFFF Individual or Mass Actions

There are more than 2,900 individual or “mass” actions pending that were filed in state or federal court in various states including California, Colorado, New York, Pennsylvania, New Mexico, Missouri, Arizona, Texas, and South Carolina against Chemguard and Tyco Fire Products and other defendants in which the plaintiffs generally seek compensatory damages, including damages for alleged personal injuries, medical monitoring, and alleged diminution in property values. The cases involve plaintiffs from various states including approximately 7,000 plaintiffs in Colorado and more than 2,900 other plaintiffs. The vast majority of these matters have been tagged for transfer to, transferred to, or directly-filed in the MDL, and it is anticipated that several newly-filed state court actions will be similarly tagged and transferred. There are several matters that are proceeding in state courts, including actions in Arizona, Illinois, and Texas.

Tyco and Chemguard are also periodically notified by other individuals that they may assert claims regarding PFOS and/or PFOA contamination allegedly resulting from the use of AFFF.

AFFF Municipal and Water Provider Cases

Chemguard and Tyco Fire Products have been named as defendants in more than 250 cases in federal and state courts involving municipal or water provider plaintiffs in various states including Alaska, Alabama, Arizona, California, Colorado, Connecticut, Florida, Idaho, Illinois, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Virginia, Washington, West Virginia, Wisconsin, the District of Columbia, and several municipalities or water providers from various states who direct-filed complaints in South Carolina. The vast majority of these cases have been transferred to or directly filed in the MDL, and it is anticipated that the remaining cases will be transferred to the MDL. These municipal plaintiffs generally allege that the use of the defendants’ fire-fighting foam products at fire training academies, municipal airports, Air National Guard bases, or Navy or Air Force bases released PFOS and PFOA into public water supply wells, allegedly requiring remediation of public property.

Tyco and Chemguard are also periodically notified by other municipal entities that those entities may assert claims regarding PFOS and/or PFOA contamination allegedly resulting from the use of AFFF.

State or U.S. Territory Attorneys General Litigation related to AFFF

In June 2018, the State of New York filed a lawsuit in New York state court (*State of New York v. The 3M Company et al* No. 904029-18 (N.Y. Sup. Ct., Albany County)) against a number of manufacturers, including affiliates of the Company, with respect to alleged PFOS and PFOA contamination purportedly resulting from firefighting foams used at locations across New York, including Stewart Air National Guard Base in Newburgh and Gabreski Air National Guard Base in Southampton, Plattsburgh Air Force Base in Plattsburgh, Griffiss Air Force Base in Rome, and unspecified “other” sites throughout the State. The lawsuit seeks to recover costs and natural resource damages associated with contamination at these sites. This suit has been removed to the United States District Court for the Northern District of New York and transferred to the MDL.

In February 2019, the State of New York filed a second lawsuit in New York state court (*State of New York v. The 3M Company et al* (N.Y. Sup. Ct., Albany County)), against a number of manufacturers, including affiliates of the Company, with respect to alleged PFOS and PFOA contamination purportedly resulting from firefighting foams used at additional locations across New York. This suit has been removed to the United States District Court for the Northern District of New York and transferred to the MDL. In July 2019, the State of New York filed a third lawsuit in New York state court (*State of New York v. The 3M Company et al* (N.Y. Sup. Ct., Albany County)), against a number of manufacturers, including affiliates of the Company, with respect to alleged PFOS and PFOA contamination purportedly resulting from firefighting foams used at further additional locations across New York. This suit has been removed to the United States District Court for the Northern District of New York and transferred to the MDL. In November 2019, the State of New York filed a fourth lawsuit in New York state court (*State of New York v. The 3M Company et al* (N.Y. Sup. Ct., Albany County)), against a number of manufacturers, including affiliates of the Company, with respect to alleged PFOS and PFOA contamination purportedly resulting from firefighting foams used at further additional locations across New York. This suit has been removed to federal court and transferred to the MDL.

In January 2019, the State of Ohio filed a lawsuit in Ohio state court (*State of Ohio v. The 3M Company et al.*, No. G-4801-CI-021804752-000 (Court of Common Pleas of Lucas County, Ohio)) against a number of manufacturers, including affiliates of the Company, with respect to PFOS and PFOA contamination allegedly resulting from the use of firefighting foams at various specified and unspecified locations across Ohio. The lawsuit seeks to recover costs and natural resource damages associated with the contamination. This lawsuit has been removed to the United States District Court for the Northern District of Ohio and transferred to the MDL.

In addition, in May and June 2019, three other states filed lawsuits in their respective state courts against a number of manufacturers, including affiliates of the Company, with respect to PFOS and PFOA contamination allegedly resulting from the use of firefighting foams at various specified and unspecified locations across their jurisdictions (*State of New Hampshire v. The 3M Company et al.*; *State of Vermont v. The 3M Company et al.*; *State of New Jersey v. The 3M Company et al.*). All three of these suits have been removed to federal court and transferred to the MDL.

In September 2019, the government of Guam filed a lawsuit in the superior court of Guam against a number of manufacturers, including affiliates of the Company, with respect to PFOS and PFOA contamination allegedly resulting from the use of firefighting foams at various locations within its jurisdiction. This complaint has been removed to federal court and transferred to the MDL.

In November 2019, the government of the Commonwealth of the Northern Mariana Islands filed a lawsuit in the superior court of the Northern Mariana Islands against a number of manufacturers, including affiliates of the Company, with respect to PFOS and PFOA contamination allegedly resulting from the use of firefighting foams at various locations within its jurisdiction. This complaint has been removed to federal court and transferred to the MDL.

In August 2020, the Attorney General of the State of Michigan filed two substantially similar lawsuits—one in federal court and one in state court—against a number of manufacturers, including affiliates of the Company, with respect to PFOS and PFOA contamination allegedly resulting from the use of firefighting foams at various locations within the State. The federal action has been transferred to the MDL, and the state court action has been removed to federal court and transferred to the MDL.

