San Francisco Urban Wind Power Task Force

Report and Recommendations

September 21, 2009

ACKNOWLEDGEMENTS

The members of the San Francisco Urban Wind Power Task Force would like to acknowledge the leadership and vision of Mayor Gavin Newsom and former Supervisor Tom Ammiano, who created the Task Force. We would also like to thank the individual Task Force members (listed in Attachment A) who contributed considerable time and dedication to the Task Force over the past year in the name of promoting clean, renewable energy and helping the City meet its sustainability goals. We thank Wade Crowfoot from the Mayor's Office and Johanna Partin from the Department of the Environment for leading Task Force meetings and guiding the development of this report, and Department of Environment interns Larry Chang and David Lara for their significant contributions to this report and Task Force meeting documentation.

I. INTRODUCTION

The City and County of San Francisco has set ambitious goals of achieving 50 MW of in-city renewable energy generation and reducing greenhouse gas emissions to 20% below 1990 levels by 2012, with complete carbon neutrality by 2030. Mayor Newsom, the Board of Supervisors and relevant City departments are united in their commitment to greenhouse gas reduction and providing the resources necessary to meet these commitments. In pursuit of these aggressive goals, the City is promoting a number of programs to support energy efficiency, solar PV, solar water heating, wave and tidal power, geothermal heat pumps and cogeneration. The City has also begun exploring whether "urban wind" might play a role in its renewable energy future.

While much remains unknown about the use of small wind turbines in urban environments, urban wind has the potential to offer several benefits. Besides mitigating climate change and reducing the need for fossil fuels, urban wind has the potential to provide:

- Homeowners and businesses with a clean, distributed energy option for managing their energy needs and savings while increasing their property values;
- Examples of distributed generation at or near the point of use;
- Integration into an existing transmission grid and built environment; and
- An opportunity to create new green jobs.

Though San Francisco has only a "moderate" medium- to large-scale wind on-shore resource,[1] the City's small-scale wind resource is not yet fully understood. Conditions in some parts of the City may be suitable—perhaps optimal—for micro- and small-scale "urban" wind applications.

In order to better understand San Francisco's urban wind opportunities, in July 2008 Mayor Gavin Newsom and then-Supervisor Tom Ammiano created the Urban Wind Power Task Force. The Task Force's mandate was to explore the potential for small-scale wind generation in San Francisco and develop recommendations for advancing City policy to encourage the expansion of local wind power generation. Comprised of representatives from the small wind industry, environmental community, green building, labor, workforce development, research labs, prospective residential and business customers, State regulatory agencies, PG&E and relevant City departments (see Taskforce Members, Attachment A), and coordinated by the Mayor's Office and the SF Department of the Environment, the Taskforce met monthly for eight months to explore key issues facing small-scale wind power development in urban environments. Specific issues addressed included:

- Small Wind Technologies, Testing and Certification
- Understanding the Wind Resource and Data Collection
- Permitting
- Costs & Incentives
- Potential Impacts on Flying Animals
- Clean Tech and Workforce Development Opportunities

[1] CEC PIER Final Project Report, "City and County of San Francisco Wind Resource Assessment Project, September 2004.

- Public Awareness and Possible Demonstration Sites

This report highlights the Task Force's key findings and provides recommendations to help the City advance urban wind power.

II. KEY FINDINGS AND RECOMMENDATIONS

A. Urban Wind Technologies, Testing and Certification

For the purposes of the Task Force's discussions, "urban wind" was defined as wind energy appropriate for urban environments.

"Small wind" is defined by the American Wind Energy Association (AWEA) as a wind turbine whose production capacity is 100 kW or less. The Consumer Energy Center (CEC) defines small wind as "electricity-producing, wind-driven generating systems with a rated output of 50 kilowatts or less." For the purposes of Task Force discussions, small wind was defined as 50 kW or less.

Though small wind generators (SWGs) are commonly sited in rural or semi-rural locations, their urban application has been quite limited. This is because optimal winds typically are easier to access in more outlying areas with fewer physical obstructions, and much zoning today reinforces the use of SWGs on relatively larger parcels of open space. At present, there are only approximately 400 small wind installations generating 2.5 MW of electricity in California, only a handful of which are in San Francisco, operating mostly for private residential use or as demonstration projects. (See section II.G for more information on current SWG installations in San Francisco.)

