NREL National Renewable Energy Laboratory
Innovation for Our Energy Future

MEMO

DRAFT

Date: July 5th, 2009

To: Ann Beier and Andrea Luecke
Milwaukee Shines
City of Milwaukee, Wisconsin

From: Jason Coughlin
National Renewable Energy Laboratory

Re: Solar America Cities
Reviewing the City of Milwaukee's Solar Financing Options

There are many ways that a city can support photovoltaic (PV) and solar hot water (SHW) installations. A city can directly finance and own PV and SHW systems on public property or use third party finance structures for larger installations. A city can also support the development of programs that are focused on residential and commercial systems. In many cases, a city will pursue a variety of options. Regardless of the path chosen, consensus on the goals of the city's solar program and what is realistic in the current economic environment will dictate what is accomplished. This is especially true as it relates to the financing decisions that the city needs to make, both for systems it plans to own and operate, as well as for the level of financial support, if any, it will offer to homeowners and businesses.

The following memo is broken down into six sections. In section one, an introduction to PV technology and costs, solar resources, and financial incentives is provided. Section two covers similar topics as they relate to solar hot water systems. Section three explores the mechanisms that the City of Milwaukee can evaluate as a means to finance public sector solar installations. Section four is dedicated to the third party finance model using a Power Purchase Agreement. Section five discusses specific projects where the City has commissioned solar site assessments. Finally, section six examines the different roles the City can play to support the financing of residential and commercial installations.

The memo has been developed under the technical assistance award that the City of Milwaukee received when it was designated a 2008 Department of Energy Solar America City. The National Renewable Energy Laboratory (NREL) is the lead technical liaison with the City of Milwaukee and its Milwaukee Shines initiative.

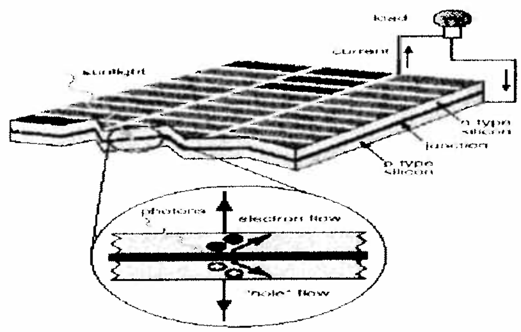
1617 Cole Blvd. • Golden, CO 80401-3393 • (303) 275-3000 • NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy operated by the Alliance for Sustainable Energy, LLC

1.0 Introduction to Photovoltaics

Although this is not a technical paper, a brief description of photovoltaic technology based on information available at NREL is presented below under the assumption that not all readers of this paper have a technical background. There are a number of technical reports available on the NREL website for those seeking more detailed information (www.nrel.gov).

1.1 Photovoltaics

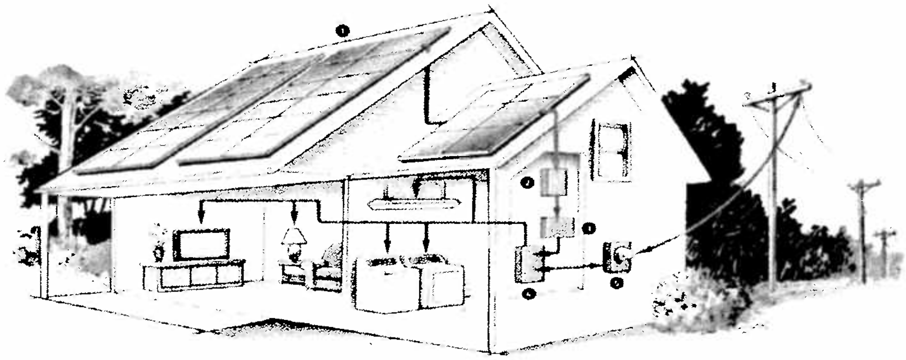
Solar cells, also called photovoltaics (PV), convert sunlight directly into electricity. Solar cells are often used to power calculators and watches. They are made of semi-conducting materials similar to those used in computer chips. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity. This process of converting light (photons) to electricity (voltage) is called the *photovoltaic (PV) effect.*



Solar cells are typically combined into modules that hold approximately 40 cells; about 10 of these modules are mounted in PV *arrays* that can measure up to several meters on a side. These *flat-plate* PV arrays can be mounted at a fixed angle facing south, or they can be mounted on a tracking device that follows the sun, allowing them to capture the most sunlight over the course of a day. About 10 to 20 PV arrays can provide enough power for a household; for large electric utility or industrial applications, hundreds of arrays can be interconnected to form a single, large PV system.

The performance of a solar cell is measured in terms of its efficiency at turning sunlight into electricity. Only sunlight of certain energies will work efficiently to create electricity, and much of it is reflected or absorbed by the material that makes up the cell. Because of this, a typical commercial solar cell has an efficiency of 15%—about one-sixth of the sunlight striking the cell generates electricity.

Grid-Tied Residential PV System



Steve Sanford
New York Times

Roof-mounted solar PV panels (1) generate electricity, which feeds into an array disconnect (2), that allows the electricity to be turned on or off. An inverter (3) converts DC electricity to AC, making it compatible with common 110-volt household appliances, before it passes through a circuit-breaker box (4). In a system like this one, excess electricity is returned to the utility grid (5); in many states, homeowners earn a bill credit to offset purchases from the utility.

1.2 Advantages and Disadvantages of PV

Installing PV systems to generate electricity has a number of advantages.

- PV can act as a hedge against increasing retail electricity costs as volatile fossil fuel prices create enormous uncertainty about future rates.
- PV is a local (non-imported) source of energy that does not produce greenhouse gas emissions when converted to electricity
- PV provides a source of local employment
- PV can offer emergency power benefits

Nonetheless, PV does have its disadvantages, such as;

- On a relative basis, it is more expensive, often even with subsidies, than traditional sources of electricity.
- Without storage, PV is not considered a base load source of power given that it is dependent on the time of day, the weather, and the season.
- The best solar resources are often far from electricity demand with inadequate transmission between the two locations.

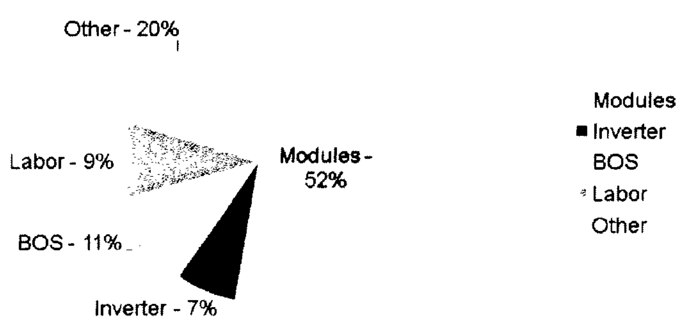
1.3 Costs of PV

As noted, solar electricity is still relatively expensive compared to other forms of traditional electricity, although costs are certainly dropping in the current environment given a mismatch between PV module supply and demand. On average, PV costs roughly 16-32¢ per kWh prior to any subsidies.[1] According to the Energy Information Administration, as of February 2009, the average cost of electricity in Wisconsin for residential, commercial and industrial users was 12.11¢, 9.66¢, and 6.77¢ per kWh respectively.[2] Thus, the disincentive to invest in PV is obvious given the significant difference in the cost of electricity on a per kWh basis.

In addition to evaluating costs on a cents per kWh basis, we can also look at them from the perspective of how much per watt does it cost to install a PV system. While the cost will vary according to local market conditions (access to PV panels, the number of qualified installers, etc.), in general terms, larger systems will cost approximately $6.50 - $8.00/watt whereas smaller systems for residential and small commercial applications (<10 kW) can cost upwards of $8 - $10/watt. Therefore if the City of Milwaukee were to install a large 1 MW system on a water treatment facility, the installed cost could be in the neighborhood of $8 million dollars before incentives are factored in. A Milwaukee homeowner is facing a cost of as much as $40,000 for a 4 kW residential rooftop system; again before incentives. Fortunately, in Milwaukee, there *are* incentives available to lower the cost to both the city and the homeowner, and these are discussed throughout this paper.

To further dissect the elements of the cost of a PV system, we can refer to a recently published report. In February 2009, Lawrence Berkeley National Laboratory (LBNL) published the results of its research which analyzed the PV market over a 10 year period (1998-2007), including a breakdown of the costs of a PV system.[3] As seen from the pie chart, clearly PV modules constitute the primary expenditure within the overall cost of a PV system which is why reducing the production cost of the modules can have such an impact on overall costs. BOS refers to "balance of system" which would include wiring, clamps, racking systems, etc. Administrative costs, filing for permits, and applying for rebates would be some of the costs captured in the "other" category.

Cost of PV System



Source: LBNL February 2009

[1] Solar America Initiative. Department of Energy http://www1.eere.energy.gov/solar/solar_america/pdfs/41786.pdf

[2] Electric Power Monthly (EIA) Average Retail Price of Electricity to Ultimate Customer http://www.eia.doe.gov/cneaf/electricity/epm/table5_6

[3] Tracking the Sun. The installed cost of Photovoltaics from 1998-2007. Wiser, R, G. Barbose, and C. Peterman. February 2009. http://eetd.lbl.gov/ea/ems/reports/lbnl-1516e-ppt.pdf

1.4 Solar Resources for PV in Milwaukee

Solar resources vary from region to region on account of latitude and climate. It is obvious that Milwaukee's solar resources do not compare favorably to those in the Southwest. NREL's solar maps illustrate that Milwaukee has average solar resources in the range of 4 $kWh/m^2/day$ compared to areas in the southwestern US with resources in excess of 7 $kWh/m^2/day$.[4] This does not mean however that solar energy doesn't make sense in Milwaukee. Another way to evaluate Milwaukee's solar resources is to compare them with cities and states that have a greater level of installed capacity of PV. In the following chart, representational cities from the 10 states with the highest level of installed PV capacity in the U.S. (as of 12/08) are compared to Milwaukee for a hypothetical 4 kW PV system. Where possible, other Solar America Cities were chosen. In addition, the average cost of electricity as of February 2009 for these states is listed as well.

2008 Ranking[5]	State	Installed Capacity (MW)	Representative City	Annual solar resources (kWh)	Average Retail Price All Sectors (¢/kWh)[6]
1	California	178.6	Sacramento	5,597	12.54
2	New Jersey	22.5	Newark	4,732	14.56
3	Colorado	21.6	Boulder	5,834	7.68
4	Nevada	14.9	Reno	6,135	9.68
5	Hawaii	11.3	Honolulu	5,840	21.71
6	New York	7.0	New York City	4,874	15.54
7	Arizona	6.4	Tucson	6,651	8.55
8	Connecticut	5.3	Hartford	4,627	17.44
9	Oregon	4.7	Portland	4,071	7.63
10	North Carolina	4.0	Raleigh	5,249	8.43
	Wisconsin		**Milwaukee**	**4,910**	**9.63**
	National Avg.				**9.79**

As one would expect, Milwaukee's solar resources are not as attractive as many of the states leading the nation in installed PV capacity. However, Milwaukee does have better solar resources than four of the top ten referenced cities. As illustrated in the table, there is no correlation within the list between rank and annual solar resources. New Jersey jumps out as the best example of a state with moderate solar resources but with a relatively high level of installed capacity. In fact, using PVWatts, Newark's average annual solar resources are actually 4% <u>less</u> than Milwaukee. In addition, if solar resources were the primary driver of installed PV capacity, one would expect to see New Mexico and Utah in the top ten list as well.

---

[4] Photovoltaic Solar Resource Map (NREL) http://www.nrel.gov/gis/images/map_pv_us_annual10km_dec2008.jpg

[5] 2008 Solar Year in Review http://www.seia.org/galleries/pdf/2008_Year_in_Review-small.pdf

[6] Electric Power Monthly (EIA) Average Retail Price of Electricity to Ultimate Customer http://www.eia.doe.gov/cneaf/electricity/epm/table5_6

Something else that stands out is the relationship (or lack thereof) between the cost of electricity and the ranking of the top 10 states. Although 5 of the 10 states have an above average cost of electricity, there is no direct correlation per se between high electricity prices and installed PV capacity. That said, electricity prices are still important as it stands to reason that PV-generated electricity that offsets expensive electricity from the utility is more valuable than offsetting cheap electricity. This is certainly the case for peak electricity prices which often are coincident with PV generated electricity (e.g. 3:00 in the afternoon in July in California or New Jersey when air conditioning use is high)

What the table implies is that although the quality of the solar resource and the cost of electricity are important, there are a number of other factors involved in making the economic case for PV. These include a renewable portfolio standard ideally with a carve-out for PV, the availability of cash rebates from the state or the local utility, tax incentives, and the existence of solar friendly policies related to interconnection, net metering, and permitting.

1.5 Financial Incentives

Although costs are coming down in the current PV market place, most people still consider it to be an expensive source of electricity which requires a large upfront investment. However, there are a number of incentives available which will reduce the installed cost of a PV system. These incentives come in many forms, including tax credits, cash rebates, production-based incentives, and renewable energy certificates (RECs). In addition, the ability to net meter PV systems creates the opportunity to sell excess electricity back to the utility. In this section, we'll examine the menu of financial incentives for PV that is available within the City of Milwaukee.

1.5.1 Federal Tax Incentives

There are significant federal tax incentives available to tax-paying entities to purchase and own PV systems. These incentives provide tremendous value to the owner and significantly reduce the installed cost of the system. Given that the federal Investment Tax Credit (ITC) and the Modified Accelerated Cost Recovery System (MACRS) alone can account for roughly 50% of the installed cost,[7] these incentives dramatically alter the economic viability of installing a PV system. The obvious caveat however, is that non-tax paying entities, such as the City of Milwaukee and non-profits in the city, can not directly take advantage of tax credits. As a result, third party finance models have emerged which create the opportunity for non-tax paying entities to indirectly benefit from these tax incentives. These will be discussed in section four of this memo.

1.5.1.1 Federal Investment Tax Credit (ITC)

For both commercial entities and homeowners, the Federal government provides a 30% investment tax credit to partially offset the installed cost of a PV system.[8] In October 2008, this credit was reauthorized and extended out until the end of 2016.[9] The $2,000 cap that had been in place for residential PV systems was also removed at the same time.

---

[7] Financing Non-Residential Photovoltaic Projects: Options and Implications. Bolinger, M. 2009. http://eetd.lbl.gov/ea/ems/reports/lbnl-1410e.pdf

[8] See Section 48 (a) (3) (Investment Credit: Energy Credit) in the IRS tax code.

[9] Federal Incentives for Renewable Energy. DSIRE. http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US02F&re 1&ee=1

The system owner can use this credit to reduce his tax burden. As an example, a commercial PV system with a qualified cost basis of $1 million will benefit from a $300,000 tax credit. The ITC, while taken upfront, vests over a 5-year period. As a result, it is subject to recapture if the owner of the system sells it before then. Recapture refers to repaying the IRS a portion of the tax credits taken in year 1 as a result of not owning the system for five years.