In December 2020, the State of Mississippi filed a lawsuit against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage of the State's land and natural resources allegedly resulting from the use of firefighting foams at various locations throughout the State. This complaint was direct-filed in the MDL in South Carolina.

In April 2021, the State of Alaska filed a lawsuit in the superior court of the State of Alaska against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage of the State's land and natural resources allegedly resulting from the use of firefighting foams at various locations throughout the State. The State's case has been removed to federal court and transferred to the MDL. The State of Alaska has also named a number of manufacturers and other defendants, including affiliates of the Company, as third-party defendants in two cases brought by individuals against the State. These two cases have also been transferred to the MDL.

In early November 2021, the Attorney General of the State of North Carolina filed four individual lawsuits in the superior courts of the State of North Carolina against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage of the State's land, natural resources, and property allegedly resulting from the use of firefighting foams at four separate locations throughout the State. These four cases have been removed to federal court and transferred to the MDL. In October 2022, the Attorney General filed two similar lawsuits in the superior courts of the State of North Carolina regarding alleged PFAS damages at two additional locations. It is anticipated that these two cases will be removed to federal court and transferred to the MDL.

In February 2022, the Attorney General of the State of Colorado filed a lawsuit in Colorado state court against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage of the State's land and natural resources, public health, and State property allegedly resulting from the use of firefighting foams at various locations throughout the State. This complaint has been removed to federal court and transferred to the MDL.

In April 2022, the Attorney General of the State of Florida filed a lawsuit in Florida state court against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage to the State's natural resources and public health allegedly resulting from the use of firefighting foams at various locations throughout the State. It is anticipated that this complaint will be removed to federal court and transferred to the MDL.

In May 2022, the Attorney General of the Commonwealth of Massachusetts filed a lawsuit against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage of the State's natural resources, property, residents, and consumers allegedly resulting from the use of firefighting foams at various locations throughout the State. This complaint was direct-filed in the MDL in South Carolina.

In July 2022, the Attorney General of the State of Wisconsin filed a lawsuit in Wisconsin state court against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFAS damage to the State's natural

resources and public health allegedly resulting, in part, from the use of firefighting foams at various locations throughout the State. This complaint has been removed to federal court and tagged for transfer to the MDL. The Attorney General has opposed transfer, and the parties are awaiting a decision from the JPML.

In November 2022, the Attorney General of the State of California filed a lawsuit in California state court against a number of manufacturers and other defendants, including affiliates of the Company, with respect to PFOS and PFOA damage of the State's land and natural resources allegedly resulting from the manufacture, use, marketing, or sale of PFAS-containing products, including firefighting foams, at various locations throughout the State. It is anticipated that this case will be removed to federal court and transferred to the MDL.

Other AFFF Related Matters

In March 2020, the Kalispel Tribe of Indians (a federally recognized Tribe) and two tribal corporations filed a lawsuit in the United States District Court for the Eastern District of Washington against a number of manufacturers, including affiliates of the Company, and the United States with respect to PFAS contamination allegedly resulting from the use and disposal of AFFF by the United States Air Force at and around Fairchild Air Force Base in eastern Washington. This case has been transferred to the MDL.

In October 2022, the Red Cliff Band of Lake Superior Chippewa Indians (a federally recognized tribe) filed a lawsuit in the United States District Court for the Western District of Wisconsin against a number of manufacturers, including affiliates of the Company, with respect to PFAS contamination allegedly resulting from the use and disposal of AFFF at Duluth Air National Guard Base in Duluth, Minnesota. This complaint has been transferred to the MDL.

The Company is vigorously defending the above matters and believes that it has meritorious defenses to class certification and the claims asserted, including statutes of limitations, the government contractor defense, various medical and scientific defenses, and other factual and legal defenses. The government contractor defense is a form of immunity available to government contractors that produced products for the United States government pursuant to the government's specifications. In September 2022, the AFFF MDL Court declined to grant summary judgment on the government contractor defense, ruling that various factual issues relevant to the defense must be decided by a jury rather than the Court. Tyco and Chemguard have insurance that has been in place for many years and the Company is pursuing this coverage for these matters. However, there are numerous factual and legal issues to be resolved in connection with these claims, and it is extremely difficult to predict the outcome or ultimate financial exposure, if any, represented by these matters, and there can be no assurance that any such exposure will not be material.

Asbestos Matters

The Company and certain of its subsidiaries, along with numerous other third parties, are named as defendants in personal injury lawsuits based on alleged exposure to asbestos containing materials. These cases have typically involved product liability claims based primarily on allegations of manufacture, sale or distribution of industrial products that either contained asbestos or were used with asbestos containing components.

The Company estimates the asbestos-related liability for pending and future claims and related defense costs on a discounted basis. In connection with the recognition of liabilities for asbestos-related matters, the Company records asbestos-related insurance recoveries that are probable.