The technological principles of wind turbines are simple: wind turbines convert the wind's kinetic energy into sufficient mechanical energy (shaft rotation) to run a generator. Besides the rotor (with blades/scoops), additional components for electrical production include a generator, gearbox, tower or support, electronic controls, and interconnection equipment. There are three main types of small wind generators (SWGs):

- Horizontal-axis wind turbines (HAWTs) utilize a horizontally mounted rotor shaft on top of a tower and have blades resembling propellers. Figures 1 and 2 show examples of some HAWTs currently on the market.
- Vertical-axis wind turbines (VAWTs) have rotor shafts that are oriented vertically and often come in Darrieus (egg-beater) or Savonius (wind scoop) configurations. Figures 3-6 show examples of some VAWTs currently on the market.
- Ducted Wind Turbines, also known as "diffuser augmented" wind turbines (DAWTs), incorporate a shroud, or 'diffuser,' which is about twice the diameter of the turbine rotor. The diffuser is a large structure which surrounds the rotor and must be supported at rotor height and be oriented to face the wind.[2] Figures 7-8 show examples of some DAWTs on the market.

[2] Geoff Henderson, http://www.wind-works.org/articles/vort_closure_hend.html

Figures 1-2 – Examples of HAWTs

Fig. 1 Southwest Windpower Skystream 3.7

Fig. 2 AeroVironment AVX1000

Figures 3-6 – Examples of VAWTs

Fig. 3 Mariah Power Windspire

Fig. 4 Wind-Sail 3kW

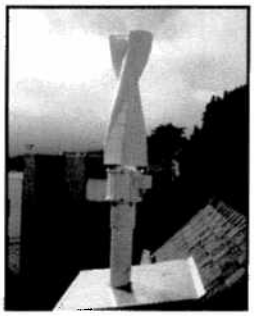

Fig. 5 Blue Green Pacific Wind Turbine

Fig. 6 Helix Wind S322

Figures 7–8 - Examples of DAWTs

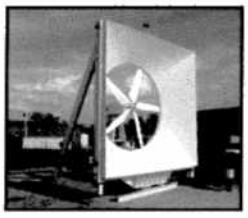

Fig. 7 Green Energy Technologies WindCube

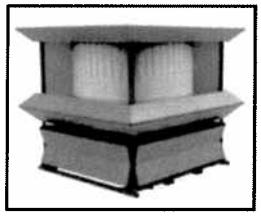

Fig. 8 Turbo Wind Mill 5000 TWM-5000

Much more research is needed on the benefits and drawbacks of the various HAWT, VAWT and DAWT technologies. The primary perceived benefits of HAWTs are that they are more efficient and produce more energy than VAWTs. The primary perceived benefits of VAWTs are that they can be installed in areas that receive low-lying, turbulent winds, have low start-up speeds, have low noise levels and fewer vibrations, and are thought to cause fewer bird or bat mortalities. To date, there have been no conclusive studies confirming these claims. The primary perceived benefits of

DAWTs are that they have the same benefits as VAWTs, but their design increases the wind speed through the turbine and thus "augments" the power output.

To date, there exists no formal state or municipal requirement in California for SWG certification prior to installation. However, to be eligible for the state's Emerging Renewables Program incentive,[3] any manufacturer must either have its product certified to the International Electrotechnical Commission (IEC) 61400-2 standard or provide one year of operational data. The current list of eligible small wind turbines can be found on the California Energy Commission's (CEC's) Consumer Energy Center website.[4]

In an effort to enhance quality assurance, the Small Wind Certification Council (SWCC) has been created as a joint project between the American Wind Energy Association (AWEA) and the Interstate Renewable Energy Council (IREC) as an independent certification body for small wind turbines. Its mission is to verify that such devices meet or exceed the performance, durability, and safety requirements of AWEA's Small Wind Turbine Performance and Safety Standard. According to SWCC, "This certification will provide a common North American standard for reporting turbine energy and sound performance, and help small wind technology gain mainstream acceptance."[5] At present, AWEA is finalizing a standard that will be recognized by the IEC before SWCC can begin accepting applications for certification sometime in fall 2009. SWCC will certify new HAWTs, VAWTs, and DAWTs (both grid-tied and off-grid) that produce 65 kW or less. In the meantime, the National Renewable Energy Laboratory (NREL) is performing its own tests on a select number of turbines, including three HAWTs and one VAWT. NREL will independently test power quality, power performance, and noise levels of these turbines to certify that they meet IEC standards.