The rules associated with calculating the ITC can be complicated as adjustments to the initial cost basis may be necessary. For example, a cash rebate that is not considered taxable income must be subtracted from the cost basis before calculating the 30% credit. Depending on the situation, it might be more advantageous to pay tax on an upfront rebate and calculate the 30% ITC on the total installed cost whereas in other instances, a non-taxable rebate may make more sense for the system owner. The Solar Energy Industry Association's *Guide to Federal Tax Incentives for Solar Energy* provides good background information on the ITC and additional detail on how to calculate it.[10]

Example: If a homeowner receives a non-taxable $10,000 rebate from the local utility, a PV system that has an initial cost of $40,000 will have a cost basis of $30,000 for the calculation of the ITC. As a result, the ITC is $9,000.

1.5.1.2 30% cash grant from the US Treasury in lieu of ITC[11]

The 2009 American Recovery and Reinvestment Act (ARRA) has introduced a new option for commercial entities interested in installing a PV system. Instead of taking the 30% ITC, there is now the option to receive a direct cash payment equivalent to 30% of the installed cost of the system. While the details of how this cash grant program will be managed are still under development, it will likely be an attractive option for both solar developers and commercial entities that may not have sufficient taxable income to take full advantage of the ITC. It is important to point out that only those <u>commercial</u> entities who already qualify for the ITC will be eligible for the cash grant. Therefore, non-tax paying entities are not eligible; nor are residential homeowners.

1.5.1.3 Modified Accelerated Cost Recovery System (MACRS)

The ability to depreciate a PV system is an additional tax benefit for commercial entities. As defined by the IRS, "depreciation is an income tax deduction that allows a taxpayer to recover the cost or other basis of certain property. It is an annual allowance for the wear and tear, deterioration, or obsolescence of the property."[12] Depreciation schedules can range from 3 to 50 years depending on the asset.[13] It is a non-cash charge recorded as a depreciation expense for tax

---

[10] Guide to Federal Tax Incentives for Solar Energy. SEIA.
http://www.seia.org/galleries/pdf/SEIA_manual_version_1.2.pdf

[11] Federal Incentives for Renewable Energy. DSIRE.
http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US02F&re=1&ee=1

[12] See *A Brief Overview of Depreciation* at
http://www.irs.gov/businesses/small/article/0,,id=137026,00.html

[13] Modified Accelerated Cost-Recovery System (MACRS) + Bonus Depreciation
Database for State Incentives for Renewables and Efficiency
http://www.dsireusa.org/index.cfm?EE=1&RE=1

purposes. Most property today is depreciated using MACRS.[14] The IRS allows commercial owners of PV systems to use a 5-yr MACRS depreciation schedule. It is important to point out that 50% of the ITC must be subtracted from the cost basis before calculating depreciation.

The 5-yr MACRS schedule is usually applied over a 6 year period given that projects are traditionally placed in service sometime during the year rather than on January 1st. The schedule for this mid-year convention is as follows:

MACRS	20.00%	32.00%	19.20%	11.52%	11.52%	5.76%

Example: A commercial PV system has an initial cost of $120,000. The ITC will be 30% or $36,000. 50% of 36,000 is $18,000 which means the cost basis for depreciation is $102,000. Therefore, the deduction in the first year will be 20% of $102,000 or $20,400. If the business has a tax rate of 35%, this depreciation expense of $20,400 will reduce its taxes by $7,140.

Depreciation reduces an entity's taxable income and subsequently, its tax burden. The shorter the depreciation schedule the greater the percentage of the asset that can be depreciated each year. As a result, the tax benefits are accelerated. The tax benefits associated with the ability to depreciate a PV system over a 5 year period accounts offsets approximately 26% of the initial cost of the system.[15] It is important to note that a longer MACRS schedule would still provide tax benefits to the owner of a PV system, but they'd be accrued over a longer period, and thus be less valuable given the time value of money.

1.5.1.4 Bonus Depreciation

The 2009 ARRA reauthorized what is called bonus depreciation through the end of 2009.[16] Bonus depreciation allows 50% of the installed cost of a PV system to be depreciated in the first year with the remaining 50% depreciated using the aforementioned 5-year MACRS. As this allows a greater tax deduction in the first year than the 5 year MACRS, the tax benefits for the system owner will also be greater in the first year as well. The rationale behind bonus depreciation is to encourage greater capital spending on the part of commercial entities by allowing them to recoup the tax benefits of such spending more quickly.

[14] See IRS Publication 946 at http://www.irs.gov/publications/p946/ch04.html

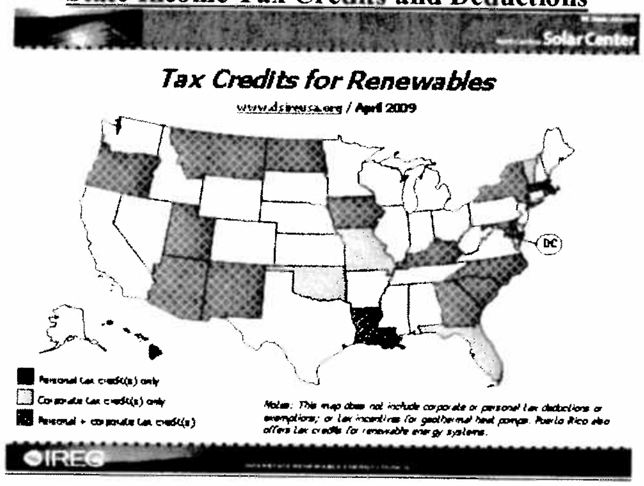
[15] Shaking Up the Residential PV Market: Implications of Recent Changes to the ITC. p. 10. Bolinger, M., G. Barbose, and R. Wiser. November 2008 http://eetd.lbl.gov/ea/EMS/cases/res-itc-report.pdf

[16] Federal Incentives for Renewable Energy. DSIRE. http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US02F&re=1&ee=1

1.5.2 State and Local Tax Incentives

The use of state tax credits, sales tax credits, and property tax exemptions for renewable energy are relatively common in the United States. According to the Database of State Incentives for Renewables and Efficiency, Wisconsin has a 100% property tax exemption and a 100% sales tax incentive for qualifying renewable energy equipment which includes solar.[17] What the state does not offer is a state income tax credit. A number of other states do offer a state income tax credit however as illustrated by the map below.[18]

State Income Tax Credits and Deductions



In addition to the more straightforward state income tax incentives, there are some unique examples that are worth mentioning which can be found in Louisiana, Oregon, and Utah.

- The Louisiana Solar and Wind Residential Tax Credit was approved by the state legislature in July 2007 to promote the installation of renewable energy systems.[19] A 50% state income tax credit is now available on the first $25,000 invested in the installation of a qualified system. This translates into a maximum tax credit of $12,500. The novel element in Louisiana is that if the tax credit exceeds the amount of state taxes owed in the year the system was placed in service, the difference will be paid via check to the homeowner as if it were an overpayment of taxes.[20] This differs from most state income tax credit programs where the credit is carried forward to offset future tax obligations.

---

[17] DSIRE database. State Income Tax Benefits http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=WI

[18] DSIRE USA Summary Maps can be found at http://www.dsireusa.org/summarymaps/index.cfm?CurrentPageID=10&EE=1&RE=1

[19] "Louisiana Incentives for Renewable Energy," Database of Incentives for Renewables and Efficiency (DSIRE), last reviewed 6/11/2008 and accessed August 2008, at http://dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=LA11F&state=LA&CurrentPageID=1&RE=1&EE=1

[20] Assuming a homeowner with state income tax payable of $2,000 installed a $30,000 PV system. The homeowner would be eligible for a $12,500 tax credit; $2,000 would eliminate state taxes owed with $10,500 paid to the homeowner in the form of a tax refund.

- The Oregon Business Energy Tax Credit (BETC) is noteworthy given its relevance to public sector entities. The BETC is a state income tax credit up to 50% of the installed costs of a renewable energy system. The tax paying entity can apply the tax credit pro-rata over five years to lower its state income tax bill.[21] In recognition of the non-tax paying status of governments and non-profits, the Oregon Department of Energy created a "Pass-Through Option" whereby a government agency or a school, for example, can sell the present value of its tax credit to a tax paying entity and use the proceeds to defray the cost of its PV project.[22] This does assume however that there are sufficient state tax paying entities to absorb the pass-through which isn't always the case.
- In October 2008, the city of St. George, Utah in collaboration with the local utility, Dixie Escalante, launched a community solar program whereby residents could purchase proportional shares in a large PV system and still take advantage of the state's 25% income tax credit. This is unique in that the individual taking the tax credit does not own the system nor is it located on his or her property.

1.5.3 Cash rebates and other financial incentives available in Milwaukee

Milwaukee is fortunate to have access to two programs that provide cash incentives for PV installations. Focus on Energy - using proceeds from the state's public benefit fund - offers cash grants to homeowners, businesses, non-profits and local governments. In addition, Milwaukee's local utility, We Energies, complements the Focus on Energy cash awards with additional incentives.

1.5.3.1 Focus on Energy Cash-Back Rewards for PV Systems[23]

Focus on Energy calculates its cash rewards based on of the expected production of kWh per year for a given PV system with a maximum system size of 50 kW.

- Residential and non-residential projects.
  - Up to 20 kW will receive $1.50 per kWh of expected annual production (first year's production). The award can not exceed 25% of the total project's cost and the maximum dollar amount of any award is $35,000.
  - 20 - 50 kW will receive $1.00 per kWh of expected annual production (first year's production). The award can not exceed 25% of the total project's cost and the maximum dollar amount of any award is $50,000.
- Non-profit and government projects.
  - Up to 20 kW will receive $2.00 per kWh of expected annual production. The award can not exceed 35% of the total project's cost with a maximum award of $45,000.
  - 20 - 50 kW will receive $1.50 per kWh of expected annual production. The award can not exceed 35% of the total project's cost with a maximum award of $75,000.

---

[21] Oregon Department of Energy -Conservation Division http://egov.oregon.gov/ENERGY/CONS/BUS/BETC.shtml

[22] "Business Energy Tax Credit Pass-Through," Oregon Department of Energy – Conservation Division, accessed April 2008. http://egov.oregon.gov/ENERGY/CONS/BUS/tax/pass-through.shtml

[23] Solar Electric Cash-back Award Pre-Approval Form. Focus on Energy. 2009. http://www.focusonenergy.com/files/Document_Management_System/Renewables/solarelectricrewardpreapproval_applicationform.pdf

- Focus on Energy will cover up to 50% of the cost of a site assessment for PV systems up to 50 kW. These assessments typically cost $300-$600.
- Energy Star homes receive an additional $500 bonus on top of the initial rebate.

1.5.3.2 We Energies[24]

Milwaukee's local utility, We Energies, provides an additional rebate for PV systems installed within its territory. Similar to Focus on Energy, the dollar amount is based on the expected production of electricity in the first year. Details are as follows:

- System owners will be paid $0.75 cents per expected first year production of kWh (AC).
- Qualifying systems will be from 1.5 - 100 kW.
- Retail net metering will be available for systems up to 20 kW.
- Participation in the program does requires a second meter and We Energies will add a per month charge to the customer's utility bill.
- The total program has a limit of 500 kW.
- We Energies will own the RECs produced during the first ten years.

1.5.3.3 Example of the net cost of a 4 kW system in Milwaukee

To better understand how the various incentives can be combined to the benefit of a prospective Milwaukee homeowner wishing to install a 4 kW PV system, it is instructive to walk through the following example (making certain assumptions).

- Installed cost per watt = $8.50
- Installed cost of a 4 kW system before any rebates or incentives = $34,000
- Annual production of a 4 kW system in Milwaukee = 4,910 kWh[25]
- It is assumed that both cash rebates are not considered taxable income to the homeowner. Therefore, they must be subtracted from the initial installed cost prior to calculating the 30% ITC.

Calculations

1. Focus On Energy Cash-Back reward:	$7,365	(4,910 kWh * $1.50/kWh)
2. We Energies cash rebate:	$3,683	(4,910 kWh * $0.75/kWh)
3. Combined award:	$11,048	
4. Adjusted cost basis:	$22,952	($34,000 - $11,048)
5. ITC:	$6,885	($22,952 * 30%)
6. Net installed cost:	**$16.067**	($22,952 - $6,885)

A number of observations can be made using this example. First, there are good incentives available for PV systems in Wisconsin equivalent to 32% of the initial installed cost. The ITC reduces the initial investment by another 20% for a total reduction of 52%. That said, the remaining cost to the PV customer is still significant. In addition, the tax credit itself does not

[24] We Energies Solar Electric Photovoltaic Expected Performance Buy-down Program. http://www.we-energies.com/residential/energyeff/PV_incentdetail.pdf

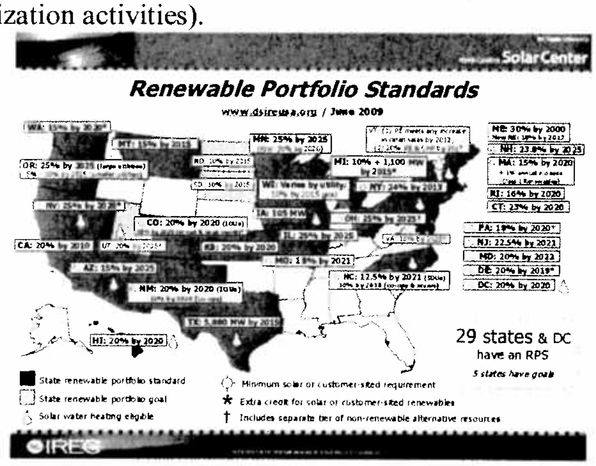
[25] PV Watts version 1 http://rredc.nrel.gov/solar/codes_algs/PVWATTS/version1/

lower the upfront cost of the system, but rather lowers the homeowner's taxes by $6,885 in the following year when taxes are filed. So, the actual upfront out of pocket expense is approximately $23,000.

The homeowner must finance this amount with cash, a home equity loan, a refinanced home mortgage or some other form of personal credit. In the current economic environment, none of these may be reasonable alternatives. It is one reason why we are seeing the development of new financial models for PV such as the property tax assessment model and the solar lease: structures that reduce or even eliminate this high upfront cost barrier to solar.

1.6 Renewable Portfolio Standards and Renewable Energy Certificates (RECs)

Twenty nines states plus Washington, D.C. have renewable portfolio standards (RPS).[26] Wisconsin is included in this list. An RPS stipulates that qualifying utilities in the state must meet a certain percentage of its customer demand for electricity with renewable energy sources at some point in the future (e.g. 25% renewables by 2025). In the case of Wisconsin, the RPS mandates 10% by 2015.[27] To comply with the RPS, a utility can produce its own renewable electricity, purchase renewable electricity from a independent power producer and in certain instances, buy renewable energy certificates. In states with an RPS, a system benefit charge is often added to the utility bill as a source of funding for renewable projects (in addition to low income heating assistance and weatherization activities).