The following table presents the location and amount of asbestos-related assets and liabilities in the Company's consolidated statements of financial position (in millions):

	September 30,	
	2022	2021
Other current liabilities	\$ 58	\$ 58
Other noncurrent liabilities	380	400
Total asbestos-related liabilities	438	458
Other current assets	37	13
Other noncurrent assets	263	365
Total asbestos-related assets	300	378
Net asbestos-related liabilities	\$ 138	\$ 80

The following table presents the components of asbestos-related assets (in millions):

	September 30,	
	2022	2021
Restricted		
Cash	\$ 6	\$ 6
Investments	239	314
Total restricted assets	245	320
Insurance recoveries for asbestos-related liabilities	55	58
Total asbestos-related assets	\$ 300	\$ 378

The Company's estimate of the liability and corresponding insurance recovery for pending and future claims and defense costs is based on the Company's historical claim experience, and estimates of the number and resolution cost of potential future claims that may be filed and is discounted to present value from 2068 (which is the Company's reasonable best estimate of the actuarially determined time period through which asbestos-related claims will be paid by Company affiliates). Estimated asbestos-related defense costs are included in the asbestos liability. The Company's legal strategy for resolving claims also impacts these estimates. The Company considers various trends and developments in evaluating the period of time (the look-back period) over which historical claim and settlement experience is used to estimate and value claims reasonably projected to be paid through 2068. At least annually, the Company assesses the sufficiency of its estimated liability for pending and future claims and defense costs by evaluating actual experience regarding claims filed, settled and dismissed, and amounts paid in settlements. In addition to claims and settlement experience, the Company considers additional quantitative and qualitative factors such as changes in legislation, the legal environment, and the Company's defense strategy. The Company also evaluates the recoverability of its insurance receivable on an annual basis. The Company evaluates all of these factors and determines whether a change in the estimate of its liability for pending and future claims and defense costs or insurance receivable is warranted.

The amounts recorded by the Company for asbestos-related liabilities and insurance-related assets are based on the Company's strategies for resolving its asbestos claims, currently available information, and a number of estimates and assumptions. Key variables and assumptions include the number and type of new claims that are filed each year, the average cost of resolution of claims, the identity of defendants, the resolution of coverage issues with insurance carriers, amount of insurance, and the solvency risk with respect to the Company's insurance carriers. Many of these factors are closely linked, such that a change in one variable or assumption may impact one or more of the others, and no single variable or assumption predominately influences the determination of the Company's asbestos-related liabilities and insurance-related assets. Furthermore, predictions with respect to these variables are subject to greater uncertainty in the later portion of the projection period. Other factors that may affect the Company's liability and cash payments for asbestos-related matters include uncertainties surrounding the litigation process from jurisdiction to jurisdiction and from case to case, reforms of state or federal tort legislation and the applicability of insurance policies among subsidiaries. As a result, actual liabilities or insurance recoveries could be significantly higher or lower than those recorded if assumptions used in the Company's calculations vary significantly from actual results.

Insurable Liabilities

The Company records liabilities for its workers' compensation, product, general and auto liabilities. The determination of these liabilities and related expenses is dependent on claims experience. For most of these liabilities, claims incurred but not yet reported are estimated by utilizing actuarial valuations based upon historical claims experience. The Company maintains captive insurance companies to manage its insurable liabilities.

The following table presents the location and amount of insurable liabilities in the Company's consolidated statements of financial position (in millions):

	September 30,	
	2022	2021
Other current liabilities	\$ 89	\$ 77
Accrued compensation and benefits	22	22
Other noncurrent liabilities	230	226
Total insurable liabilities	<u>\$ 341</u>	<u>\$ 325</u>

The following table presents the location and amount of insurable receivables in the Company's consolidated statements of financial position (in millions):

	September 30,	
	2022	2021
Other current assets	\$ 10	\$ 5
Other noncurrent assets	20	15
Total insurable receivables	<u>\$ 30</u>	<u>\$ 20</u>

Other Matters

The Company is involved in various lawsuits, claims and proceedings incident to the operation of its businesses, including those pertaining to product liability, environmental, safety and health, intellectual property, employment, commercial and contractual matters, and various other casualty matters. Although the outcome of litigation cannot be predicted with certainty and some lawsuits, claims or proceedings may be disposed of unfavorably to us, it is management's opinion that none of these will have a material adverse effect on the Company's financial position, results of operations or cash flows. Costs related to such matters were not material to the periods presented.

22. SUBSEQUENT EVENTS

In October 2022, the Company acquired Rescue Air Systems, a leading provider of firefighter air replenishment systems, for \$100 million to enhance its Fire Suppression portfolio.

In October 2022, the Company repaid a €200 million (\$196 million as of September 30, 2022) term loan with an interest rate of EURIBOR plus 0.5% and entered into a €150 million term loan with an interest rate of EURIBOR plus 0.7% which is due in April 2024.

In October 2022, a third party warehouse in Menominee, Michigan, at which the Company stores certain Global Products inventory related to its fire suppression business, was severely damaged by a fire. The fire originated at an adjacent location not owned or operated by the Company. The Company is evaluating the losses incurred, including inventory and other assets that were damaged or destroyed, as well as expected lost revenues and profits due to the business interruption. The Company believes losses will be at least partially covered by insurance and also plans to seek recovery from the responsible parties. The Company expects the majority of the financial impact will be recognized in the first quarter of fiscal 2023. Based on the current evaluation, the Company believes the warehouse fire will not have a material impact on fiscal 2023 financial results, financial position or cash flows.

JOHNSON CONTROLS INTERNATIONAL PLC AND SUBSIDIARIES
SCHEDULE II - VALUATION AND QUALIFYING ACCOUNTS
(In millions)

	Year Ended September 30,		
	2022	2021	2020
<u>Accounts Receivable - Allowance for Expected Credit Losses</u> ⁽¹⁾			
Balance at beginning of period	\$ 110	\$ 173	\$ 173
Provision (income) charged to costs and expenses	(2)	(3)	20
Accounts charged off, net of recoveries	(38)	(65)	(21)
Currency translation	(3)	1	1
Other	(5)	4	—
Balance at end of period	<u>\$ 62</u>	<u>\$ 110</u>	<u>\$ 173</u>
<u>Deferred Tax Assets - Valuation Allowance</u>			
Balance at beginning of period	\$ 5,853	\$ 5,518	\$ 5,068
Allowance provision for new operating and other loss carryforwards	326	505	624
Allowance held for sale	(8)	—	—
Allowance benefits	(204)	(170)	(174)
Balance at end of period	<u>\$ 5,967</u>	<u>\$ 5,853</u>	<u>\$ 5,518</u>

⁽¹⁾ Allowance for doubtful accounts as of September 30, 2020, prior to the adoption of ASU 2016-13.

