

San Francisco Mayor's Renewable Energy Task Force

Recommendations Report

September 2012



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This report represents the recommendations of the Mayor's Renewable Energy Task Force, not the recommendations of the Department of Environment or other City agencies.

Acknowledgements

This undertaking started with a short sentence, in front of a large solar system. “San Francisco has a new goal: to be 100% renewably powered within ten years,” proclaimed Mayor Newsom at the Sunset Reservoir solar project commemoration in December 2010. Within his first month in office, Mayor Lee convened the first meeting of the San Francisco Mayor’s Renewable Energy Task Force to advise the city on how to achieve this lofty goal. Both Mayor Newsom and Mayor Lee’s vision and support have helped make San Francisco a sustainability leader, and the 100% renewable goal will again set a precedent for the rest of the world to follow.

A goal is nothing without a plan to achieve it, and a city is nothing without its citizens. San Francisco owes a huge debt to the citizen-members of the Renewable Energy Task Force who made their time and expertise available for over a year and a half of study to help develop practicable recommendations to make San Francisco a more sustainable, secure, just, and economically prosperous city. A special thanks to subcommittee chairs Adam Browning, Carrie Byles, and David Hochschild, and to several Task Force members who went above and beyond the call of duty: Jeanine Cotter (whose commitment to public service, social equity, and developing a strong local renewable energy industry in San Francisco is unparalleled); Joe Boss (a tireless proponent of smart local energy policy, who reminded us not to let the perfect be the enemy of the good); Neal de Snoo (who cranked out demand and efficiency scenario spreadsheets faster than we could ask for them); Michael Schmitz (who reminded us of the bigger picture, and the importance of cities taking the lead on climate action); Saul Griffith (who pushed the conversation, questioned everything, and always brought us back to the data); and Laura Tam (whose entire pregnancy and maternity leave came and went during the course of the Task Force, and who still managed to provide extensive input and review of the report).

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Executive Summary

In recent years, renewable energy has moved from alternative to mainstream. Forward-thinking cities, states, and entire countries are now considering ways to shift to renewable energy-based economies. They are motivated by desires to address public health and safety concerns about traditional energy sources, mitigate global climate change, increase energy independence, strengthen local economies, and create jobs. **San Francisco's goal is to meet 100% of its electricity demand with renewable power.** The Mayor's Renewable Energy Task Force was established in January 2011 to develop recommendations to help meet this goal within 10 years. This report outlines the major findings and recommendations of the Task Force.

San Francisco's electricity supply is already 41% renewable,¹ due to a completely renewable municipal power supply from the San Francisco Public Utilities Commission's (SFPUC) hydroelectric, solar, and biogas facilities, and a state renewable portfolio standard (RPS) that required most utilities and electricity service providers to meet 20% of their electricity demand with eligible renewable resources by 2010, increasing to 33% by 2020. Pacific Gas and Electric (PG&E), which provides most of the power for San Francisco residents and businesses, is on track to meet the 20% requirement by 2013, with a 2010 supply mix that included 15.9% RPS-eligible resources and another 15.6% from large hydroelectric sources.

The Task Force has determined that **it is technically and economically feasible for San Francisco to achieve a 100% renewable power supply.** Reaching this goal will require coordinated action in three main areas: improving energy efficiency to reduce total electricity demand, increasing in-city renewable distributed generation (DG) to reduce the need for imported green power, and finally, providing all San Francisco customers a 100% renewable power purchasing option. Public policy at municipal and state levels will be necessary to enable and encourage these strategies. Funding and financing mechanisms must also be put in place to encourage investment in renewable energy and growth in local renewable energy deployment. These in turn will need support through public education and outreach efforts.

Improving Energy Efficiency: Reduce, Then Produce

Increasing energy efficiency is a critical first step to reaching San Francisco's 100% renewable goal. By maximizing energy efficiency and encouraging conservation, we reduce the amount of electricity generation needed, and thus the amount of renewable energy generation that needs to be supplied. Building energy audits and energy labeling can provide property owners, potential buyers, and renters with timely information on energy use and the most effective energy efficiency improvements. San Francisco's Existing Commercial Buildings Energy

¹ The task force's working definition of "renewable" includes all RPS-eligible resources, as well as existing large hydroelectric power. See p. 16 for full explanation.

Performance Ordinance will significantly improve energy efficiency in large commercial buildings, requiring energy audits every five years and energy demand disclosures every year, which can then be integrated into building energy labels. Updating the Residential Energy Conservation Ordinance (RECO), or “retrofit on resale” rules, to include performance-based improvements and reduce exemptions would ensure a basic level of efficiency across most residential properties in the city as the building stock turns over. Given the long timeline in property development, adjusting the order in which permitting and zoning approvals are made for new developments would help ensure that buildings are designed to meet the latest energy code, rather than out-of-date codes in place when the development was first conceived.

Expanding Local Renewable Distributed Generation

Increasing the amount of renewable energy-based distributed generation (DG) in San Francisco has several important co-benefits in addition to health and environmental benefits. Local generation increases energy independence, security, and resiliency during emergencies. Renewable energy investments often have high up-front costs but very low operating costs, improving long-term electricity price stability for customers and reducing vulnerability to fuel price fluctuations. Finally, renewable energy deployment can spur local economic development, driving business growth for local installation companies, creating “green collar” jobs for local workers, attracting renewable energy manufacturers and developers to open offices in the city, and ultimately keeping our energy dollars close to home.

In order to increase renewable DG, financing options need to be made available and known to property owners. On-bill financing, Property Assessed Clean Energy (PACE) financing, power purchase agreements, and solar leases can all reduce up-front cost barriers to renewable DG, bringing system payments in line with energy savings. The interconnection process for these small systems should be streamlined and grid-integration processes improved. Correct and stable price signals need to be put in place to give potential renewable energy system owners confidence that their investment will pay off. Continued success of the state’s net energy metering program will require increasing participation caps and ensuring that net-metering rates fairly represent the full value of renewable DG. New tools such as feed-in tariffs can also be used to provide stable, long-term payments for renewable power and can be targeted to small, in-city generation. In San Francisco, where two-thirds of residential units are in multi-family buildings and over 60% of households rent, overcoming split incentives and providing access to renewable energy investment opportunities is key. These steps can occur through green leases, virtual net metering, and community solar.

There are also major opportunities to increase energy efficiency and reduce greenhouse gas (GHG) emissions through renewable thermal energy technologies. Solar water heating is a proven technology that uses the sun’s heat to provide hot water and space heating, reducing the electricity or natural gas demand from domestic water heaters. As with solar electric systems, making financing options available (and known) and ensuring that new buildings are designed to take advantage of this clean, free energy source will help bring this technology into the mainstream. District energy, in which multiple buildings are connected to a shared heating and electric system, increases overall energy efficiency by putting the waste heat from electricity generation to use in heating and cooling nearby buildings. These systems also

reduce heating system redundancy at the building level, freeing up space and capital for real estate developers. All redevelopment projects around the city should consider opportunities to integrate district energy and transition these typically natural gas-powered systems to renewable fuel sources over time.

Increasing Utility-Scale Provision of Renewable Power

San Francisco will remain reliant on imported power for the foreseeable future. While the electricity supply from California's investor-owned utilities (IOUs) is becoming increasingly green thanks to the state RPS, it will not be 100% renewable within the next 10 years. Therefore, providing renewable power purchasing options at the utility-scale is necessary to meet the city's 100% renewable goal.

SFPUC's power supply, which primarily serves municipal facilities, is already 100% renewable. Providing this power to more customers — including all tenants at municipal facilities (like the SF Port), new developments, and public transit providers — would directly increase the share of renewable power in the city's overall supply mix and also provide stable revenues to enable the City and County of San Francisco (the City) to further increase its investment in both energy efficiency and renewable power.

San Francisco electricity customers could soon have a new electricity supply option through the state's Community Choice Aggregation (CCA) legislation. San Francisco's proposed CCA program, CleanPowerSF, is slated to provide 100% renewable power to its customers, beginning as soon as 2013. There will be a price premium for this power, however, and as such, some customers — particularly price-sensitive businesses — are expected to opt to remain with PG&E's power supply.

PG&E has recently proposed offering a "green option" to enable its customers to purchase REC-based renewable energy, also at a price premium. While this program still requires regulatory approval, it may also be able to provide San Francisco customers with green power down the road.

The extent to which the City is able to provide attractive renewable electricity purchasing options to citizens and businesses — whether by providing GHG-free municipal power to more customers, through full rollout of a 100% renewable CleanPowerSF, through other utility renewable energy or green pricing programs, or a combination thereof — will be the determining factor in how close San Francisco comes to reaching its 100% renewable goal.

Supporting Investment in Renewable Energy

While the renewable energy industry has grown significantly in the past decade, with technologies maturing and prices dropping dramatically, it is still a nascent market and one that investors are not as experienced in or comfortable with. The City can leverage its own resources to support renewable energy investment and development. Community renewable energy bonds and municipal bonds could be used to develop municipal renewable energy

projects. Expanding SFPUC retail electricity sales would generate revenues that could be reinvested in renewable energy capital projects and power purchase agreements.

If implemented, CleanPowerSF could also provide unique opportunities for the City to actively support investment in renewable energy projects, both as a project developer and/or purchaser of renewable electricity. CleanPowerSF could create new demand for renewable power, and that demand could be used to reduce risks to project developers and investors, encouraging greater investment. For example, the City can offer long-term contracts to renewable energy project developers to purchase power from their systems, which in turn provides the assurance of project revenues that financiers need to invest in the projects. These contracts could be issued based on a feed-in tariff, a competitive request for proposals, or a combination thereof. These would drive private development of renewable energy projects and could also be used to install renewable energy at underutilized municipal property — such as school roofs or the Hetch Hetchy transmission right-of-way — through public-private partnerships. Finally, CleanPowerSF could enable community solar programs in San Francisco by cooperating on billing integration and administration. These community solar programs would allow San Franciscans, particularly tenants or those without good renewable energy resources at their own property, to invest in community-scale renewable energy projects and receive generation credits from those systems on their own utility bill.

Changes in the way solar power systems are valued by assessors and classified by banks can help reduce the long-term cost of capital for solar energy projects. Recognizing solar systems as “real property” and developing standardized underwriting criteria for this asset class could help these systems to be securitized and financed at low rates similar to home mortgages. Educating local banks on renewable energy technologies, true risks, and opportunities of investing in renewable energy projects and connecting project developers with these banks could unlock millions of dollars in private capital to support renewable energy development in the region. The San Francisco Employees’ Retirement System and other employee pension funds could also be leveraged to support renewable energy development. Educating and encouraging fund managers to include renewable energy investments in their portfolios would help deliver the array of public benefits discussed above along with stable, long-term returns to the fund.

Continuing Public Education and Outreach

Educating the public about energy efficiency and renewable energy is essential to developing support for these efforts and increasing their uptake. It can be difficult for the public to stay abreast of rapidly evolving energy efficiency and renewable energy technologies and costs. Confusion, misconceptions, or simply the time needed to make an informed decision often lead to inaction. The City can provide unbiased, third-party assistance to help property owners understand the renewable energy technologies and efficiency improvements that may be appropriate for their homes and businesses, and ensure that they are aware of the various incentives, funding, and financing options available to them. Making energy data available to potential new tenants and property owners, in an easy-to-understand format, can help the real estate market drive demand for more energy efficient buildings. Providing information on renewable energy technologies, incentives, and financing to new property owners can

encourage them to include energy upgrades in planned capital improvements and allow them to roll capital expenses into their mortgage. Ensuring all residents and businesses are aware of the energy purchasing and investment options available to them — whether through green power purchasing programs, community solar investment opportunities, or self-generation on-site — can empower San Franciscans to make choices that support their own social, economic, and environmental values. And finally, the city can provide ongoing education and outreach to remind and encourage San Franciscans to conserve energy through behavior changes and by choosing efficient appliances and electronic devices.

San Francisco’s Goal in the Regional Context

San Francisco is not an island. While we would have unique opportunities to take increased control of our local power supply through CCA, much of our energy supply will remain outside of City control. We would like to see not just San Francisco but the entire State become renewably powered. This will require significant coordination, increased energy storage, and major smart grid improvements to match supply with demand and overcome the barriers posed by intermittent renewable resources and ever-changing electricity demands. San Francisco can lead the way by creating demand for renewable energy, enabling local generation, and driving market development and investment.

Recommendations

The following recommendations, based on discussions and findings of the Renewable Energy Task Force over its year of study, outline important actions the City can take to move toward achieving the Mayor’s 100% renewable energy goal. The recommendations in this report reflect the general agreement of the Renewable Energy Task Force members, but do not signify endorsement by any of the individuals or organizations represented on the task force. Further detail and context for these recommendations are provided in the full report.

ENERGY EFFICIENCY

1. **Update Planning and Permitting Process:** The City should update the Planning Department’s development review and Department of Building Inspection’s site permit processes to require that developments meet the energy code that is in place upon application for a fully specified building permit, rather than at time of site permit, in order to ensure buildings are built to current energy code. [p.29]
2. **Strengthen Retrofit on Resale Rules:** The City should amend the San Francisco Residential Energy Conservation Ordinance (RECO) to require new measures and remove the permanent exemption. The updated ordinance should require performance-based improvements, require compliance for multi-tenant buildings that are held in trust, apply to new leases, and provide for publicly accessible asset ratings and historic energy use disclosure, which could be integrated into a home energy label. [p.30]
3. **Promote Energy Audits:** The City should develop outreach programs and provide incentives to encourage home energy audits and continue work begun under the Energy

Upgrade California program to incent energy efficiency, identify financing options, and train contractors. The City should also expand its commercial building efficiency programs to include mixed-use and multi-family residential properties. [p.31]

4. **Integrate Energy Labeling of Real Estate:** The City should implement and expand upon its plan to recognize energy performance ratings, green building certifications, and other credible environmental labels. These labels should be integrated into the Assessor's database, the easiest channel to propagate such data into private databases used by real estate professionals, including but not limited to the Multiple Listing Service (MLS). Real estate labeling activities should be compatible with — and leverage — local policies such as San Francisco's Green Building Ordinance and the City's Existing Commercial Buildings Energy Performance Ordinance, and related state laws such as AB 1103 and AB 758. [p.32]
5. **Provide Outreach and Support for Property Owners:** The City should provide unbiased information on energy efficiency, renewable energy, and financing options to new property owners at point of sale. A dedicated, unbiased city "energy advisor" should walk new and existing homeowners through the energy upgrade process, educate about energy efficiency and renewable energy technologies and options, and help navigate available incentives and financing options. [p.34]
6. **Facilitate Access to Energy Data:** The City should advocate that the California Public Utilities Commission require investor-owned utilities (IOUs) and energy service providers (ESPs) to provide customer-level data to the City and its agents for purposes of implementing and measuring the impacts of the City's Climate Action Strategy and energy efficiency programs. Building owners should also be able to easily obtain energy usage information about their own facilities, so that they can readily comply with the California AB 1103 Commercial Building Energy Use Disclosure Program and local law. [p.34]
7. **Undertake Building Energy Data Study:** If data is not available from local utilities, the City should undertake a building energy use data collection effort to obtain more accurate, San Francisco-specific building energy use information for the commercial and residential sectors, including type and timing of demand for various end-uses, facilitating development of plans and legislation that will lead to measurable and meaningful energy reductions. [p.35]

DISTRIBUTED GENERATION

8. **Support Expanding Net Energy Metering:** The City should participate in relevant regulatory proceedings and encourage the California Public Utilities Commission to update net energy metering rules and participation limits to better reflect actual technical constraints to distributed generation integration and current costs and benefits of increased on-site distributed generation. This would include increasing the net energy metering cap, increasing the rate at which customers are compensated for net-surplus generation, and allowing net-metered systems to be sized beyond on-site demand where excess generation is likely to be used by other customers on the distribution line. [p.41]

- 9. Support Expanding Virtual Net Metering:** The City should support the expansion of Virtual Net Metering for multiunit customers in California (both residential and commercial) and implement pilot installations in San Francisco in coordination with interested property owners and tenants. Expansion should include allowing Virtual Net Metering for developments served by multiple service delivery points, easing size limitations, and expanding eligibility to all multi-tenant and multi-meter properties. [p.43]
- 10. Support Community Renewable Energy Policies:** The City should support state community energy legislation to enable Californian electricity customers to invest in or purchase a subscription to off-site renewable energy projects and utilize community energy ownership and billing models to be credited for the power from those systems. These steps would expand the opportunity to take part in renewable energy development to all customers, including tenants and property owners without suitable incentives or opportunities to develop on-site renewable energy resources. [p.44]
- 11. Support Robust and Sustainable Feed-In-Tariffs for Local Renewables:** The City should advocate the adoption of feed-in tariff programs and tariff rates that fairly compensate small-scale local, renewable distributed generation projects commensurately with their additional social and environmental benefits — and thereby stimulate increased private investment in local renewable energy projects. The City should also explore integrating such a program into the proposed CleanPowerSF Community Choice Aggregation program. [p.45]
- 12. Streamline and Standardize Renewable Energy Permitting Processes:** The City should continue to streamline renewable energy permitting processes, including shifting to electronic permitting, to reduce time and costs for the City and system owners, while maintaining public safety. The City should work with neighboring jurisdictions to share best practices and implement standardized, streamlined processes across the region, further reducing installation costs. [p.46]
- 13. Adopt a Solar-Ready Policy:** The City should adopt a policy that incents or requires new construction, heavily renovated buildings, and buildings undergoing roof replacement to either install renewable energy systems or put in place appropriate conduit (electrical and/or plumbing) and stanchions for future renewable energy installation if the site has viable renewable energy resources. [p.47]
- 14. Address Solar System Shading:** The City should address the risk of existing solar installations becoming shaded by new construction with policies that balance densification goals and private property rights. The City should consider policies that protect solar access and/or compensate early adopters of solar if their systems become shaded by new construction, such as through a solar access indemnity fund. [p.48]
- 15. Encourage Green Leases:** The City should continue to encourage green lease adoption in the commercial sector, including working with the Business Council on Climate Change to

promote the Green Tenant Toolkit, which includes information and sample documents for property owners, tenants, and real estate agents in San Francisco. [p.49]

16. Enable Energy Efficiency and Renewable Energy Pass-Throughs under Rent

Control: The Board of Supervisors should adopt as ordinance the energy conservation pass-through provision put forth by the Rent Board, thereby clarifying pass-through eligibility for specific energy efficiency and renewable energy measures (those determined to reduce net costs to tenants and provide reasonable payback to landlords) as approved capital improvements under the Rent Ordinance. The Rent Board should also ensure that third-party owned or financed solar systems are eligible under the pass-through provision. [p.50]

17. Expand Clean Energy Financing: The City should continue its commercial Property Assessed Clean Energy (PACE) program and reinstate the residential PACE program as soon as possible, either by overcoming objections to the use of the PACE program by mortgage insurers such as Fannie Mae and Freddie Mac or by identifying alternative financial arrangements. The City should also continue to explore other opportunities to spur and improve access to financing for renewable energy and efficiency upgrades, such as financing enhancements, revolving loan funds, and interest rate buy-downs to attract and stretch private capital, and expansion of mortgage-backed energy efficiency financing instruments. [p.51]

18. Expand On-Bill Financing: The City should support the expansion of on-bill financing or third-party on-bill repayment of energy efficiency and renewable energy with local utilities, and explore the potential to allow on-bill financing through the San Francisco Public Utilities Commission (e.g., on the water and sewage utility bill or through a Community Choice Aggregation program). [p.52]

19. Recognize Solar Energy Installations as Real Property: The City should recognize solar power installations as real property by including its value in property assessments by the Assessor-Recorder's office. The City should explicitly make solar property tax exempt until the 100% renewable goal or similar solar market development targets are met. [p.54]

20. Support Standardization and Expand Lending: The City should support regional or national efforts to develop standardized underwriting criteria for solar projects in order to reduce transaction costs and increase financing opportunities for renewable energy projects. The City should also work with local community banks and institutional investors to increase understanding of renewable energy technologies and markets and build comfort with renewable energy investments, thereby increasing financing opportunities for local renewable energy projects, and serving as a catalyst for an increase in such lending nationwide. The City could act as a convener of parties to bring together these banks, investors, and renewable energy project developers. [p.55]