The absence of third-party certification and verification of SWGs serves as a significant barrier to the promotion of small wind in San Francisco and elsewhere. Presently, consumers do not have access to the information they need to assess whether small wind is a good option for them. San Franciscans interested in small wind do not know what types of SWGs are available, cannot access verifiable and easily understandable information about the output and efficiencies of small wind turbines, are unable to "compare apples to apples" when evaluating different SWGs, and often express confusion over the different claims made by different SWG vendors. Many are also understandably confused about the pros and cons of HAWTs versus VAWTs versus DAWTs. Having SWCC's certification and verification process in place will provide important criteria by which consumers can make informed decisions.

Recommendations:

1. The City should encourage the rapid implementation of SWCC's certification procedures, and wide-scale adoption of SWCC standards by SWG manufacturers.
2. The City should encourage or require manufacturers to adopt information labels (similar to the Energy Star appliance program) that will assist the general public with SWG comparisons.
3. The Department of the Environment should develop informational materials to provide the public with the information necessary for making informed product comparisons.

[3] Section IID provides more information on incentive programs.
[4] www.consumerenergycenter.org/cgi-bin/eligible_smallwind.cgi
[5] http://www.smallwindcertification.org/

B. Understanding the Wind Resource and Data Collection

Understanding the quality of the wind resource in absolutely critical before any program or policy can be established to promote small wind. Although there are wind maps for San Francisco—for example, NREL's 50-meter wind resource map,[6] and 3 Tier's "First Look" wind map[7]—their resolutions do not provide adequate detail for a reliable assessment at the neighborhood or building level.

Wind energy experts agree that assessing a site's wind resource—including wind velocity, pressure, direction and turbulence—is a critical first step in evaluating whether a site is a good candidate for wind. These factors can be measured by a device known as an "anemometer," or wind meter. Most wind experts recommend collecting 12 months' worth of data or more for a thorough understanding of a site's wind quality. However, computer models can be used to extrapolate annual wind data from shorter collection periods. The cost of an anemometer ranges from $165 to $8,000, depending on the anemometer. Some anemometers can be purchased online and installed relatively easily. The CEC's Public Interest Energy Research program (CEC-PIER) commissioned a 2005 report[8] to recommend protocol for a possible statewide anemometer loan program, and several anemometer loan programs exist around the country to help potential wind customers better understand their wind resource. (See Attachment B for more information on these anemometer loan programs.)

The San Francisco Public Utilities Commission (SFPUC) has installed anemometers at 20 locations around the City. Some of these locations have been gathering wind data since 2001; others for only a few months. This data has not yet been made publicly available due to necessary adjustments in monitoring equipment, but is expected to be posted on the SFPUC web site (www.sfwater.org) in the fall of 2009.

Additional San Francisco wind data has been gathered and modeled by scientists at UC Davis, who conducted a wind tunnel study of several downtown San Francisco buildings in 2006. This study, conducted by UC Davis' Environmental Fluid Dynamics Lab, created physical models of downtown buildings, then placed them into an atmospheric boundary-layer wind tunnel to simulate and study wind behavior. To predict average wind power on the surface of buildings, measurements were taken across multiple points on a given model's surface, then adjusted to full-scale values. Many of the buildings studied, such as the Fox Plaza high-rise on Market Street, showed multiple points along the building's roof and sides with good or excellent power densities. Such wind tunnel studies, while not exhaustive, can provide a relatively quick, accurate and economical preliminary assessment of urban wind resources.

The San Francisco Department of the Environment is planning to use the SFPUC and UC Davis data to map the city's wind resource at the finest possible resolution, with the desired end product being a web-based map, similar to the SF Solar Map (www.sf.solarmap.org), that provides wind resource data on a neighborhood-by-neighborhood or city block-by-city block level.