ITEM 9 **CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE**

None.

ITEM 9A **CONTROLS AND PROCEDURES**

Disclosure Controls and Procedures

The Company's management, with the participation of the Company's Chief Executive Officer and Chief Financial Officer, has evaluated the effectiveness of the Company's disclosure controls and procedures (as such term is defined in Rule 13a-15(e) under the Securities Exchange Act of 1934, as amended (the "Exchange Act")) as of the end of the period covered by this report. Based on such evaluations, the Company's Chief Executive Officer and Chief Financial Officer have concluded that, as of the end of such period, the Company's disclosure controls and procedures are effective in recording, processing, summarizing, and reporting, on a timely basis, information required to be disclosed by the Company in the reports that it files or submits under the Exchange Act, and that information is accumulated and communicated to the Company's management, including the Company's Chief Executive Officer and Chief Financial Officer, as appropriate, to allow timely decisions regarding required disclosure.

Management's Report on Internal Control Over Financial Reporting

The Company's management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rule 13a-15(f). The Company's management, with the participation of the Company's Chief Executive Officer and Chief Financial Officer, has evaluated the effectiveness of the Company's internal control over financial reporting based on the framework in Internal Control-Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on this evaluation, the Company's management has concluded that, as of September 30, 2022, the Company's internal control over financial reporting was effective.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

PricewaterhouseCoopers LLP, an independent registered public accounting firm, has audited the Company's consolidated financial statements and the effectiveness of internal control over financial reporting as of September 30, 2022 as stated in its report which is included in Item 8 of this Form 10-K and is incorporated by reference herein.

Changes in Internal Control Over Financial Reporting

There have been no changes in the Company's internal control over financial reporting during the quarter ended September 30, 2022, that have materially affected, or are reasonably likely to materially affect, the Company's internal control over financial reporting.

ITEM 9B OTHER INFORMATION

None.

ITEM 9C DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

None.

PART III

In response to Part III, Items 10, 11, 12, 13 and 14, parts of the Company's definitive proxy statement (to be filed pursuant to Regulation 14A within 120 days after Registrant's fiscal year-end of September 30, 2022) for its annual meeting to be held on March 8, 2023, are incorporated by reference in this Form 10-K.

ITEM 10 DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information relating to directors and nominees of Johnson Controls is set forth under the caption "Proposal Number One" in Johnson Controls' proxy statement for its annual meeting of shareholders to be held on March 8, 2023 (the "Johnson Controls Proxy Statement") and is incorporated by reference herein. Information about executive officers is included in Part I, Item 4 of this Annual Report on Form 10-K. The information required by Items 405, 407(c)(3), (d)(4) and (d)(5) of Regulation S-K is contained under the captions "Governance of the Company - Nomination of Directors and Board Diversity," "Governance of the Company - Board Committees", and "Committees of the Board - Audit Committee" of the Johnson Controls Proxy Statement and such information is incorporated by reference herein.

Code of Ethics

Johnson Controls has adopted a code of ethics for directors, officers (including the Company's principal executive officer, principal financial officer and principal accounting officer) and employees, known as Values First, The Johnson Controls Code of Ethics. The Code of Ethics is available on the Company's website at www.valuesfirst.johnsoncontrols.com. The Company posts any amendments to or waivers of its Code of Ethics (to the extent applicable to the Company's directors or executive officers) at the same location on the Company's website. In addition, copies of the Code of Ethics may be obtained in print without charge upon written request by any stockholder to the office of the Company at One Albert Quay, Cork, Ireland.

ITEM 11 EXECUTIVE COMPENSATION

The information required by Item 402 of Regulation S-K is contained under the captions "Compensation Discussion & Analysis" (excluding the information under the caption "Compensation Committee Report on Executive Compensation"), "Executive Compensation Tables" and "Compensation of Non-Employee Directors" of the Johnson Controls Proxy Statement. Such information is incorporated by reference.

The information required by Items 407(e)(4) and (e)(5) of Regulation S-K is contained under the captions "Committees of the Board - Compensation Committee Interlocks and Insider Participation" and "Compensation Discussion & Analysis - Compensation Committee Report on Executive Compensation" of the Johnson Controls Proxy Statement. Such information (other than the Compensation Committee Report on Executive Compensation, which shall not be deemed to be "filed") is incorporated by reference.

ITEM 12 **SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS**

The information in the Johnson Controls Proxy Statement set forth under the caption "Security Ownership of Certain Beneficial Owners and Management" is incorporated herein by reference.

On March 10, 2021, the shareholders of the Company approved the Johnson Controls International plc 2021 Equity and Incentive Plan, which terminated the Johnson Controls International plc 2012 Share and Incentive Plan, as amended in September 2016 (collectively, the "Plans"). Both Plans authorize stock options, stock appreciation rights, restricted (non-vested) stock/units, performance shares, performance units and other stock-based awards. The Compensation and Talent Development Committee of the Company's Board of Directors determines the types of awards to be granted to individual participants and the terms and conditions of the awards.

The following table provides information about the Company's equity compensation plans as of September 30, 2022:

	(a)	(b)	(c)
<u>Plan Category</u>	<u>Number of Securities to be Issued upon Exercise of Outstanding Options, Warrants and Rights</u>	<u>Weighted-Average Exercise Price of Outstanding Options, Warrants and Rights</u>	<u>Number of Securities Remaining Available for Future Issuance Under Equity Compensation Plans (Excluding Securities Reflected in Column (a))</u>
Equity compensation plans approved by shareholders	5,683,847	\$ 42.46	53,652,821
Equity compensation plans not approved by shareholders	—	—	—
Total	<u>5,683,847</u>	<u>\$ 42.46</u>	<u>53,652,821</u>

ITEM 13 **CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE**

The information in the Johnson Controls Proxy Statement set forth under the captions "Committees of the Board," "Governance of the Company - Director Independence," and "Governance of the Company - Other Directorships, Conflicts and Related Party Transactions," is incorporated herein by reference.