- 21. Fully Fund GoSolarSF:** The San Francisco Public Utilities Commission (SFPUC) should fully fund energy programs that meet the City’s objectives, including GoSolarSF, municipal energy efficiency, and municipal renewables programs. [p.56]
- 22. Prioritize Workforce Development:** The City should continue to integrate workforce development and training, especially for disadvantaged San Franciscans with employment barriers (such as low educational attainment, criminal history, disability, language proficiency, and homelessness) into its energy programs to help meet the needs of growing energy efficiency and renewable energy industries, and support local green job development through the San Francisco Local Hiring Policy for Construction. [p.56]
- 23. Upgrade Distribution Grid Citywide:** The City should work with PG&E to determine the cost effectiveness of upgrading the distribution infrastructure as necessary citywide to enable increased penetration of renewable DG and increased loads due to electric vehicles. These efforts should build off of existing CPUC requirements that utilities such as PG&E identify the surplus capacity on their distribution system available for connecting DG systems. [p.58]
- 24. Enable Distributed Generation on Downtown Network:** The City should work with PG&E to study the City’s secondary distribution network to identify the technical feasibility and expected costs to upgrade this network and its operation, or find other suitable solutions to enable renewable energy installations in the downtown core, North Beach, and the Tenderloin, while maintaining utility worker safety and grid reliability. [p.59]
- 25. Support Energy Storage Market Development:** The City should support research and development of technologies that support increased renewable energy and act as test bed for such technologies, simultaneously supporting economic development and environmental goals. In particular, San Francisco should support state efforts to develop cost-effective energy storage options and encourage energy storage deployment in San Francisco, both through pilot installations and appropriate planning and permitting requirements. [p.60]
- 26. Support Emerging Clean Technologies:** As part of the City’s efforts to nurture local cleantech innovation and market development in San Francisco, the City should seek continued collaboration with the state and federal governments to support the development of renewable energy markets, pilot renewable energy and energy efficiency technologies and programs, and showcase best practices in renewable energy permitting, financing, outreach, and deployment. The City should promote the testing and evaluation of new clean technologies that may be suitable for urban deployment. [p.61]
- 27. Increase Use of Solar Water Heating:** The City should a) undertake an outreach campaign to improve awareness and understanding of solar water heating (SWH) technology and identify financing mechanisms to overcome the challenges of high up-front costs and long payback periods, such as solar thermal power purchase agreements and on-bill repayment with utilities; b) require SWH on all new residential construction with adequate solar access, thereby reducing installation costs (versus retrofits) and enabling

property owners to finance the system with their home mortgage or line of credit, or emerging financing options such as PACE or on-bill repayment. Heating bill savings can in turn offset financing costs; c) explore the feasibility of using SWH at municipal facilities with high hot water loads and install SWH systems on those facilities where energy savings are found to outweigh SWH installation costs. [p.61]

28. Increase District Energy: In order to ensure that district energy opportunities are explored and, where appropriate, developed, the City should require that the developer or sponsor of large commercial real estate projects prepare a district energy feasibility study as part of the project development process, concurrent with the conceptual design phase of the project. The study would consider three components of energy: heat, chilled water, and generated electricity. Elements of the study scope would include potential cogeneration projects, integration with existing city steam loops, ground source geothermal, and other district energy concepts. The study would be reviewed by an interagency committee and used as a decision-making tool for the project developers and City policy makers. [p.63]

UTILITY-SCALE GENERATION

29. Align Municipal Electricity Rates: The City should transition the electric rates it charges so that all SFPUC power customers at least pay the actual delivered cost of service. This would encourage energy efficiency and enable the SFPUC to receive a stand-alone credit rating necessary to issue long-term bonds to finance further renewable energy developments, energy efficiency, and other capital improvements. The City should develop a plan and timeline to achieve full cost of service rates; for example, to minimize budget impacts, these rate changes could be phased in over a four- to eight-year period. [p.68]

30. Expand Municipal Deliveries of 100% Renewable Power: The SFPUC is committed to procuring 100% renewable energy to serve any new municipal loads. The City should support the SFPUC in its efforts to increase the number of customers served by the SFPUC, require all electrical loads located on City-owned property be served by the SFPUC (e.g., Airport and Port tenants), and expand the number of SFPUC-powered electric vehicle charging stations. The City's Administrative Code should be revised to allow the SFPUC to be the default provider, with first right of refusal, for all major construction projects within San Francisco, not just for redevelopment projects. SFPUC should also seek to provide power for public transportation agencies and institutional customers such as hospital and school campuses. [p.70]

31. Pursue Third-Party Ownership Structures with Private Sector Partners: The City should explore and expand the use of power purchase agreements (PPAs) and lease ownership models to finance municipal renewable energy projects, in order to take advantage of federal tax incentives and minimize the City's capital requirements, while also leveraging municipal funding opportunities to reduce financing costs and increase project returns. [p.72]

32. Utilize Energy Bonds: The City should advocate for the issuance of more Clean Renewable Energy Bonds by the U.S. Department of Treasury and take greater advantage

of this option, and explore the use of Qualified Energy Conservation Bonds to help finance municipal solar PV and solar thermal installations. [p.73]

33. Clarify Labor Requirements: The City should continue to work with the California Department of Industrial Relations to clarify prevailing wage rates for solar projects and explore other options to minimize jurisdictional disputes among labor unions and provide clarity to contractors on the appropriate prevailing wage rates that should be paid for construction work on solar projects. [p.74]

34. Implement 100% Renewable Community Choice Aggregation Program: The City should: a) offer a 100% renewable electricity supply to San Francisco residents and businesses through a CCA program. Renewable energy for the program should be procured, to the maximum extent technically and economically feasible, from local projects or projects on City-owned property, and the rest from RPS-eligible resources; b) explore options to cost-effectively encourage and leverage private renewable energy project development, for example through appropriately-priced power purchase agreements or feed-in tariffs to procure generation for the CCA program, development of public-private partnerships, and/or use of municipal bonds to support low-cost financing for local renewable energy projects; c) target broad participation in the CCA program, including by integrating CCA participation into eligibility requirements for energy-related municipal incentives and recognition programs, and identifying ways to encourage businesses' participation in CleanPowerSF or other green power purchasing programs. [p.74]

35. Encourage Robust PG&E Green Power Purchasing Option: The City should work with PG&E to offer a green power product to their customers that will allow them to purchase 100% renewable electricity and spur additional new renewable energy development beyond state RPS requirements [p.76]

36. Encourage Renewable Energy–Based Direct Access: The City should make San Francisco's direct access customers (including BART) aware of the availability of 100% renewable ESPs, including SFPUC power service, and encourage their procurement of 100% renewable power. [p.77]

37. Support Enabling Statewide Renewable Energy Policies: The City should support steadily increasing the statewide RPS while also recognizing those utilities that already have minimal or zero-GHG emissions, such as the SFPUC. The City should support the successful implementation of the SB 32 feed-in tariff program to stimulate private sector investment and financing for mid- to large-scale renewable energy projects. [p.78]

38. Advocate for State and Federal Incentives: The City should advocate for the continuation or extension of state and federal renewable energy grant and incentive programs, including the Investment Tax Credit, Production Tax Credit, and accelerated depreciation, and seek funding and technical assistance to support implementation of the City's renewable energy plans and fulfillment of the 100% renewable goal. [p.79]

39. Engage Public Pension Funds to Support Renewable Energy Deployment: The City, through the SFERS, should investigate opportunities to invest in clean energy to promote local economic development and renewable energy deployment while meeting the fund's investment goals. [p.79]

CHAPTER 1

The Mayor's Renewable Energy Task Force

Mayor's 100% Renewable Energy Goal

In December 2010, then-Mayor Gavin Newsom announced a new goal for San Francisco: to be completely powered by renewable energy in 10 years. In pursuit of this goal, Mayor Edwin Lee, together with his predecessor, established the Mayor's Renewable Energy Task Force in January 2011, with the directive to develop recommendations for the City and County of San Francisco (the City²) to achieve a fully renewable electricity supply for San Francisco. The Task Force, comprising local clean energy leaders, business and community stakeholders, and relevant City departments (see list of Renewable Energy Task Force Members, p. iii), met nearly monthly from January 2011 through May 2012 to examine local and regional barriers to and opportunities for renewable energy, including policy, regulatory, technical, financial, and public awareness aspects. This report reflects the Task Force's discussions and recommendations for meeting the City's 100% renewable energy goal.³

Task Force Objectives

In developing its recommendations, the Task Force worked to promote a number of objectives, following a triple bottom line approach that addresses environmental, economic, and social equity factors. The primary objective is to provide recommendations to lead to a practicable plan to achieve a 100% renewable energy-based electricity supply for San Francisco and to identify steps for meeting this goal within 10 years (by 2023). The Task Force believes it is important to simultaneously pursue the following strategies to achieve this goal:

REGIONS SETTING AMBITIOUS RENEWABLE ENERGY GOALS

Forward-thinking cities, states, and entire countries are now considering ways to shift to renewable energy-based economies. They are motivated by desires to address public health and safety concerns about traditional energy sources, mitigate global climate change, increase energy independence, strengthen local economies, and create jobs. Among those setting ambitious renewable energy goals, in addition to San Francisco, are the California cities of San Jose (100% renewable electricity by 2025) and Santa Barbara ("Fossil-Free by 2033"), and a number of German regions, including Munich (100% renewable electricity for households by 2015), Berlin (first 100% renewable capital), and Trier (100% renewable by 2050). At the national level, plans have come from such disparate countries as Denmark (100% renewable by 2050) and Nicaragua (94% renewable by 2017). Recent studies for Minnesota and New York have shown that entire states could be powered completely and reliably by renewable energy.

² Throughout this report, the capitalized term "the City" is used to denote the City & County government, while "the city" is used to refer to the geographic area and/or community of San Francisco.

³ The recommendations in this report reflect the general agreement of the Renewable Energy Task Force members but do not signify endorsement by any of the individuals or organizations represented on the task force.

Maximize energy conservation and energy efficiency: Energy conservation and efficiency should remain a top priority for the City. The easiest and most cost-effective way to reduce use of electricity from harmful fossil fuels is to reduce electricity consumption in the first place.

Reduce total energy demand and GHG emissions: While the mayor's 100% renewable goal applies specifically to electricity, the Task Force acknowledges that thermal loads (heating and cooling) and transportation energy significantly contribute to San Francisco's GHG emissions profile. The Task Force worked under a "do no harm" principle, with an overall goal of increasing energy efficiency, reducing total primary energy demand, and reducing GHG emissions, recognizing that in some cases this might mean increasing electricity demand (e.g., shifting from petroleum to electric vehicles or switching from natural gas heating to electric air-source heat pump space and water heaters). The Task Force did not consider recommendations to shift electricity to natural gas unless they would result in net efficiency improvements and/or GHG emissions reductions.

Additionally, the Task Force recognizes the opportunity to gain efficiency from thermal energy systems, such as the existing downtown steam loop and individual building heating and cooling systems. Increasing the amount of cogeneration and trigeneration, which provide electricity, heating, and cooling for buildings and even neighborhoods in district systems, is much more efficient than producing electricity and heat separately, and reduces overall energy losses and GHG emissions. While cogeneration is most commonly based on natural gas, as more renewable resources become available, these systems can also be shifted to renewable fuels (such as landfill gas or biodigester gas from farms, delivered through PG&E's natural gas distribution system).

Protect the environment and human health: The City should work to ensure that the generation and transmission of electricity minimizes harm to our air, land and water, and in turn human health and well-being.

Create jobs and promote local economic development: Where possible, the City should create employment opportunities for local residents, particularly in economically disadvantaged and environmental justice communities (for example, through the use of the San Francisco Local Hiring Policy for Construction⁴), while ensuring wage and working condition protections on municipal renewable energy projects through application of the City's prevailing wage ordinance.

Promote environmental justice: A core element of this work is the integration of environmental justice values into the development and implementation of any plans or actions

⁴ The local hiring policy is an amendment to Chapter 6.22(G) of the San Francisco Building Code. It was put into effect on March 25, 2011. San Francisco requires that public work or improvement projects have 50% of project work hours performed by local residents, with not less than 25% of project hours performed by disadvantaged residents, by 2014. The policy applies to prime contractors doing work costing at least \$350,000 and subcontracted work costing at least \$100,000. See San Francisco Office of Economic and Workforce Development, *San Francisco Local Hiring for Construction Implementation Plan*, March 2011, <http://oewd.org/media/docs/WorkforceDevelopment/GoSolarSF/Local%20Hire/Local%20Hiring%20Implementation.pdf>.

resulting from this report. Residents in our underserved neighborhoods face multiple barriers to food security, safe and affordable housing, and meaningful employment. Poor residents living close to industrial facilities (including fossil fuel power plants) and freeways are often exposed to more air pollution and environmental stressors than those living in San Francisco's more affluent neighborhoods. These barriers and burdens will only grow more challenging as the effects of global warming unfold. While climate change affects everyone, it disproportionately hurts those with the least resources. Inclusion of these diverse communities in this work is critical for the true success of this effort.

Ensure fiscal responsibility: The City should pursue fiscally responsible policy strategies for increasing the supply of renewable electricity in order to provide stable, affordable electricity bills for residents, businesses, and municipal facilities. The Renewable Energy Task Force recognizes that funding mechanisms must be identified for all recommendations and that policy that significantly or suddenly increases rates could place undue burden on customers in San Francisco and disproportionately impact certain customer classes. At the same time, the costs of inaction on climate change are often undervalued and will only increase with time, making proactive GHG-reduction actions more cost-effective in the long run. As such, the Task Force aims to balance current economic impacts and long-term health, environmental, and economic benefits, though further analysis will be needed for all recommendations.

Maintain reliable service: It is critical to maintain reliable electricity service for San Francisco's residents, businesses, and services.

The Task Force also recognizes the work that has already been done around climate and energy planning in San Francisco, and its recommendations are intended to complement existing policy documents in San Francisco, including *San Francisco's 2011 Updated Electricity Resource Plan* (which includes recommendations to achieve a GHG-free electricity supply for the city by 2030),⁵ the *Climate Action Plan for San Francisco*,⁶ the *San Francisco General Plan*,⁷ and the *Community Choice Aggregation Implementation Plan*.⁸

Definition of Renewable Energy

For the purposes of their investigation and this report, the Task Force adopted a definition of *renewable energy resources* that includes California's RPS eligible resources as well as existing,

⁵ SFPUC, *San Francisco's 2011 Updated Electricity Resource Plan*, March 2011, <http://sfwater.org/modules/showdocument.aspx?documentid=40>.

⁶ San Francisco Department of Environment, *Climate Action Plan for San Francisco*, 2004, www.sfenvironment.org/downloads/library/climateactionplan.pdf. San Francisco Department of Environment, *San Francisco Climate Action Strategy*, forthcoming 2012.

⁷ San Francisco Planning Department, *San Francisco General Plan*, last updated 2011, www.sf-planning.org/ftp/General_Plan/index.htm.

⁸ San Francisco Board of Supervisors, *Resolution Approving a Community Choice Aggregation Implementation Plan*, May 24, 2005, www.sfbos.org/index.aspx?page=4158. Joint Resolution of the SFPUC and SF LAFCo Affirming Commitment to CCA Program and Work-Plan for 2009 (Resolution 2009-03), April 24, 2009, www.sfbos.org/Modules/ShowDocument.aspx?documentid=19047.

but not new, large-scale hydroelectric power.⁹ Under the Task Force's renewable energy definition, **San Francisco's current electricity supply is 41% renewable** [see Table 1].

Report Structure

Chapter 2 provides an overview of San Francisco's current electricity demand and supply profile to give context for the ensuing discussions and recommendations. It also explores the interconnections between energy and climate, including the GHG profile of the city's electricity supplies, and summarizes the actions the City has taken to date to meet its clean energy goals and reduce climate change and its impacts. Chapter 3 considers ways to reduce energy demand through efficiency and conservation, thereby reducing the amount of renewable energy needed to meet the 100% renewable goal. Chapters 4 and 5 address distributed and utility-scale generation, respectively, and contain the bulk of the Task Force's renewable energy recommendations. Each chapter summarizes current programs, highlights key issues relevant to each topic, and lists recommended actions the City should take in support of the City's 100% renewable goal. Each recommendation also includes a table outlining the recommendation action type (policy, regulatory, financial, technical, or public awareness), the potential level of impact (enabling, moves the market, or game changing), the ultimate level where decision-making must occur to achieve that impact (amongst individuals or the private sector, or at the local, state or federal government level), the timeframe for action (near-term (2012-2015), mid-term (2015-2020), or long-term (2020-2030)), and finally primary agencies responsible for implementing the recommendation (San Francisco agencies unless otherwise noted). Finally, chapter 6 provides a recap of the key strategies the City should follow to meet the 100% renewable goal, and provides a summary table of recommendations.

⁹ California RPS eligible resources include biomass, biodiesel, fuel cells using renewable fuels, digester gas, geothermal, landfill gas, municipal solid waste, ocean wave, ocean thermal, tidal current, small hydroelectric, solar photovoltaic, solar thermal, and wind. For full definitions, see California Public Utilities Commission, "Renewable Energy and RPS Eligibility," 2009, www.cpuc.ca.gov/PUC/energy/Renewables/FAQs/01REandRPSeligibility.htm.

CHAPTER 2

San Francisco's Electricity and Greenhouse Gas Profile: Fighting Climate Change with Clean Energy

The 100% renewable electricity goal must be considered within the broader context of San Francisco's energy demand and the regional energy supply system, including the GHG profile of those supplies. One of the key drivers of the mayor's 100% renewable goal and the Renewable Energy Task Force's recommendations is to identify additional steps that can be taken to further reduce San Francisco's GHG emissions from the electric sector.

San Francisco's Electricity Profile

San Francisco currently consumes about 6,000 gigawatt hours (GWh) of electricity annually, with a peak load of roughly 970 MW. Approximately 41%, or 2,400 GWh, of San Francisco's demand is met with renewable sources (including large hydroelectric). Therefore, in simple terms, the Task Force's job is to determine the best strategies to fill the 59% gap in nonrenewable electricity currently being used.

San Francisco's private sector load is primarily served by PG&E, while the city's municipal load (including tenants at San Francisco International Airport and the Port) is served by the SFPUC. As shown in Figure 5 (p.65), PG&E supplies about 73% (4,472 GWh) of total city power, SFPUC supplies around 16% (951 GWh), and third-party electricity services providers (ESPs) supply the remaining 11% (668 GWh) to a small group of direct access (DA) customers.¹⁰

ELECTRICITY BASICS

Measuring Electricity—Electricity is measured in units of power. Power is the rate at which energy is used. Electricity is measured in units of power called watts. For example, a typical compact fluorescent light bulb consumes 10 to 15 watts. Since one watt is a very small amount of electricity, electricity is often measured in larger units such as kilowatts (1 kW = 1,000 watts), megawatts (1 MW = 1,000,000 watts), and gigawatts (1 GW = 1,000,000,000 watts), for example when speaking of citywide energy demand or a power plant's capacity.

Electricity Use Over Time—Electricity use over time is measured in watt-hours (Wh), kilowatt-hours (kWh), megawatt-hours (MWh), and gigawatt-hours (GWh). These measurements are determined by multiplying the power demand by the number of hours of use. For example, a 15 watt light bulb running for 10 hours consumes 150 Wh, or 0.15 kWh.

Energy (watt-hours) = **Power** (watts) x **Time** (hrs)

In 2010, 15.9% of PG&E's power came from California-compliant RPS eligible resources, including geothermal, biomass, wind, and solar, and another 15.6% from large hydroelectric.¹¹ All of SFPUC's power comes from renewable sources, with nearly all provided by hydroelectric

¹⁰ Direct access customers purchase electricity supplies from ESPs authorized to sell energy by the CPUC and purchase transmission and distribution services from IOUs (from PG&E for direct access customers in San Francisco). More information regarding CPUC-registered ESPs can be found at the CPUC website, www.cpuc.ca.gov/Published/ESP_Lists/esp_udc.htm. Data from San Francisco Department of Environment, *San Francisco Community GHG Emissions Inventory 2010, 2012*.

¹¹ PG&E, "PG&E's 2010 Electric Power Mix Delivered to Retail Customers," *Clean Energy Solutions* web page, <http://pge.com/about/environment/pge/cleanenergy/>, viewed 12/19/2011. PG&E is expected to increase its renewable procurement to 20% of its entire portfolio in the 2011–2013 timeframe.

power generated by the Hetch Hetchy system. The exact makeup of direct access supply from ESPs is not publicly available, and so is assumed to roughly mirror the state's wholesale electricity market, with 21.6% of electricity coming from renewable resources, including 11% from large hydroelectric and 10.6% from RPS-eligible resources.¹² San Francisco's energy supply mix sources and proportions are summarized in Table 1 and Figures 1.

KEY FACTS ABOUT SAN FRANCISCO ELECTRICITY DEMAND

In San Francisco, an average home uses approximately 4,200 kWh per year. In comparison, New York City households use 5,077 kWh/yr, while the average across the U.S. is over double that, at 11,496 kWh/year.

Altogether, San Francisco consumes about 6,000 GWh of electricity annually. Average hourly electric demand in San Francisco is just under 700 MW, and peak demand (the highest hourly demand) is about 970 MW.

As of 2010, San Francisco's electricity supply is already 41% renewable.