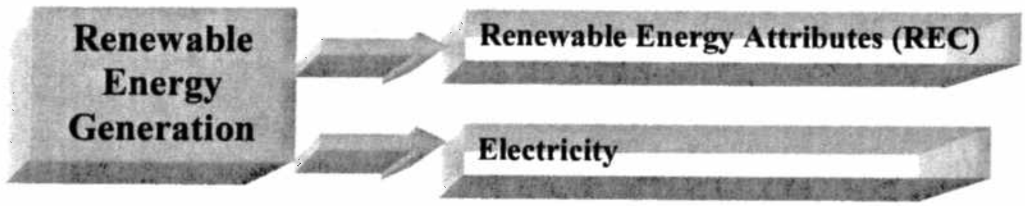
When electricity is generated from renewable energy sources, a renewable energy certificate (REC) is also generated. RECs are commodities with monetary value, separate from the electricity produced, that bundle the "environmental attributes" of renewable electricity generation. SRECs refer specifically to the environmental attributes of solar electricity. The definition of "attributes" can vary across contracts but will likely include any future carbon trading credits, emission reduction credits, and emission allowances, among others. One REC typically represents the attributes of 1 megawatt-hour (MWh) of renewable electricity generation. Once the REC is separated from the underlying electricity and sold to another party, claims to the

---

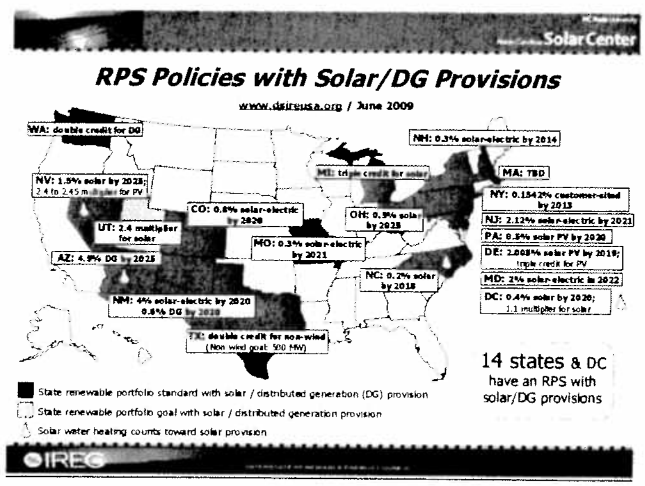
[26] DSIRE database Summary Maps. http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1

[27] Wisconsin Incentives and Policy for Renewables and Efficiency. DSIRE database. http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=WI

attributes can only be made by the REC owner, and not by the electricity owner or the owner of the project.



As generating electricity from PV systems is usually more expensive than most other renewable energy technologies, some states have established "solar carve-outs" within their RPS as a way to ensure that a portion of the renewable electricity generated comes from PV. Otherwise, in the absence of a carve-out, it will be cheaper for utilities to meet their RPS goals with cheaper renewables, such as wind, biomass, waste coal, hydroelectric, etc. As the map below indicates, as of June 2009, 14 states and Washington, D.C. had some sort of solar/distributed generation provision as part of their RPS. Wisconsin's RPS does not have a solar carve out.



One of the benefits of a solar carve-out is that it tends to increase the price of solar RECs (SRECs). This is because utilities need to incentivize the production of PV-generated electricity so that they can meet the carve-out requirements within the RPS. As PV is more expensive than wind, for example, utilities have to provide higher incentives to make PV systems more attractive to install. Two attractive SREC markets in the US can be found in Colorado and New Jersey, two states with solar carve-outs in their RPS.

- Colorado's Xcel Energy's Solar*Rewards program[28] will purchase SRECs in advance from the owners of systems up to 10 kW at a price of $1.50/watt, up to a maximum of $6,000 for a 4 kW system. For systems between 10 kW and 100 kW, Xcel will pay, on a monthly basis, $115/MWh as electricity is generated by the system. Systems larger than 100 kW will bid on SREC prices under an auction-like process. Note that the SREC incentive is in addition to a $2.00/watt cash rebate up to a maximum of $200,000.
- The New Jersey utility, PSE&G, has set a minimum price of $475/MWh for a SREC when it calculates its value for repayment of loans under its solar loan program.[29] At this level, homeowners may be able to repay the entire loan amount solely using SRECs over a 10-year period.

Under We Energies PV incentive program described in section 1.5.3.2, the utility will own the SRECs generated by qualifying systems for the first 10 years of operation. It is conceivable that after year 10, when SREC ownership reverts back to the PV system owner, that there could be a market for SRECs in Wisconsin. If so, PV system owners could sell their SRECs and create additional cash flow to further reduce their utility bills.

1.7 Net Metering

Net metering refers to the ability of a customer with on-site renewable electricity generation to send excess electricity back to its utility and receive a bill credit in return.[30] In some cases, the meter actually spins backwards whereas in other cases, a second meter is required. The price that the system owner receives for this excess electricity varies by state and sometimes by utility. The utility may pay for this excess generation at retail rates (the best case for PV) or at some lower, wholesale rate. Net metering can also allow excess generation in any given month to be carried over to the next billing month, typically for up to a year. At the end of a 12-month period, the utility usually buys any outstanding credits or resets the amount to zero with no payment to the homeowner. One unique aspect of Wisconsin's net metering policy is that the utility will pay the customer directly by check if the net metered amount exceeds $25.00 in a month.[31] Utilities usually establish a limit as to how large of a system they will allow to net meter. Small net metering caps act as a disincentive to interconnecting larger PV systems to the grid since there is no compensation for any excess electricity generated. In such cases, the PV system should be sized so that its production is always less then the building's base load.

Unfortunately, Wisconsin's net metering policy does not compare well against other states. The state's net metering policy received an "D" in the *2008 Freeing the Grid Report*[32] that grades the

---

[28] Xcel Energy Solar*Rewards Program.
http://www.xcelenergy.com/Residential/RenewableEnergy/Solar_Rewards/Pages/home.aspx

[29] PSE&G Solar Loan Program.
http://www.pseg.com/customer/solar/index.jsp

[30] For more information, please see "State Energy Alternatives: Net Metering," U.S. Department of Energy
http://apps1.eere.energy.gov/states/alternatives/net_metering.cfm

[31] Wisconsin Net Metering Policy
http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WI03R&re=1&ee=1

[32] 2008 Freeing the Grid. New Energy Choices.
http://www.newenergychoices.org/uploads/FreeingTheGrid2008_report.pdf

net metering and interconnection policies across the United States. The primary weakness cited for receiving such a low grade was a net metering limit capped at 20 kW (100 kW for wind in We Energies territory). The report recommends either no net metering limits whatsoever or at least limits in excess of 1 MW per system.

Summary

As illustrated in this section, Milwaukee has comparable solar resources to cities in states with a much higher level of installed PV capacity. In addition, there are good incentives from at least two sources - Focus on Energy and We Energies - in addition to certain local tax benefits. Federal tax incentives are also available to tax-paying entities within the City. Net metering limits are limited which is a disadvantage as is the lack of a solar REC market.

2.0 Introduction to Solar Hot Water

Despite the fact that more than 20,000 SHW systems were installed in 2008 in the United States (Hawaii and Florida accounting for 50+%),[33] it is often overlooked as a renewable energy option for households and businesses alike. SHW systems offer an affordable and clean alternative to traditional water heating fuels such as natural gas, electric, and fuel oil, with the potential to save money over the long term. It may make more financial sense to install a SHW system at a particular site in Milwaukee rather than a PV system. This section summarizes the benefits of SHW, provides an overview of the technology, and discusses the cost to install a SHW system.

2.1 Benefits

A solar water heater can generate both economic and environmental benefits. The economic benefits will depend on the following;

- The amount of hot water consumed at the property
- The system's performance
- Geographic location and quality of the solar resources
- Available financing and incentives
- The current cost of conventional fuels (natural gas, oil, and electricity) used to heat water

The Department of Energy claims that on average, if a homeowner installs a solar water heater, the water heating bills should drop 50%–80%.[34] In more northern climates, this range could vary to as low as 30% in the winter, and as high as 90% or more in the summer. Wisconsin's Focus on Energy notes that water heating accounts for approximately 14 percent of total residential energy costs.[35]

2.2 Technology Overview

Solar water heaters can be a cost effective way to generate hot water for residential, commercial, and pool applications. Generally, this technology consists of two main components: a solar collector and a well-insulated storage tank. There are several types of collectors, but the most common is the flat-plate collector. Often mounted on a roof-top with optimal sun exposure, the flat-plate collector uses a black absorber plate to generate thermal heat. Attached to this plate are tubes which carry fluid (either water or an antifreeze solution) that will retain the heat produced by the absorber plate and carry it to a storage tank. The fluid can then either be used directly (if it is potable) as hot water, or can circulate in coils (acting as a heat exchanger) within the storage tank thereby heating the surrounding potable water.

The solar water heater technology can be differentiated by two system types: passive and active (forced circulation) systems. Passive water heater systems consist of a water tank that is either integrated into, or located above, a solar collector. The benefits of this system include; reliability due to simplicity; and typically, a lower cost when compared to active systems. However,

[33] SEIA 2008 Year in Review. http://www.seia.org/galleries/pdf/2008_Year_in_Review-small.pdf

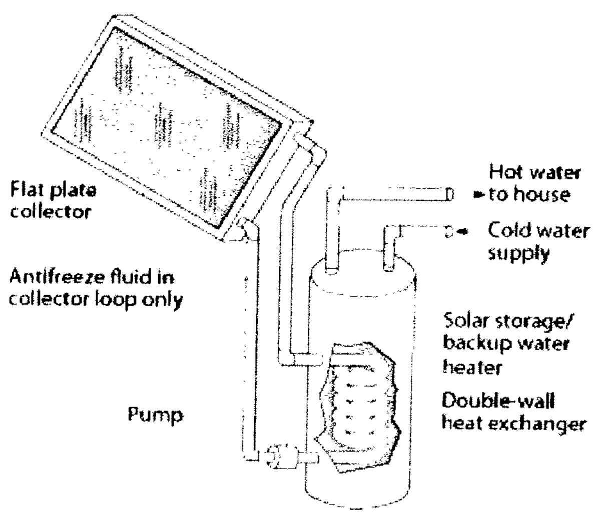
[34] Energy Efficiency and Renewable Energy (EERE). The Economics of a Solar Water Heater. http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12860

[35] Wisconsin Focus on Energy: Fact Sheet. Found at http://www.wifocusonenergy.net/files/Document_Management_System/Renewables/V_RW_MKFS_SolWaterHeatFS0707.pdf

integrated systems do not work well in cold (below freezing) climates. In addition, locating a separate water tank on the roof has design issues related to the ability of the roof to support it. Further, passive systems are usually not as efficient as active systems.

Active systems, also known as forced circulation systems, use a pump which allows for the water tank to be located inside the home or building. These efficient systems can either use direct circulation to pump the potable water through the collectors and into the home or building for use or indirect circulation, running a non-freezing heat transfer fluid (such as glycol) through the collectors and ultimately a heat exchanger. The diagram below highlights the key features of this method of producing solar hot water. For the Milwaukee climate in particular, with below freezing winter temperatures, the most viable and cost effective technology will probably be the active, closed loop solar water heating system.

Active, Closed Loop Solar Water Heater



Source: US DOE/EERE, Consumers Guide: Solar Hot Water

2.3 Sizing a system

While system size is often measured by collector size and the number of gallons the storage tank can hold based on the needs of the property owner, the performance of the system is usually evaluated in terms of the energy it displaces. For the homeowner, estimating the size of the system is relatively straightforward using some rules of thumb.[36] Commercial users of hot water as well as public entities like fire stations need to spend more time analyzing their water use prior to selecting a system size. Referencing a fire station is intentional as many cities identify them as appropriate places to install SHW systems given their hot water needs for showering, laundry, cooking and washing equipment.

[36] Rules of thumb are just that and often there are different rules of thumb. A local installer will have a good sense of what it the most appropriate in Milwaukee.

When deciding on a residential system, both roof space for the collectors as well as space within the house for the storage tank has to be taken into account. According to the Department of Energy,[37] 20 square feet per person up to 2 people is needed for the roof top collectors. For each additional person in the house, an additional 8 to 14 square feet is necessary; with 8 sq. ft. appropriate for the southwest and 14 sq. ft, for northern US locations. As far as the storage tank, the rule of thumb is approximately 1.5 gallons for every sq. foot of collector area. So to illustrate, let's assume a 4-person household in Milwaukee, using 14 sq. ft for each additional person in the home above two.

- **Collector**: (2 people x 20 sq. ft. = 40 sq. feet) + (2 people x 14 sq. ft. = 28) = **68 sq. feet.**
- **Storage Tank**: 68 sq. ft. x 1.5 gallons = **102 gallon storage tank**

2.4 Upfront costs of SHW Systems

Given the different types of SHW systems and the difference in demand for hot water from building to building, the costs of systems vary widely. Residential systems can range from $2,000 to $5,000 on new construction and upwards of $10,000 for an installation on an existing home. A successful installation requires plumbing, electrical, and roofing skills, all of which can be costly.

2007-08 information from Focus on Energy's solar hot water program is very helpful when framing the upfront cost discussion.[38]

- The 70 residential SHW projects that received cash rebates during this time frame had an average initial cost of $9,638. Average project size for the collectors was 68 sq. ft which is in line with the calculation in the preceding section. The average per square foot cost for these residential systems was approximately $142.
- In the commercial sector, six healthcare facilities installed SHW systems with an average cost of $47,529 or $110/sq. ft.
- Seven additional commercial sites, including a hotel, a laundry, and a car wash, installed SHW systems at an average cost of $43,550 or $104/sq. ft.

In each of these cases, the initial cost was reduced by 19-24% as a result of Focus on Energy's cash grants. The declining cost per square foot as systems get larger illustrates the benefit of economies of scale when it comes to SHW (and PV for that matter). As a result, it may make more sense to focus on commercial and other large scale SHW installations rather than small, residential ones. This is a conclusion that San Diego came to as part of its pilot SHW program which will be discussed below. Larger, non-residential SHW systems may also have a bigger demand for hot water during the day (e.g. laundry, food preparation, equipment washing) which can take better advantage of the available solar resource.

2.5 On-going system performance and cost savings

After the initial investment, the owner of the SHW system will begin accruing savings as solar energy displaces conventional fuels to heat water. However, it is highly unlikely that a SHW system will offset all of a building's hot water needs throughout the year. As a result, an auxiliary

[37] Sizing your solar hot water system. US Department of Energy http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12880

[38] Information obtained from Focus on Energy's Solar Hot Water program.

system will remain in place to provide hot water when necessary or to further heat the water coming from the SHW system up to the desired temperature. Therefore, once a SHW system is installed, the annual operating costs will primarily be the fuel costs associated with this auxiliary system and modest maintenance costs which Focus on Energy calculates to be approximately $30 per year.[39] This cost can be compared to the cost of heating 100% of a building's water with conventional fuels. The difference between the two will be the savings derived from the SHW system.