ITEM 14 **PRINCIPAL ACCOUNTING FEES AND SERVICES**

The information in the Johnson Controls Proxy Statement set forth under "Proposal Number Two" related to the appointment of auditors is incorporated herein by reference.

PART IV

ITEM 15 **EXHIBITS, FINANCIAL STATEMENT SCHEDULES**

Page in
Form 10-K

(a) The following documents are filed as part of this Form 10-K:

(1) Financial Statements

Report of Independent Registered Public Accounting Firm	47
Consolidated Statements of Income for the years ended September 30, 2022, 2021 and 2020	50
Consolidated Statements of Comprehensive Income for the years ended September 30, 2022, 2021 and 2020	51
Consolidated Statements of Financial Position at September 30, 2022 and 2021	52
Consolidated Statements of Cash Flows for the years ended September 30, 2022, 2021 and 2020	53
Consolidated Statements of Shareholders' Equity for the years ended September 30, 2022, 2021 and 2020	54
Notes to Consolidated Financial Statements	55

(2) Financial Statement Schedule

For the years ended September 30, 2022, 2021 and 2020:

Schedule II - Valuation and Qualifying Accounts	109
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(3) Exhibits

Reference is made to the separate exhibit index contained on page 113 filed herewith.

All other schedules are omitted because they are not applicable, or the required information is shown in the financial statements or notes thereto.

Financial statements of 50% or less-owned companies have been omitted because the proportionate share of their revenue or profit before income taxes is individually less than 20% of the respective consolidated amounts and investments in such companies are less than 20% of consolidated total assets.

ITEM 16 **FORM 10-K SUMMARY**

Not applicable.

Johnson Controls International plc
Index to Exhibits

- (a) (1) and (2) Financial Statements and Supplementary Data - See Item 8
(b) Exhibit Index:

Exhibit	Title
2.1	<u>Separation and Distribution Agreement, dated as of September 8, 2016, by and between Johnson Controls International plc and Adient Limited (incorporated by reference to Exhibit 2.1 to the registrant's Current Report on Form 8-K filed September 9, 2016)</u>
2.2	<u>Agreement and Plan of Merger by and among Johnson Controls, Inc., Johnson Controls International plc (formerly Tyco International plc) and Jagara Merger Sub LLC, dated as of January 24, 2016 (incorporated by reference to Exhibit 2.1 to the registrant's Current Report on Form 8-K filed January 27, 2016)</u>
2.3	<u>Merger Agreement, dated as of May 30, 2014, between Tyco International Ltd., and Johnson Controls International plc (formerly Tyco International plc) (incorporated by reference to Exhibit 2.1 to the registrant's Current Report on Form 8-K filed on June 4, 2014)</u>
3.1	<u>Memorandum and Articles of Association of Johnson Controls International plc, as amended by special resolutions dated September 8, 2014, August 17, 2016 and March 7, 2018 (incorporated by reference to Exhibit 3.1 to the registrant's Quarterly Report on Form 10-Q filed on May 3, 2018)</u>
4.1	<u>Indenture, dated December 28, 2016, between Johnson Controls International plc and U.S. Bank National Association, as trustee (incorporated by reference to Exhibit 4.1 to the registrant's current report on Form 8-K filed on December 28, 2016)</u>
4.2	<u>First Supplemental Indenture, dated December 28, 2016, between Johnson Controls International plc, and U.S. Bank National Association, as trustee, and Elavon Financial Services DAC, UK Branch, as paying agent for the New Euro Notes attaching forms of 2.355% Senior Notes due 2017 (retired; no longer outstanding), 7.125% Senior Notes due 2017 (retired; no longer outstanding), 1.400% Senior Notes due 2017 (retired; no longer outstanding), 3.750% Notes due 2018 (retired; no longer outstanding), 5.000% Senior Notes due 2020 (retired; no longer outstanding), 4.25% Senior Notes due 2021 (retired; no longer outstanding), 3.750% Senior Notes due 2021 (retired; no longer outstanding), 3.625% Senior Notes due 2024, 6.000% Notes due 2036, 5.70% Senior Notes due 2041, 5.250% Senior Notes due 2041, 4.625% Senior Notes due 2044, 6.950% Debentures due December 1, 2045, 4.950% Senior Notes due 2064, 4.625% Notes due 2023, 1.375% Notes due 2025, 3.900% Notes due 2026, and 5.125% Notes due 2045 (incorporated by reference to Exhibit 4.2 to the registrant's current report on Form 8-K filed on December 28, 2016)</u>
4.3	<u>Second Supplemental Indenture, dated February 7, 2017, between Johnson Controls International plc and U.S. Bank National Association, as trustee, attaching form of 4.500% Senior Notes due 2047 (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on February 7, 2017)</u>
4.4	<u>Third Supplemental Indenture, dated March 15, 2017, among Johnson Controls International plc, U.S. Bank National Association, as trustee and Elavon Financial Services DAC, UK Branch, as paying agent, attaching form of 1.000% Senior Notes due 2023 (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on March 15, 2017)</u>
4.5	<u>Fifth Supplemental Indenture, dated September 11, 2020, among Johnson Controls International plc, Tyco Fire & Security Finance S.C.A. and U.S. Bank National Association, as trustee, attaching form of the 1.750% Senior Notes due 2030 (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on September 11, 2020)</u>
4.6	<u>Sixth Supplemental Indenture, dated September 15, 2020, among Johnson Controls International plc, Tyco Fire & Security Finance S.C.A., U.S. Bank National Association, as trustee, and Elavon Financial Services DAC, as paying agent, attaching forms of the 0.375% Senior Notes due 2027 and the 1.000% Senior Notes due 2032 (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on September 15, 2020)</u>