Table 1: San Francisco's Electricity Supply Mix, 2010¹³

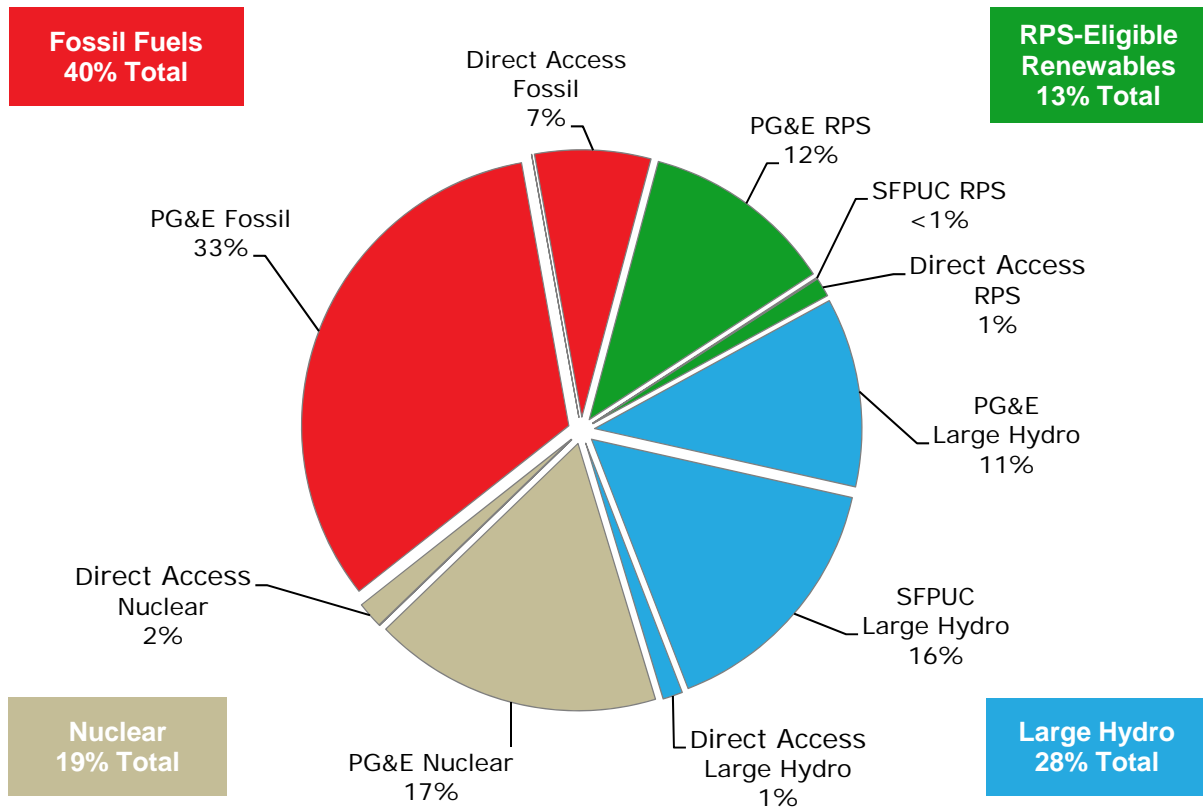
	PG&E		SFPUC		Direct Access		Weighted Average	
	%	GWh	%	GWh	%	GWh	%	GWh
Biomass and Waste	4.2%	189	0.1%	1	2.1%	14	3%	204
Geothermal	4.8%	217			4.5%	30	4%	247
Solar	0.1%	4	0.4%	4	0.2%	1	0%	8
Wind	3.8%	171			2.4%	16	3%	187
Small Hydroelectric	2.9%	130			1.4%	9	2%	139
Large Hydroelectric	15.6%	698	99.5%	950	11.0%	73	28%	1,722
Nuclear	23.8%	1,064			14.5%	97	19%	1,161
Natural Gas	19.6%	877			45.7%	305	19%	1,182
Coal	1.0%	45			18.2%	122	3%	166
Other fossil	1.2%	54					1%	54
Unspecified	22.9%	1,024					17%	1,024
Total Electricity Supplied	100%	4,472	100%	955	100%	668	100%	6,095
Total Renewable	31.5%	1,408	100%	955	21.6%	144	41%	2,507

¹² ESPs must meet state RPS requirements, but are not required to report their overall electricity mix to the public. In line with the San Francisco Electricity Resource Plan and Community GHG Emissions Inventory, we assume direct access customers receive power supply that roughly mirrors the state's electricity wholesale market, as recommended in the World Resources Institute's GHG Protocol. In reality more of the ESPs power mix may come from fossil fuel-based sources. More information regarding CPUC-registered ESPs can be found at the CPUC website:

http://docs.cpuc.ca.gov/published/ESP_Lists/esp_udc.htm. California wholesale electricity market data from CAISO, "Renewable Resources and the California Electric Power Industry: System Operations, Wholesale Markets and Grid Planning," July 2009, p. 5, www.caiso.com/23f1/23f19422741b0.pdf.

¹³ Note: All data for 2010, except direct access supply mix percentages, which are based on most recently available data from CAISO. Data sources: PG&E, "PG&E's 2010 Electric Power Mix Delivered to Retail Customers," Clean Energy Solutions, <http://pge.com/about/environment/pge/cleanenergy/>, viewed 12/19/2011; SFPUC, using CEC Power Content Label reporting methodology, electric power mix used to serve City departments and retail customers in San Francisco, 2010. Excludes Treasure Island loads and resources (purchases from Western Area Power Authority); direct access supply mix percentages assumptions based on wholesale market data from CAISO, "Renewable Resources and the California Electric Power Industry: System Operations, Wholesale Markets and Grid Planning," July 2009, p. 5, <http://www.caiso.com/23f1/23f19422741b0.pdf>; direct access total demand figure from Pacific Gas and Electric, *San Francisco Community Wide Climate Action Plan*, Green Communities 2009.

Figure 1: San Francisco Electricity Supply Mix, 2010¹⁴



Greenhouse Gas Emissions from the Electricity Sector

According to SF Environment's latest citywide GHG emissions inventory, San Francisco is responsible for approximately 5.26 million metric tons (MMT) of carbon dioxide (CO₂) emissions annually. Of this, 1.26 MMT (24% of total) is associated with electricity use in buildings (see Table 2 and Figure 2¹⁵).

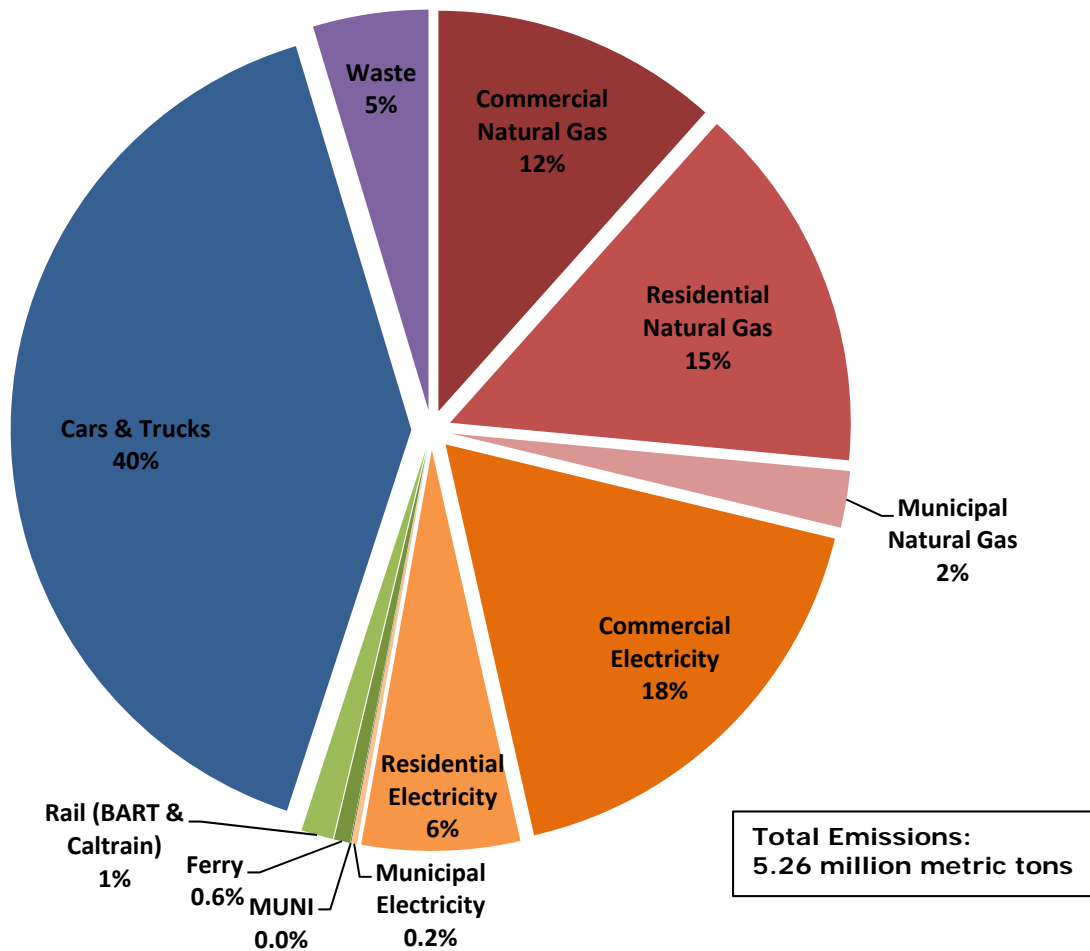
¹⁴ See footnote 13 for Table 1 for sources.

¹⁵ In 2010, electricity use in buildings was responsible for 1.28 MMT CO₂, or 24.3% of community emissions. Natural gas use in buildings was responsible for 1.51 MMT CO₂, or 28.8% of community emissions. Transportation accounted for 2.22 MMT CO₂, which is 42.3% of emissions, and waste accounted for 244,625 metric tons CO₂, which is 4.7% of emissions. San Francisco Department of Environment, *San Francisco Community GHG Emissions Inventory 2010, 2012*.

Table 2: San Francisco Communitywide GHG Emissions by Sector (2010)

Source	Metric Tons	Percent
Cars & Trucks	2,118,863	40.3%
Commercial Electricity	928,785	17.7%
Residential Natural Gas	782,960	14.9%
Commercial Natural Gas	609,521	11.6%
Residential Electricity	335,195	6.4%
Waste	244,625	4.7%
Municipal Natural Gas	119,860	2.3%
Rail (BART & Caltrain)	68,046	1.3%
Ferry	34,103	0.6%
Municipal Electricity	12,268	0.2%
MUNI	1,453	0.0%
Total:	5,255,679	100%

Figure 2: San Francisco Communitywide GHG Emissions by Sector (2010)



Achieving a 100% renewable supply will require a combination of deeper energy efficiency improvements and significant changes in the electricity provision. As identified in the San Francisco Climate Action Strategy, achieving the 100% renewable electricity goal is the single biggest action San Francisco can take to reduce its GHG emissions, and the city will have to achieve a GHG-free electricity supply in order to meet the City's aggressive emissions reduction targets for 2025 and beyond.¹⁶

EXPECTED CLIMATE CHANGE IMPACTS IN SAN FRANCISCO

San Francisco has much at stake in the fight against climate change. Over the course of the 21st century, San Franciscans can expect numerous impacts, including the following:

Increased air pollution: If people continue to rely on fossil fuels for their energy needs, the result will be increased harmful effects on public health. The emissions and particulate matter caused by burning fossil fuels have been shown to increase cardiovascular diseases, lung and respiratory diseases such as asthma, and various other adverse health impacts. These pollutants also change our environment, such as through acid rain and climate change, affecting water cycles, agricultural production, and other natural resources.¹⁷

Sea-level rise: Global climate change is expected to result in sea-level rises in the San Francisco Bay Area of 16 inches by midcentury and 55 inches by the end of the century.¹⁸ This would inundate a significant portion of San Francisco's land area and damage billions of dollars' worth of infrastructure. Most of San Francisco International Airport and approximately 99 miles of major roads in the Bay Area are vulnerable to inundation and flooding from a 16-inch rise in sea level.¹⁹

Extreme weather events and increased temperatures: Because San Francisco does not often experience severe heat waves, residents are less prepared for a future with more extreme weather events. Experts predict higher temperatures will increase exposure to air pollutants such as smog, which can aggravate asthma and other respiratory diseases. The burdens of these effects will fall disproportionately on the poor, the elderly, and young children.²⁰ Warmer summertime temperatures throughout California will strain the electricity grid, and while San Francisco's Hetch Hetchy watershed is somewhat protected by its high elevation, changes in precipitation patterns, along with the timing and quantity of runoff from precipitation in the Sierra Nevada, could affect San Francisco's future water supply.²¹ Reduced snowpack in the Sierra Nevada could also alter the electricity output of the Hetch Hetchy hydroelectric facilities.²²

Fortunately, San Francisco has a rich history of working aggressively to reduce GHG emissions that cause climate change. In 2002, the Board of Supervisors (BOS) passed a resolution committing the City to a GHG reduction goal of 20% below 1990 levels by the year 2012.²³ That ordinance prompted the development of the City's 2004 Climate Action Plan.²⁴ In 2008, the BOS extended the City's climate goals when it adopted an ordinance establishing GHG reduction targets of 25% below 1990 levels by 2017, 40% below by 2025, and 80% below by 2050.²⁵ As of 2010, San Francisco has already reduced GHG emissions to 14.5% below 1990 levels, making San Francisco one of the first jurisdictions to meet and exceed Kyoto Protocol targets.²⁶ Meeting the city's own aggressive GHG reduction goals for 2025 and beyond will require achieving a completely GHG-free electricity supply, as supported by the 100% renewable goal.

¹⁶ San Francisco Department of Environment, *San Francisco Climate Action Strategy*, forthcoming 2012.

¹⁷ US EPA, *Our Nation's Air - Status and Trends through 2010*, EPA-454/R-12-001, February 2012, www.epa.gov/airtrends/2010/report/airpollution.pdf.

¹⁸ San Francisco Bay Conservation Development Commission, "Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline," Staff Report, October 6, 2011, p.2. www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf.

¹⁹ San Francisco Bay Conservation Development Commission, "Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline," Staff Report, October 6, 2011, pp.69 and 78. www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf.

²⁰ "Climate Change Hits Home: Adaptation Strategies for the Bay Area," SPUR, May 2011.

²¹ "Programmatic EIR for the SFPUC Water System Improvement Program," case no. 2005.0159E, Master Responses to Comments, Section 14.11: Master Responses on Climate Change, San Francisco Planning Department, 2008.

²² "Climate Change Hits Home: Adaptation Strategies for the Bay Area," SPUR, May 2011.

²³ San Francisco Board of Supervisors, *Resolution 158-02: Supporting efforts to reduce Greenhouse Gas Emissions, City and County of San Francisco*, 12 February 2002, www.sfbos.org/ftp/uploadedfiles/bdsupvrs/resolutions02/r0158-02.pdf.

²⁴ San Francisco Department of Environment, *Climate Action Plan*, 2004, www.sfenvironment.org/downloads/library/climateactionplan.pdf.

²⁵ San Francisco Board of Supervisors, *Ordinance 81-08: Climate Change Goals and Action Plan Ordinance*, City and County of San Francisco, 26 May 2008.

²⁶ San Francisco Department of Environment, *San Francisco Community GHG Emissions Inventory 2010*, 2012.

Progress Made toward Meeting San Francisco's Energy and Climate Goals

In 2008, the BOS adopted an ordinance requiring citywide GHG emissions to be reduced to 25% below 1990 levels by 2017, 40% below by 2025, and 80% below by 2050. The ordinance also encouraged pursuit of GHG-free electricity by 2030.²⁷ In 2011, the BOS endorsed the SFPUC's updated *Electricity Resource Plan (ERP)*, which outlined recommendations for achieving San Francisco's GHG-free electricity vision, and called for the city to take more direct control over its energy future.²⁸

The City already has a number of initiatives in place to support these climate and energy goals, including the following:

Clean municipal power. The city's municipal power supply is already 100% renewable, thanks to the Hetch Hetchy hydroelectric system, which provides almost all the power for municipal facilities. On December 13, 2011, the SFPUC adopted its Enforcement Program for the California Renewable Energy Resources Act (SBx1-2), which ensures the SFPUC will meet all of its energy needs from its Hetch Hetchy-generation and RPS-eligible resources.²⁹

Closure of two local fossil fuel power plants. The last remaining fossil fuel power plant in the city, the Potrero Power Plant, was closed in early 2011. This accomplishment was the result of City efforts to identify new transmission and in-city generation options to allow the plant to be retired while maintaining the reliability of San Francisco's electric system. As noted in the 2011 ERP, the closure of the Potrero Power Plant alone reduced in-city GHG emissions by 300,000 metric tons per year. San Francisco's other fossil-fueled power plant at Hunters Point was retired in 2006, also as a result of City efforts. These are victories for the climate and for San Francisco's environmental justice communities.

Over 22 megawatts (MW) of local renewable electricity. In all, San Francisco is home to 22 MW of renewable electricity, including 12 MW of distributed solar PV on private homes and businesses. San Francisco has installed over 7 MW of solar PV electric generation on city-owned buildings and properties, including the 5-MW Sunset Reservoir project, one of the largest municipally-owned solar PV projects in the country. San Francisco also has 3.2 MW of biogas cogeneration at the City's wastewater treatment plants.

GoSolarSF incentive program. In 2008, the City established a 10-year solar incentive program, GoSolarSF, which has already helped to add 5.3 MW of new solar power in San Francisco, four times the amount installed on private homes and businesses at the outset of the program (see Figure 7).

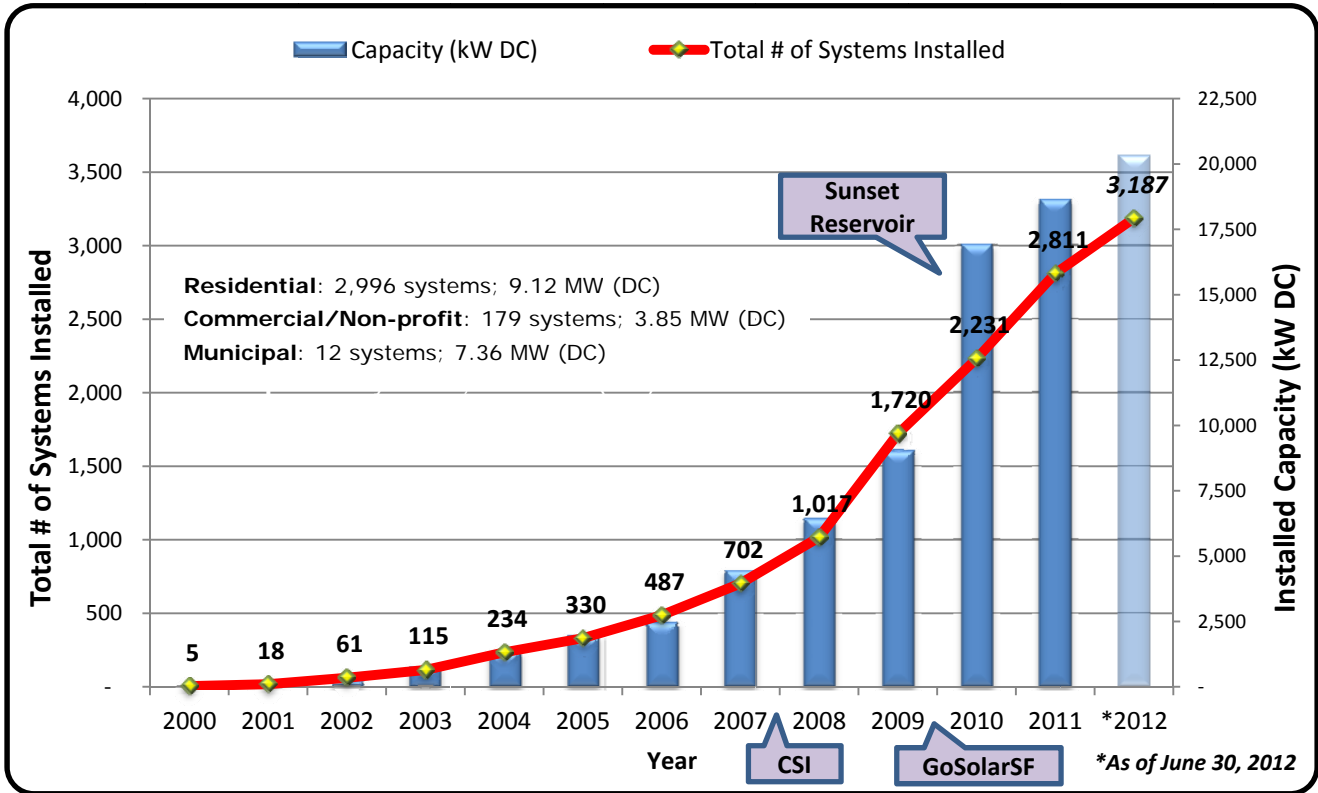
²⁷ *Ordinance 81-08 Climate Change Goals and Action Plan*, City and County of San Francisco (2008).

²⁸ *Resolution 349-11 Electricity Resource Plan Update*, August 8, 2011. SFPUC, *San Francisco's 2011 Updated Electricity Resource Plan*, March 2011, <http://sfwater.org/modules/showdocument.aspx?documentid=40>.