Retail consumption of natural gas is measured in units called therms.[40] Therefore, we can measure the annual cost savings of a solar hot water system by calculating how many therms of natural gas are saved by using solar energy to heat water. This annual savings can then be compared to the initial cost of the SHW system to determine the economic feasibility of the installation and how long it would take for the savings to offset the cost of the system.

For electric hot water systems, kWh of electricity rather than therms would be offset by the installation of a SHW system. While electric hot water heaters are relatively inexpensive to purchase, the associated operating costs tend to be higher than natural gas water heaters. It is assumed that the majority of Milwaukee residents use natural gas hot water heaters. This is an important assumption since in general; the economics of a SHW system that displaces natural gas are less attractive than installing a SHW to displace electric water heating.

2.6 Financial Incentives for Solar Hot Water Systems

Despite being cheaper than a PV system, a solar water heater is still more expensive to purchase and install than traditional water heaters. To reduce the upfront costs of SHW systems, there are a number of federal, state and local government incentives available. In addition, utilities often fund rebate programs for solar hot water systems as well. Milwaukee is fortunate that a number of these incentives are available for city residents wishing to install a SHW system. Many of the incentives described below are similar, if not identical, to the incentives described in the PV section.

2.6.1 Investment Tax Credit (ITC)[41]

The Energy Policy Act of 2005 established a 30% tax credit for the purchase and installation of certain renewable energy equipment, including solar water heating systems (it had been 10% for a reduced number of renewable energy technologies). After being extended through the end of December 2008, the passage of the Energy Improvement and Extension Act of 2008 guaranteed the ITC's availability at 30% for an additional eight years through the end of 2016. Originally, the tax credit for residential SHW systems was capped at $2,000, whereas commercial systems had

[39] Focus on Energy Solar Hot Water fact sheet. http://www.focusonenergy.com/Information-Center/Renewables/Fact-Sheets-Case-Studies/Solar-Water.aspx

[40] 1 therm = 100,000 Btu (British thermal unit). A BTU is a unit of energy with the following technical definition: A BTU is defined as the amount of heat required to raise the temperature of one pound of liquid water by one degree from 60° to 61° Fahrenheit at a constant pressure of one atmosphere.

[41] Federal Incentives for Renewable Energy. DSIRE. http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US02F&re=1&ee=1 Business ITC-

no cap. However, the $2,000 cap was removed in February 2009 as part of the America Recovery and Reinvestment Act (ARRA).

Some important notes on the Federal ITC include:

- In order for a residential solar water-heating system to be eligible, it must supply at least half the energy used to heat the dwelling's hot water supply.
- The tax credit does not apply to solar pool heating systems (including hot tubs).
- Equipment must be verified by the Solar Rating Certification Corporation (SRCC), or a comparable entity endorsed by the respective state's government.
- As part of the ARRA, commercial entities will be able to choose to receive a cash grant from the U.S Treasury equal to 30% of qualified installed costs in lieu of the ITC. Residential beneficiaries of the ITC will not have this option.

2.6.2 Modified Accelerated Cost-Recovery System (MACRS)[42]

The Modified Accelerated Cost-Recovery System, or MACRS, is a method for depreciating an asset over a shorter period of time than the expected life of the asset per se. Depreciation is a non-cash expense that reduces a business' taxable income which in turn reduces the amount of taxes owed to the government. By accelerating the rate at which a solar hot water system can be depreciated, a commercial entity can accelerate the tax benefits of the investment. Under MACRS, solar water heaters, like PV systems, can be depreciated over 5 years even though their useful life may exceed 20 years.

2.6.3 Bonus Depreciation

The 2009 ARRA reauthorized what is called bonus depreciation for the 2009 tax year.[43] Bonus depreciation allows 50% of the installed cost of a SHW system to be depreciated in the first year with the remaining 50% depreciated using the aforementioned 5-year MACRS. As this allows a greater tax deduction than the 5 year MACRS in the first year ("a bonus"), the tax benefits for the system owner are also greater in the first year. The rationale behind bonus depreciation is to encourage greater capital spending on the part of commercial entities by allowing them to recoup the tax benefits of such spending more quickly.

2.7 State Tax Incentives

As was noted in the section on PV incentives, Wisconsin offers 100% property tax and sales tax exemptions for solar hot water systems. However, as was pointed out earlier, Wisconsin does not offer a state income tax credit for renewable energy projects.

2.8 Financial incentives in Wisconsin

The two local incentive programs available for Milwaukee residents are offered by Focus on Energy and the local utility, We Energies.

[42] Ibid.
[43] Ibid.

2.8.1 *Wisconsin's Focus on Energy Renewable Energy Cash Back Rewards*[44]

The Focus on Energy program offers cash incentives for solar hot water systems based on system size and status of the applicant.

- Small solar hot water systems (displacing 250 therms or less on an annual basis) receive $20/therm with a maximum cost share of 25% of qualified project costs. The maximum cash benefit is $2,500.
- Mid-sized systems (250 to 2,500 therms) are eligible to receive $10/therm with a maximum cost share of 25% of qualified project costs. The maximum cash reward is $25,000.
- Large systems (2,500 - 5,000 therms) are eligible to receive $8/therm with a maximum cost share of 25% of qualified project costs. The maximum cash reward is $40,000.
- Public facilities and non-profits are eligible get a $5/therm premium at the different award levels (e.g. a small system would receive $25/therm) with a maximum cost share of 35% up to $65,000.
- In addition, Focus on Energy will cover up to 50% of the cost of a SHW site assessment. These assessments typically cost $300-$600.

Two additional elements of the Focus on Energy Program are rebates for repairing existing SHW systems and an Energy Star bonus.

- Existing systems in need of repair can qualify for up to $1,500 for residential systems and $5,000 for non-residential systems. These awards are calculating using 50% of the per therm incentive for new SHW systems.
- Energy Star homes receive an additional $500 bonus on top of the standard SHW rebate

2.8.2 *We Energies Solar Hot Water Incentives*[45]

Similar to PV, Milwaukee's local utility, We Energies also offers cash incentives for SHW. In essence, We Energies piggybacks on the Focus on Energy incentive program.

- For commercial and residential SHW systems, We Energies will offer a 30% match of the Focus on Energy cash incentive up to $750 for residential systems and up to $15,000 for commercial systems.
- For non-profit and government entities installing SHW systems, We Energies will provide a 100% match of the Focus on Energy cash incentive up to $50,000.
- We Energies will own any environmental attributes associated with the SHW systems receiving awards.

2.8.3 *Economics of an average residential SHW system*

As one would expect, estimates for annual savings as a result of installing a solar hot water heating system will vary tremendously based on the factors discussed in section 2.1. A commonly cited range of annual savings for residential SHW systems is $100 to $500. Using the data made

[44] Focus on Energy's Solar Water Heating System Cash Back Reward Pre-Approval Application. http://www.focusonenergy.com/files/Document_Management_System/Renewables/solarhotwaterrewardpreapproval_applicationform.pdf

[45] We Energies Solar Water Heating Incentive Program. http://www.we-energies.com/residential/energyeff/reqapp_SWH2009.pdf

available by the Focus on Energy SHW program, we can walk through a calculation of the costs and savings associated with a SHW system.

Let's assume the system has an initial cost of $9,600 and will offset natural gas water heating. Instead of calculating the Focus on Energy incentive on a per therm basis, we'll use the average rebate size, again from program data, of $1,800. The We Energies incentive would be $540 (30% of $1,800) for a total incentive package of $2,340. Assuming these incentives are non-taxable, they need subtracted from the initial cost of $9,600 to get the cost basis for the ITC calculation.

- This cost basis is $7,260.
- The 30% ITC is $2,178. ($7,260 * 30%)
- Therefore, the final cost after incentives is $5,082. ($9,600-$2,340-$2,178)

Again as mentioned previously, the tax credit does not lower the upfront investment required to install a SHW system. In this example, the homeowner would have an upfront cost of $7,260.

If the mid-range of possible annual savings is used - $300 - the simple payback period will be approximately 17 years.[46] Another way to interpret this information is from a rate of return perspective. If the $5,082 was viewed as a financial investment, the annual return on this investment would be approximately 6%. The actual annual savings and thus the payback period will fluctuate as volatile natural gas prices bounce up and down over the life of the SHW system. What this example illustrates is that even with incentives equivalent to 47% of the initial cost of the system, an average residential SHW system is still a medium to long term investment. This is why commercial SHW systems with lower per square foot installed costs might be the more attractive investment and why we've seen the development of new financial models such as the property tax assessment financing to better align the costs and benefits of SHW systems over time.

2.5 Examples of SHW programs in other areas of the country

There are a number of states, cities and utilities that offer incentives for solar hot water systems. Many are similar to the cash rebate programs available in Wisconsin. Loan programs are also quite common as well. A few variances to these standard programs include New York's interest rate buy down program,[47] rather than a direct loan program per se; Austin Energy's focus on incentives only for those with electric hot water heaters;[48] and Oregon's incentives for swimming pools, spas and hot tubs.[49] These programs, as well as all SHW incentives programs available across the country, are detailed on the Database for State Incentives and Renewables website.

[46] While simple payback ignores the time value of money, it is a decent estimate of the relative attractiveness of the investment. The shorter the payback period, the quicker the system owner recoups his investment.

[47] New York Energy $mart Loan Program. http://www.nyserda.org/loanfund/default.asp

[48] Austin Energy Solar Water Heater Rebate Program. http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Solar%20Rebates/Solar%20Water%20Heater/index.htm

[49] Energy Trust of Oregon. Solar Water Heating http://www.energytrust.org/solar/water/provide.html

One program to note in particular is the pilot solar hot water program in San Diego given a recent evaluation report that provides some good insight that may be of value to the City of Milwaukee.

2.5.1 San Diego SHW Pilot Program[50]

In 2007, the California Public Utilities Commission authorized $1.5 million in ratepayer funds (via a system benefit surcharge) to support a Solar Water Heating Pilot Program (SWHPP) in San Diego. As part of the California Solar Initiative (CSI), and administered by the California Center for Sustainable Energy (CCSE), the program provides incentives for businesses and residential customers who install solar water heating systems. Residential systems receive up to a $1,500 rebate, and commercial systems receive up to $75,000. The program was launched in July 2007 and has had mixed success. As a frame of reference, total installed costs for a residential system in San Diego is approximately $7,500, prior to incentives.

In January 2009, San Diego released an Interim Evaluation Report[51] that assessed the challenges and opportunities of deploying solar water heater systems. The results from this report are very instructive. Similar to Milwaukee, San Diego predominantly uses natural gas as a water heating source. In a state with extremely high electricity prices, natural gas is a fairly cost effective fuel source. Prior to removing the cap on the residential ITC, the average payback for residential systems ranged from 15 to 20 years (without the cap, this payback period may be shorter depending on system size). Furthermore, it has been difficult for homeowners to get a loan for a relatively small investment such as a SHW system and transaction costs are high if they do proceed with such a loan. Larger commercial systems have a faster payback and financing is more readily available. In addition, certain commercial establishments such as hotels, restaurants, and health care facilities use more hot water during the day than residential locations; increasing the capacity level of the SHW systems. As a result, the San Diego program may increase its focus on the commercial SHW market.

Summary

In many cases, installing a solar hot water system will be more financially viable than a PV system. Initial costs are much less than PV and incentives are available. Larger systems offer attractive economies of scale and as illustrated by the San Diego experience, it may make sense to target commercial users of day time hot water. Given the predominance of natural gas water heat in Milwaukee, the economics of installing a SHW will less attractive than if electric water heaters were more prevalent. Nonetheless, if the City wants to target one solar technology in particular, a strong case can be made that solar hot water is preferable to PV.

---

[50] San Diego Solar Water Heating Pilot Program. http://www.cpuc.ca.gov/PUC/energy/Solar/swh.htm

[51] San Diego SWHPP Interim Report. http://www.cpuc.ca.gov/PUC/energy/Solar/swh.htm

3.0 The Role of the City in the creation of a solar marketplace

As noted at the beginning of this memo, there are a number of roles that a city can play in the promotion and financing of PV installations. The spectrum can range from a more modest focus on outreach and education combined with streamlining the permitting process and solar access laws, to more direct financial involvement. Such direct involvement would include installing PV systems on public buildings, providing cash incentives directly to homeowners, businesses, and other institutions and acting as a financial intermediary by creating loan programs.

3.1 Public Sector projects

If a city decides that installing PV and SHW projects directly on public buildings will be part of its solar program, the city will need to identify which sites are the most appropriate. Milwaukee is currently in the process of identifying these sites in cooperation with the Midwest Renewable Energy Association (MREA).

Once the city has identified solar projects to pursue, the next step is to determine how to finance them. With the emergence of third party finance models, the city does not necessarily have to invest its own resources to meet its solar goals. However, not all projects are candidates for a third party solution. The third party PPA model for solar hot water is not common nor is it commonly viable for PV projects of less than 100 kW. In the current economic environment, this minimum project size may be as high as 300-500 kW. This means that while a 10 kW system on a single school will likely need to be financed, owned and operated by the City (or school district), installing PV systems on all of the schools throughout the district might be a good candidate for the PPA model.

Even if Milwaukee has identified a large project which it wants to install using a third party finance model, it is not certain there will be interested bidders at a price that makes sense for the parties involved. Large solar developers such as SunEdison, Recurrent Energy, SolarPower Partners, SunPower, and Chevron Energy Services, are focused on states where the economics of solar make the most sense. A state with attractive financial incentives, including solar RECs, solar-friendly policies like retail net metering for large systems, good solar resources and above average electricity prices will be much more appealing to these solar developers than a market with little or no incentives, weak net metering policies, and cheap electricity. Section four will describe the third party finance model in much greater detail.

3.2 Direct Ownership of PV systems

If a city decides to directly finance and own its PV and SHW systems or if the project is too small for the third party model there are a number of ways to finance the investment. Many of these are common municipal finance vehicles whereas others are limited to renewable energy projects. If Milwaukee does proceed in this fashion, it will not be able to benefit from the various tax incentives that have already been described. To compensate, certain state and utility programs provide higher cash incentives for non-taxpaying, public sector and non-profit entities. This is the case in Wisconsin. In addition to receiving higher incentives, a city will likely have a lower cost of capital than the cost of capital of the investors supporting the third party model.

3.2.1 Tax Exempt Financing

If the city decides to finance and own solar energy systems it can consider a number of traditional tax-exempt financing vehicles.

3.2.1.1 Municipal bonds

General obligation, tax-exempt municipal bonds can be a source of capital for PV and SHW projects. In most cases, a single PV or SHW project will not be large enough for a dedicated issuance, but rather it will bundled into a larger capital spending plan financed by bonds. There are a limited number of cases where a city or state has issued bonds solely for renewable energy and energy efficiency. The City of Honolulu issued $7.85 million in "solar" bonds in FY05 for solar powered parking lots, energy retrofits, and LED streetlamps.[52] While it was a general obligation bond (i.e. backed by the broad taxing powers of the city) and not a revenue bond per se (i.e. revenue from the project itself pays back the bond), the city does view the investments in these solar projects as generating saving on utility bills which then can be used to pay back the bonds. Other jurisdictions have received *approval* in the past to issue bonds dedicated to renewable energy projects such as New Mexico's Energy Efficiency and Renewable Energy Bonding Act and San Francisco's Propositions B & H., but no debt has actually been issued.