Johnson Controls International plc
Index to Exhibits

Exhibit	Title
4.7	<u>Seventh Supplemental Indenture, dated September 16, 2021, among Johnson Controls International plc, Tyco Fire & Security Finance S.C.A. and U.S. Bank National Association, as trustee, attaching form of the 2.000% Sustainability-Linked Senior Notes due 2031 (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on September 16, 2021)</u>
4.8	<u>Eighth Supplemental Indenture, dated as of September 7, 2022, among Johnson Controls International plc, Tyco Fire & Security Finance S.C.A., U.S. Bank Trust Company, National Association, as trustee and Elavon Financial Services DAC, as paying agent attaching form of the 3.000% Senior Notes due 2028 (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on September 7, 2022)</u>
4.9	<u>Ninth Supplemental Indenture, dated as of September 14, 2022, among Johnson Controls International plc, Tyco Fire & Security Finance S.C.A. and U.S. Bank Trust Company, National Association, as trustee (attaching form of the 4.900% Senior Notes due 2032). (incorporated by reference to Exhibit 4.2 to the registrant's Current Report on Form 8-K filed on September 14, 2022)</u>
4.10	<u>Description of the Ordinary Shares of Johnson Controls International plc (filed herewith)</u>
4.11	<u>Description of the Johnson Controls International plc Notes (filed herewith)</u>
4.12	<u>Description of the Johnson Controls International plc and Tyco Fire & Security Finance S.C.A. Notes (filed herewith)</u>
4.13	Miscellaneous long-term debt agreements and financing leases with banks and other creditors and debenture indentures.*
4.14	Miscellaneous industrial development bond long-term debt issues and related loan agreements and leases.*
10.1	<u>Credit Agreement, dated as of December 5, 2019, among Johnson Controls International plc, certain of its subsidiaries party thereto from time to time, the lenders party thereto from time to time, and JPMorgan Chase Bank, N.A., as administrative agent (incorporated by reference to Exhibit 10.1 to the registrant's Current Report filed December 6, 2019)</u>
10.2	<u>Amendment to Credit Agreement, dated as of December 2, 2021, by and between Johnson Controls International plc, and JPMorgan Chase Bank, N.A., as administrative agent (incorporated by reference to Exhibit 10.1 to the registrant's Quarterly Report on Form 10-Q filed February 2, 2022)</u>
10.3	<u>Amendment to Credit Agreement, dated as of May 25, 2021, by and between Johnson Controls International plc, and JPMorgan Chase Bank, N.A., as administrative agent (incorporated by reference to Exhibit 10.2 to the registrant's Quarterly Report on Form 10-Q filed February 2, 2022)</u>
10.4	<u>Tax Matters Agreement, dated as of September 8, 2016, by and between Johnson Controls International plc and Adient Limited (incorporated by reference to Exhibit 10.2 to the registrant's Current Report on Form 8-K filed on September 9, 2016)</u>
10.5	<u>Employee Matters Agreement, dated as of September 8, 2016, by and between Johnson Controls International plc and Adient Limited (incorporated by reference to Exhibit 10.3 to the registrant's Current Report on Form 8-K filed on September 9, 2016)</u>
10.6	<u>Tax Sharing Agreement, dated September 28, 2012 by and among Pentair Ltd., Johnson Controls International plc (formerly Tyco International Ltd.), Tyco International Finance S.A. and The ADT Corporation (incorporated by reference to Exhibit 10.1 to the registrant's Current Report on Form 8-K filed on October 1, 2012) (Commission File No. 1-13836)</u>

Johnson Controls International plc

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Exhibit	Title
10.7	<u>Non-Income Tax Sharing Agreement dated September 28, 2012 by and among Johnson Controls International plc (formerly Tyco International Ltd.), Tyco International Finance S.A. and The ADT Corporation (incorporated by reference to Exhibit 10.2 to the registrant's Current Report on Form 8-K filed on October 1, 2012) (Commission File No. 1-13836)</u>
10.8	<u>Trademark Agreement, dated as of September 25, 2012, by and among ADT Services GmbH, ADT US Holdings, Inc., Johnson Controls International plc (formerly Tyco International Ltd.) and The ADT Corporation (incorporated by reference to Exhibit 10.3 to the registrant's Current Report on Form 8-K filed on October 1, 2012) (Commission File No. 1-13836)</u>
10.9	<u>Form of Deed of Indemnification between Johnson Controls International plc (formerly Tyco International plc) and certain of its directors and officers (incorporated by reference to Exhibit 10.4 to the registrant's Current Report on Form 8-K filed on September 6, 2016)</u>
10.10	<u>Form of Indemnification Agreement between Tyco Fire & Security (US) Management, Inc. and certain directors and officers of Johnson Controls International plc (incorporated by reference to Exhibit 10.5 to the registrant's Current Report on Form 8-K filed on September 6, 2016)</u>
10.11	<u>Johnson Controls International plc 2012 Share and Incentive Plan, amended and restated as of March 8, 2017 (incorporated by reference to Exhibit 10.2 to the registrant's Quarterly Report on Form 10-Q filed on May 4, 2017)**</u>
10.12	<u>Johnson Controls International plc 2007 Stock Option Plan (incorporated by reference to Exhibit 10.7 to the registrant's Current Report on Form 8-K filed on September 6, 2016)**</u>
10.13	<u>Johnson Controls International plc 2012 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.6 to the registrant's Current Report on Form 8-K filed on September 6, 2016)**</u>
10.14	<u>Johnson Controls International plc 2021 Equity and Incentive Plan (incorporated by reference to Annex B to the registrant's Definitive Proxy Statement on Schedule 14A filed on January 22, 2021)**</u>
10.15	<u>Johnson Controls International plc Severance and Change in Control Policy for Officers, amended and restated March 11, 2021 (Incorporated by reference to Exhibit 10.4 to the registrant's Quarterly Report on Form 10-Q filed on April 30, 2021)**</u>
10.16	<u>Johnson Controls International plc Executive Deferred Compensation Plan, as amended and restated March 11, 2021 (Incorporated by reference to Exhibit 10.5 to the registrant's Quarterly Report on Form 10-Q filed on April 30, 2021)**</u>
10.17	<u>Johnson Controls International plc Retirement Restoration Plan, as amended and restated March 11, 2021 (incorporated by reference to Exhibit 10.7 to the registrant's Quarterly Report on Form 10-Q filed on April 30, 2021)**</u>
10.18	<u>Tyco Supplemental Savings and Retirement Plan as amended and restated effective January 1, 2018 (incorporated by reference to Exhibit 10.2 to the registrant's Current Report on Form 8-K filed on September 19, 2017)**</u>
10.19	<u>Johnson Controls International plc Executive Compensation Incentive Recoupment Policy effective December 10, 2020 (incorporated by reference to Exhibit 10.3 to the registrant's Quarterly Report on Form 10-Q filed on January 29, 2021)**</u>
10.20	<u>Letter Agreement between Johnson Controls International plc and George R. Oliver dated December 8, 2017 (Incorporated by reference to Exhibit 10.1 to the registrant's Current Report on Form 8-K filed on December 11, 2017)**</u>