²⁹ SFPUC, "Workshop and Discussion of the Staff's proposed Enforcement Program for the California Renewable Energy Resources Act," memo, 2 November 2011.

https://docs.google.com/viewer?a=v&q=cache:oTMr_JVF4ZoJ:https://infrastructure.sfwater.org/fds/fds.aspx%3Flib%3DSFPU%26doc%3D728280%26data%3D280387800+&hl=en&gl=us&pid=bl&srcid=ADGEEShJL9A6tdGqiwsLBwFnPXM4M7etxIAm2NqGreuEL6lytB6oWylcyWJtxNAZkYBluAY5DJMd6Mb1Li40ho0DQpSgxOcl3DU0iyu87PI-zYqNvEPG9QyKDF0tj-l78-9KFIPmz-ld&sig=AHIEtbSq-DD0mb7ing3P3SjWZDsswW2fhQ

Figure 3: San Francisco Solar PV Installations 2000 to mid-2012³⁰



Local solar market development. San Francisco received two funding awards under the U.S. Department of Energy's Solar America Cities program, allowing the San Francisco Department of the Environment (SF Environment) to carry out local solar market development work. SF Environment has provided ongoing community outreach to increase awareness and understanding of solar technologies and funding opportunities, including development of the award-winning SF Energy Map (formerly SF Solar Map, www.sfenergymap.org). SF Environment has also worked with the Department of Building Inspection (DBI) and the San Francisco Solar Task Force to streamline solar permitting processes and reduce permitting costs in San Francisco. Residential solar permits are available over the counter and online, and have one of lowest fees in California, while maintaining cost recovery for DBI. SF Environment has also pioneered innovative purchasing and financing models, including aggregated purchasing, or "group buy," campaigns with neighborhood associations, businesses, and schools.³¹

Urban wind power Task Force. In July 2008, Mayor Gavin Newsom and Supervisor Tom Ammiano created the Urban Wind Power Task Force in order to better understand San Francisco's urban wind opportunities. 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. The Urban Wind Power Task Force released its recommendations report in 2009, identifying the need for performance

³⁰ PG&E solar interconnection data, February 2012, and SFPUC municipal installation data. Installed capacity data provided in kW direct current (DC) based on solar nameplate capacity.

³¹ More information on San Francisco's work under the US DOE's Solar America Cities initiative can be found at www.nrel.gov/docs/fy12osti/50203.pdf.

testing and third-party certification of small wind turbines, and better data on the San Francisco urban wind resource. To address the latter, SF Environment undertook computational fluid dynamics modeling of the city's urban wind resource and added a new wind resource layer to the SF Energy Map.³²

Ocean power studies. Drawing on San Francisco's unique geographical location, the City has studied the tidal and wave power potential in the San Francisco Bay and off Ocean Beach. The City is currently completing environmental studies and finalizing conceptual design studies for a wave power pilot installation. A preliminary study shows that a 30-MW wave power project could generate enough power to meet 10% of the city's residential demand.³³

Solar water heating for multi-family properties. The City has installed two large solar water heating systems at multi-family affordable housing properties in conjunction with the Mayor's Office of Housing's Green Retrofit Initiative and with support from the U.S. Department of Energy's Solar America Cities program. SF Environment is also carrying out targeted outreach to high hot-water use businesses and multi-family properties about solar water heating, leveraging the new CSI-Thermal state incentive program to reduce GHG emissions in San Francisco.

Over 36 MW of energy efficiency in homes and businesses. The City has a long history of promoting energy efficiency among private-sector buildings, originally through the SFPUC, and since 2001 through SF Environment. SF Environment's first energy program, Power Savers, funded by state energy emergency funds, retrofit lighting systems in 4,000 small businesses, saving 6 MW of load. Since 2006, SF Environment has operated ratepayer funded programs averaging over \$5 million annually for small businesses, commercial buildings, and multi-family buildings. This includes commercial and multi-family building energy audits and retrofits conducted under the Energy Watch partnership with PG&E, resulting in 6,000 energy efficiency projects, 30 MW of electricity-demand reductions, and annual savings of 1.1 million therms of natural gas. Together these programs are saving customers \$34 million annually. Most recently, using federal Energy Efficiency and Conservation Block Grant funding from the U.S. Department of Energy, SF Environment has assisted with energy efficiency upgrades in more than 250 buildings through the department's Boiler Retrofit Program for multi-family buildings, the San Francisco Home Improvement & Performance Program for single-family and 2- to 4-unit residential buildings, and a door-to-door community education program on energy conservation, recycling, home safety and earthquake preparedness. This is part of a statewide attempt to ramp up a new industry in home performance retrofits.

Commercial Buildings Ordinance. The 2011 Existing Commercial Buildings Energy Performance Ordinance also recently went into effect, requiring buildings over 10,000 square feet to track and report energy use annually and to complete an energy efficiency audit every five years. The ordinance seeks to create a virtuous cycle where public labels about building performance motivate investment in energy efficiency, raising median performance and inspiring further investment in improvements to improve asset value. The estimated net

³² See www.sfenergymap.org.

³³ URS, *Wave Power Feasibility Study Report*, for City and County of San Francisco, December 2009, <http://sfwater.org/modules/showdocument.aspx?documentid=1624>. URS, *Tidal Power Feasibility Study*, for San Francisco Public Utilities Commission, March 2008, <http://sfwater.org/ftp/large-documents/SFPUC-587377v.pdf>. See the SFPUC's wave power website for more information at <http://sfwater.org/index.aspx?page=78>.

present value to the private sector of the San Francisco ordinance over the first 10 years after adoption is projected to be \$612 million.³⁴

Municipal energy efficiency. From 2003 through 2011, the SFPUC conducted energy audits in over 230 municipal facilities and has completed energy efficiency projects in almost 120 facilities, resulting in approximately 9.5 MW of demand reduction, 40,000 MWh per year of electricity savings, and 800,000 therms per year of natural gas savings.³⁵

Municipal green buildings. In 2004, municipal projects greater than 5,000 square feet were required to be LEED Silver certified, increasing to LEED Gold for projects that initiated budgeting after November 1, 2011. This requirement has affected more than \$3.5 billion in municipal investments across more than 60 projects that have triggered this requirement. At the time of this report, more than 2.5 million square feet of municipal projects in San Francisco have earned LEED certification, and 7 million square feet are in the pipeline.³⁶

Green Building Ordinance. To engage the private sector, in 2006 the San Francisco Planning Department initiated priority permitting for new and renovated buildings that achieve LEED Gold or higher. The 2008 Green Building Ordinance requires LEED Gold for new commercial buildings over 25,000 square feet and GreenPoint Rated for new homes. As a result of these policies and the Existing Commercial Buildings Energy Performance Ordinance, as well as the immense leadership and expertise in San Francisco's private sector, more than 37% of competitive (Class A or similar) office space was LEED certified as of June 2011, and 75% of competitive office stock had achieved ENERGY STAR rating in 2010. In 2010 and 2011, San Francisco was recognized as the #1 city in North America in the Green Building Opportunity Index, and in 2011, the city was awarded "Best Green Building Policy" on the planet by the World Green Building Council.

PACE financing. In 2010, the city launched a residential PACE financing program, GreenFinanceSF, which authorized \$150 million in financing for renewable energy and efficiency retrofits in existing buildings. In July 2010, federal housing mortgage regulators issued directives to lenders expressing concerns about these programs, which caused the City to suspend the residential program. Following this, San Francisco developed a commercial-only PACE program, which was launched in October 2011 and authorizes up to \$100 million in special tax bonds to finance clean energy upgrades to qualified nonresidential buildings.³⁷

Net Zero Energy Homes Initiative. This initiative is creating the tools and support for San Franciscans to reduce the energy they use and offset the remainder with solar hot water and solar PV technologies. These homes will be connected to the grid just like a typical home; however, unlike typical homes, a net zero energy home will incorporate energy efficiency measures to reduce usage while generating enough renewable energy annually to offset the amount purchased from the utility, resulting in a net zero annual energy bill. The first steps have included training contractors and starting a performance-based retrofit program for

³⁴ "2011 Existing Commercial Buildings Energy Performance Ordinance," Section 2000-2008. Chapter 20. San Francisco Environmental Code. www.partneresi.com/Resources/Partner%20Energy%20Ref%20101105.pdf

³⁵ Communication with the SFPUC, 4 April 2012.

³⁶ Green Building data from San Francisco Department of Environment, May 2012.

³⁷ See GreenFinanceSF website at www.greenfinancesf.org.

residential buildings, developing web tools for homeowners and apartment owners to characterize their home or buildings to identify opportunities for improving performance, and creating case studies and providing recognition for homeowners who achieve net zero.³⁸

State Actions That Affect San Francisco's Energy Supply and Greenhouse Gas Emissions

In addition to local programs and policy, actions at the state level are helping reduce GHG emissions and increase the supply of renewable energy:

In 2002, the California legislature passed, and the Governor signed, an RPS that required utilities and ESPs to meet at least 20% of their energy needs from RPS-eligible renewable resources by 2010. In 2011, California adopted SB X 1-2, the California Renewable Energy Resources Act, which extended this requirement and increased the RPS to 33% by 2020.³⁹

In 2006, with the passage of Assembly Bill (AB) 32, California's Global Warming Solutions Act, California committed to reducing its GHG emissions to 1990 levels by 2020. This will require approximately an 11% reduction from 2005 levels.⁴⁰ In 2011, under AB 32, California adopted a cap-and-trade program for GHG emissions that will reduce emissions from the electricity sector and other major sources by 15% below 2005 levels by 2020.⁴¹

California has adopted a "loading order" requiring IOUs, such as PG&E, to maximize their energy efficiency and use of renewable energy before acquiring new gas-fired or other fossil fuel-based electricity generation. PG&E estimates it now spends \$25 million per year of ratepayer funds in San Francisco on energy efficiency (some of which is provided to SFEnvironment to fund energy efficiency programs such as San Francisco Energy Watch), resulting in an estimated peak demand reduction of 10 MW per year, reducing infrastructure costs for the utility and energy bills for consumers.

³⁸ See San Francisco Home Improvement & Performance program website at www.sfenvironment.org/sfhip.

³⁹ The RPS was established in 2002 under SB 1078. In 2006, SB 107 codified the 20% compliance target by 2010. SB X 1-2, which effectively preempts SB 107, rules that utilities must meet the new RPS goals of 20% of retail sales from renewables by the end of 2013, 25% by the end of 2016, and 33% by the end of 2020. For more information, see www.cpuc.ca.gov/PUC/energy/Renewables/overview.htm.

⁴⁰ For more information on California's Global Warming Solutions Act (AB 32), see www.arb.ca.gov/cc/ab32/ab32.htm.

⁴¹ For more information on California's cap-and-trade program, see <http://arb.ca.gov/cc/capandtrade/capandtrade.htm>.

CHAPTER 3

Energy Efficiency and Renewable Energy: “Reduce then Produce”

While this Task Force focused on renewable energy, energy efficiency is a critical part of reaching San Francisco’s 100% renewable goal. Understanding the city’s overall energy demand and the GHG profile of those energy sources is important to ensure appropriate planning and policies are put in place, particularly where there are synergies between electric and natural gas usage. By maximizing efficiency and encouraging conservation, we reduce the amount of electricity generation needed, and thus the amount of renewable energy generation that needs to be supplied.

Recognizing that there has been considerable previous work improving building energy efficiency (see the *ERP*,⁴² *Mayor’s Task Force on Green Buildings report*,⁴³ and the *SF Existing Commercial Buildings Task Force report*⁴⁴), the Task Force has not provided exhaustive recommendations on the subject. Rather, this section outlines some of the major opportunities for improving energy efficiency in San Francisco, particularly where these opportunities intersect with renewable energy deployment.

Electricity Use in Buildings

Electricity use accounts for 45% of building-related GHG emissions in San Francisco, and 24% of the city’s total GHG emissions.⁴⁵ The biggest uses of electricity in commercial buildings are interior lighting followed by refrigeration, ventilation, and cooling.⁴⁶ In residential buildings, electricity usage is dominated by lighting and appliances [see Table 3].⁴⁷

Occupant behavior is a key factor in electricity demand. California has long led the way on appliance efficiency standards, but it is becoming increasingly important to change attitudes and behaviors around electricity use, particularly as the use of electronic devices and their share of electricity demand grows. Two simple and easy ways to conserve electricity are power strips to reduce phantom loads (power that is consumed by devices while they are off or in

⁴² San Francisco Public Utilities Commission, 2011 *Updated Electricity Resource Plan*, March 2011, <http://sfwater.org/modules/showdocument.aspx?documentid=40>.

⁴³ “Mayor’s Task Force on Green Buildings: Reports and Recommendations.” Mayor’s Task Force on Green Buildings. June 2007. www.fypower.org/pdf/SF_GreenBuildingTFReport.pdf

⁴⁴ “Mayor’s Task Force on Existing Commercial Buildings: Final Report.” SF Commercial Buildings Task Force. December 2009. www.imt.org/files/FileUpload/files/Benchmark/sf_existing_commercial_buildings_task_force_report.pdf

⁴⁵ Electricity demand from buildings accounted for 1,333,763 MT of CO₂ in San Francisco in 2010. San Francisco Department of Environment, *San Francisco Community GHG Emissions Inventory 2010*, 2012.

⁴⁶ California Energy Commission, “California Commercial End-Use Survey,” CEC-400-2006-005, March 2006, www.energy.ca.gov/ceus.

⁴⁷ “Typical Wattages of Various Appliances.” US Department of Energy. http://www.energysavers.gov/your_home/appliances/index.cfm/mytopic=10040

Table 3: Electric usage (GWh) by building type and end use from California commercial end-use survey (CEUS)⁴⁸

Building Type	Heat	Cool	Ventilation	Refrigeration	Water Heating	Cook	Int. Lighting	Ext. Lighting	Office Equipme	Miscellaneous	Air Compr	Motors	Process	Total
Small Office	30.40	311.20	179.40	62.10	25.20	7.10	478.50	91.20	360.40	124.10	0.70	15.40	11.60	1697.30
Large Office	155.50	932.50	894.30	104.10	34.00	37.20	1273.00	96.90	1116.50	152.30	0.40	216.50	25.40	5038.70
Restaurant	1.10	231.20	135.00	596.40	19.60	617.20	374.20	95.20	34.80	49.80	0.80	13.90	1.10	2170.20
Retail	30.50	433.50	447.60	266.70	31.30	56.80	1467.70	170.60	136.10	213.90	7.20	74.60	20.20	3356.80
Food Store	1.40	121.70	134.30	1283.30	7.70	123.20	451.80	48.30	20.20	61.00	0.00	5.80	3.10	2261.80
Refrigerated Warehouse	1.30	14.00	14.90	159.60	1.50	2.00	151.60	21.80	10.90	30.70	4.10	95.80	17.20	1125.60
Unrefrigerated Warehouse	4.10	40.10	28.50	44.20	6.60	3.00	391.60	62.10	37.50	62.80	0.70	70.00	12.00	763.30
School	21.60	161.20	178.60	93.70	10.90	41.80	528.00	142.00	70.40	50.10	0.70	18.40	1.40	1318.70
College	39.10	112.70	233.00	40.50	12.60	27.00	305.90	62.30	39.90	49.70	0.00	32.70	7.30	962.70
Health	59.20	250.60	327.00	56.00	4.50	42.80	363.30	39.60	61.90	177.30	0.00	76.30	18.80	1477.70
Lodging	53.60	173.50	172.70	87.10	5.30	69.00	326.60	63.40	13.70	101.40	0.00	45.40	2.90	1114.70
Miscellaneous	49.30	368.80	429.60	388.50	51.60	141.50	1253.30	445.00	180.50	439.40	49.90	314.40	107.60	4219.30
All Offices	185.90	1243.70	1073.70	166.30	59.30	44.30	1751.50	188.00	1476.90	276.40	1.20	231.80	37.00	6736.00
All Commercial	447.20	3151.00	3174.80	3782.30	210.80	1168.40	7365.60	1338.40	2082.80	1512.50	64.60	979.10	228.70	25506.30

standby mode) and all-off switches (like the key card light switches in some hotels) to reduce energy use when rooms or buildings are unoccupied.

Home electricity demand is also expected to increase as more residents purchase electric vehicles. Developing smart charging technologies that can help stabilize the electricity grid and encouraging behaviors such as charging at night when electricity demand and rates are low will become increasingly important in the coming years, as will pairing electric vehicles with onsite renewable generation, such as solar.

Thermal Loads and Natural Gas Use in Buildings

Thermal (heating and cooling) demands in San Francisco are relatively low thanks to our mild climate, but they remain a significant portion of our energy demand and an even bigger part of our GHG profile. Most heating in San Francisco is provided by burning natural gas, a fossil fuel

⁴⁸ California Energy Commission, *California Commercial End-Use Survey*, CEC-400-2006-005, March 2006, <http://www.energy.ca.gov/ceus/>.

that, while cleaner-burning than coal or petroleum, releases significant amounts of GHGs when burned. In fact, natural gas use in buildings accounts for 28.8% of the city's total GHG emissions.⁴⁹ While California's energy efficiency requirements for new buildings are the most stringent in the country, much of San Francisco's building stock predates the 1978 introduction of energy standards in our state building code, and so were not required to be designed with heating efficiency in mind.⁵⁰ The combination of leaky or drafty home construction and inefficient heaters leaves many San Francisco residents fighting against the chill through long stretches of the year, while their heat — and money — goes out the window.

In addition to tail-end emissions from burning natural gas, many of the environmental impacts of natural gas occur upstream from end users. Drilling, hydraulic fracturing ("fracking"), and leaks in transmission and distribution networks all release methane directly into the atmosphere, where it has a global warming potential 23 times that of carbon dioxide (the end product of burning natural gas).⁵¹ Reducing natural gas demand in San Francisco is one of the largest opportunities for San Francisco to reduce its GHG emissions. The San Francisco Home Improvement and Performance program has delivered average energy reductions of 33% in participating buildings, and over 50% savings in some homes. 96% of this energy reduction has been in natural gas demand, rather than electric.⁵²

Energy Efficiency Recommendations

Building on existing programs and policies, the Task Force recommends the following actions to increase energy efficiency in San Francisco's building stock, and thereby reduce the total electricity demand that must be met with renewable sources.

⁴⁹ Natural gas demand from buildings accounted for 1,512,325 MT of CO₂ in San Francisco in 2010, as reported in San Francisco Department of Environment, *San Francisco Community GHG Emissions Inventory 2010*, 2012.

⁵⁰ Title 24.

⁵¹ *IPCC Third Assessment Report - Climate Change 2001, 2003*, www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg1/248.htm.

⁵² 33% modeled energy savings are a combination of electricity and natural gas savings in participating SF Home Improvement and Performance Program homes. San Francisco Department of the Environment, *The San Francisco Zero Net Energy Homes Project*, July 2011, p. 7, http://sfenvironment.org/sites/default/files/fliers/files/sfe_ee_zeronethomesreport.pdf.

RECOMMENDATION 1:

Update Planning and Permitting Process

The City should update the Planning Department’s development review and Department of Building Inspection’s site permit processes to require that developments meet the energy code that is in place upon application for a fully specified building permit, rather than at time of site permit, in order to ensure buildings are built to current energy code.

Once built, new buildings may not be significantly improved for 20 to 50 years, so it is imperative that new buildings be constructed to meet the most current building codes and energy regulations. Unfortunately, in San Francisco, there is often a long delay between when a permit is first issued and when a building is finally entitled to begin construction, resulting in the application of outdated standards.

Currently, developers may apply for a “Site Permit” from the Department of Building Inspection, and then they are referred to Planning for zoning review — which can take years and can be renewed or extended due to economic conditions. State law requires that the building code applied to a project be fixed at the time of first building permit application. Thus, a building that begins construction in 2012 might have to meet only the building standards in effect in 2008 when the building permit was applied for. In other jurisdictions, zoning permits and building permits are separate and zoning approval must be complete before a building permit application can be filed. San Francisco should adopt such a practice.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Moves the Market	Local Government	Near-term	Planning Department, Department of Building Inspections, Department of Environment

RECOMMENDATION 2:

Strengthen Retrofit on Resale Rules

The City should amend the San Francisco Residential Energy Conservation Ordinance (RECO) to require new measures and remove the permanent exemption. The updated ordinance should require performance-based improvements, require compliance for multi-tenant buildings that are held in trust, apply to new leases, and provide for publicly accessible asset ratings and historic energy use disclosure, which could be integrated into a home energy label (see recommendation 4).

Developed in the 1980s, the San Francisco RECO requires that homes, at time of sale, have basic energy efficiency measures in place (including exterior door weather-stripping, ceiling insulation, a water heater blanket, 6 feet of hot water pipe insulation, an efficient showerhead, and duct insulation installed). RECO was updated in 1992 to increase the spending cap for these improvements, but, 20 years later, the ordinance needs to be updated again.

Under RECO, a seller does not have to spend more than \$1,500 in total for all improvements and, therefore, does not have to complete all of the measures to complete that sale. Before its next sale, the new homeowner can complete the remaining RECO measures and obtain the RECO certificate for the home. Once a home passes RECO, it is forever exempted from any future RECO inspection. Energy audits of homes have changed markedly in the last 20 years, adding new approaches that utilize air pressure testing and thermal imaging to diagnose energy, safety, and air-quality problems unique to each home. Modern energy audits allow a trained specialist to identify specific solutions for each home to reduce air leaks in the shell and ducts, which create pressure imbalances that can lead to mold and poor indoor air quality. These leaks have a profound effect on energy use, indoor air quality, and combustion safety.