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[6] http://www.windpoweringamerica.gov/wind_maps.asp
[7] http://firstlook.3tiergroup.com/
[8] CEC-PIER, *Wind Anemometer Loan Program Protocol*, December 2005.

Recommendations:

1. The SFPUC should make data (including site-specific characteristics and data collection methods) from its 20 wind monitoring stations publicly available as soon as possible, but no later than September 2009.
2. The SFPUC should consider installing additional anemometers in parts of the City that prove to be particularly windy.
3. The Department of the Environment should develop an "SF Wind Map" to map the city's wind resource at the finest possible resolution.
4. The City should consider working with UC Davis and other research labs to conduct city-wide wind tunnel studies to better understand the City's wind resource.
5. The City should consider implementing a wind anemometer loan program (in collaboration with national labs, wind experts, wind industry representatives and academic institutions) to help potential wind customers in San Francisco better understand their wind resource.

C. Permitting

A recent survey by the California Wind Energy Collaborative[9] indicates that frustration with the permitting process is common among SWG vendors in the state. Length of permitting period, inconsistent regulations, over-restrictive codes, and high permit fees are common complaints. Additional plan check requirements (e.g., engineering analysis and design) imposed by permitting authorities also inflict extra costs and time.

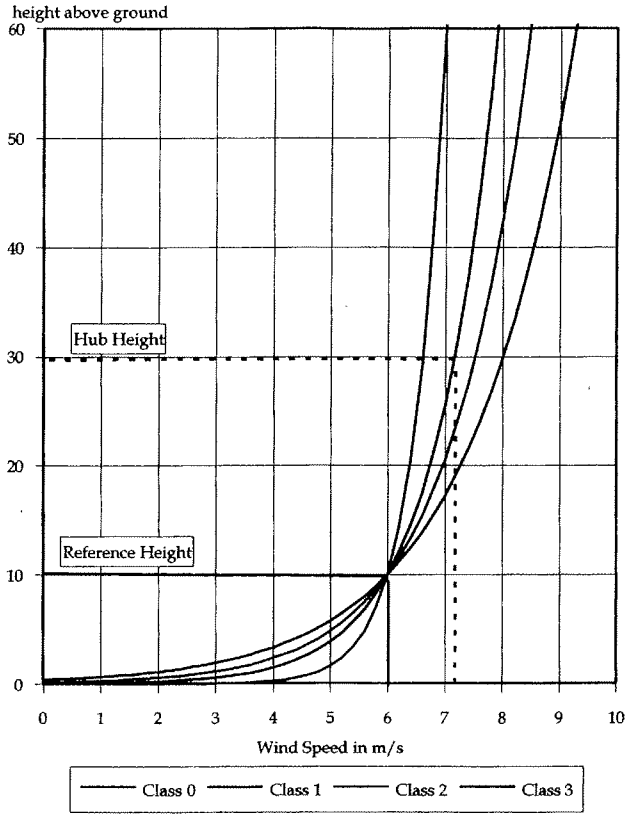
The Task Force identified the following key permitting issues:

- Height – Planning Code dictates that SWGs may not be installed higher than 10-16 feet, depending on the zone, above the building's mapped height.[10] Depending on adjacent structures and available wind, the City's height allowances may be insufficient for effective operation of some turbines. As a general rule, the higher a SWG can be placed, the better its access to faster wind. As illustrated in Figure 9, wind power generation increases exponentially as a function of wind speed.
- Public Notification – Roof-mounted SWGs usually do not require Section 311/312 public notification, but free-standing SWGs must undergo this 30-day process. Historic properties and landmark structures may require additional review and hearings.
- Permitting Fees – San Francisco wind permitting fees are reported by vendors who have completed projects in San Francisco to be in the range of $1,000-$5,000, depending primarily on whether public notification is required. Currently fees are assessed as a percentage of installed cost, making fees higher for larger—though not necessarily more complex—SWG installations.

[9] "Small Wind Permitting Challenges: Findings from a Survey of Small Wind Installers," CWEC-2009-01, http://cwec.ucdavis.edu/smallwindreports/.