3.2.1.2 Commercial Paper

The author has been involved in conversations with two Solar America Cities who evaluated the use of tax exempt commercial paper (TECP) to initially finance their PV projects. Commercial paper is issued for short periods (up to 270 days) and is a common municipal financing tool. Once issued, the TECP would be either refinanced with longer term debt or amortized down over time. In the end, one of the cities is continuing to evaluate the TECP market whereas the other has decided to proceed with the third party, PPA approach.

3.2.1.3 Leasing

Leasing equipment instead of purchasing it is a common way for cities to finance certain assets (e.g. vehicles, software, computers, office equipment, etc.). However, the use of a tax exempt lease to finance a PV or SHW installation for a public sector entity is not common. If Milwaukee were to issue a tax exempt lease to finance the acquisition of a PV system, the lessor (owner of the system) would <u>not</u> be able to benefit from the federal investment tax credit because the user of the system (Milwaukee) is not subject to US income taxes.[53] This makes sense intuitively since the federal government is already providing a tax subsidy in the form of the tax-exempt lease payments. In that tax exempt leases can be more expensive than other forms of municipal debt, in part, given that lease payments are normally paid for using annually appropriated funds (which may be subject to budget constraints and thus, considered riskier than general obligation bonds, for example, which are back by the taxing authority of the issuer) it is unlikely that tax-exempt leasing will be the first choice for Milwaukee.[54]

---

[52] Lori Goropse Winguard, Chief of Staff to Council Member Charles K. Djou. Email communication. 10/16/2007.

[53] SEIA Guide to Federal Tax Incentives for Solar Energy Version 1.2 http://www.seia.org/galleries/pdf/SEIA_manual_version_1.2.pdf

[54] Financing Non-Residential Photovoltaic Projects: Options and Implications. Bolinger, M. 2009 http://eetd.lbl.gov/ea/ems/reports/lbnl-1410e.pdf

3.2.2 *Qualified Tax Credit Bonds (QTCB)*

There are a variety of tax credit bonds in which investors receive a tax credit from the Federal government instead of (or in combination with) interest from the issuer. Two of these bonds, Clean Renewable Energy Bonds and Qualified Energy Conservation Bonds, are potential sources of capital for Milwaukee as it contemplates public sector PV and SHW installations as well as the creation of loan or rebate programs..

3.2.2.1 Clean Renewable Energy Bonds (CREBs)

Initially authorized under the Energy Policy Act of 2005, Clean Renewable Energy Bonds (CREBS) are an attempt to level the playing field for public entities unable to benefit from the tax incentives. Conceptualized as interest free debt, investors who purchase a CREB receive a federal tax credit in lieu of interest payments from the issuer. As part of the 2008 Economic Stabilization Act, Congress authorized an additional $800 million for the CREBs program, of which, 1/3rd has been allocated to government entities, including cities. In 2009, this amount was increased to $2.4 billion. As far as the Solar America Cities program, public agencies in San Francisco, Denver and Tucson have issued CREBs to date.

The US Treasury publishes the CREBs tax credit rate on a daily basis and it is an average of select corporate bonds rated A to BBB. Each month, the Treasury calculates the maximum term for a CREB. Since the program's inception, the maximum term has fluctuated within a 12-16 year range. Currently, it is set at 16 years. NREL will be publishing a detailed report of the CREBs program in the near future. There is also a presentation on CREBs available through the Solar America Cities program.

There are some caveats with the CREBs program. It has been difficult to entice investors to purchase a CREB solely on the basis of the federal tax credit. As a result, many issuers have had to either issue the bonds at a discount to par or make a supplemental interest payment. CREB allocations for government agencies are awarded on a smallest to largest basis; meaning large projects have not received allocations in the past (e.g. large meaning an amount greater than $3.5 to 4 million dollars). Finally, the transaction costs associated with CREBs can be high given that the issuance is relatively small and investors need to be educated about the product. One way to overcome the small issuance problem is to apply for individual projects separately in order to receive an allocation, but then bundle them together in a single bond. This of course needs to be put in the context of the current economic crisis where the interest in tax credits in general is lower than in previous years as many investors have less taxable interest to offset or actual losses, making tax credits unnecessary.

Guidelines for the new CREBs program (which differs in certain respects from the original program) are available online.[55] Changes between the old CREBs program and the new one can be considered both positive and negative. On the positive side, cities can issue CREBs with a bullet maturity at the end of the term (one payment for the full amount at maturity) versus the annual amortization requirement in prior years. Arbitrage restrictions are more flexible as well. However, offsetting these positive developments, the available tax credit will be reduced by 30%

[55] IRS Guidelines for New Crebs. 2009-33
http://www.irs.gov/pub/irs-drop/n-09-33.pdf

and only 2% of bond proceeds (down from 5%) can be used to cover issuance costs. Given this reduction in the size of the tax credit and based on conversations with professionals in the financial markets, it is very likely that an issuer of a CREBs today will have to either make a supplemental interest payment or issue the bond at a discount.

Therefore, CREBs may be appropriate in certain situations, but it is certainly not a silver bullet for all of Milwaukee's financing needs. First and foremost, the city must compare the rate that it will pay on other long-term, tax-exempt debt instruments versus the final cost of issuing a CREB. The CREB rate should be favorable in most cases although issuance costs may be higher and the term will be shorter. If the city decides that the cost of CREBs' financing is attractive, it then has to select individual projects. Remembering that small projects will be chosen first, CREBs are appropriate for PV systems on schools, libraries, and fire stations. It will unlikely be the first choice for a large 1 MW project at a water treatment facility or some other big project, unless Milwaukee has other sources of financing to combine with the CREBs proceeds. Applications for CREBs' allocations are due by **August 4, 2009**.

3.2.2.2 Qualified Energy Conservation Bonds (QECB)[56]

QECBs are very similar to CREBs. Created as part of the 2008 Energy Improvement and Extension Act and upsized in 2009, QECBs are a $3.2 billion tax credit bond program for local governments which can be used to finance renewable energy projects, including PV and SHW systems. However, unlike CREBs, up to 30% of QECBs can be used to finance private sector activity. Also, there are a number of additional renewable energy and energy conservation projects that can be financed with QECBs, including:

(i) Capital expenditures for reducing energy consumption in publicly-owned buildings by at least 20 percent.

(ii) Capital expenditures for implementing green community programs (including the use of loans, grants, or other repayment mechanisms to implement such programs).

(iii) Capital expenditures for rural development involving the production of electricity from renewable energy resources.
- Expenditures with respect to research facilities, and research grants, to support renewable energy and energy efficiency research.

(iv) Mass commuting facilities and related facilities that reduce the consumption of energy, including expenditures to reduce pollution from vehicles used for mass commuting.

(v) Demonstration projects designed to promote the commercialization of
- green building technology,
- conversion of agricultural waste for use in the production of fuel or otherwise,
- advanced battery manufacturing technologies,
- technologies to reduce peak use of electricity, or
- technologies for the capture and sequestration of carbon dioxide emitted from combusting fossil fuels in order to produce electricity.

(vi) Public education campaigns to promote energy efficiency.

---

[56] IRS Guidelines for QECBs. 2009-29
http://www.irs.gov/pub/irs-drop/n-09-33.pdf

Unlike CREBs, where an application is made to the IRS for a tax credit allocation, the QECB tax credits are allocated to the states based on population. This state-by-state allocation has already taken place. Wisconsin received an allocation of approximately $58 million dollars.[57] Cities within Wisconsin with populations greater than 100,000 automatically receive a sub-allocation of some amount. As Milwaukee meets the 100,000 population threshold, it will have a QECB allocation at its disposal.

As far as the IRS is concerned, it is now up to the individual states and large cities to manage their QECB programs. Given these entities have been occupied with other federal stimulus related activities, there has not been much, if any, QECB activity to date. Fortunately, there is no deadline (or sunset date as it is called in the guidance) for the QECB program. It is expected that states will turn their attention to the QECBs sometime after the deadline for the CREBs applications in August 2009.

The tax credit structure will be for all intents and purposes similar to CREBs. Therefore, the advantages and disadvantages highlighted in the section 3.2.2.1 also hold true for QECBs. Thus, it is likely that issuers will need to sell QECBs at a discount to par or make supplemental annual interest payments.

One area which is peaking interest in a number of Solar America Cities is the idea of using QECBs to fund a loan or rebate program. In particular, a QECB could be issued to provide seed capital for establishing a property tax assessment program. This model will be discussed in the next section. A second potential use of QECB proceeds is to buy down the cost of a third party PPA by having the City pay for some aspect of the installation of a large PV system. This would lower the amount that the third party would have to finance which should translate into a lower cost per kWh in the PPA itself. This particular concept is analyzed in a legal memo prepared by the law firm, Stoel Rives, LLP which is available through the Solar America Cities program (intranet).

Boulder County, Colorado demonstrated this concept of using other funds in combination with a third party PPA which resulted in a cost of electricity two cents below what the County was paying the local utility. While QECBs were not the source of financing, the concept of buying down a PPA was demonstrated nonetheless.

Care should be taken if the proceeds from a QECB will be used for something other than a loan program, a PV or SHW system, or to buy down a PPA. For example, Milwaukee could issue a QECB to finance a solar education and outreach program. However, in that this program in and of itself would not generate either income or utility bill savings, the City would have to repay the bonds with some other source of funding. This would also apply to funding a rebate program with the proceeds of a QECBs.

3.2.3 New Market Tax Credits (NMTC)

NMTC is a mechanism by which private capital is channeled into low income neighborhoods with the express intent of promoting economic development and jobs.[58] Investors get a tax credit

[57] Ibid.

[58] New Market Tax Credits Program.

over a 7-year period equivalent to 39% of the value of the investment. While not a traditional source of capital for solar projects, recently, a few entities, including Renewable Ventures, have received a NMTC allocation with the goal of incorporating PV installations into a larger community development initiative. Milwaukee would have to work with an established Community Development Entity (CDE) or establish one, as only CDEs can take advantage of NMTC.

3.2.3.1 Renewable Ventures (formerly MMA Renewable Ventures)

In October 2007, Renewable Ventures received a NMTC allocation in order to channel investment into low income neighborhoods in the San Francisco Bay Area.[59] The goal is to invest in renewable energy and energy efficiency within these neighborhoods to hedge against rising electricity costs. The rationale is that stable electricity costs will help retain existing development and community services as well as attract new investment. A second component of the proposal is to create green-collar jobs in these neighborhoods by using a portion of the NMTC proceeds to train residents to be solar installers and energy efficiency auditors. As it relates to PV, Renewable Ventures would install PV systems at businesses, municipalities, and schools in these targeted neighborhoods and sign long-term power purchase agreements with these entities. According to conversations with Renewable Ventures, the work on this initiative was slowed by the uncertainty surrounding the extension of the solar ITC in 2008 and the current financial crisis, but Renewable Ventures expects to have results in 2009. Whether the recent sale of Renewable Ventures to Fotowatio in March 2009[60] will impact the NMTC program is unknown.

While it will unlikely be a primary vehicle for PV and SHW within the City of Milwaukee, exploring the use of NMTC could make sense as one component of a broader community development initiative, especially one that includes dis-advantaged neighborhoods and job training.

3.2.4 Performance Contracting

It is possible to combine an energy service performance contract (ESPC) with PV and SHW although SHW may be more realistic given its shorter payback period. The ESPC model is one in which an Energy Services Company or ESCO (such as Johnson Controls or Honeywell, to name two) make energy efficiency investments on behalf of the city and then gets repaid out of the energy savings that result from these investments. Many energy conservation mechanisms (ECM) such as upgrading a facility's lighting, or installing a new boiler, will have much shorter payback periods than a PV or a SHW system. Therefore, by combining these shorter payback ECMs with PV or SHW, ideally, a package of energy efficiency and renewable energy investments can be created that has a total payback period that is attractive to the city. As Johnson Controls is based in Milwaukee, it may be option to explore with them.

---

[59] http://www.cdfifund.gov/what_we_do/programs_id.asp?programID=5
2007 New Market Tax Credits Award Profiles.
http://www.cdfifund.gov/docs/2007/nmtc/NMTCProgramProfiles.pdf

[60] Spanish Solar Company to become one of largest in US. Renewable Ventures Press Release March 2009.
http://www.renewableventures.com/news/20090302-pressrelease-mma.htm

Summary

As illustrated in this section, if Milwaukee decides to directly finance the installation of a PV or SHW system, there are a number of potential options available to it. These options may be limited by the characteristics of the project however. Bundling PV or SHW with energy efficiency is always a good idea regardless of the financing structure, but in particular, it may open the door for performance contracting. There are a number of relatively new federal programs such as the tax credit bonds the City can take advantage of. In addition, creatively thinking about solar from an economic development and jobs perspective, may allow the City to take advantage of New Market Tax Credits.

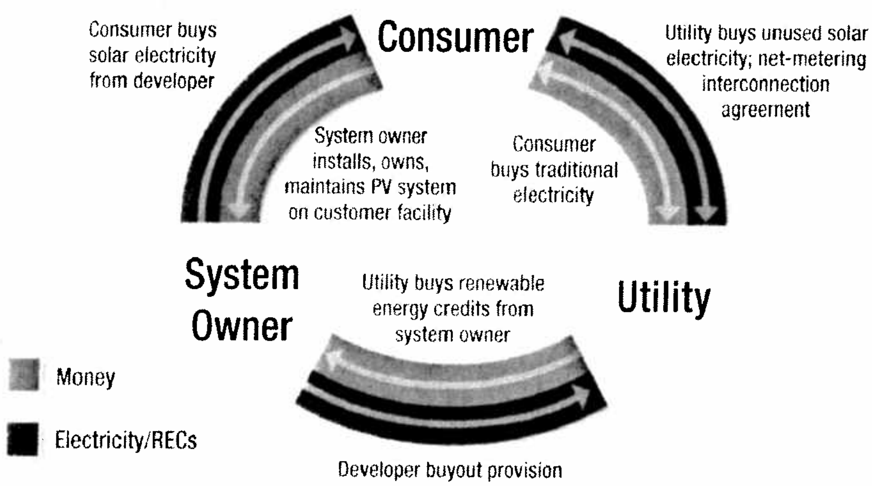
4.0 Financing Milwaukee's PV installations using the Third-Party PPA Model

Many city governments are moving away from direct ownership of PV systems and partnering with third-party owners and solar developers. Cities see the third-party ownership model as a way to effectively monetize federal tax benefits, avoid paying the up-front cost of solar, more efficiently allocate public funds, and accelerate the deployment of PV.