RECO should be amended to require new efficiency measures and remove the permanent exemption. The new measures should be performance-based, rather than prescriptive, and could include a home performance test, air sealing, proper ventilation, Title 24-compliant lighting in bathrooms and kitchens, and correction of gas leaks and combustion safety problems. Multi-tenant properties are particularly problematic under RECO. The update should require compliance for multi-tenant buildings that are held in trust (and rarely sold) and apply to new leases, not just property sales. Some approaches to deal with the staggered occupancy turnover of multi-tenant properties could include requiring a blower door test on each unit at time of vacancy rather than immediate RECO compliance, and exceptions could be made for economic hardship. Costs of complying with a more stringent RECO could be reduced by waiving a portion of the transfer tax based on eligible improvements.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Moves the Market	Local Government	Near-term	Board of Supervisors, Planning Department, Department of Building Inspections, Department of Environment

RECOMMENDATION 3:

Promote Energy Audits

The City should develop outreach programs and provide incentives to encourage home energy audits and continue work begun under the Energy Upgrade California program to incent energy efficiency, identify financing options, and train contractors. The City should also expand its commercial building efficiency programs to include mixed-use and multi-family residential properties.

Energy audits provide property owners vital information on their building's energy performance and opportunities for improving efficiency and comfort. Energy audits should be encouraged for current owners and occupants, not just at time of sale (as with RECO, see Recommendation 2). Since 2011, the Energy Upgrade California program has provided contractor training on energy audits, education to homeowners, and significant incentives for energy efficiency improvements taken after such audits. While originally funded by American Recovery and Reinvestment Act, such work will be continued going forward using state public goods charge funds, collected on the utility bill.

As mentioned in Chapter 2, large nonresidential buildings are now subject to the Existing Commercial Buildings Energy Performance Ordinance, which uses a phased approach and requires a thorough energy audit meeting ASHRAE "Procedures for Commercial Building Energy Audits" at least every five years. The requirement is date-certain and not related to time of sale. However, mixed-use residential and multi-family residential buildings are exempt from this requirement. Similar programs in other cities include mixed-use and multi-family residential buildings in their regulations, significantly increasing their scope and impact. For example, New York City's Local Law 84 requires energy audits for all buildings larger than 50,000 square feet, and more than 60% of these buildings are mixed use or multi-family.⁵³

⁵³ New York Local Law 84 requires benchmarking in all buildings larger than 50,000 square feet. More than 60% of the 16,000 affected buildings are wholly or partly residential. Seattle's Energy Benchmarking and Reporting Ordinance applies to commercial buildings as well as multifamily buildings of five or more units. Austin's Energy Conservation and Disclosure Ordinance requires audits and energy benchmarks for the entire residential sector, as well as commercial buildings larger than 10,000 gross square feet.

"Local Law 84, Article 309: Benchmarking Energy and Water Use." Chapter 3. Title 28. Administrative Code of the City of New York. 2009. <http://www.nyc.gov/html/dob/downloads/pdf/1184of2009.pdf>.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness	Moves the Market	Individuals & Local Government	Near-term	Department of Environment

RECOMMENDATION 4:

Integrate Energy Labeling of Real Estate

The City should implement and expand upon its plan to recognize energy performance ratings, green building certifications, and other credible environmental labels. These labels should be integrated into the Assessor’s database, the easiest channel to propagate such data into private databases used by real estate professionals, including but not limited to the Multiple Listing Service (MLS). Real estate labeling activities should be compatible with — and leverage — local policies such as San Francisco’s Green Building Ordinance and the City’s Existing Commercial Buildings Energy Performance Ordinance, and related state laws such as AB 1103 and AB 758.

Obtaining information on a building’s energy use is fundamental to making the necessary changes and choices to reduce energy costs, and building-specific energy labels, normalized for the number of users or size of building, can play an important role in providing this information to owners and occupants. Building energy labels are similar to the fuel economy labels on new cars. They help convey a building’s energy use in comparison to similar buildings in a given climate zone, while also providing building owners with building-specific information to highlight potential energy saving opportunities. Building owners and operators can see how their building compares to similar buildings, providing a metric for potential improvement in energy performance.

Integrating building energy labeling into property databases and real estate listings can play a role in both helping new owners or tenants better understand future operational costs and motivating property owners and landlords to provide more energy efficient buildings. Building owners can use the information provided to differentiate their building from others to secure potential buyers or tenants.

San Francisco’s Green Building Ordinance and Existing Commercial Building Energy Performance Ordinance (ECB Ordinance) have laid the foundation for commercial building

“Energy Use and Benchmarking Ordinance.” Ordinance 123226. Chapter 22.920. Title 22. Seattle Municipal Code. 2009. http://clerk.ci.seattle.wa.us/~archives/Ordinances/Ord_123226.pdf.

“Energy Conservation and Disclosure Ordinance” Ordinance 20110421-002. Chapter 6-7. Austin City Code. 2009. <http://www.austinenergy.com/about%20us/environmental%20initiatives/ordinance/ordinance.pdf>

energy labeling, and new programs and requirements should build on them. The Green Building Ordinance requires private new construction projects and large renovations to meet LEED Gold or GreenPoint Rated standards. The ECB Ordinance requires nonresidential buildings of 10,000 gross square feet or larger to benchmark operational performance with ENERGY STAR Portfolio Manager and annually report summary statistics. State laws have also been put in place to support energy labeling, including AB 1103 (requiring detailed disclosure of at least 12 months of operational performance data via ENERGY STAR Portfolio Manager to prospective purchasers, whole building lessees, and banks refinancing commercial property mortgages) and AB 758 (which may require energy asset ratings for existing commercial and residential buildings statewide at the time of transaction, among other actions).

Providing energy labeling for residential buildings is vital to providing potential homeowners and tenants the information needed to make informed decisions. As noted in Recommendation 3, the ECB Ordinance is limited to commercial buildings, while similar policies in New York, Seattle, and Austin also address residential buildings.⁵⁴ However, municipal utilities in Austin and Seattle make these laws easier to implement. California’s codes and regulations for energy usage data make it logistically difficult for building owners and managers to acquire and aggregate energy usage for individually metered tenants. In multi-family buildings, it is common for individual units to share common heating systems but be separately metered. If the building owner or manager must obtain a release from each individual tenant, as California regulations are currently interpreted, mandatory labeling for multi-family buildings would be resource-intensive. As such, regulations will also need to be tackled at the state level. For single-family and small multi-family properties, RECO could be updated to include requirements for residential energy audits and labeling, similar to the Home Energy Performance Certificate in Europe.⁵⁵

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness	Enabling	Individuals & Local Government	Near-to-midterm	Assessor-Recorder, Department of Environment

⁵⁴ See footnote 53.

⁵⁵ European Parliament and Council of the European Union, Energy Performance of Buildings Directive 2002/91/EC, 2002. See also European Commission Environmental Technologies Action Plan, “Energy Performance Certificates for Buildings in the UK,” July 2006, http://ec.europa.eu/environment/etap/pdfs/july06_building_energy_perf_certificate.pdf; UK Department for Communities and Local Government, “Requirements for energy performance certificates (EPCs) when marketing homes for sale or let,” 2008, www.communities.gov.uk/archived/publications/planningandbuilding/epcrequirements.

RECOMMENDATION 5:

Provide Outreach and Support for Property Owners

The City should provide unbiased information on energy efficiency, renewable energy, and financing options to new property owners at point of sale. A dedicated, unbiased city “energy advisor” should walk new and existing homeowners through the energy upgrade process, educate about energy efficiency and renewable energy technologies and options, and help navigate available incentives and financing options.

For any of the programs and policies outlined in this report to be successful, they must be paired with education and outreach to building owners and tenants to increase their awareness of their building’s energy performance, available energy efficiency and renewable energy technologies, and financing opportunities. This type of outreach is likely most fruitful at the time of purchase of a property, so awareness campaigns should be developed to target new property owners and be integrated into the purchasing process.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness	Enabling	Individual & Local Government	Near-term	Department of Environment

RECOMMENDATION 6:

Facilitate Access to Energy Data

The City should advocate that the California Public Utilities Commission require investor-owned utilities (IOUs) and energy service providers (ESPs) to provide customer-level data to the City and its agents for purposes of implementing and measuring the impacts of the City’s Climate Action Strategy and energy efficiency programs. Building owners should also be able to easily obtain energy usage information about their own facilities, so that they can readily comply with the California AB 1103 Commercial Building Energy Use Disclosure Program and local law.

At the most basic level, utility customers receive their demand data each month in the form of a utility bill. More robust data on the demand and load profile of these customers is held by relevant utilities (PG&E for most customers in San Francisco). Making this data more easily

accessible to customers will help them understand their own energy use, undertake appropriate energy efficiency measures, and comply with state and local energy regulations.

While customer-level energy demand data is protected under state privacy laws,⁵⁶ it has been difficult for local governments to obtain demand data even at the aggregate level. Additionally, supply mix data for DA customers is not publicly available. This lack of data frustrates efforts to develop effective energy efficiency or climate policy and programs. Understanding when, where, how, and how much energy is being used is crucial to developing appropriate energy demand management and supply plans, and enabling the City to write and prepare better legislation that will lead to measurable and meaningful energy reductions. Without baseline data and ongoing measurement, it is impossible to measure the impact of efficiency programs. Without better information on the electricity supply mix that serves San Francisco’s DA customers, the city is unable to fully account for the GHG emissions from the electricity sector, and may be significantly underestimating the GHG impact of the city’s largest electricity users.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness Regulatory	Enabling	Individual & State Government	Near-term	Department of Environment, SFPUC, CPUC

RECOMMENDATION 7:

Undertake Building Energy Data Study

If data is not available from local utilities, the City should undertake a building energy use data collection effort to obtain more accurate, San Francisco–specific building energy use information for the commercial and residential sectors, including type and timing of demand for various end-uses, facilitating development of plans and legislation that will lead to measurable and meaningful energy reductions.

As discussed in Recommendation 6, understanding when, where, how, and how much energy is being used is crucial to developing appropriate energy demand management and supply plans, and enabling the City to write and prepare better legislation that will lead to measurable and meaningful energy reductions. The most recent and detailed publicly available report on local building energy use is the California Commercial End-Use Survey (CEUS).⁵⁷ While the

⁵⁶ The California Information Privacy Act of 1977 prohibits state agencies from sharing, disclosing, or selling consumption data or personal information, and such protections were expanded under SB 1476 to include smart meter data collected by utilities. See California Public Utilities Commission, Decision 11-07-056, http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/140369.pdf, and Senate Bill No. 1476 (Padilla), California State Senate, Chaptered September 2010. www.leginfo.ca.gov/pub/09-10/bill/sen/sb_1451-1500/sb_1476_bill_20100929_chaptered.pdf.

⁵⁷ California Energy Commission, “California Commercial End-Use Survey,” CEC-400-2006-005, March 2006, www.energy.ca.gov/ceus.

CEUS provides a first indication of where energy is being used in California’s commercial sector, this data is from the 2002/2003 study year and only includes data from an average of four buildings per usage type. Reports like this can help identify targets to reduce energy use in buildings, but the data on which they are based has been too sparse to confidently predict the outcome of policy interventions. More up-to-date, representative energy data from San Francisco’s commercial and residential building sectors is needed, including details like time and rate of demand for various uses (e.g., heating, cooling, lighting, and servers). The Existing Commercial Buildings Ordinance will help fill some of this data gap, as will efforts like the American Institute of Architects 2030 Commitment Program,⁵⁸ but there is no similar data source for the residential sector. Thanks to advances in meter and monitoring technology, building energy data gathering is now less invasive and less costly, making a statistically relevant study a realistic option for the City if this data cannot be obtained from PG&E.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness Technical	Enabling	Local Government	Near-to- midterm	Department of Environment

⁵⁸ American Institute of Architects, “AIA Introduces 2030 Commitment Program for Architecture Firms to Develop Action Plans to Reach Goal of Carbon Neutrality by 2030,” press release, 2009, www.aia.org/press/AIAB079729.

CHAPTER 4

Distributed Generation

Electricity that is produced on a small scale near where it is being consumed, rather than in a large, centralized, and often distant power plant, is referred to as *distributed generation*. A key benefit of DG is that it reduces the need for transmission infrastructure and losses of electricity that occur as power travels long distances over transmission lines. Renewable energy technologies, such as solar panels, are a particularly good fit for DG in communities because they produce no local air pollution or related health concerns, and can often be integrated into the built environment. Further, DG can help promote local economic development and green job growth, along with energy independence and resiliency.

San Francisco currently has 22 MW of renewable energy–based DG. This includes over 2,900 privately owned solar installations totaling 12 MW of capacity, and 11 municipal solar installations totaling 7 MW.⁵⁹ The City also produces 3.2 MW of renewable electricity from biogas generated at wastewater treatment plants. While it is not possible to supply all of the city's electricity with in-city renewables (see table 4), fully utilizing San Francisco's available resources is an important first step toward meeting the 100% renewable goal and increasing local control and energy independence.

Enabling and Encouraging Energy Investments by Multitenant-Property Owners and Renters

Two of the biggest challenges to installing more residential renewable energy are the high number of renters in San Francisco and the fact that most San Franciscans live in multi-family buildings.⁶⁰ Similar issues arise in the commercial sector, in which many businesses lease property or space in multi-tenant office buildings. The principal financial incentives for home and business owners to invest in DG in San Francisco are the federal renewable energy tax credit, and the California Solar Initiative (CSI) rebate and the GoSolarSF incentive, offered through the collection of public goods charges and local funding appropriations, respectively. While these incentives have helped dramatically increase the number of residential and commercial renewable energy installations in San Francisco in the last five years, they are primarily geared toward single-family, owner-occupied residences and owner-occupied commercial properties, which are a small portion of San Francisco's building stock.

⁵⁹ Solar data in terms of direct current (DC) installed capacity, as of March 2012.

⁶⁰ For more information, see San Francisco Planning and Urban Research Association (SPUR), *Greening Apartment Buildings*, February 2011, p.1, http://www.spur.org/files/SPUR_Greening_Apartment_Buildings.pdf.

Table 4: Local Renewable Electricity Opportunities

	Capacity (MW)	Technical Potential (GWh/yr)	% of 2010 Demand
2010 San Francisco Electricity Demand		6,096	
Renewable Electricity Supply 2010			
Existing renewable energy supply		2,509	41%
RPS-eligible renewables		786	13%
Large hydro		1,723	28%
Balance of Non-Renewable		3,578	59%
San Francisco Renewable Electricity Technical Potential Estimates⁶¹			
In-City Resources	579	1,757	29%
Solar PV ⁶²	400	440	7%
Small wind ⁶³	15	30	0%
Biogas from wastewater treatment ⁶⁴	5	44	1%
CHP from existing steam loop ⁶⁵	53	315	5%
CHP from existing large heating systems ⁶⁶	106	929	15%
Offshore Resources	50 – 462	160 – 1,320	3% - 22%
Wave ⁶⁷	30 – 100	100 – 330	2% - 5%
Wind ⁶⁸	20 – 362	60 – 990	1% - 16%
Increased Hetch Hetchy hydroelectric deliveries to San Francisco customers	218	500	8%
Total SF Renewable Electricity Technical Potential	847 – 1,259	2,917 – 3,577	40% - 59%

MULTI-TENANT PROPERTIES AND SPLIT INCENTIVES

Over two-thirds of San Francisco's roughly 365,000 residential housing units are in multi-family buildings, and the majority (almost all those built before 1979, which accounts for over 80% of San Francisco's building stock) are under rent control. Altogether, only 37% of San

⁶¹ "Technical potential" in San Francisco (or directly offshore), defined here as the amount of a renewable energy resource that is practically (though not necessarily economically) available given technical constraints (such as currently available technology, capacity factors, and manufacturing base) and physical constraints (such as developable land, rooftops, or ocean areas). Where ranges are provided, they refer to differing maximum technical potentials identified by studies cited.

⁶² Estimates derived from detailed rooftop and shade modeling for San Francisco Department of Environment's SF Solar Map, 2010.

⁶³ George E. Sansoucy, "In-City Renewable Energy Resource Development as part of the CCA Program [Draft]," prepared for the San Francisco Public Utilities Commission, August 2009. See also Edward F. McCarthy & Associates Wind Resource Assessment for City-Owned Land in San Francisco County and Along the Hetch-Hetchy Right-of-Way, March 31, 2007.

⁶⁴ 3-5 MW biogas potential from SFPUC's in-city wastewater treatment plants. An additional 55 MW of biogas could be imported (via natural gas pipeline) for use in fuel cells or CHP to provide another 435 GWh of renewable power from fuel cells or CHP. George E. Sansoucy, "In-City Renewable Energy Resource Development as part of the CCA Program [Draft]," prepared for the San Francisco Public Utilities Commission, August 2009.

⁶⁵ Local Power Inc., "Community Choice Aggregation Program Report," submitted to San Francisco LAFCO, February 2009.

⁶⁶ Fuel cells and CHP or cogeneration, fired utilizing a renewable fuel source such as biogas, are considered a renewable resource. However, even utilizing a natural gas cogeneration or CHP resource typically creates environmental benefits due to the high operating efficiency. Philip M. Perea, "An Assessment of Cogeneration for the City of San Francisco," San Francisco Department of Environment, June 2007.

⁶⁷ URS, "Wave Feasibility Study," 2009.

⁶⁸ George E. Sansoucy, "In-City Renewable Energy Resource Development as part of the CCA Program [Draft]," prepared for the San Francisco Public Utilities Commission, August 2009. See also Dvorak, M.J., et 2007. "California offshore wind energy potential," Renewable Energy: An International Journal, June 2010.

Francisco's housing units are owner-occupied, and many of those are also in multi-family residential buildings, such as condos and homeowners' associations.⁶⁹

Multi-tenant and rental properties pose unique challenges for both energy efficiency and renewable energy due to a number of factors, including the number of parties involved (landlords and tenants); variable lengths of leases and staggered turnover; and combinations of shared and individual unit space, infrastructure and building systems (such as electrical wiring and heating systems), and costs. For example, in regard to costs, the so-called split incentive problem arises because building owners often pay the capital expenses for energy efficient upgrades to the base building, but tenants receive the financial benefits of energy savings through a reduction in their proportionate share of base building operating expenses, or individual unit utility bills. Similarly, landlords do not have the right incentives to install on-site renewable generation like solar PV, as they would pay for the system but in most cases their renters would benefit from reduced utility bills. One party pays, while another benefits. The 2011 Updated ERP recognized that overcoming this split incentive is key to moving efficiency improvements forward in San Francisco's overwhelmingly multi-tenant building stock.⁷⁰

EXPANDING ACCESS TO RENEWABLE ENERGY MARKETS

Even where split-incentives can be overcome, there simply may not be opportunity to take advantage of on-site renewable energy generation. For example, the property may be shaded by neighboring buildings, hills, or trees, or the roof may be too small or cluttered with heating, ventilation, and air-conditioning equipment to accommodate solar. Developing mechanisms by which tenants and others can take part in the renewable energy economy (e.g., through investment in renewable energy projects, by subscribing to and receiving credit for generation from off-site systems, or participating in a green power purchasing program) will help engage a broader swath of the public, expand renewable energy market demand and financing opportunities, and ultimately increase installed capacity and help address current inequity issues among solar incentive programs. Similarly, expanding the ability to develop, interconnect, and receive reasonable compensation for local electricity generation for provision to those who cannot produce their own on-site power will help expand access to renewable energy and realize San Francisco's in-city renewable generation potential.

Promoting Fair Compensation for Distributed Generation

In the past, many people who installed renewable energy systems were motivated primarily by environmental concerns. As prices have come down, the market has opened to those who are also motivated by project economics. As the market has matured and prices have come down, economics have moved to center stage. While protecting the environment and public health

⁶⁹ According to the 2010 Census, there are 241,340 rental housing units in San Francisco and 123,646 owner-occupied units. US Census Bureau, "Profile of General Population and Housing Characteristics: San Francisco County, California, 2010," 2010 Census. US Census Bureau, "Selected Housing Characteristics: San Francisco County, California," 2010 American Community Survey. Data available at <http://factfinder2.census.gov>.

⁷⁰ SFPUC, *San Francisco's 2011 Updated Electricity Resource Plan*, March 2011, p. 46, <http://sfwater.org/modules/showdocument.aspx?documentid=40>.

are still important, ensuring that projects can realize a reasonable payback is vital to widespread adoption of renewable DG — and increasing the societal benefits that come along with it.

Financing and Funding for Distributed Generation and Energy Efficiency

Innovative financing models for energy efficiency upgrades and renewable energy technologies have emerged over the past decade, helping to bring down costs and provide greater financing access to homeowners and commercial property owners. Ambitious state energy policy is aspiring to net zero energy goals for residential and commercial buildings in the coming decades. With incentive programs for both sectors coming to an end over the next several years, these new financing models will be critical to continued investment in San Francisco's clean energy future.

Education and Awareness

San Francisco enjoys broad support for renewable energy and environmental protection, but lack of public awareness and information about renewable energy in the city remains a barrier to market penetration in the private sector. Misconceptions about our available resources (such as the city's relatively high solar potential), permitting, and financing requirements, combined with the arcane world of rebates and tax incentives, make the process of installing renewables intimidating for many. In response, SF Environment has developed a one-stop online resource that provides all the necessary information for property owners to make informed decisions about renewable energy. In 2007, SF Environment launched the award-winning San Francisco Solar Map (sf.solarmap.org) to provide the community with a tool that easily and accurately shows the solar potential of any rooftop in the city. Users can evaluate the economics of installing solar at a particular property and find information about local installers and financing options. The map has recently been expanded to include a solar water heating calculator and wind resource layer. SF Environment staff is also available to answer questions and help property owners through the renewable energy purchasing and installation process.