[10] Some "Special Use Districts" in the City have set even more stringent height restrictions. For example, before 2007 Bernal Heights prohibited roof-mounted structures, including SWGs, from being installed higher than 5 feet above the building's mapped height. However, Bernal Heights' special use code was amended by Supervisor Ammiano in (date) to exclude SWGs from this special height requirement.

Figure 9 – Wind speed as a function of height



[11]

- Noise – Noise from wind turbines varies, depending on the particular design and placement of the SWG; some are virtually silent, while others make audible "whirring" noises while they spin. Placing SWGs higher can reduce emitted noise, as doubling the distance can decrease sound levels by a factor of four.
- Vibrations – Wind turbines vibrate when they spin, some more than others. The expected impact of vibrations from rooftop mounted turbines upon building structures must be evaluated by building inspectors to ensure the building integrity remains intact.
- Visual Impact – The visual impact of SWGs is a very subjective matter. Some enjoy the appearance of wind turbines, seeing them as a sign of their owner's commitment to sustainability, and viewing them as "green sculptures" or "green art." Others consider them an eyesore. Some wind turbines can produce a "strobe light" effect as the sun reflects off their rotors, causing an annoyance to neighbors.

All of these factors must be taken into account when issuing permits.

On July 17, 2008, Mayor Newsom issued Executive Directive 08-08 (Attachment C), instructing the Department of Building Inspection (DBI) and Planning Department to "expedite permitting and

[11] http://www.afriwea.org/download/R-WindAfrika_010404_engl.pdf

minimize costs for the installation of residential, commercial and municipal wind generation turbines in the City." On October 22, 2008, the Planning Department issued a memo detailing the small wind permit application and review process (Attachment D), and on October, 15, 2008, by action of the Building Inspection Commission, DBI revised Administrative Bulletin AB-004 to prioritize permit review for wind generation projects (Attachment E).

Recommendations:

1. The City should explore ways to offer permitting cost refunds to offset or partially offset the cost of permitting SWGs. The SF Department of the Environment should work with DBI/Planning to identify possible refund programs.
2. DBI and Planning should convene a "small wind permitting subcommittee" comprised of representatives of the small wind industry, bird and bat advocates and relevant permitting authorities, to review current permitting requirements for SWGs and revise them based on subcommittee discussions. Permitting requirements should be revised and posted no later than winter 2009.
3. SWG permitting requirements and application process should be posted on the DBI and Planning Department websites to ensure that the public is fully aware of these procedures.
4. DBI and Planning should ensure that all relevant staff are knowledgeable about SWG permitting requirements to minimize inconsistency in the permit application process.
5. The City should consider revising city-wide height limits to exceed what is currently allowed, thereby allowing for greater wind power generation.
6. Planning should work with the Department of the Environment to require and collect wind and turbine output data as a condition of approval for SWG permit applications. This will help build data points for a citywide Wind Map and to improve overall understanding of San Francisco's small wind resource.

D. Costs and Incentives

Due to the emerging nature of small wind turbines, it is difficult to estimate a "typical" cost for installing SWGs. Many SWG manufacturers are start-ups and have not yet begun mass production of their products; therefore most of the SWGs currently installed in San Francisco and other urban centers have been done so as demonstration sites, with costs determined on a case-by-case basis. Vendors report permitting costs as a large percentage of current installation costs. (This issue is addressed at greater length in Section C above.)

The following State and Federal incentive programs are in place to support SWGs:

- Owners of small wind systems with 100 kW of capacity or less can receive an uncapped federal investment tax credit for 30% of total installed costs.
- The CEC's Emerging Renewables Program offers rebates for small wind systems (rated output of 50 kW or less) at $2.50/watt for the first 7.5 kW and $1.50/watt for 7.5-30 kW.
- For SWGs between 30 kW and 5 MW, the CEC's Self Generation Incentive Program provides $1.50/watt up to 1 MW, $.75/watt for 1-2 MW, and $.375/watt for 2-3 MW.
- Like solar photovoltaics (PVs), net metering is available for grid-tied SWGs.