Johnson Controls International plc

Index to Exhibits

Exhibit	Title
10.21	<u>Form of terms and conditions for Option / SAR Awards, Restricted Stock / Unit Awards, Performance Share Awards under the Johnson Controls International plc 2012 Share and Incentive Plan for periods commencing December 6, 2018 (incorporated by reference to Exhibit 10.2 to the registrant's Quarterly Report on Form 10-Q filed February 1, 2019)**</u>
10.22	<u>Form of terms and conditions for Option / SAR Awards, and Restricted Stock / Unit Awards, under the Johnson Controls International plc 2012 Share and Incentive Plan commencing December 6, 2018 applicable to Mr. Stief (incorporated by reference to Exhibit 10.3 to the registrant's Quarterly Report on Form 10-Q filed February 1, 2019)**</u>
10.23	<u>Form of Option/SAR Award for Executive Officers (incorporated by reference to Exhibit 10.24 to the registrant's Annual Report on Form 10-K for the fiscal year ended September 30, 2019 filed on November 21, 2019)**</u>
10.24	<u>Form of terms and conditions for Option / SAR Awards, Restricted Stock / Unit Awards, Performance Share Awards under the Johnson Controls International plc 2012 Share and Incentive Plan for fiscal 2018 (incorporated by reference to Exhibit 10.3 to the registrant's Quarterly Report on Form 10-Q filed on February 2, 2018)**</u>
10.25	<u>Form of terms and conditions for Option / SAR Awards, and Restricted Stock / Unit Awards, under the Johnson Controls International plc 2012 Share and Incentive Plan for fiscal 2018 applicable to Messrs. Oliver and Stief (incorporated by reference to Exhibit 10.4 to the registrant's Quarterly Report on Form 10-Q filed on February 2, 2018)**</u>
10.26	<u>Form of terms and conditions for Option / SAR Awards, Restricted Stock / Unit Awards, Performance Share Awards under the Johnson Controls International plc 2012 Share and Incentive Plan for periods commencing on September 2, 2016 (incorporated by reference to Exhibit 10.33 to the registrant's Annual Report on Form 10-K for the fiscal year ended September 30, 2016 filed on November 23, 2016)**</u>
10.28	<u>Form of terms and conditions for Option / SAR Awards, and Restricted Stock / Unit Awards, under the Johnson Controls International plc 2012 Share and Incentive Plan for periods commencing on September 2, 2016 applicable to Messrs. Molinaroli, Oliver and Stief (incorporated by reference to Exhibit 10.1 to the registrant's Quarterly Report on Form 10-Q filed on February 8, 2017)**</u>
10.28	<u>Form of terms and conditions for Option Awards, Restricted Unit Awards, Performance Share Awards under the 2012 Share and Incentive Plan for fiscal 2016 (incorporated by reference to Exhibit 10.2 to the registrant's Current Report on Form 8-K filed on October 13, 2015)**</u>
10.29	<u>Form of terms and conditions for Option Awards, Restricted Unit Awards, Performance Share Awards under the 2012 Stock and Incentive Plan for fiscal 2015 (incorporated by reference to Exhibit 10.9 to the registrant's Annual Report on Form 10-K for the fiscal year ended September 26, 2014 filed on November 14, 2014) (Commission File No. 1-13836)**</u>
10.30	<u>Form of terms and conditions for Option Awards, Restricted Unit Awards, Performance Share Awards under the 2012 Stock and Incentive Plan for fiscal 2014 (incorporated by reference to Exhibit 10.9 to the registrant's Annual Report on Form 10-K filed on for the year ended September 27, 2013 filed on November 14, 2013) (Commission File No. 1-13836)**</u>
10.31	<u>Johnson Controls, Inc. 2012 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1(a) to Johnson Controls, Inc.'s Current Report on Form 8-K filed January 28, 2013) (Commission File No. 1-5097)**</u>
10.32	<u>Form of option/stock appreciation right agreement for Johnson Controls, Inc. 2012 Omnibus Incentive Plan (incorporated by reference to Exhibit 10.1(c) to Johnson Controls, Inc.'s Current Report on Form 8-K filed November 21, 2013) (Commission File No. 1-5097)**</u>