In addition, SF Environment has developed targeted outreach and financing programs to scale up renewable energy penetration in areas that have traditionally been hard to reach, including group purchasing programs targeted at small- to medium-sized commercial properties and nonprofit schools. In coordination with the Mayor's Office of Housing, SF Environment has worked to integrate solar water heating into green retrofits of affordable housing properties in San Francisco and develop a sustainable financing model to continue these types of energy-efficient retrofits. Building upon and expanding these efforts will be necessary to achieve high levels on in-city renewable DG.

Distributed Generation Recommendations

The Task Force recommends that the City pursue the following strategies to enable and encourage on-site self-generation as well as expand access to renewable energy through community-scale DG: promote fair compensation for DG; enable and encourage multi-tenant

and off-site investments in DG; ensure the distribution grid is ready for increased DG; increase renewable energy in new construction projects; increase funding and financing opportunities for DG and energy efficiency; and support development of efficient, renewable energy–based district energy systems and solar water heating.

RECOMMENDATION 8:

Support Expanding Net Energy Metering

The City should participate in relevant regulatory proceedings and encourage the California Public Utilities Commission to update net energy metering rules and participation limits to better reflect actual technical constraints to distributed generation integration and current costs and benefits of increased on-site distributed generation. This would include increasing the net energy metering cap, increasing the rate at which customers are compensated for net-surplus generation, and allowing net-metered systems to be sized beyond on-site demand where excess generation is likely to be used by other customers on the distribution line.

For most San Franciscans who install a renewable energy system, the monetary value of their investment is realized through a reduction in what they pay for electricity on their utility bill, through a mechanism called net energy metering (NEM), or net-metering. Under NEM, the customer’s electric meter keeps track of how much electricity the customer consumes and how much excess electricity is generated by the renewable energy system and sent back into the electric utility grid. In the simplest terms, net metering allows a solar or other DG system to “spin the meter backward.” Over a 12-month period, the customer has to pay the utility for only the net amount of electricity used after subtracting the amount of electricity generated by their solar system. NEM customers therefore receive the full retail value of the electricity their system generates.

NEM, together with other state and local incentives, has been quite successful in spurring renewable energy installations — primarily solar PV systems on owner-occupied homes and businesses with high electricity demand. This is in large part because of PG&E’s tiered rate structure, as the solar generation is credited against highest priced, top-tier electricity use on a customer’s bill first. This makes the financial payback of solar systems most attractive for high-energy-consuming customers and least attractive for very energy-efficient homes.

Despite the success of net-metering, San Franciscans remain limited in the amount of renewable energy they can install both legally and economically because current incentives, compensation structures, and sizing regulations tend to limit installation size. Residents with highly energy-efficient homes, for example, may have a larger solar resource on their roof than they need for their own use. They are not able to install larger systems and provide

excess power to their community, though, as they are required under net-metering rules to size their system to not exceed their on-site electricity load.

If NEM customers do produce more power than they use in a year (for example, due to new energy-efficiency improvements that reduce their demand), they will now receive some compensation for the excess electricity that the utility has historically received for free. The CPUC recently set the rate of this “net surplus compensation” equal to the 12-month average spot market price for electricity between the hours of 7 am to 5 pm for the year in which the customer generated surplus power — about \$0.04/kWh in 2010, which is much lower than the retail value of electricity in San Francisco.⁷¹ While this currently affects only a small percentage of solar system owners, providing rate structures that encourage property owners to generate renewable power above and beyond their own on-site needs will assist in improving local energy security and increasing local renewable energy supply. While PG&E has argued that this would add undue distribution costs for the company and its ratepayers, any excess generation would almost certainly be immediately consumed by neighboring properties, adding minimal load to the distribution network and in fact reducing demands on the distribution grid in some cases.⁷²

A more imminent threat to the future of renewable DG in California is the cap on NEM, put in place to prevent large amounts of intermittent renewable DG from adversely affecting grid reliability and to limit cost-shifting among customers. Existing state law requires PG&E to offer NEM to customers up to a cap set at 5% of PG&E’s aggregate customer peak demand. In 2010, this was raised from 2.5% of aggregate customer peak demand, as PG&E was reaching the 2.5% threshold. While the increased cap was a significant step forward, the 5% net metering threshold that was originally set by the CPUC was calculated by the participating utilities in such a manner that it was projected to be reached as early as 2013 in PG&E territory, prohibiting new customers from receiving credits for installing solar on their roof and therefore severely restricting the market for rooftop solar.⁷³

However, on May 24, 2012, the California Public Utilities Commission clarified the method that the utilities are to use to calculate that 5% cap. Previously, the IOUs calculated “aggregated customer peak demand” using the highest simultaneous demand from all customers (encompassing residential, commercial and industrial) at any one time. Because these three sectors have their highest peak demand at different times of day (e.g. residential in the

⁷¹ Net surplus compensation was originally implemented by AB 920 and was codified as CPUC Code 2827. CPUC Decision 11-06-016, issued June 9, 2011, stated, “The net surplus compensation rate will be a simple rolling average of each utility’s [Default Load Aggregation Point] price from 7 a.m. to 5 p.m. to match the hours that most net surplus generators produce electricity with their generating facilities. The simple rolling average will match the 12-month period over which a customer’s net surplus generation is calculated. In 2009, this average DLAP price for Pacific Gas and Electric Company was approximately four cents per kilowatt hour.” NEM customers who elected to receive net surplus compensation in January 2010 will receive ~\$0.04/kWh for all net surplus generated from January 2010 to present. See http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/137431.htm; CPUC, Net Surplus Compensation FAQs, 2011, www.cpuc.ca.gov/NR/rdonlyres/C085BDE6-7DC1-4FD8-8208-52300A082672/0/FAQs_NSC_91411.pdf.

⁷² A 2012 study by Crossborder Energy found that the net economic impact to the electricity system from net-metered solar systems is -\$0.02/kWh for residential systems, but +\$0.02/kWh for commercial systems, resulting in a net benefit system-wide. See R. Thomas Beach and Patrick McGuire, “Re-evaluating the Cost-Effectiveness of Net Energy Metering in California,” Crossborder Energy, January 2012, pp. 3-4, <http://votesolar.org/wp-content/uploads/2012/01/Re-evaluating-the-Cost-effectiveness-of-Net-Energy-Metering-in-California-1-9-2012.pdf>.

⁷³ CPUC, “Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues” (Rulemaking 10-05-004), 24 May 2012.

evening, commercial during the day), renewable advocates argued that this method did not appropriately represent peak demand for the purposes of this calculation. The CPUC’s ruled that aggregate customer peak demand means the sum of the individual peaking demands of all customers in the three sectors.⁷⁴ This clarification doubles the amount of solar systems that can participate in NEM, according to the CPUC. While this is a highly beneficial development for distributed solar, the issue will still need to be revisited in a few years time if solar continues its current growth rate. Given that net-metering has been a key driver for on-site solar generation, the Task Force supports increasing the NEM cap or removing it until negative impacts from increased NEM have been demonstrated.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Regulatory Financial	Enabling	State Government	Near-term	Department of Environment, SFPUC, CPUC

RECOMMENDATION 9:

Support Expanding Virtual Net Metering

The City should support the expansion of Virtual Net Metering for multiunit customers in California (both residential and commercial) and implement pilot installations in San Francisco in coordination with interested property owners and tenants. Expansion should include allowing Virtual Net Metering for developments served by multiple service delivery points, easing size limitations, and expanding eligibility to all multi-tenant and multi-meter properties.

Even if a property owner and tenants jointly desire to install solar, there is currently no easy way to share the benefits of on-site renewable energy generation among the building occupants. Additionally, many buildings — whether single-family or multi-tenant — do not have optimal physical characteristics for on-site renewable energy. For example, many buildings suffer shading from neighboring properties or rooftop obstructions (like heating, ventilation, and air-conditioning systems, chimneys, or vent pipes), or have little southern exposure, making them ill-suited for solar PV systems. Similar challenges apply to commercial customers, especially small businesses that lease property or are tenants in larger office buildings.

Fortunately, there are opportunities to expand options for these types of customers to invest in renewable, distributed electricity. One opportunity is the expansion of Virtual Net Metering

⁷⁴ “Huge Win for California Solar: CPUC keeps Net Energy Metering Alive.” Trabish, Herman. Greentechmedia. May 24, 2012. <http://www.greentechmedia.com/articles/read/Huge-Win-For-California-Solar-CPUC-Keeps-Net-Energy-Metering-Alive/>

(VNM). VNM is the concept of allocating an on-site renewable energy system’s benefits to multiple customers through the utility’s billing system, rather than, for example, hard-wiring the solar system to every individual unit’s electricity meter. The CPUC currently allows VNM for customers who participate in the state’s Multifamily Affordable Solar Housing (MASH) Program, and in 2011, the CPUC expanded eligibility for the VNM program to any multi-tenant or multi-meter property, as long as it is served by a single service delivery point. The CPUC also expanded the eligibility rules for VNM for affordable housing in the MASH program to multiple buildings throughout a single development (multiple service delivery points).⁷⁵

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Regulatory Financial	Moves the Market	State Government	Near-to- midterm	Department of Environment, SFPUC, CPUC

RECOMMENDATION 10:

Support Community Renewable Energy Policies

The City should support state community energy legislation to enable Californian electricity customers to invest in or purchase a subscription to off-site renewable energy projects and utilize community energy ownership and billing models to be credited for the power from those systems. These steps would expand the opportunity to take part in renewable energy development to all customers, including tenants and property owners without suitable incentives or opportunities to develop on-site renewable energy resources.

A second opportunity, similar in concept to VNM (see Recommendation 9), involves development of new ownership models that enable investment in off-site, community-scale renewable energy projects. A few states, such as Colorado, have adopted policies that allow customers to own or subscribe to an off-site renewable energy system and get credited on their utility bill for the electricity that their portion of the renewable energy system provides to the grid. Community energy policy would expand options for those who cannot install renewable energy on-site, whether through “community solar,” “solar gardens,” or “community wind.” This would require legislation changes to the state Public Utilities Code to allow power

⁷⁵ See CPUC Decision 11-07-031.

from community energy projects and participants to be credited to participants' accounts. California Senate Bill 843 (Wolk) is proposing such changes.⁷⁶

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Game Changing	State Government	Near-to- midterm	Department of Environment, SFPUC, CPUC

RECOMMENDATION 11:

Support Robust and Sustainable Feed-In Tariffs for Local Renewables

The City should advocate the adoption of feed-in tariff programs and tariff rates that fairly compensate small-scale local, renewable distributed generation projects commensurately with their additional social and environmental benefits — and thereby stimulate increased private investment in local renewable energy projects. The City should also explore integrating such a program into the proposed CleanPowerSF Community Choice Aggregation program.

There are also other successful models for increasing renewable DG that, unlike NEM, disconnect on-site demand from generation potential. In regions as varied as Germany, Ontario, and Gainesville, Florida, property owners are able to sell power from small renewable energy installations back to their utility through the benefit of standardized long-term contracts that guarantee a set price over many years. This is often referred to as a feed-in tariff (FIT), or standard offer program. FITs have been the primary driver behind the rapid increase in solar power generation in what are now leading solar countries, including Germany, Spain, and Italy.

PG&E has a limited and little-understood FIT program in place for small- to mid-sized renewable energy projects (up to 1.5 MW in size) that is currently being revised by the CPUC. A key policy question the CPUC must resolve as it revises the FIT is the price that generators will be offered. Generators are currently offered the market price referent (MPR), which is based on what the utility would pay to procure a kilowatt-hour of electricity from a new natural gas power plant and includes a value for avoided GHG emissions. However, this type of pricing does not explicitly account for any additional benefits of DG compared to the proxy gas plant, particularly localized grid and public health benefits, and has not proven to provide a high enough payment to attract any significant investment or stable financing for these smaller

⁷⁶ See proposed amendments in SB 843, "Community-Based Renewable Energy Self-Generation Program," 2011, http://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB843.

projects. An appropriate FIT policy should compensate renewable DG resources for all of the benefits they provide compared to alternatives, which can include reduced transmission requirements and other social and environmental benefits. It should also be designed to provide certainty to the financial industry to encourage greater investment in and financing of these projects. A CCA program would offer a new opportunity to develop this type of standard offer program and encourage local DG installation and investment.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Regulatory Financial	Game Changing	Local and State Government	Mid-term	Department of Environment, SFPUC, CPUC

RECOMMENDATION 12:

Streamline and Standardize Renewable Energy Permitting Processes

The City should continue to streamline renewable energy permitting processes, including shifting to electronic permitting, to reduce time and costs for the City and system owners, while maintaining public safety. The City should work with neighboring jurisdictions to share best practices and implement standardized, streamlined processes across the region, further reducing installation costs.

Another barrier to installing renewable energy in San Francisco is permitting. San Francisco has made great strides in streamlining the solar PV permitting process, reducing permitting fees, and incorporating solar electrical permits into the new electronic permitting system at the DBI. “E-permitting” has significantly reduced time and paperwork for both permitting officials and applicants where it has been introduced, such as through the City of Sacramento’s Electronic Processing Initiative.⁷⁷ However, permitting requirements for other renewable energy technologies, such as wind turbines and solar water heating, remain indefinite and difficult for those navigating the system. For example, the Planning Department’s small wind permitting guidelines remain in draft form, and proposed turbines that meet the guidelines have faced challenges from neighbors’ opposition. As with solar PV, DBI should work with the renewable energy industry and other cities to identify ways to reduce soft-costs related to permitting, while maintaining public safety and high quality standards for installation.

⁷⁷ For more information, see US DOE, “Solar in Action: Sacramento, CA,” USDOE Solar America Communities Program, September 2011, <http://solaramericacommunities.energy.gov/pdfs/sacramento.pdf>.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Enabling	Local Government	Near-to-midterm	Department of Environment, Department of Building Inspection

RECOMMENDATION 13:

Adopt a Solar-Ready Policy

The City should adopt a policy that incents or requires new construction, heavily renovated buildings, and buildings undergoing roof replacement to either install renewable energy systems or put in place appropriate conduit (electrical and/or plumbing) and stanchions for future renewable energy installation if the site has viable renewable energy resources.

One hurdle to the development of more renewable energy systems in San Francisco is that many buildings do not have adequate electrical or structural infrastructure to install renewable technologies such as solar or small wind. Building owners must complete considerable rewiring in order to install renewables, roof penetrations required to mount solar systems often void roofing warranties, and roof-mounted wind turbines may cause vibrations and unsafe stress on the building structure.

Ensuring that all new buildings with sufficient renewable energy resource potential are built ready to accommodate future renewable energy installations can help reduce costs of renewable energy over the long-term. Creating incentives for developers and property owners to include renewable energy from the start, or in conjunction with major retrofits or reroofing, would further hasten the development of local renewable power. This could be done, for example, through fast-tracked approvals or density bonusing.⁷⁸

The California building code (Title 24) has been updated to require solar-ready measures for low-rise, nonresidential buildings (both new construction and major retrofits) to allow solar PV and water heating to be easily added in the future.⁷⁹ Numerous jurisdictions have established “solar-ready” requirements or “solar ordinances” that require new buildings to have completed

⁷⁸ Bonusing is a planning tool used to allow a development to exceed certain zoning limitations, such as floor area ratios or density, in return for various social or economic benefits as determined by the City.

⁷⁹ California Energy Commission, *2013 Building Energy Efficiency Standards*, California Energy Code, California Code of Regulations, Title 24, Part 6. <http://www.energy.ca.gov/title24>.

a site plan and be prewired for solar in order to receive a building permit.⁸⁰ San Francisco should consider adopting such requirements.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Enabling	Local Government	Mid-term	Department of Environment, Board of Supervisors

RECOMMENDATION 14:

Address Solar System Shading

The City should address the risk of existing solar installations becoming shaded by new construction with policies that balance densification goals and private property rights. The City should consider policies that protect solar access and/or compensate early adopters of solar if their systems become shaded by new construction, such as through a solar access indemnity fund.

With the increase in solar installations comes greater concern over solar access rights. While state law protects solar systems from shading by new vegetation,⁸¹ at least four instances of solar systems being shaded by new developments or building additions were brought before the SF Planning Commission’s Discretionary Review panel in the past two years. If this becomes an increasing problem, it could discourage potential solar customers from moving

⁸⁰ For example

- **Tucson, Arizona:** Tucson passed an ordinance in 2009 that requires all new single-family and duplex residences to either have a solar PV and solar water heating system installed, or to have all the necessary hardware installed so that a system can easily be installed at a later date. This includes a site plan that must indicate the best roof space for locating the PV panels, and provide a roof structure designed for the additional panel or collector weight. The site plan must also illustrate the best space available for accommodating PV equipment (meter, inverter, disconnect, etc.), and it should be adjacent to the electrical service panel or on a wall near the proposed location of the panels. There must also be a minimum 3,800-volt-ampere solar PV electrical load entry on the service load calculation, and an electrical panel schedule with a 240-volt circuit breaker space labeled “reserved for Photovoltaic.” The ordinance requires either a conduit run and stub-out or site plan in addition to the electrical load entry. Contractors have the freedom to do either, and the city government is flexible if a site has shading or other factors that make it impractical for solar. There is nothing to suggest that contractors have not been compliant, although according to the Tucson Citizen, they expressed a desire for a small incentive for solar readiness rather than a regulation. A key aspect in getting the ordinance passed was the inclusion and support of the Tucson Association of Realtors and the Southern Arizona Homebuilders Association. It is important to note that with all these ordinances the full impact is difficult to gauge given the steep drop off in new home construction due to economic factors.⁸⁰
- **Chula Vista, California:** Chula Vista adopted an ordinance in 2009 that requires solar PV pre-wiring and conduit in all new single-family homes and multifamily buildings that have sufficient common space to benefit from solar. The city’s staff reports anecdotally that there has been an increase in the installation of solar on new homes since the ordinance was adopted.
- **New Mexico:** In 2007, the State of New Mexico passed the Solar Ready Roofs Act, based on the International Code Council Recommendations for solar preparedness, which requires state agencies to adopt codes for new construction to accommodate the later installation of solar panels/collectors, including roof orientation, roof strength, location of obstructions to sunlight, access to installation locations, built-in conduit, and wiring, piping and brackets for attaching solar panels/collectors.

Andrea Watson, Linda Giudice, Lars Lisell, Liz Doris, and Sarah Busche, *Solar Ready: An Overview of Implementation Practices*, National Renewable Energy Laboratory (NREL), January 2012, www.nrel.gov/docs/fy12osti/51296.pdf.

⁸¹ Solar Shade Control Act of 2009, California Public Resources Code Section 25980-25986.

forward with their installations due to fear that they will not recoup their large up-front investments. Any attempt to protect solar access, though, must be balanced against the significant benefits of urban infill and densification, and property owners' development rights. One solution could be a solar access indemnity fund, which would compensate solar system owners for production losses due to shading from new construction. This could be funded through a very small fee on certain building permits or development impact fees.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Enabling	Local Government	Mid-term	Department of Environment, Department of Building Inspection, Planning Department

RECOMMENDATION 15:

Encourage Green Leases

The City should continue to encourage green lease adoption in the commercial sector, including working with the Business Council on Climate Change to promote the Green Tenant Toolkit, which includes information and sample documents for property owners, tenants, and real estate agents in San Francisco.

In addition to defining the relationship between the owner or manager and tenants, the lease agreement is an opportunity to enable and institutionalize energy efficiency and sustainable practices such as recycling and compost collection. However, due to lack of information and limited experience with these tools, the opportunity is usually overlooked. Implementation of “green leases” will benefit owners and tenants by aligning their interests toward saving energy and resources.

The two most common types of commercial lease are gross and triple net. In a gross lease, which is commonly used for office space, the lessor provides and pays for all services including utilities. In return, the tenant pays a proportionate share of operating and capital expenses. It is nearly impossible to know the exact energy use of one tenant office unless a submeter is present. In a triple net lease, common in the retail and industrial sectors, the tenant is directly responsible for utility costs. In this case, the owner or property manager is rarely motivated to pay for energy efficiency upgrades because savings accrue to tenants. Tenants have little incentive to install equipment or lighting upgrades if the period required to recoup the investment through savings is longer than their lease term. These split incentives make it difficult for owners, managers, and tenants to come to clear, mutually beneficial terms about the costs and benefits of energy efficiency, as well as on-site renewable energy. However, new tools are helping overcome this barrier — for example, an “Energy Aligned Lease” (a specific

type of green lease) is a simple, straightforward template lease provision that enables both property owners and tenants to benefit from energy efficiency upgrades.⁸²

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness Financial	Enabling	Local Government	Near-term	Department of Environment, Business Council on Climate Change

RECOMMENDATION 16:

Enable Energy Efficiency and Renewable Energy Pass-Throughs Under Rent Control

The Board of Supervisors should adopt as ordinance the energy conservation pass-through provision put forth by the Rent Board, thereby clarifying pass-through eligibility for specific energy efficiency and renewable energy measures (those determined to reduce net costs to tenants and provide reasonable payback to landlords) as approved capital improvements under the Rent Ordinance. The Rent Board should also ensure that third-party owned or financed solar systems are eligible under the pass-through provision.