Recommendations:

1. It is premature to consider a local incentive program, like the City's GoSolarSF incentive program, for SWGs. However, the City can take other actions to promote increased adoption of SWGs, such as those that follow.
2. The City should support legislation to continue or expand federal and state incentive programs.
3. The City should include SWGs in the City's on-property-tax-bill financing program, which is currently under development.
4. The City should support efforts at the state level to exempt SWGs from property tax increases.

E. Potential Impacts on Flying Animals

While wind turbines most certainly have been responsible for avian mortalities, extensive evidence suggests that buildings and cats are far more dangerous to birds than wind turbines. For example, one study reported that together they cause roughly 65% of annual avian fatalities, yet only 0.1-0.2% are attributable to wind turbines. However, while bird/bat mortalities at utility-scale installations (e.g. Altamont Pass) have been researched at length, there are few, if any, studies of urban-based bird and bat impacts due to SWGs.

Variables that might influence mortality rates in urban environments include the kinds of species present, migration patterns, behavior within an urban context, light pollution, and reaction to specific SWG designs. For example, it is unclear whether horizontal or vertical-axis turbines might be easier for birds to avoid than horizontal-axis turbines due to motion smear or apparent solidness. This lack of information makes critical the need for a bird and bat data collection program to assess the impact of these devices in urban environments.

San Francisco's Building Inspection and Planning Departments require SWG owners to report any flying animal impacts as a condition of receiving a wind turbine permit. None have been reported to date; however, it is unclear whether this is the result of a lack of SWG-related mortalities, or whether data collection methodologies should be better defined and monitored.

Recommendations:

1. The City should work closely with the Golden Gate Audubon Society and other bird and bat advocacy organizations to monitor, research and mitigate the potential impacts of SWGs on birds and bats.
2. The Building Inspection and Planning Departments should continue to require SWG users to record and report any SWG-related flying animal impacts as a condition of receiving a wind turbine permit, and should consider imposing more stringent data collection standards.

F. Clean Tech and Workforce Development Opportunities

In 2008, there was a total installed capacity of 2,517 MW of large- and small-scale wind power in California, up from a total of 2,439 MW the year before. Though a 3% increase might seem modest, U.S. wind power capacity has risen 27% per year on average in this decade. The impact of this growth on the job market, including small wind, will be further detailed in a comprehensive report by AWEA to be released in late 2009.

While there are currently only a handful of wind energy distribution and installation companies and only one wind turbine manufacturer based in San Francisco, there is room for many more. Mayor Newsom has put a number of programs in place to encourage clean tech businesses to locate in San Francisco, including the City's Clean Tech Payroll Tax Exclusion, for which small wind companies are eligible. Given the emerging nature of urban wind and the significant needs facing small wind start-ups, the City will need to consider additional services it can provide to such companies to encourage them to locate in SF.

As the demand for wind energy increases, so should a number of corresponding green jobs including turbine and system design, manufacturing, installation, operations and maintenance, project management and business development. According to *Green Industries and Jobs in CA* (Jan. 2009), a report by the Centers of Excellence/CA Community Colleges, over 25,000 turbines exist in the U.S. but fewer than 15 schools nationwide are presently training heavy wind technicians. In California, only two schools (Cerro Coso Community College and Shasta College) provide such instruction, with Fresno City College joining the list in spring 2010. Similarly, small wind courses might develop through community colleges and other sources of workforce training or become extensions of existing solar technician programs. San Francisco City College is developing new curricula to prepare students for green jobs, but to date, has not included wind-related training. The local electricians' union also has green apprenticeship programs but to date has not included training in wind installation or technologies. There are many similarities in the way roof-mounted solar and wind systems are installed; including wind installation training in existing solar installation training courses is an untapped opportunity.