4.1 How it works

Instead of owning the PV system, a Milwaukee city government facility would host a system that is owned and operated by a third party, usually in the form of a limited liability corporation (LLC). In simple terms, Milwaukee can enter into a long-term contract (the "PPA") with the LLC to purchase the electricity generated from the PV system on City property. The electricity price is typically set at a rate competitive with the host's current retail rate in the first year, and then it will escalate at some fixed percentage per year over the life of the contract. Alternatively, the price of electricity in the PPPA could be fixed for the length of the contract. The developer manages all aspects of system financing, installation, and maintenance, and bears all standard operating risks.

Figure 1. Contracts and Cash Flow in Third-Party Ownership Model



4.2 Advantages of the Third-Party PPA Model

There are several key reasons why Milwaukee may consider the third-party PPA finance model an integral component of its PV strategy. These reasons are listed below.

- Ability to Monetize Federal Tax Incentives: As noted, the federal ITC for PV projects is 30% of the installed capital cost. In addition, businesses can accelerate the depreciation of the cost of a solar system using the 5-yr MACRS. Together, these two tax incentives have a tremendous impact on both the cost and the financial returns of a PV installation. However, as a non-tax paying entity, Milwaukee cannot benefit from these attractive incentives if it directly owns its PV systems. The third-party ownership model introduces a taxable entity into the structure that can benefit from the federal tax incentives, lowering the overall cost to the non-taxable entity.

- Low/No Upfront Costs: PV systems are not cheap. As mentioned at in section 1.0, at $6.00 - 8.50/watt, a large public sector PV system in Milwaukee can easily exceed a million dollars. Even if rebates and incentives reduce this amount, the upfront cost will still be significant. Given budget constraints, committing to such a large initial investment, even if the long-run economics make sense, may not be feasible. The third-party ownership structure pushes this initial cost onto the solar developer and its investors and off of Milwaukee's balance sheet.

- Pre-Determined Electricity Price for 20-25 years: In today's volatile energy markets, a fixed-priced PPA offers predictable electricity pricing for the portion of the entity's load served by the PV system. To make the third-party ownership model attractive to the City, the initial price of electricity in the PPA will usually be set at a rate that is competitive with the host's current retail rate. This rate will then escalate each year at some predetermined rate (2-5%) for the life of the contract. This pricing structure provides a hedge against the potential volatility of both the fossil fuel and electricity markets. PPAs can also be structured so that Milwaukee pays a flat rate for the entire life of the contract. In this case, the initial cost of the electricity in the PPA will likely be higher than rates the City is currently paying but with the expectation that retail electricity rates will eventually surpass the PPA rate. Some public sector hosts have considered a electricity rate which is set at some fixed discount to the retail electricity rate as a way to guarantee that they'll always be below the retail rate. This provides some downside protection in case electricity rates fall. However, in most cases, this is very complicated to structure and manage, and probably not worth the effort.

- Shift O&M Responsibility to Qualified Third-Party: Owning a large PV system implies a certain degree of oversight and maintenance that Milwaukee may not want to be responsible for or have the expertise to carry out. One of the attractive features of the third-party ownership structure is the ability to assign the operation and maintenance of the PV system to more qualified counterparties. The third-party ownership model streamlines the number of counterparties that city has to deal with down to basically one, the PPA provider.

- Path to Ownership: It is common to include a buy-out option in the PPA. From a financial perspective, this buy-out option would likely be available starting after year 6 so that the original investors are able to capture all of the tax incentives (and avoid any tax credit recapture issues with the IRS). This buy-out option can be priced in a number of ways; but will likely include the present value of the electricity that the city would have purchased from the PPA provider if the contract was left in place. If a buy-out option is not exercised prior to the end of the original PPA term, the three likely scenarios at the end of the contract period would be that Milwaukee could 1) extend the PPA agreement, 2) purchase the system, or 3) ask that the system be removed at no cost to the City.

4.3 Disadvantages and Caveats with the Third-Party Ownership Model

While the third-party ownership model is an attractive one, it is not without its downsides. There are nuances to PPA agreements which must be understood before moving ahead with the third-party ownership structure.

- Green versus Brown Energy: In third-party PPA agreements, the ownership of the solar RECs resides with the owner of the system (i.e. not Milwaukee). As a result, the City has to be cautious about how it promotes the PV systems that it is hosting. In the absence of SREC ownership, it is inaccurate to claim that the Milwaukee Convention Center (for the sake of an example) is solar powered since only the owner of the SRECs can claim the environmental attributes generated by the PV system. The rationale behind this concept is to avoid double-counting of renewable energy certificates.[61] As a result, it is common to see a clause in the PPA that requests that the City coordinate with the PPA provider on marketing materials and press releases regarding the PV system.

  Given the absence of a solar REC market in Wisconsin, it may be feasible for the City to agree to purchase both the electricity and the SRECs generated by the PV system as part of the PPA. Many cities request pricing for electricity with and without SRECs. If the bundled price is not considerably higher than the price of the electricity alone, the City may consider buying the SRECs as well. In most cases, and in order to drive down the cost of electricity as low as possible, cities forego the purchase of the SRECs.

  To summarize this point, if Milwaukee decides not to purchase the SRECs in any future PPA that it may enter into, the accurate description is that the city is ***hosting*** solar panels on its property. This may be sufficient for the city's needs. However, if Milwaukee wants to make additional green power claims, it can either buy the SRECs from the PPA provider or explore the idea of buying replacement RECs in the voluntary REC market. It will likely be much cheaper to purchase RECs generated by wind or biomass projects than SRECs per se. For example, if a rooftop PV system generates 10,000 kWh per year, the city could buy wind RECs in the same quantity and then claim that the particular building is powered by renewable energy (but not solar powered since the SRECs weren't purchased).

- Ownership and Facility Access: In some cases, initial ownership of the system is important.
  - One of the attractive concepts of PV is this idea of "free electricity". While nothing is free as the City has to pay for the system, owning a PV system outright will reduce the utility bill at the site. Under a PPA, although a portion of the electricity expense is redirected away from the utility and to the third party PPA provider, 100% of the electricity consumed must be paid for. As noted earlier however, the amount purchased under the PPA will act as a hedge against higher

[61] Holt, E. & Associates, R. Wiser, and M. Bolinger. 2006. Who Owns Renewable Energy Certificates? An Exploration of Policy Options and Practice. Lawrence Berkeley National Laboratory. http://eetd.lbl.gov/ea/emp/reports/59965.pdfstill working on reference

retail prices. As mentioned, while a third party PPA can allow for system buy-out options.

- Some government agencies and personnel, including plant and facility managers, may not be comfortable with a third-party having access to and installing equipment on city property. On-going site access is critical to the performance of the system and if that is not acceptable, the third-party ownership model will unlikely be a viable option.

- Transaction Costs: There are a number of contracts involved in the third party PPA process. While Milwaukee will not necessarily be a party to all of these contracts, it is safe to say that it is a legally intensive and expensive process. In addition to lawyers, facility managers, procurement officers, and energy managers also need to be involved, resulting in a significant number of labor hours dedicated to the project.

4.5 Examples of Third Party PPA Models

There are many cities in the US already using the third party PPA model, including a number of Solar America Cities. More are in the RFP process. Below are four examples of completed transactions.

San Diego's Alvarado Water Treatment Plant[62]

San Diego's Water Department has a PPA with SunEdison for 1 MW of solar PV at its Alvarado Water Treatment Plant. According to the City's press release, $6.5 million in upfront installation costs were avoided by signing the PPA with SunEdison (as opposed to buying the system). Once installed, the PV system will cover 20% of the plant's power needs.

Port of Oakland[63]

The Port of Oakland hosts a 756 kW, ground-mounted PV system. SunEdison financed, and built, and now owns and operates the system. The Port signed a PPA with SunEdison to purchase "clean and predictably priced electricity" for 20 years at a total cost of approximately $4.1 million.[64]

Fresno State University[65]

Chevron Energy Solutions installed a 1.1 MW PV system that provides the University with 20% of its annual electricity needs. The project cost approximately $12 million, but it benefited from a $2.8 million rebate from PG&E under California's Self-Generation Incentive Program. Chevron Energy Solutions installed the PV system but it was financed and is owned by MMA Renewable Ventures and its investors. Fresno State signed a 20-year PPA with MMA RV and they expect to save $13 million in avoided electricity costs over a 30-year period.

---

[62] City of San Diego Press Release. March 1, 2007. http://www.sandiego.gov/environmental-services/energy/news/pdf/070301.pdf

[63] Port of Oakland Press Release. November 7, 2007. http://www.portofoakland.com/newsroom/pressrel/view.asp?id=82

[64] Port of Oakland Press Release. June 6, 2006. http://www.portofoakland.com/newsroom/pressrel/view.asp?id=28

[65] Fresno State News. November 9, 2007. http://www.fresnostatenews.com/2007/11/solarwrapup2.htm

Denver International Airport (DIA)[66]

In 2007, DIA signed a 25-year PPA with MMA Renewable Ventures for a 2 MW solar PV system which will produce 3.5 million kWh per year when it is fully completed. The total cost of power to be purchased under the PPA was reported to be $10.9 million or roughly 12.5c/kWh. Xcel Energy will provide a $200,000 rebate to partially offset the project's initial costs, in addition to purchasing the SRECs as they are generated. Built into the agreement is a buyout option after 5 years allowing DIA to assume ownership of the system.

4.6 The Current Financial Crisis in the U.S.

As noted throughout this paper, tax credits are an important element in the financing of PV systems. As a result, the ability to benefit from these tax credits - or "monetize" them in industry parlance - is critical. For large projects that are financed using the third party PPA model, the solar developer is often unable to fully monetize the tax credits as its taxable income is not large enough. As a result, the solar developer either enters into a partnership with an investor(s) or alternatively, leases the PV system from these investors (a sales-leaseback transaction). The investors are brought into these transactions because the do have the taxable income - or tax appetite - to benefit from the tax credits. Prior to the financial crisis and based on conversations with industry professionals, there were approximately 14 large tax investors in the renewable energy sector. For the most part, these were banks and insurance companies as these industries traditionally reported sizeable and consistent taxable income. However, with the onset of the current financial crisis, the number of active tax equity investors has now been reduced to around four.[67]

This reduction in the number of tax equity investors combined with reluctance on the part of investors to part with cash has created two issues. The minimum returns that the remaining tax equity investors require for their investment is increasing - informally, rates are said to have increased by 2-3% or so, to 9-10% if not higher (after tax equity returns). In addition, investors can be more selective about which projects to invest in. Counterparty risk is much more important these days. So even if a transaction can support a higher rate of return for the investor, it may not get done, if the investor is worried about getting its money back. As an anecdote, the author was assisting a non-profit organization outside of Denver with a PPA for a 100kW system. Everything was going smooth until the PPA provider (and its investors) backed out of the transaction citing concerns about the credit quality of the host.

The other side of the financial crisis is that solar developers have received commitments from investors to finance their projects. It remains to be seen if large PPA projects that were moving through the documentation stage are put on-hold, if the investors are no longer able to meet their funding commitments.

In summary, the current financial crisis has indeed impacted the third party finance model. If Milwaukee decides that it wants to pursue a PPA-financed transaction to install PV on a public

---

[66] The Denver Post. October 1, 2007. http://www.denverpost.com/ci_7056394?source=rss

[67] Trends in Tax Equity for Renewable Energy-Will New Players Emerge? Webinar on December 16, 2008.

building, if it can get a deal done, it will likely be more expensive than it would have been a year or two ago. An additional drag on the economics of PV is that falling prices for coal and natural gas make the relative comparison more difficult. However, there is some optimism that the higher cost of capital and declining fossil fuel prices are tempered somewhat by the declining prices in other commodities, particularly steel (for racking and other structures to mount PV) as well as falling PV module prices.[68] Given this volatility, many solar industry analysts are predicting a tough 2009, with the hope that the economic environment becomes more conducive to PV installations again in 2010.

Summary

The third party finance model for large PV systems is an attractive option for public sector entities that are unable to monetize tax credits available for renewable energy projects. Like any structure, there are certain disadvantages to the third party model. However, more often cities are choosing to sign a PPA rather than finance and own PV systems. Purchase options allow the city to take ownership of the system once the tax benefits have been utilized by investors. The current economic crisis has certainly had an impact on the third party PPA model and Milwaukee may find it difficult to identify solar developers that are interested and able to finance a large PV system in Wisconsin at this time. The picture should improve as the country's economic condition stabilizes and as Congress pursues regulations on greenhouse gas emissions.

[68] PVNews. Vol.27. No. 12. December 2008. Published by the Prometheus Institute and Greentech Media.

5. 0 Specific Projects in Milwaukee

The City of Milwaukee, as part of its Solar America Cities technical assistance grant, has contracted (through the National Renewable Energy Laboratory) the Midwest Renewable Energy Association to conduct 25 solar site assessments across the City and surrounding counties. These site assessments will be finished by August 2009. The City selected a diverse list of sites to assess for the potential to host either a PV system or a SHW system. The list includes;

- 10 fire stations (SHW)
- 3 parking garages (PV)
- 3 schools (PV)
- 2 water treatment facilities (PV)
- 2 senior housing complexes (SHW)
- 1 low income housing complex (SHW)
- 1 hospital (SHW)
- 1 police department building (PV)
- 1 church and school complex (PV)
- 1 pool (SHW)

The size of each system - to be determined by the site assessment - and the choice of technology will guide the financing options available in each case. From the list, it is apparent that there will be modest size systems such as SHW on the fire stations and the PV on the schools, and large systems such as PV at the water treatment facilities and SHW at the hospital. There are very few, if any, instances of third party PPA transactions involving SHW. Therefore, it is likely that all of the SHW systems will be owned and operated by the host agency.

Depending on the final size of the 2 water treatment systems, the third party PPA model may be the right approach. Systems at such facilities tend to be large. Electricity loads are high and there is often considerable space to site a system. In fact, PV at water treatment facilities is one of the most common applications of the third party PPA model with San Diego, San Francisco, and the City of Boulder just three examples within the Solar America Cities program itself.

The third party model PPA might also be effective if the City for smaller PV projects if the City can bundled them together. Boulder County's seven project, PPA transaction comes to mind as do several school district projects in California. As was noted in section four, a minimum size is required for a PPA to make economic sense. Thus, if some combination of the parking garages, schools, water treatment facilities, and the police building are bundled together, the total project size should be sufficient to at least approach the market to gauge interest in a third party financed transaction using a PPA. The church PV project was intentionally left out as it not City owned.