Overcoming split incentives between residential tenants and landlords is crucial in San Francisco, where roughly two-thirds of our housing is renter-occupied. Residential landlords are allowed by the San Francisco Rent Ordinance to pass the costs of certain capital improvements through to their tenants. The Rent Board has put forth an additional energy conservation pass-through provision, including a list of eligible energy conservation measures, developed by SF Environment, that save energy, provide reasonable payback to the property owner, and reduce net costs to the tenants.⁸³ This energy conservation provision has not been adopted by the Board of Supervisors, however, leaving some uncertainty for property owners interested in undertaking these types of energy efficiency improvements and renewable energy investments. Additionally, as third-party ownership and financing arrangements such as solar leases and power purchase agreements become more common, it is important that the city ensure and clarify that these systems qualify under the pass-through provision.

⁸² For more information on green leases and overcoming split incentives, see the BC3 Green Tenant Toolkit website, www.greentenanttoolkit.com.

⁸³ See Chapter 37 of the San Francisco Administrative Code: The Residential Rent Stabilization and Arbitration Ordinance, Section 37.7—Certification of Rental Increases for Capital Improvements, Rehabilitation and Energy Conservation Measures. www.sfrb.org/index.aspx?page=1256.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Enabling	Local Government	Near-to- midterm	Board of Supervisors, Rent Board, Department of Environment

RECOMMENDATION 17:

Expand Clean Energy Financing

The City should continue its commercial Property Assessed Clean Energy (PACE) program and reinstate the residential PACE program as soon as possible, either by overcoming objections to the use of the PACE program by mortgage insurers such as Fannie Mae and Freddie Mac or by identifying alternative financial arrangements. The City should also continue to explore other opportunities to spur and improve access to financing for renewable energy and efficiency upgrades, such as financing enhancements, revolving loan funds, and interest rate buy-downs to attract and stretch private capital, and expansion of mortgage-backed energy efficiency financing instruments.

PACE financing arrived with great promise in 2008 as a means to unlock unprecedented levels of private capital to fund building retrofits that would dramatically cut energy use, reduce GHG emissions, and create jobs in a slowing economy. PACE financing allows property owners to finance energy efficiency and renewable energy upgrades on their property tax bill, with payments made over the expected life of the improvement. If the property is sold, the payments, along with the energy saving benefits, stay with the property and thus the new owner. Despite strong bipartisan support from local, state, and federal policymakers, PACE hit a wall in 2010 when a directive from the federal mortgage regulator, Federal Housing Finance Agency, halted the City's residential program, along with those in 26 other states.⁸⁴

In response to the inability to use PACE financing for residential properties, San Francisco's PACE program ("GreenFinanceSF") was redesigned for commercial buildings only. Launched in October 2011, it utilizes the "open market" PACE model, which lets owners negotiate directly with capital providers, who finance the projects and secure repayment through a special tax levied by the county. This approach relies on sophisticated parties (e.g., mortgage holder, property owner, retrofit lender) to negotiate specific deal terms while offering the security of

⁸⁴ For more information and timeline of actions, see Mark Zimring and Merrian Fuller, "PACE and the Federal Housing Finance Agency (FHFA)," Lawrence Berkeley National Laboratory Clean Energy Financing Policy Brief, 17 March 2010, http://eetd.lbl.gov/ea/emp/reports/ee-policybrief_031710.pdf.

the PACE lien. An American Recovery and Reinvestment Act–funded debt service reserve fund will also provide credit enhancement to project lenders.⁸⁵

PACE financing may not be appropriate or available for all properties. As such, the City should continue to explore other opportunities to spur and improve access to financing for renewable energy and efficiency upgrades, such as financing enhancements, revolving loan funds, and interest rate buy-downs to attract and stretch private capital.

Mortgage-backed energy efficiency financing, such as an Energy Efficient Mortgage or home equity lines of credit, provide additional borrowing capacity and/or better terms for purchasing a new energy efficient home or investing in energy improvements in an existing home. In the case of an Energy Efficient Mortgage, the financing is rolled into the home mortgage. As banks and credit unions become more comfortable with energy efficiency and renewable energy, this may become a more standard option. The City could help facilitate accelerated uptake through education and outreach to both banking institutions and homeowners — for example, through the development of an arm’s-length Energy Efficiency Corporation, as has been done in New York,⁸⁶ and possibly through the addition of a loan loss reserve or credit enhancement, as is being explored by the California Treasurer’s office.⁸⁷

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial	Enabling	Local Government	Near-term	Department of Environment

RECOMMENDATION 18:

Expand On-Bill Financing

The City should support the expansion of on-bill financing or third-party on-bill repayment of energy efficiency and renewable energy with local utilities, and explore the potential to allow on-bill financing through the San Francisco Public Utilities Commission (e.g., on the water and sewage utility bill or through a Community Choice Aggregation program).

Because of their scale, service offerings, sophisticated billing systems, and existing customer relations, California’s utilities are in a unique position to facilitate the financing of customers’

⁸⁵ For more information on San Francisco’s PACE program, see www.greenfinancesf.org.

⁸⁶ See New York Energy Efficiency Corporation, www.nyceec.com/mission; Daniel Byrd and Richard Cohen, “A Roadmap to Energy Efficiency Loan Financing,” Progressive Energy Group Memorandum to U.S. Department of Energy, April 2001, www.cleanenergyfinancecenter.org/wp-content/uploads/DOE-Energy-Efficiency-Report-rev-8-29-11.pdf.

⁸⁷ California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA), AB X1 14: Clean Energy Upgrade Program, 2012, www.treasurer.ca.gov/caeatfa/abx1_14/index.asp.

energy improvements. As directed by the CPUC, each of the large California IOUs is offering zero-interest on-bill financing (OBF) to non-residential customers, including local governments, during the 2010-2012 program cycle.

Under OBF, a utility provides qualifying customers with unsecured loans which cover as much as 100% of the energy efficiency equipment and installation costs (net of rebates or other incentives). Customers then repay the loans through charges that are added onto their regular utility bills. Default rates are expected to be low, as non-payment could result in loss of service from the utility. Loan capital is raised through utility rates and the energy efficiency program budgets cover payment defaults and program administration. Successful utility pilot programs from Sempra, PG&E, and utilities in 19 other states have reported very good loan performance, with default rates at around 2% or less.⁸⁸

The CPUC is currently considering a proposal for the development of a larger efficiency financing program supported with both IOU ratepayer funds and private capital funds. A key idea put forth by the ruling is to investigate the deployment of private third-party capital to provide the financing, with repayment still occurring on the utility bill (known as “on-bill repayment,” or OBR). This might also allow customers to bundle efficiency with other renewable energy projects, which is currently not possible since the OBF funds are allocated only for efficiency.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Enabling	Local Government	Near-to- midterm	Department of Environment, SFPUC, CPUC, PG&E

⁸⁸ Catherine J. Bell, Steven Nadel, and Sara Hayes, “On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices,” Report Number E118, American Council for an Energy-Efficient Economy, December 2011, p.3, <http://www.cleanenergyfinancecenter.org/wp-content/uploads/On-bill-financing-ACEEE-report.pdf>.

RECOMMENDATION 19:

Recognize Solar Installations as Real Property

The City should recognize solar power installations as real property by including its value in property assessments by the Assessor-Recorder's office. The City should explicitly make solar property tax exempt until the 100% renewable goal or similar solar market development targets are met.

Lowering the cost of financing will go a long way toward making renewable energy projects more economically viable. Solar installations, with their long lifetimes, fixed installation locations, and non-moving parts, are more like real estate than mechanical equipment, and should be assessed as such. If renewable energy installations were recognized as "real property," it could help enable them to be securitized and financed at lower rates, similar to what is seen in the real estate market with home mortgages and Real Estate Investment Trusts (REITs), lowering the cost of solar power from such projects by as much as 30%. While action is needed at the federal level to address the way the tax code treats solar installations, San Francisco can act locally by including recognizing the value of solar systems on property assessments, and thereby also helping provide a valuation metric for local banks, as discussed in the next recommendation.

Sandia National Laboratories has already produced a solar value calculation tool ("PV Value") for home appraisers, which is supported by the nation's largest professional association of real estate appraisers, the Appraisal Institute. This challenge presents an opportunity for the City to take the national lead on appraiser solar PV valuation adoption. In order to continue to support the development of the local solar market, the City should explicitly make the newly appraised value of solar installations in San Francisco property tax-exempt until solar market development targets (to be determined by the City) are met.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Enabling	Local Government	Near-to- midterm	Assessor-Recorder, Department of Environment

RECOMMENDATION 20:

Support Standardization and Expand Lending

The City should support regional or national efforts to develop standardized underwriting criteria for solar projects in order to reduce transaction costs and increase financing opportunities for renewable energy projects. The City should also work with local community banks and institutional investors to increase understanding of renewable energy technologies and markets and build comfort with renewable energy investments, thereby increasing financing opportunities for local renewable energy projects, and serving as a catalyst for an increase in such lending nationwide. The City could act as a convener of parties to bring together these banks, investors, and renewable energy project developers.

Developing standardized underwriting criteria for solar PV projects will help lower transaction costs and enable smaller banks (without the in-house expertise to develop such criteria on a one-off basis) to begin lending in this sector. With these lending criteria in place, a targeted effort to build understanding of renewable energy technologies and markets could make community banks and local investors key drivers in renewable energy project finance. Community banks (small to mid-sized, often local or regional, banks) have traditionally sought to demonstrate their local ties by remaining active in the community, supporting local non-profits and community events, and investing locally. Renewable energy project finance could provide a new opportunity for these banks to lend locally.

There is currently a "participation gap" on the part of local or regional community banks with respect to providing capital to the U.S. solar industry. Current research shows less than 5% of the approximately 6,500 U.S. lending institutions currently provide project finance. By engaging with various industry initiatives and stakeholders, there is an immediate opportunity to connect local capital with local jobs, local solar installations, and our local community. Generally speaking, local or regional community banks tend to have stronger balance sheets, weathered the credit crisis better than their larger counterparts, and have existing customers that would most likely be interested in solar if more cost effective solutions were available. The industry has progressed to the point where underwriting standards are emerging, risk mitigation approaches are proven, and the process infrastructure vetted by traditionally larger institutions can be leveraged here in San Francisco.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial Awareness	Enabling	Local Government and Private Sector	Near-mid and long-term	Department of Environment, SFPUC, US Department of Energy

RECOMMENDATION 21:

Fully Fund GoSolarSF

The San Francisco Public Utilities Commission (SFPUC) should fully fund energy programs that meet the City’s objectives, including GoSolarSF, municipal energy efficiency, and municipal renewables programs.

GoSolarSF, the City’s solar incentive program, has been very successful in helping to dramatically increase PV installation in the City. In addition, the program helped over 450 low-income households go solar, and resulted in local solar companies hiring 21 new employees from the city’s disadvantaged communities through the City’s workforce development program. This year GoSolarSF took a 40% budget cut (from \$5 million to \$3 million in new annual funding), and funding is set to drop further to \$2 million next year due to the budget and revenue constraints discussed under Recommendation 29. Municipal energy efficiency and renewable energy capital budgets have suffered similar cuts. Continuing full funding for the GoSolarSF program, while adjusting incentive rates based on market conditions, will provide certainty for the local market and help further increase the number of rooftop solar systems across San Francisco.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial	Moves the Market	Local Government	Near-term	SFPUC, Board of Supervisors

RECOMMENDATION 22:

Prioritize Workforce Development

The City should continue to integrate workforce development and training, especially for disadvantaged San Franciscans with employment barriers (such as low educational attainment, criminal history, disability, language proficiency, and homelessness) into its energy programs to help meet the needs of growing energy efficiency and renewable energy industries, and support local green job development through the San Francisco Local Hiring Policy for Construction.

Local economic development is one of the much heralded benefits of a shift toward increased renewable energy. The City has made workforce development in the cleantech sector a priority in recent years through TrainGreenSF and hiring requirements for GoSolarSF contractor eligibility.

TrainGreenSF is a network of training and employment programs coordinated by San Francisco’s Office of Economic and Workforce Development. The program aims to support emerging labor market demand for skilled and sustainable green jobs and careers. One of TrainGreenSF’s programs is the Green Building Construction Program, which partners with the non-profit Asian Neighborhood Design to provide general construction training with an emphasis on green building practices and solar installation.

Another important way the City is promoting the development of local green jobs is through the hiring requirements for GoSolarSF installers. In order to receive a GoSolarSF incentive, customers must hire a contractor employing graduates of the City’s Workforce Development Program.⁸⁹ To date, this requirement has resulted in local solar companies hiring 21 new employees from the city’s disadvantaged communities.

Finally, San Francisco is promoting local workforce development through its recently-adopted Local Hiring Policy for Construction. This amendment to the City’s administrative code requires contractors performing public works or improvement projects to hire a minimum proportion of San Francisco residents.

The City should continue to support and expand these efforts in coordination with the proposed CleanPowerSF program and ongoing energy efficiency and renewable energy programs in order to maximize the creation of local jobs in the cleantech sector.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Enabling	Local Government	Near-term	SFPUC

⁸⁹ This requirement does not apply to non-profit installers or to installers with three or fewer employees operating their principal place of business in San Francisco. For more information, see www.solarsf.org.

RECOMMENDATION 23:

Upgrade Distribution Grid Citywide

The City should work with PG&E to determine the cost effectiveness of upgrading the distribution infrastructure as necessary citywide to enable increased penetration of renewable DG and increased loads due to electric vehicles. These efforts should build off of existing CPUC requirements that utilities such as PG&E identify the surplus capacity on their distribution system available for connecting DG systems.

As more property owners install on-site renewable generation, distribution grid design and interconnection procedures will become limiting factors for further DG expansion. Much of the existing distribution grid infrastructure is not designed or being managed in a manner that would allow increased renewable DG while confidently meeting reliability and safety concerns of grid operators. For example, variable electricity supply, sudden voltage spikes and drops, and reverse current flow can result from distributed renewable energy sources, particularly when there are multiple renewable generating systems on a distribution line (e.g. in a neighborhood with multiple solar PV installations). For that reason, there are limits to the amount of net metering and renewable DG interconnections allowed on any given distribution line. Current limits in PG&E's territory, though, are quite conservative at 15%,⁹⁰ whereas utilities in other regions allow significantly higher penetration (Sacramento Municipal Utility District allows 30%,⁹¹ and Hawaiian utilities have accepted upwards of 40% penetration⁹² in some instances) without any significant risk to reliability and/or change in grid management. Furthermore, as discussed in Recommendation 8, the net metering cap threatens to unnecessarily limit local renewable DG. Smart grid technologies and management techniques are being developed to mitigate any negative effects of DG on the grid, and leverage the ability of DG to improve grid reliability, but this type of research and technology uptake will need to be hastened to meet both California's and San Francisco's DG goals, as well as to enable new loads from electric vehicle charging.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Technical Regulatory	Enabling	Local and State Government	Mid-term	SFPUC, CPUC, PG&E

⁹⁰ "Distribution Interconnection Handbook." Pacifica Gas and Electric Company. 2003. p. 2–10.

<http://www.pge.com/includes/docs/pdfs/shared/newgenerator/netenergymetering/dih050103.pdf>

⁹¹ "Rate Policy and Procedures Manual: Interconnection Guidelines." Sacramento Municipal Utility District. 2011.

<https://www.smud.org/en/business/customer-service/rates-requirements-interconnection/documents/11-Q1InterconnectionGuidelines.pdf>.

⁹² "Energy Agreement among the State of Hawaii, Division of Consumer Advocacy of the Department of Commerce and Consumer Affairs, and the Hawaii Electric Companies." Hawaii Electric Companies and State Government of Hawaii. 2009. <http://hawaii.gov/dcca/dca/HCEI/HECI%20Agreement.pdf>.

RECOMMENDATION 24:

Enable Distributed Generation on Downtown Network

The City should work with PG&E to study the City’s secondary distribution network to identify the technical feasibility and expected costs to upgrade this network and its operation, or find other suitable solutions to enable renewable energy installations in the downtown core, North Beach, and the Tenderloin, while maintaining utility worker safety and grid reliability.

In San Francisco, a large swath of the northeast section of the city (including parts of North Beach, the Tenderloin, the financial district, and SOMA) is served by the “secondary network.” This type of distribution grid is designed to provide redundancy and better protection against power outages, but as a result severely limits the ability to install DG in these areas, as, for reliability reasons and safety concerns, PG&E will not allow power to back feed onto the grid in these networks.

In addition to technical challenges, there are administrative challenges to address, particularly related to interconnection agreements and procedures. Several solar systems have been installed on San Francisco’s secondary network to date (with significant added costs to prevent backflow onto the grid). This has happened on a one-off basis, though, and clarity and transparency is needed from PG&E’s Generation and Interconnection Services (GIS) department around approval processes and design parameters required for interconnection of renewable energy systems on the secondary network. For example, one possible solution could be to utilize grid connected energy storage systems that ensure that all generated energy is either used immediately for onsite loads or stored for later use, and not sent back onto the grid.

Finally, DG projects in San Francisco would benefit significantly from a streamlined, electronic interconnection process. The current interconnection process is a lengthy and unpredictable step for many contractors, but it is especially difficult for smaller renewable energy generators who want to connect to the system distribution side of the meter, as they are subject to a different set of standards than those who connect on the customer side. An electronic interconnection application process that follows a standardized statewide protocol is a vital part of lowering costs and promoting the growth of DG. Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) already offer electronic interconnection for solar PV, but PG&E does not.⁹³

⁹³ For more information on distribution system interconnection, see CPUC Rule 21 proceedings, www.cpuc.ca.gov/PUC/energy/Procurement/LTPP/rule21.htm.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Technical Regulatory	Enabling	Local and State Government	Mid-term	SFPUC, PG&E, CPUC

RECOMMENDATION 25:

Support Energy Storage Market Development

The City should support research and development of technologies that support increased renewable energy and act as test bed for such technologies, simultaneously supporting economic development and environmental goals. In particular, San Francisco should support state efforts to develop cost-effective energy storage options and encourage energy storage deployment in San Francisco, both through pilot installations and appropriate planning and permitting requirements.

The state can play an important role in identifying and addressing technical barriers to increased renewable energy penetration in California, such as issues around intermittency, transmission, and storage,⁹⁴ and local governments such as San Francisco can act as a test bed to implement solutions to these barriers. Storage will become increasingly important as greater percentages of the electricity supply come from intermittent renewable sources. Distributed storage could be integrated into the urban fabric in the future, for example through electric vehicle batteries or building-level storage.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial Technical	Enabling	Local and State Government	Mid-term	SFPUC, Department of Environment, California Energy Commission

⁹⁴ For example, under California’s AB 2514 Energy Storage legislation, the CPUC will be establishing energy storage procurement requirements for the IOUs and POUs.

RECOMMENDATION 26:

Support Emerging Clean Technologies

As part of the City’s efforts to nurture local cleantech innovation and market development in San Francisco, the City should seek continued collaboration with the state and federal governments to support the development of renewable energy markets, pilot renewable energy and energy efficiency technologies and programs, and showcase best practices in renewable energy permitting, financing, outreach, and deployment. The City should promote the testing and evaluation of new clean technologies that may be suitable for urban deployment.

The City of San Francisco has been fortunate to receive several state and federal grants to study and implement renewable energy projects, policies, and financing mechanism, namely under the U.S. DOE’s Solar America Cities and SunShot Initiative, and California Energy Commission (CEC) Public Interest Energy Research grants. It was through the Solar America Cities grant funding that SF Environment was able to develop outreach tools like the SF Solar Map, streamline permitting processes, and develop innovative financing and purchasing models to help reduce costs and increase renewable energy deployment. The 2011 Updated ERP outlined the Green Test Bed concept to support cleantech demonstration projects in San Francisco, and the City has worked with industry to deploy such new technologies, including urban wind turbines and electric vehicle charging stations.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial Technical Awareness	Enabling	Local Government	Near- mid and long-term	SFPUC, Department of Environment, California Energy Commission, US Department of Energy

RECOMMENDATION 27:

Increase Use of Solar Water Heating

The City should undertake an outreach campaign to improve awareness and understanding of solar water heating (SWH) technology and identify financing mechanisms to overcome the challenges of high up-front costs and long payback periods, such as solar thermal power purchase agreements and on-bill repayment with utilities.

The City should require SWH on all new residential construction with adequate solar access, thereby reducing installation costs (versus retrofits) and enabling property owners to finance the system with their home

mortgage or line of credit, or emerging financing options such as PACE or on-bill repayment. Heating bill savings can in turn offset financing costs.

The City should explore the feasibility of using SWH at municipal facilities with high hot water loads and install SWH systems on those facilities where energy savings are found to outweigh SWH installation costs.

Solar water heating (SWH) is a proven, cost-effective renewable energy technology that uses the sun’s heat to preheat domestic hot water, pool water, or hydronic heating systems, thereby reducing the amount of fuel or electricity needed for space and water heating. Domestic SWH has been used for decades, and has seen widespread adoption in some countries, such as Greece and China, and is required in Spain and Israel, where adoption rates now top 90%.