Recommendations:

1. The City should continue to make small wind companies eligible for the Clean Tech Payroll Tax Exclusion and other incentive programs to attract clean tech firms to the City.
2. The City should consider providing additional services for SF-based small wind start-ups, such as:
   - Small business incubation services, such as subsidized office and manufacturing space and facilitating access to angel investors or venture capitalists;
   - Fostering partnerships with local research labs (i.e. Lawrence Berkeley National Laboratories, Stanford University, NASA) to allow for free or subsidized access to wind tunnels and/or other high-tech testing equipment necessary for wind companies;
   - Implementing City-owned small wind demonstration installations to help drive local demand for SF-based companies' products and services.
3. The City should encourage and support efforts by CityBuild Academy, the City's Green Academy, SF City College and/or relevant labor unions to provide wind assessment and small wind technician training and/or to provide dual solar PV-small wind installation training programs.

G. Public Awareness and Possible Demonstration Sites

As of July 2009, only a handful of SWGs have been installed in San Francisco, including three VAWTs on homes in Bernal Heights and the Castro, two HAWTs in the Mission and Twin Peaks neighborhoods, two VAWTs on the Hornblower Ferries, one VAWT at the Randall Museum, and another VAWT is being installed for testing on Treasure Island. Plans are in place for some additional commercial and residential SWG installations, at SF Zoo and on the new SFPUC headquarters building in the Civic Center.

One of the primary ways a city can support the development of emerging technologies is by installing them on city-owned facilities. In the Mayor's Executive Directive 08-08 issued July 17, 2008 (Attachment C), Mayor Newsom instructed all City departments to "make every effort to advance wind power generation by incorporating wind turbines into the design of existing and new City facilities whenever and wherever possible." A number of locations in the City have been suggested as possible demonstration sites, including Twin Peaks, Treasure Island, the Civic Center, Golden Gate Park, Ocean Beach, the San Francisco Zoo and SF International Airport. Such installations would serve a number of purposes, including providing real-world data on the viability of small wind technologies and power generated, serving as public educational opportunities, and providing tangible evidence of the City's commitment to clean energy technologies, to name a few.

Further, the SF Department of the Environment is in discussions with the Mayor's Office and Lawrence Berkeley National Laboratories about developing a SWG turbine testing facility and demonstration site on Treasure Island. This would serve not only to test SWG performance in a real-world setting, but also to better understand SWGs' impacts on flying wildlife and to build public awareness around the different types and models of SWGs available in the marketplace and how they perform in San Francisco conditions.

Recommendations:

1. The City should encourage City departments to comply with Mayor Newsom's Executive Directive 08-08 instructing City departments to "incorporate wind turbines into the design of existing and new City facilities whenever and wherever possible."
2. The SFPUC, the City's power provider, should work with City departments, especially those with facilities where the wind resource is expected to be good (SF Zoo, Port Authority, Parks and Recreation, SF Unified School District, Treasure Island and others), to identify and install municipal SWG demonstration sites. A City demonstration site plan should be developed no later than November 2009.
3. The Mayor's Office, in collaboration with Lawrence Berkeley National Laboratories and the SF Department of the Environment, should develop a SWG testing facility and demonstration site on Treasure Island.
4. To promote public awareness, the City should sponsor a SWG training course to teach San Franciscans how to assess the wind energy potential at their site, how to select an appropriate system for their needs, and how to navigate the permitting and installation processes, similar to the course offered in Davis by the California Wind Energy Collaborative.
5. The City should perform outreach to residents, private companies, institutions and organizations to promote more non-municipal SWG installations.
6. The City should consider revising its current Green Building standards to require all new residential & commercial construction and significant renovations to be built with the *potential* for installing renewable energy devices, including SWGs. Appropriate renewable energy technologies should be determined by specific site conditions.

SUMMARY OF RECOMMENDATIONS

Urban Wind Technologies, Testing and Certification

1. The City should encourage the rapid implementation of SWCC's certification procedures, and wide-scale adoption of SWCC standards by SWG manufacturers.
2. The City should encourage or require manufacturers to adopt information labels (similar to the Energy Star appliance program) that will assist the general public with SWG comparisons.
3. The Department of the Environment should develop informational materials to provide the public with the information necessary for making informed product comparisons.