Johnson Controls International plc
Index to Exhibits

Exhibit	Title
10.33	<u>Restrictive covenants applicable to equity award agreements beginning December 2019 (incorporated by reference to Exhibit 10.3 to the registrant's Quarterly Report on Form 10-Q filed on January 31, 2020)**</u>
10.34	<u>Form of terms and conditions for Option / SAR Awards, Restricted Stock / Unit Awards, Performance Share Awards under the Johnson Controls International plc 2012 Share and Incentive Plan for fiscal 2021 (incorporated by reference to Exhibit 10.1 to the registrant's Quarterly Report on Form 10-Q filed on January 29, 2021)**</u>
10.35	<u>Form of terms and conditions for Option / SAR Awards, Restricted Stock / Unit Awards, Performance Share Awards under the Johnson Controls International plc 2021 Equity and Incentive Plan (incorporated by reference to Exhibit 10.2 to the registrant's Quarterly Report on Form 10-Q filed on April 30, 2021)**</u>
10.36	<u>Form of terms and conditions for Restricted Stock Units for Directors under the Johnson Controls International plc 2021 Equity and Incentive Plan (incorporated by reference to Exhibit 10.3 to the registrant's Quarterly Report on Form 10-Q filed on April 30, 2021)**</u>
10.37	<u>Form of terms and conditions for Restricted Stock / Unit Awards under the Johnson Controls International plc 2021 Equity and Incentive Plan applicable to Ms. Schlitz (filed herewith)**</u>
21.1	<u>Subsidiaries of Johnson Controls International plc (filed herewith)</u>
22.1	<u>Co-Issuer of Debt Securities (filed herewith)</u>
23.1	<u>Consent of Independent Public Accounting Firm (filed herewith)</u>
31.1	<u>Certification by the Chief Executive Officer pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002 (filed herewith)</u>
31.2	<u>Certification by the Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002 (filed herewith)</u>
32.1	<u>Certification by the Chief Executive Officer and Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 (filed herewith)</u>
101	Financial statements from the Annual Report on Form 10-K of Johnson Controls International plc for the fiscal year ended September 30, 2022 formatted in iXBRL (Inline Extensible Business Reporting Language): (i) the Consolidated Statements of Financial Position, (ii) the Consolidated Statements of Income, (iii) the Consolidated Statements of Comprehensive Income, (iv) the Consolidated Statements of Cash Flow, (v) the Consolidated Statements of Shareholders' Equity and (vi) Notes to Consolidated Financial Statements (filed herewith)
*	These instruments are not being filed as exhibits herewith because none of the long-term debt instruments authorizes the issuance of debt in excess of 10% of the total assets of Johnson Controls International plc and its subsidiaries on a consolidated basis. Johnson Controls International plc agrees to furnish a copy of each agreement to the Securities and Exchange Commission upon request.
**	Management contract or compensatory plan.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

JOHNSON CONTROLS INTERNATIONAL PLC

By /s/ Olivier Leonetti
Olivier Leonetti
Executive Vice President and
Chief Financial Officer

Date: November 15, 2022

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below as of November 15, 2022, by the following persons on behalf of the registrant and in the capacities indicated:

/s/ George R. Oliver
George R. Oliver
Chairman and Chief Executive Officer
(Principal Executive Officer)

/s/ Olivier Leonetti
Olivier Leonetti
Executive Vice President and
Chief Financial Officer (Principal Financial Officer)

/s/ Daniel C. McConeghy
Daniel C. McConeghy
Vice President and Chief Accounting and Tax Officer
(Principal Accounting Officer)

/s/ Jean Blackwell
Jean Blackwell
Director

/s/ Pierre Cohade
Pierre Cohade
Director

/s/ Michael E. Daniels
Michael E. Daniels
Director

/s/ W. Roy Dunbar
W. Roy Dunbar
Director

/s/ Gretchen R. Haggerty
Gretchen R. Haggerty
Director

/s/ Simone Menne
Simone Menne
Director

/s/ Jürgen Tinggren
Jürgen Tinggren
Director

/s/ Mark P. Vergnano
Mark P. Vergnano
Director

/s/ R. David Yost
R. David Yost
Director

/s/ John D. Young
John D. Young
Director

CERTIFICATIONS

I, George R. Oliver, of Johnson Controls International plc, certify that:

1. I have reviewed this annual report on Form 10-K of Johnson Controls International plc;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - a. Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - c. Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of registrant's board of directors (or persons performing the equivalent functions):
 - a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - b. Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: November 15, 2022

/s/ George R. Oliver

George R. Oliver
Chairman and Chief Executive Officer

CERTIFICATIONS

I, Olivier Leonetti, of Johnson Controls International plc, certify that:

1. I have reviewed this annual report on Form 10-K of Johnson Controls International plc;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - a. Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b. Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - c. Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d. Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of registrant's board of directors (or persons performing the equivalent functions):
 - a. All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - b. Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: November 15, 2022

/s/ Olivier Leonetti

Olivier Leonetti
Executive Vice President and
Chief Financial Officer

CERTIFICATION OF PERIODIC FINANCIAL REPORTS

We, George R. Oliver and Olivier Leonetti, of Johnson Controls International plc, certify, pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that:

1. the Annual Report on Form 10-K for the year ended September 30, 2022 (Periodic Report) to which this statement is an exhibit fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m or 78o(d)) and
2. information contained in the Periodic Report fairly presents, in all material respects, the financial condition and results of operations of Johnson Controls International plc.

Date: November 15, 2022

/s/ George R. Oliver

George R. Oliver
Chairman and Chief Executive Officer

/s/ Olivier Leonetti

Olivier Leonetti
Executive Vice President and Chief Financial Officer