Bundling will also be important for those projects that the City decides to finance, own and operate. As many of the proposed projects are small, a critical mass of them must be aggregated to warrant a dedicated financing. This should also have a positive impact on the installed cost of the various projects given economies of scale. For example, Milwaukee could apply for an individual CREB allocation (or use a portion of its QECB allocation) for all the projects on the list with certain exceptions noted below. Each individual application will be for a modest allocation. None of which would large enough to absorb the issuance costs of a CREB or a

QECB. However, assuming all projects get an allocation, and for the sake of an example, the total is 400 kW, then it would be feasible to consider a bundled $3 million CREB or QECB issuance. Tucson did something similar when it combined seven separate CREB projects into one $7 million financing

In previous rounds, the cut-off for CREBs was less than $4 million. Assuming a system size of 1 MW, the water treatment PV installation would likely exceed this amount. However, it is still possible to apply for a CREB allocation for a portion of the funding of the PV system at the water treatment facility as long as the City can demonstrate where the remainder of the funding will be coming from to complete the project (the "Plan of Financing").

Under the CREBs program, the church would not be considered a qualified issuer. However, QECBs does allow up to 30% of the allocation to be used by private entities which may open the door for the PV system at the church/school complex.

Solar pool heating is traditionally excluded from renewable energy tax incentives. So, in the case of the proposed SHW system at the Pulaski Park Pool, it will depend on whether or not the SHW system will be used for the showers or to heat the pool. If it is the former, then it should qualify for a CREB or a QECB; if it is the latter, it is unlikely to qualify.

The focus on CREBs, QECBs, and the PPA does not imply that there aren't more straightforward ways to finance these proposed projects. As many of them will be modest in size, each agency, be it the Milwaukee Fire Department or the local school district, may have access to internal funding to pay for the installations. Including these projects in the normal capital budgeting process would be the easiest and the most familiar. However, this analysis does recognize that the current economic environment may not be conducive to capital spending for new solar energy projects using more traditional financing structures.

To conclude this section, the following paragraphs will examine a subset of the sites targeted for site assessments to provide some additional detail about potential options to finance the proposed PV and SHW installations. In total, they represent 18 of the 25 sites.

5.1 SHW on the 10 Milwaukee Fire stations

Given the hot water use at fire stations for laundry, showering, food preparation and equipment washing, a solar hot water system makes sense. In fact, the City of Madison has installed solar hot water systems on all eleven of its fire stations, taking advantage of Focus on Energy incentives.[69] In 2007, Milwaukee issued an RFP for SHW installations on select fire stations but the projects did not go forward.

Reviewing the MREA site assessment report for fire station #25 in Milwaukee (the only one available at this time) the initial installed cost is calculated to be $18,000- 19,200. After incentives from Focus on Energy and We Energies (but no tax credits), the net installed cost is approximately $6,000 - 7,000. If we assume that fire station #25 is representational of the other

[69] "Solar hot water douses rising energy costs at Madison's fire stations." Focus on Energy http://www.mpoweringmadison.com/media/madisonFIREstations_1208.pdf

nine fire stations, then the total net investment for all ten fire stations is approximately $60,000 to 70,000.

This modest total amount makes financing the projects with bonds an unattractive proposition, including the use of CREBs or QECBs (unless bundled). Certainly, the third party model would not be an option. Instead, Milwaukee could use grant funds from We Energies for all ten projects. Stimulus funding could be directed towards these projects as well. The City could finance them with short-term, tax exempt commercial paper or out of general funds (if available). Finally, the SHW systems could be combined with energy efficiency investments and bid out under an energy services performance contract of some type.

5.2 PV on the municipal parking garages

From the maps, the three parking garage sites appear to be municipal garage facilities with large roof spaces. One has a new roof and another one is scheduled to be re-roofed in 2010. Depending on the activity that takes place inside of these garages - i.e. what is the base load electricity consumption and when does it occur - it may be possible to site PV systems in excess of 20 kW (net meter cap) on at least two of the three. The Lincoln Ave garage is listed as having an old roof with no plans for a new one. Depending on the age and the condition of the roof, this may not be a good site for a PV system until a new roof is installed.

For discussion purposes, let's assume 20 kW systems on both the Municipal Services Building and the Northwest Garage. This would translate into an estimated initial installed cost of $160,000 (assuming $8/watt). Both garages would appear to qualify for Focus on Energy and We Energies rebates. Using PVWatts, a 20 kW system in Milwaukee will produce approximately 25,500 kWh in the first year. This translates into a combined incentive of $57,000 for a net installed cost of roughly $100,000 per system.

Similar to the fire station analysis, grant funding, city general funds, and stimulus funding could be combined to finance these projects. Alternatively, they could be part of a bundled CREB or QECB issuance or part of a large PPA project encompassing many separate installations.

5.3 PV on schools

Installing PV systems on schools is very common. While system size will be probably smaller than the 20 kW used above for systems at the municipal garages, the analysis is similar as are the options to finance them. There are examples from California where the third party PPA model has been used to install PV systems on a number of schools throughout a particular school district.

- In December 2008, Chevron Energy Solutions with financing from BankAmerica completely the installation of PV systems on parking structures at 13 Milpitas, California schools and one additional school district building for a total of 3.4 MW. Milpitas entered into a 23 year PPA with BankAmerica. The project was combined with energy efficiency investments and is expected to reduce electricity expenses by 22% throughout the district.[70]

[70] Chevron Energy Solutions
http://www.chevronenergy.com/news_room/default.asp?pr=pr_20081215.asp

The exciting aspect of installing PV or SHW on schools is the ability to incorporate it into classroom activities on renewable energy. Using special software to view the system's production on-line and in real time, students get a first hand look at how electricity can be produced from renewable resources.

5.4 PV at Water Treatment Facilities

As noted earlier, installing large PV systems at water treatment facilities is a common application. The large investment associated with these projects is often beyond the scope of what a city can or wants to finance directly; not to mention the maintenance obligations. In addition, the value of the tax credits in a large, multi-million dollar project are so great that one would be loathe leaving them "on the table". Three similar projects within the Solar America Cities program are:

- In May 2009, the City of San Francisco signed a 5 MW PPA with Recurrent Energy for a PV system at one of its water reservoirs.[71]
- The City of Boulder, CO is nearing completion of a 1 MW PV system on a wastewater treatment facility under a PPA agreement with EyeOn Energy Ltd.[72]
- As noted in section four, since 2007, San Diego has had 1 MW PV system of what is a 5 MW plan at its Alvarado water treatment plant.

Assuming the site assessments for the two water treatment facilities indicate that a large PV system is feasible and the City decides that at least one of the two is considered a priority project under the Milwaukee Shines initiative, it will be useful to compare the economics associated with owning and operating a large PV system versus entering into a third party PPA. There are some simple tools available within the Solar America Cities program to assist with this analysis. This analysis will likely show that the third party approach is the most economic while still creating the option for the city to purchase the facility in the future.

As noted earlier, the caveat is that even if Milwaukee decides to pursue the third party model to finance a large water treatment PV system, there is no guarantee that solar developers will be interested in the project, especially in today's market. Remember that solar developers and their investors look for markets with attractive financial incentives, solar REC markets, strong solar friendly policies and local support for renewable energy. Milwaukee does not score high on all of these dimensions. As a result, if the City issues an RFP for a PV system at a water treatment facility, assuming it attracts interested bidders, the proposed price per kWh of electricity will likely be higher than current retail utility rates. Whether or not it is realistic to consider paying above market rates for electricity is something to be determined locally. The context within which to make this determination must also include expectations for future retail electricity rates and the likelihood that over a 20-25 year timeframe, they exceed what is proposed in a PPA.

Another possibility and one that some cities are beginning to explore, is the idea of making either prepayments of electricity as part of a third party PPA model, or making certain upfront investments using city resources to lower the cost of the system to be financed under the PPA. In

---

[71] The San Francisco Sunset Reservoir Solar Project.
http://www.recurrentenergy.com/resources/sfsunset.php

[72] Boulder Wastewater Treatment Solar Power Project.
http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=8763&Itemid=1189

the aforementioned multi-project PPA transaction involving Boulder County, the County used its own financial and human resources (master electricians on staff) to do some of the initial project development. Thus, the amount that the solar developer had to finance was reduced. This resulted in lower financing charges over a 20 year period which were be passed along to the County in the form of a lower price per kWh in the PPA.

In another instance, a city in Sonoma County, CA is evaluating a PPA proposal where it is being asked to invest $1 million upfront. This will help the developer complete the financing necessary to move forward with the project while lowering the cost to the city when it plans to exercise its buy-out option.

In the case of Milwaukee, when appropriate, it will make sense to evaluate prepayments or buy-downs within the context of a third party, PPA transaction. Grant funding could be used for either a prepayment of electricity or to make certain upfront investments at the site. In addition, it would be feasible to issue a QECB to pay for certain upfront investments (but not for the prepayment of electricity). The Solar America Cities program has a legal brief from the law firm Stoel Rives, LLP on combining QECBs and the PPA on its intranet site.

Summary

Once all 25 site assessments have been completed, the City will prioritize them according to which ones present the best opportunities for solar energy systems. Once prioritized, the next step is to evaluate which ones can be realistically financed and with what source of funds. As this section has tried to illustrate, there are no single or necessarily simple answers to these questions. In many cases, multiple sources of funds need to be combined to get a system installed. In others, given the current economic environment, some projects may not be feasible at this time - for example, a third party financed PPA at a water treatment facility. Nonetheless, given the scope and diversity of the 25 sites being studied and the variety of potential sources of capital available, Milwaukee should be able to finance and install some of the systems in the near term, while developing a longer term plan to complete more of them over time.

6.0 City Support for residential and commercial solar projects

In addition to installing PV and SHW systems on public buildings, Milwaukee can also provide support for residential and commercial projects. Often cities will consider the creation of a rebate fund or a loan program in order to provide additional financial support to homeowners and businesses. However, before offering financial incentives, there are a number of important actions that a city should take to facilitate the installation of solar energy systems (or at least not hinder them). Creating solar-friendly building codes and standards, streamlining solar permitting practices, protecting solar access, and providing appropriate outreach and education are all important first steps. In addition, energy efficiency should always be either a prerequisite to participation in a PV or SHW program or at least, highly encouraged. All of these activities, while beyond the scope of this memo, create an environment in which homeowners and small businesses can take full advantage of whatever financial incentives may be available for PV and SHW.

6.1 Financial Support

States and cities across the country have set up a number of programs where they either create loan programs or provide cash incentives as a way to ease the upfront cost burden. Loan programs can have a number of different funding sources. City rebate programs, more often than not, tend to be found within cities with a municipal utility where a surcharge on utility bills or some other sort of transfer of funds into a rebate program is more easily accomplished.

6.1.1 Traditional Loan Funds

Where loan programs for solar have been established, governments have been quite creative in finding a source of funding. The following list illustrates how different states have funded their loan programs.

- Iowa uses money from an oil overcharge settlement and appropriations for its Iowa Energy Bank program and utility funds for its Alternate Energy Revolving Loan Program (AERLP).[73]
- Montana uses funds raised by penalties paid for air quality violations.[74]
- Oregon issues municipal debt to fund the program.[75]
- New York's NYSERDA program provides an interest subsidy (funded by a system benefit charge) paid directly to participating financial institutions, to lower the cost of financing a PV or SHW system.[76]

With the recent actions by the Federal government, there are now additional sources of funding for a loan program of some type. This funding would include QECBs and possibly the incremental funding provided to state energy offices and the energy efficiency community block grant program (EECBG) if not already committed to other projects. As a final example of diverse

---

[73] Iowa Incentives and Policies for Renewables and Efficiency
http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=IA

[74] Montana Incentives and Policies for Renewables and Efficiency
http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=MT

[75] Oregon Energy Loan Program
http://egov.oregon.gov/ENERGY/LOANS/selphm.shtml

[76] NYSERDA Energy Smart Loan Fund
http://www.nyserda.org/loanfund/

funding for a loan program, and in this case, a property tax assessment loan program, Palm Desert, CA's program is briefly described.

6.1.1.2 Palm Desert, CA Energy Independence Loan Fund[77]

Palm Desert has established an Energy Independence Loan Fund as part of its Energy Independence Program. The program has funded 208 loans for a total of $7.5 million dollars. The initial $2.5 million dollars for the loan fund came from the city's General Fund, as seed money to get the program off the ground. A second $5 million tranche came from selling a bond to the local redevelopment agency. However, the Loan fund has been set up in such a way that it can receive funding from any number of sources. According to city documents, these sources would include:

...additional funding from the General Fund, the issuance of notes, bonds, or agreements with utilities or public or private lenders or other governmental entities and quasi-governmental entities such as the California Public Employees Retirement System (CalPERS)...

6.1.2 Direct Rebates

In addition to loan funds, it is possible to create a rebate program where the city provides cash incentives directly to homeowners and businesses buying a PV or SHW system. This local incentive could be combined with state and utility incentives, and tax credits, to narrow the affordability gap. In Milwaukee's case, stimulus funds, QECB proceeds, and/or an existing grant from We Energies could be used to create a rebate program. There are a number of examples from cities across the country that illustrate the creativity that goes into the design of solar programs. The two examples which follow are interesting as they attempt to address workforce development and solar energy systems for low income families and non-profit organizations.

6.1.2.1 San Francisco's GoSolarSF Incentive Program[78]

Under the GoSolarSF Incentive Program, the city of San Francisco is offering up to $6,000 for residential homeowners and up to $10,000 for businesses as an incentive to install a PV system. Low income residents can get up to an additional $5,000. The San Francisco Public Utility Commission (SFPUC) is managing the program. The one year pilot program is funded with $3 million from the SFPUC renewable energy fund, which comes from the sale of power generated by the Hetch Hetchy dam.[79] The program has a unique element to it as the highest incentives go to those people who hire solar installers that have graduated from the city's workforce development program.

6.1.2.2 ClimateSmart Solar Grant Fund - Boulder, Colorado[80]

Given the cost of PV and SHW, low income households are usually unable to afford systems that would have an important and positive impact on reducing monthly utility bills. Non-profits have

[77] City of Palm Desert Energy Independence Program. http://www.cityofpalmdesert.org/Index.aspx?page=484

[78] GoSolarSF - Solar Energy Incentive Program http://sfwater.org/mto_main.cfm/MC_ID/12/MSC_ID/139/MTO_ID/361

[79] Ibid.

[80] Boulder County, Colorado ClimateSmart Program. http://www.bcclimatesmart.com/programs/solarGrantFund.php

the additional issue of not being able to take advantage of tax credits. With these barriers in mind, the City of Boulder, Colorado has created a unique program. The City redirects a portion of its 3.40% sales tax paid on residential and commercial PV and SHW installations into its ClimateSmart Solar Grant Fund. The Fund then makes grants to low income households and non-profits. In 2008, $92,000 in grants were made.

6.2 Property Tax Assessment Model

Two of the major barriers associated with PV systems are addressed by the property tax assessment model. The first barrier is the initial cost and the second is the difficulty of recouping a 20-year investment when the average property owner may move one or more times within this time frame. Wisconsin has recently joined the list of a growing number of states to allow for this property tax model. The list includes California, Colorado, New Mexico, and Vermont.