Understanding the Wind Resource and Data Collection

4. The SFPUC should make data (including site-specific characteristics and data collection methods) from its 20 wind monitoring stations publicly available as soon as possible, but no later than September 2009.
5. The SFPUC should consider installing additional anemometers in parts of the City that prove to be particularly windy.
6. The Department of the Environment should develop an "SF Wind Map" to map the city's wind resource at the finest possible resolution.
7. The City should consider working with UC Davis and other research labs to conduct city-wide wind tunnel studies to better understand the City's wind resource.
8. The City should consider implementing a wind anemometer loan program (in collaboration with national labs, wind experts, wind industry representatives and academic institutions) to help potential wind customers in San Francisco better understand their wind resource.

Permitting

9. The City should explore ways to offer permitting cost refunds to offset or partially offset the cost of permitting SWGs. The SF Department of the Environment should work with DBI/Planning to identify possible refund programs.
10. DBI and Planning should convene a "small wind permitting subcommittee" comprised of representatives of the small wind industry, bird and bat advocates and relevant permitting authorities, to review current permitting requirements for SWGs and revise them based on subcommittee discussions. Permitting requirements should be revised and posted no later than winter 2009.
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14. Planning should work with the Department of the Environment to require and collect wind and turbine output data as a condition of approval for SWG permit applications. This will help build data points for a citywide Wind Map and to improve overall understanding of San Francisco's small wind resource.

Costs and Incentives

15. It is premature to consider a local incentive program, like the City's GoSolarSF incentive program, for SWGs. However, the City can take other actions to promote increased adoption of SWGs, such as those that follow.
16. The City should support legislation to continue or expand federal and state incentive programs.
17. The City should include SWGs in the City's on-property-tax-bill financing program, which is currently under development.
18. The City should support efforts at the state level to exempt SWGs from property tax increases.

Potential Impacts on Flying Animals

19. The City should work closely with the Golden Gate Audubon Society and other bird and bat advocacy organizations to monitor, research and mitigate the potential impacts of SWGs on birds and bats.
20. The Building Inspection and Planning Departments should continue to require SWG users to record and report any SWG-related flying animal impacts as a condition of receiving a wind turbine permit, and should consider imposing more stringent data collection standards.

Clean Tech and Workforce Development Opportunities

21. The City should continue to make small wind companies eligible for the Clean Tech Payroll Tax Exclusion and other incentive programs to attract clean tech firms to the City.
22. The City should consider providing additional services for SF-based small wind start-ups, such as:
    - Small business incubation services, such as subsidized office and manufacturing space and facilitating access to angel investors or venture capitalists;
    - Fostering partnerships with local research labs (i.e. Lawrence Berkeley National Laboratories, Stanford University, NASA) to allow for free or subsidized access to wind tunnels and/or other high-tech testing equipment necessary for wind companies;
    - Implementing City-owned small wind demonstration installations to help drive local demand for SF-based companies' products and services.
23. The City should encourage and support efforts by CityBuild Academy, the City's Green Academy, SF City College and/or relevant labor unions to provide wind assessment and small wind technician training and/or to provide dual solar PV-small wind installation training programs.

Public Awareness and Possible Demonstration Sites

24. The City should encourage City departments to comply with Mayor Newsom's Executive Directive 08-08 instructing City departments to "incorporate wind turbines into the design of existing and new City facilities whenever and wherever possible."
25. The SFPUC, the City's power provider, should work with City departments, especially those with facilities where the wind resource is expected to be good (SF Zoo, Port Authority, Parks and Recreation, SF Unified School District, Treasure Island and others), to identify and install municipal SWG demonstration sites. A City demonstration site plan should be developed no later than November 2009.

26. The Mayor's Office, in collaboration with Lawrence Berkeley National Laboratories and the SF Department of the Environment, should develop a SWG testing facility and demonstration site on Treasure Island.
27. To promote public awareness, the City should sponsor a SWG training course to teach San Franciscans how to assess the wind energy potential at their site, how to select an appropriate system for their needs, and how to navigate the permitting and installation processes, similar to the course offered in Davis by the California Wind Energy Collaborative.
28. The City should perform outreach to residents, private companies, institutions and organizations to promote more non-municipal SWG installations.
29. The City should consider revising its current Green Building standards to require all new residential & commercial construction and significant renovations to be built with the *potential* for installing renewable energy devices, including SWGs. Appropriate renewable energy technologies should be determined by specific site conditions.