As a result of recent legislation (AB 255) in Wisconsin, Milwaukee is able to create a property tax assessment model to finance energy efficiency, PV and solar hot water. According to the text of AB 255,

> *This bill authorizes a political subdivision (a municipality or county) to make a loan to a resident of the political subdivision for making or installing an energy efficiency improvement or a renewable resource application to the resident's residential property. The bill also authorizes the political subdivision to collect the loan repayment as a special charge. A special charge that is imposed for such a loan repayment may be collected in installments and may be included as a charge on the resident's property tax bill even if the special charge is not delinquent.*[81]

The basic structure under the property tax assessment model is as follows. Using resources from a number of potential sources, the City of Milwaukee would pay for the upfront cost of a SHW or PV system; in essence lending the property owner 100% of the money to install a solar energy system. The city creates a lien on the property in the amount of the loan. The property owner then pays this loan back over an extended period of time - 20 years in the case of Berkeley - via a special property tax assessment collected annually or semi-annually, depending on the structure of the program. As property taxes take priority over mortgage debt, the program has identified a relatively secure repayment source for the debt taken on to finance the installations. The homeowner pays a modest administration fee upfront which overcomes the first barrier of the high upfront costs associated with installing a solar energy system.

If a property owner sells the home before the loan is repaid, the system and the associated special property tax remain with the property. This addresses the second barrier. The property owner only pays for (and benefits from) the system while occupying the building. When the building or home is sold, the new owners assume the costs (and the benefits) of the system, until the property tax assessment is paid off, or they move.

[81] Wisconsin State 2009 Assembly Bill 255. Page 6. http://www.statesurge.com/bills/529338-ab255-wisconsin

As these property tax assessment programs are still in their pilot phases, it is still early for Milwaukee to identify any definitive lessons learned program design and/or implementation. However, does have the luxury evaluating the variations of the model that fellow Solar America Cities (Berkeley, Sonoma County, San Diego, San Francisco, and Boulder County) are implementing in order to design its own program. Another source of information on this model, as well as a possible third party administrator and financier, is a company called Renewable Funding. Renewable Funding hired the architect of the Berkeley program, Francisco DeVries after Mr. DeVries left the city to advise other cities across the country on the property tax assessment model. Renewable Funding is also providing the funding for the pilot phase of the Berkeley's FIRST Initiative which is described below. More information on Renewable Funding can be found at its website (http://www.renewfund.com/).

6.2.1 The City of Berkeley's FIRST Initiative[82,83]

The basic property tax assessment model in Berkeley is structured after the State's Mello-Roos Community Facilities Act of 1982, which was created to allow for alternative financing mechanisms for community improvements and services.[84] Berkeley's City Charter allows it to finance the upfront cost of burying electric wires underground on behalf of the utility by issuing tax exempt bonds. Residents in the neighborhoods where such projects are carried out, repay the city over 20-years through a special line item assessment on their property tax bills. Using this authority, Berkeley established a Sustainable Energy Financing District, which will create a local, special tax financing law for energy improvements, including PV and SHW. Both residences and businesses can participate in the program.

The Financing Initiative for Renewable and Solar Technologies (FIRST) program sets a maximum amount of any individual loan of $37,500 with a minimum amount of $5,000. The debt service on the bonds and any administrative fees will be paid from a special assessment added to the homeowner's property tax bill over a 20-year period. According to the City of Berkeley's Mayor's Office, the interest rate on the loans during the pilot phase will be the greater of the 10-year U.S Treasury rate + 3.25% or 6.75%.[85] The city will add a 1% per annum charge to this interest rate to cover the city's administrative costs.

As of June 26, 2009, the total interest rate was 7.75%. According to the Berkeley FIRST calculator, a $20,000 loan repaid over 20 years would have semi-annual payments of $991.00[86] This would be equal to a monthly payment of $165. The tax assessment will be offset by the savings that the homeowner will have on his monthly utility electric bill which will reduce the net

---

[82] Email exchanges with City staff in July and August 2008 provided much of the content for this section.
[83] "Berkeley FIRST: Financing Initiative for Renewable and Solar Technology, FAQs," City of Berkeley. Office of the Mayor's website, accessed August 2008, at http://www.cityofberkeley.info/mayor/GHG/SEFD-FAQ.htm
[84] See "What is Mello-Roos?" at http://www.mello-roos.com/pdf/mrpdf.pdf.. Accessed August 2008.
[85] City of Berkeley. Energy and Sustainable Development. Berkeley FIRST- Program Requirements and Frequently Asked Questions. Accessed in September 2008 at http://www.cityofberkeley.info/ContentDisplay.aspx?id=27076.
[86] Berkeley FIRST payment calculator accessed at http://www.berkeleyfirst.renewfund.com/node/105

cost of participating in the program. The interest portion of the special assessment may also be tax deductible which would create additional savings.

In order to participate, the following conditions must be met.

- All property owners on title must agree to terms of the program and sign the required FIRST documents.
- Property must not have any notices of default on mortgage, property taxes or any other type of financial obligation; no tax liens as a result of a failure to pay taxes within past 3 years and no current mechanic liens in excess of $1,000.
- Property must comply with the City of Berkeley Residential or Commercial Ordinances (RECO/CECO) prior to the disbursement of payment for the solar installation.
- Property owner is required to apply for and comply with the California Solar Initiative (CSI) rebate program in order to receive a rebate on the cost of the program.
- Property owner is required to consent to release of names and contact information to CSI and PG&E billing information for the period of 18 months prior and following installation

In November 2008, Berkeley opened the application process for the pilot phase of the program in order to test the concept before proceeding with a large-scale launch. 39 projects were selected and are moving forward. When these projects are completed, Berkeley will analyze the results and determine if the program will continue, what modifications if any are necessary, and what source of funding will be used to expand it.

6.2.2 Boulder County ClimateSmart Property Tax Assessment Model[87]

Boulder County, Colorado has its own version of the property tax assessment model as part of its ClimateSmart program. The underlying structure is similar in many respects to that of Berkeley. Renewable Funding is also involved in the administration of the program. However, Boulder has chosen to issue bonds to finance both residential and commercial projects rather than use Renewable Funding as a financing source. Voters approved up to $40 million in bonds for the program in November 2008. The County plans to allocate $28 million to residential projects and $12 million for commercial projects. The individual loans can be used for qualified energy efficiency investments, solar hot water and PV (among other qualifying projects).

Boulder has created an income qualified tranche of the program that will be funded with tax exempt bonds and an open tranche funded by taxable bonds. Income qualified loans are capped at $15,000 whereas open loans can be up to the lesser of $50,000 or 20% of a property's value. As an example, a 4-person household income can not exceed $135,000 for the income qualified loan. The term for all loans is 15 years. The County Board of Commissioners has established "not to exceed" levels of interest of 6.75% for income qualified loans and 8.75% for open loans.

[87] Boulder County Climate Smart Loan Program https://webpubapps.bouldercounty.org/BOCC/CSLPINFO/Default.aspx

In the Spring of 2009, Boulder County launched the first phase of its program. A total of 394 energy efficiency and renewable energy projects were financed using $6.6 million in bond proceeds. The second round will begin in July-August 2009.

As illustrated by these two examples, the property tax assessment model, while sharing a common underlying source of repayment, can be structured and financed in a number of ways. As more states permit its cities and counties to establish similar models, we expect to see additional variations develop. Currently, Renewable Funding can act as a third party administrator and a financier of projects. However, it is fair to assume that as the model expands across the country, other companies will enter the business of offering similar services. Traditional financial institutions will also likely get involved in providing the capital for the programs as well.

The caveat with the property tax assessment model is that for those with access to home equity lines of credit, it may not be the cheapest way to install a SHW or PV system. Granted that in the current economic environment, home equity loans are tough to come by. But by no means are such loans unavailable. Given the interest rates being charged in both Boulder and Berkeley, it is very possible that the home equity loan will be the cheaper alternative. Nonetheless, for those without access to these loans, the property tax assessment model can be a viable solution.

6.3 Options for Milwaukee

The Milwaukee Shines Solar America Cities program has a goal of creating a vibrant solar energy marketplace. A successful market is one that is sustainable. As the City contemplates additional financial assistance to lower the installed cost of PV and SHW throughout its jurisdiction, it has to not only define the initial source of funding but also the stability of this funding. Given stimulus funding and other grant monies (We Energies, for example), it should be feasible to launch a pilot rebate program and possibly a pilot loan program. For example, the City of Knoxville, TN has allocated approximately $300,000 of its EECBG funds for a PV and SHW rebate program. The bigger issue is once this initial seed capital is exhausted (in the case of rebates) or lent out (in the case of loans), where does the next round of financing come from. QECBs come to mind as one avenue to raise additional capital. Traditional public debt is another potential source of long-term funding.

A counter argument to the sustainability concept is that it may be valid to provide cash rebates for a limited number of projects as a way to jump start the market while waiting for module prices to continue to fall and R&D efforts to improve efficiencies. Early adopters would get the benefit of an additional incentive which it could combine with the Focus on Energy incentive, the matching We Energies grant, and tax credits. Ideally, later adopters would not need the additional assistance.

6.3.1 Incentive program

If Milwaukee decides to create an incentive program for PV and SHW, the most logical approach would be to piggyback off of the Focus on Energy grant award process much like We Energies is doing with its matching grant program. It doesn't make a lot of sense for the City of Milwaukee to create an infrastructure to evaluate individual applications for cash incentives, when a good one already exists in the state. Instead, the City would set the amount of the incentive per system (or per kW in the case of PV) and make payments based on the recommendation of Focus on Energy. .

There are two questions that come to mind when considering the creation of an incentive program.

1. Is it the best use of available funds?
2. If so, what would be the level of the incentive?

As mentioned above, creating a rebate program with a one-time source of funding, while not sustainable per se, may create some momentum in the market. The idea of issuing a QECB to fund a rebate program may be problematic in that there is no way to generate a source of repayment of the bonds from the rebate program itself. The We Energies grant of $100,000 could be the source of financing for a rebate program as could stimulus funding. Assuming a $100,000 pilot program and individual grants of $1,000/kW (up to 4 kW) for residential PV systems, the City could make at least 25 individual grants. Referring back to the Focus on Energy's SHW program data with an average incentive of $1,800, if Milwaukee provided a 50% match for residential SHW systems, $100,000 would translate into more than 100 individual grants.

The idea of targeting an incentive program (or a loan program for that matter) to a specific segment of the solar energy market is an interesting one. As illustrated earlier in this memo, the net installed cost of a 4 kW PV system was approximately $16,000 whereas for a residential SHW system, it was closer to $5,000. An additional $4,000 in city incentives would lower the net installed cost of a PV system to $13,300. An additional $900 in city incentives would lower the net installed cost of a SHW system to $4,450. This raises additional questions to ask regarding the potential program structure.

1. Should the rebates be focused on PV since it is the more expensive technology?
2. Should the rebates be focused on SHW as it is the more appropriate technology for Milwaukee with a lower investment barrier?
3. Should the rebate program be open to both?
4. If there are rebates for SHW, should it be limited to larger systems (non-residential) since the economies of scale are more attractive? As was pointed out in the San Diego report, there does exists a rationale to focus on commercial systems given the lower per unit costs and their better utilization of the day time solar resource. Alternatively, should rebates be targeted to those property owners who have electric water heaters given the more attractive economics?

From this partial list of questions, it is apparent that there is a number of trade-offs inherent in the creation of a rebate program. If the goal is installed capacity, then a case can be made to focus on larger systems. If the goal is the number of installations, then obviously, supporting many small systems makes sense. Which path supports the most solar installer and ancillary green jobs? It would seem that a lot of smaller projects would create more jobs than fewer, larger projects. Does Milwaukee want to link the rebate program with the development of manufacturing capabilities? If so, as the recently completed CH2M Hill report concluded, there appear to be elements within the City to create a SHW manufacturing cluster. If this is indeed the case, then a rebate program focused solely on SHW installations would support this local manufacturing goal.

6.3.2 Loan program

There are a number of ways for the City to create or financially support a program that makes loans available to homeowners and businesses for the installation of solar energy systems. The caveat with any loan program is the administrative requirements to establish and manage it. Added to this is the political element involved in pursuing borrowers who are behind on their loan payments or who have defaulted. The attractive element of the property tax assessment loan program is that the security of repayment is high given that property tax payments are made before mortgage lenders get paid in the event of a foreclosure. Regardless of the structure, if the political will isn't there to aggressively pursue overdue loans, it might make sense to stick with a one time rebate program or adopt the NYSERDA model and buy down the interest rate in a private sector banking transaction so that the risk of collection is borne by the financial institution rather than the city itself.

One advantage of a loan program is that a source of cash flow is generated to cover administrative costs and repay debt used to finance the program. As was noted earlier, Berkeley is charging 7.75% whereas Boulder County can charge up to 8.75% (open program). These are market rates which allow both programs to cover their costs and amortize debt. Other programs across the country charge less than market rates or even 0% interest, but these programs are not self-sustaining but rather are dependent on other sources of funding. Of course market-based interest rates, may make other options, like the home equity loan more attractive to potential program participants. Again, it is about trade-offs.

As loans require a larger investment per installation than a rebate program, Milwaukee would need to find a source for a significant amount of capital. Unless focused solely on residential SHW systems, the $100,000 We Energies grant is insufficient to fund a pilot property tax assessment program or a more traditional loan program. Note that Berkeley's pilot phase was $1.5 million and Boulder County's was $6.6 million. Instead, the $100,000, if not dedicated to a city rebate program, could be used to fund the start-up costs of a loan program with the actual loan fund coming from the issuance of a QECB or some other form of municipal debt. Alternatively, Milwaukee Shines could apply for funding under the most recent Solar America City competitive grant program for seed capital for a pilot loan program to demonstrate proof of concept. Once demonstrated, the City could then seek out other sources of financing.

Section Summary

As illustrated in this section, the City of Milwaukee can pursue a number of alternatives. A rebate program modeled after the current Focus on Energy incentive program would be relatively straightforward to implement. The amount of money needed to create a pilot rebate program is modest and probably obtainable. The more difficult part of this approach would be how to target the rebates so that they are most effective. Given recent legislation, the City may also be in a position to develop a property tax assessment loan program. It has the benefit of the lessons being learned by its fellow Solar America Cities. In addition, the recently created QECB program may be one way to finance it. Milwaukee could also approach Renewable Funding to gauge their interest in consulting on the development of a program, administering it, and possibly funding the pilot phase.

Conclusion

The purpose of this report is to provide solar stakeholders in the City of Milwaukee with information about both PV and SHW technologies and the menu of financing options available to them. As is obvious throughout the document, California and Colorado are two states in particular where this a great deal of solar-related investment taking place. It is unlikely that Milwaukee, in the near term, can create as vibrant a solar energy market given the current level of incentives and solar-related policies. However, it is reasonable to assume that Milwaukee can install significantly more PV than what is in place today by creating the right mix of local programs that leverage existing financial support for solar energy. And while not a new revelation, solar hot water systems may be the more promising of the two technologies for the City of Milwaukee to aggressively pursue. This would align with the study that the City has commissioned from CH2M Hill (also under the Solar America Cities program) related to economic development opportunities for the manufacturing of solar hot water systems and components.