In California, current state rebates (under the CSI-Thermal program) and federal tax-related incentives (including the Investment Tax Credit and accelerated depreciation) can reduce SWH system costs by as much as 50%. Despite these incentives, adoption remains slow, due largely to lack of awareness and the long payback periods. Due to the relatively low cost of natural gas in California, payback periods on residential SWH can still be as long as 10-20 years, making it unattractive at first look. SWH systems generally have warranties for 20-30 years, though, meaning significant long-term energy bill savings. SWH is particularly cost effective for multi-family properties and businesses with high hot water loads such as laundromats and hotels.

Increasing the use of solar water heating is one of the largest and most cost-effective opportunities for San Francisco to reduce GHG emissions, and so should be a priority in the coming years. The City should work to stimulate SWH market development and overcome these market barriers through a combination of public outreach (including collaborating with PG&E to leverage their CSI-Thermal marketing and outreach campaign in San Francisco), requirements for new construction, and municipal deployment at public facilities with high hot water demand (including, for example, hospitals, fire stations, recreational facilities, and affordable housing properties).

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness Policy Technical	Enabling and Moves the Market	Local Government	Near-to- midterm	Department of Environment, Department of Building Inspection, Planning Department, SFPUC

RECOMMENDATION 28:

Increase District Energy

In order to ensure that district energy opportunities are explored and, where appropriate, developed, the City should require that the developer or sponsor of large commercial real estate projects prepare a district energy feasibility study as part of the project development process, concurrent with the conceptual design phase of the project. The study would consider three components of energy: heat, chilled water, and generated electricity. Elements of the study scope would include potential cogeneration projects, integration with existing city steam loops, ground source geothermal, and other district energy concepts. The study would be reviewed by an interagency committee and used as a decision-making tool for the project developers and City policy makers.

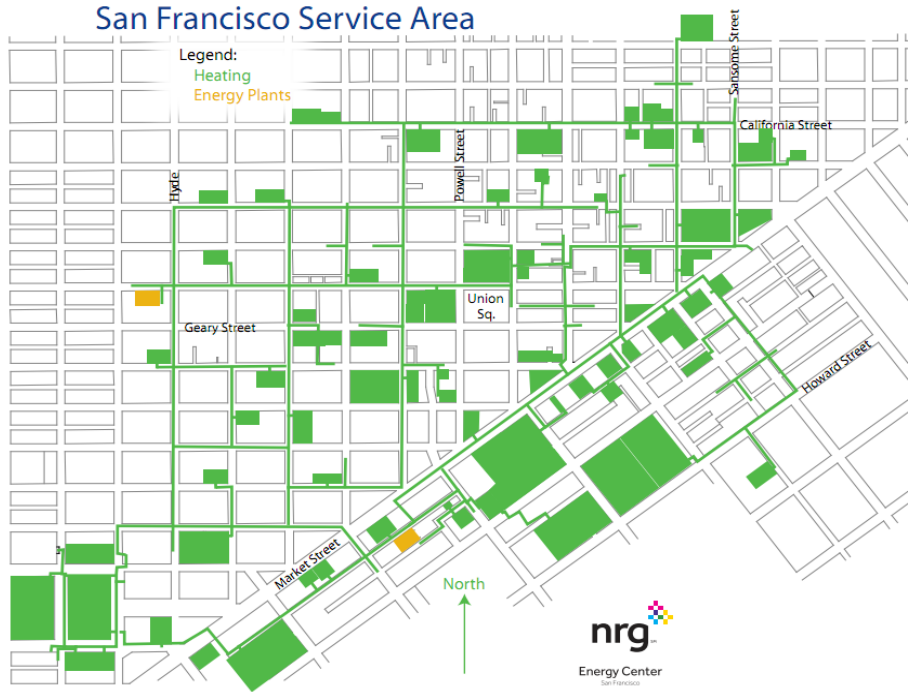
Another form of DG, district energy offers an opportunity to produce electricity, heating, and cooling at the neighborhood scale.⁹⁵ District energy systems are inherently more efficient than centralized combustion-based power plants, which release large amounts of waste heat “up the stack” as a byproduct, and more efficient than individual heating and cooling systems in each building. Larger, central boilers generally operate at higher efficiency than individual systems in each building. With central heat production, it is common to install several boilers so that individual units can be brought on as needed, and they operate at full-load for highest efficiency. Boilers at individual buildings (residential or commercial) are sized to meet peak heating loads, but most of the time they operate at part-load, which reduces efficiency. Combined heat and power (CHP) plants, which are well suited to district energy systems, offer much higher source-energy efficiency than conventional power generation, and are cleaner, per unit of heat delivered, than operating smaller boilers or furnaces at individual buildings.

While most district energy systems are currently natural gas-based, the fuel source can be shifted to renewable resources relatively easily. For example, if a gas-fired CHP plant is serving a district heat network, additional capacity can be delivered by adding a renewable-energy-fired plant (woodchips or landfill methane, for example) on the same heat distribution network. The gas plant can also be converted to run on renewable fuels, such as biogas. This may be a long term strategy for meeting San Francisco’s 100% renewable goal, as well as the city’s GHG reduction goals.

⁹⁵ District energy systems produce hot water, steam or chilled water at a central plant and then distribute the energy through underground pipes to buildings connected to the system, eliminating the need for boilers, chillers or cooling towers in each individual building. Customers use the hot and chilled water to meet their space heating, water heating, processing and air-conditioning needs. Once used in customer buildings, the water is returned to the central plant to be reheated and rechilled and then recirculated through the closed-loop piping system.

San Francisco already has one large district energy system, the NRG Energy Center steam loop, which supplies energy-efficient district heating services to approximately 180 buildings over two square miles of the central business district and Civic Center. Steam is produced at the Energy Center’s two downtown plants and piped through the network for space heating, domestic hot water, air conditioning, and industrial process use in customer buildings. There is significant opportunity to increase the use of district energy systems in the city’s redevelopment areas, such as the Transbay redevelopment area, the Central Corridor, and at institutional campuses, such as hospitals and universities.

Figure 2: NRG Energy Center district heating system



Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy	Game Changing	Local Government	Near-mid- and long-term	Planning Department, SFPUC, Department of Environment

CHAPTER 5

Utility-Scale Generation, Provision, and Investment

While increasing the amount of energy efficiency and local, distributed renewable energy will reduce demand significantly, San Francisco will remain reliant on imported electricity for the majority of its power supply for the foreseeable future. Ensuring that there are 100% renewable utility purchasing options to San Francisco electricity customers is essential to meeting the Mayor's 100% renewable goal. As explained in Chapter 2, there are currently two main electric utilities in San Francisco: SFPUC and PG&E. A small number of large commercial and industrial customers buy power directly from electricity service providers through Direct Access, and the city is reviewing a proposal to launch a CCA program, CleanPowerSF, later this year.

Renewable Power from San Francisco's Electricity Providers

PG&E

PG&E, like all California IOUs, is subject to the state RPS which requires 20% RPS-eligible renewable content by 2010 and 33% by 2020.⁹⁶ In 2010, 15.9% of PG&E's power came from California-compliant RPS-eligible resources and another 15.6% from large hydroelectric.⁹⁷ PG&E is expected to meet the 20% RPS target by the end of the 2013 compliance period based on contracts for future supply and to continue to increase renewable energy supply to meet the 2020 requirement. Even with the RPS requirements and their existing hydropower capacity, over half of PG&E's supply will continue to be nonrenewable over the next 10 years, unless the state RPS is further increased or PG&E voluntarily procures more renewable power. The latter could occur over the long run as renewable energy cost reductions make renewable energy supply competitive with traditional generation, or more quickly through a green power purchasing program. PG&E has recently proposed offering a "green option" to its customers, which would allow them to purchase REC-based renewable energy at a price premium versus their standard supply mix. This program is currently undergoing initial regulatory review at the CPUC.⁹⁸

SFPUC

The SFPUC provides electricity to all municipal facilities, including the Muni railway, San Francisco General Hospital, San Francisco International Airport (including tenants), the San

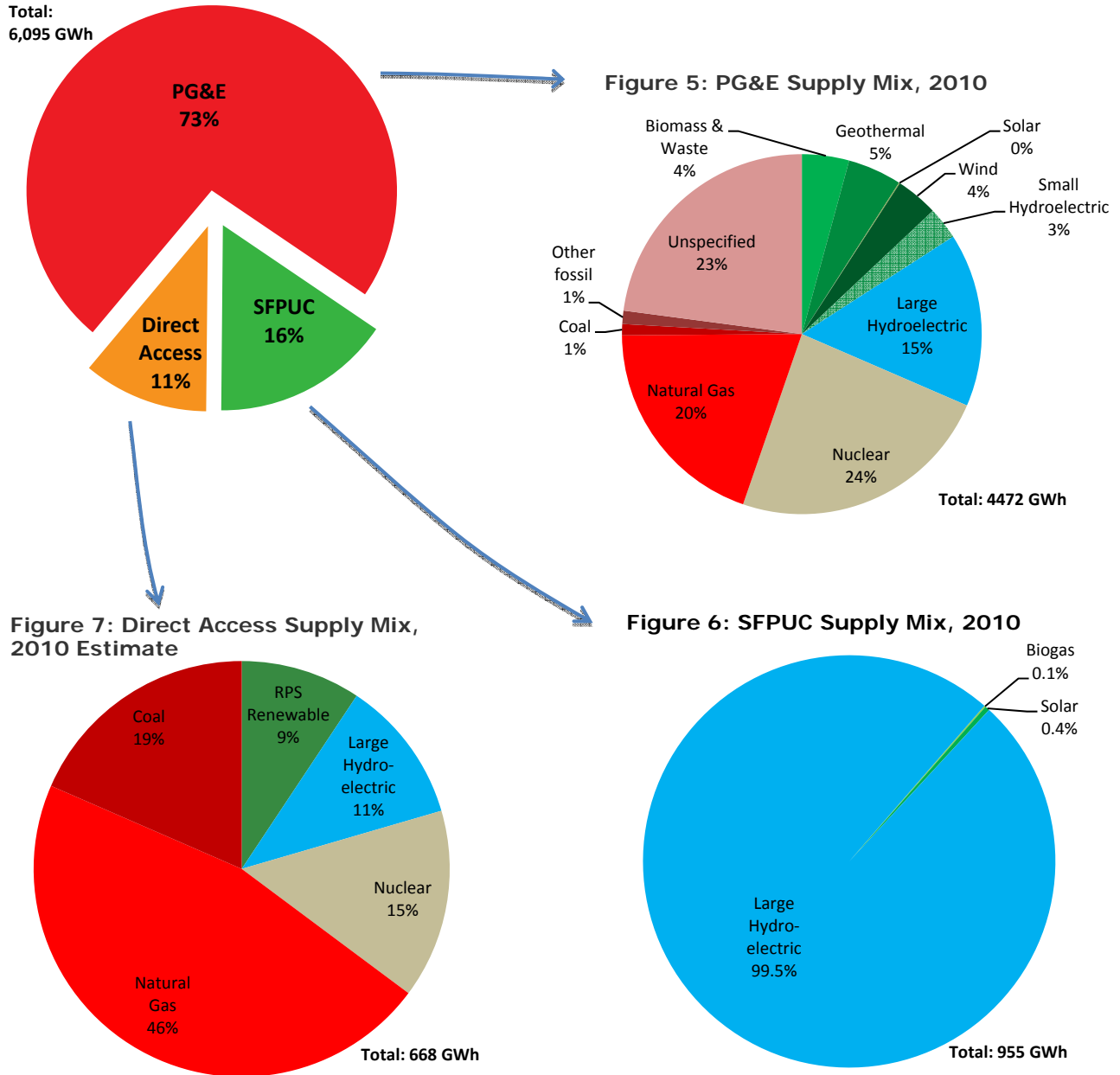
⁹⁶ See footnote 39.

⁹⁷ PG&E, "PG&E's 2010 Electric Power Mix Delivered to Retail Customers," *Clean Energy Solutions* web page, <http://pge.com/about/environment/pge/cleanenergy/>, viewed 12/19/2011. PG&E is expected to increase its renewable procurement to 20% of its entire portfolio in the 2011-2013 timeframe.

⁹⁸ "Application to Establish a "Green Option Tariff" Submitted by Pacific Gas and Electric to the California Public Utilities Commission, 24 April 2012. <http://docs.cpuc.ca.gov/efile/A/164910.pdf>

Francisco Unified School District, and water and wastewater facilities. Over 99% of SFPUC's electricity supply currently comes from the Hetch Hetchy hydro system, which also provides water for San Francisco. The remainder comes from renewable resources, including biogas at the City's wastewater treatment facilities and solar from the SFPUC's 13 solar PV arrays in San Francisco. The SFPUC is committed to meeting all non-Hetch Hetchy electricity demand with RPS-compliant power, as required by the CPUC, which means that its power supply will continue to be 100% renewable.

Figure 3: San Francisco Electricity Deliveries by Supplier, 2010⁹⁹



⁹⁹ See Table 1 for supply data by utility and sources.

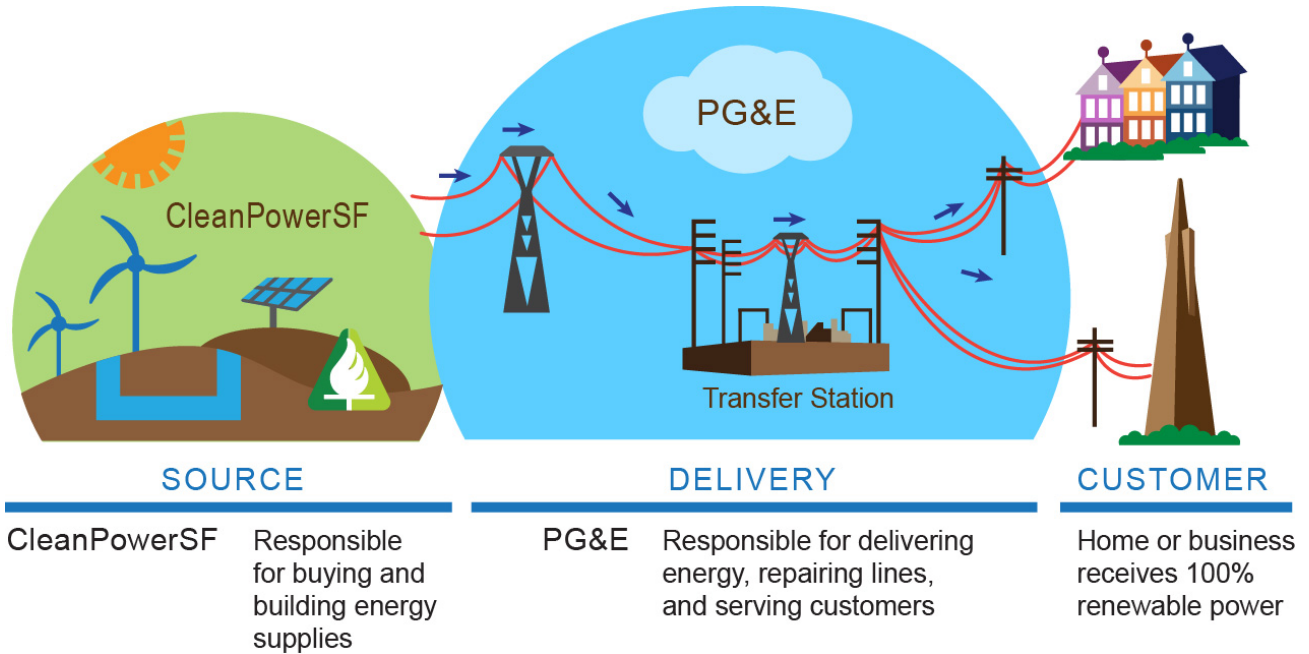
DIRECT ACCESS ELECTRICITY SERVICE PROVIDERS

Some of San Francisco’s largest commercial and industrial energy customers buy power through direct contracts with ESPs under the state’s Direct Access program. While there are only about 200 such customers in San Francisco, they account for 11% of electricity demand in the city.¹⁰⁰ As mentioned in Recommendation 6, data on the makeup of ESP’s supply is not publicly available. While these ESPs must meet the state RPS requirements, the remainder of their supply mix is unknown. For the purposes of the City’s climate inventory and this report, it is assumed that their generation mirrors the state supply mix, though in reality it is likely significantly more fossil fuel heavy due to these providers’ market niche providing low-cost power under long-term contracts, and the lack of required public disclosure.

CLEANPOWERSF

As authorized under *California Assembly Bill 117: Community Choice Aggregation Enabling Legislation* (Migden, 2002), CCA enables greater local control of the power supply by allowing city and county governments to procure electricity generation for their residents and businesses, while delivering the power using the existing transmission and distribution system (see Figure 5).¹⁰¹ San Francisco is considering its own CCA program, CleanPowerSF, which would allow San Francisco to advance local priorities, including this 100% Renewable goal,

Figure 8: Community Choice Aggregation allows cities and counties to pool their residential, business, and municipal electricity loads, and to purchase and/or generate power on their behalf. Electricity transmission, distribution, repair, and customer service functions remain with the incumbent utility. The diagram below shows how such a program could work in San Francisco. (Graphic adapted from LEAN Energy US, www.leanenergyus.org.)



¹⁰⁰ SFPUC, *San Francisco’s 2011 Updated Electricity Resource Plan*, March 2011, p.36-38.

¹⁰¹ California AB 117 (Statutes of 2002, chapter 838).

reducing GHG emissions and supporting local economic development. As currently envisioned, CleanPowerSF is slated to provide 100% renewable power to San Francisco homes and businesses who take part in the program, starting as early as late 2012 (see Recommendation 34). CleanPowerSF could provide a new path for helping meet the City's energy and climate goals by providing 100% renewable power to large numbers of San Francisco's private sector electricity customers, while spurring investment in local and regional renewable energy projects.

Utility-Scale Generation Recommendations

San Francisco has no direct control over PG&E, nor DA customers or their ESPs. The City's primary means of influencing these suppliers' electricity mix is by advocating for increased renewable energy content through state channels (namely the legislature and CPUC). Yet given their important role as a local business and service provider, the Task Force recommends working with PG&E to encourage them to increase the renewable energy options available to their customers (e.g. green purchasing programs). San Francisco does have direct control over its own power programs under the SFPUC's purview, and so a number of the following utility-scale recommendations focus on these areas where the City can take direct action, particularly related to increasing SFPUC's delivery of renewable power and rolling out the proposed CleanPowerSF program. The recommendations also lay out some unique opportunities for the City to encourage private sector renewable energy investment and reduce financing costs, making renewable energy more cost-competitive and thereby helping the City achieve its 100% renewable goal.

RECOMMENDATION 29:

Align Municipal Electricity Rates

The City should transition the electric rates it charges so that all SFPUC power customers at least pay the actual delivered cost of service. This would encourage energy efficiency and enable the SFPUC to receive a stand-alone credit rating necessary to issue long-term bonds to finance further renewable energy developments, energy efficiency, and other capital improvements. The City should develop a plan and timeline to achieve full cost of service rates; for example, to minimize budget impacts, these rate changes could be phased in over a four- to eight-year period.

The SFPUC provides electricity to all municipal facilities, including the Muni railway, San Francisco General Hospital, San Francisco International Airport (including tenants), the San Francisco Unified School District, and water and wastewater facilities. SFPUC customers are classified as either "General Fund" or "Enterprise" customers. General Fund customers pay subsidized rates that do not reflect the actual cost of producing and delivering the electricity. Enterprise customers pay rates that are comparable to the rates PG&E would charge them.

Further, the rates that each SFPUC customer class pays do not go through a rigorous approval process, frustrating efforts to charge at least the true cost of power and restricting the SFPUC Power Enterprise from obtaining a bond rating.

In 2004, the Board of Supervisors passed a resolution establishing the policy that San Francisco should "...transition to annually appropriate funds for each General Fund department sufficient to compensate HHWP [Hetch Hetchy Water & Power] for all electricity sales to such departments at rates that reflect the same cost principles as outlined in the City Charter."¹⁰² The intent was two-fold. First, by authorizing the SFPUC to collect through rates the true cost of producing and delivering power to end-use customers, the SFPUC would be able to continue funding the programs and projects that meet the City's objectives. Secondly, by setting a policy to recover the true cost of power, the SFPUC would be in a better position to take advantage of borrowing capacity authorized by the voters of San Francisco through Propositions B and H in 2001.¹⁰³

Proposition B authorized the issuance of up to \$100 million in revenue bonds with Board approval for solar, energy conservation, or renewable energy facilities and equipment. However, Proposition B bonds must be repaid by revenues generated or costs avoided by funded projects. Proposition H amended the City Charter to allow renewable energy and energy conservation revenue bonds to be approved by the Board. Both of these bonding authorities require that the City adopt rates through a formal process that covers the actual cost of generation and delivery. Further, the only cost effective way for the SFPUC Power Enterprise to access capital markets would be for it to have a stand-alone investment-grade credit rating. The cost of borrowing for an unrated entity is too high to make the underlying projects cost-effective.

In January 2012, the SFPUC was authorized to implement a 2 cent/kWh increase to General Fund power customers. The total rate increase will be phased in half cent increments over 4 years beginning in fiscal year 2012-13. This increase in General Fund customer rates will provide for critical infrastructure maintenance on the Hetch Hetchy power system and provide minimal funding levels for the City's municipal energy efficiency and renewable programs, including \$2 million annually for GoSolarSF, \$1 million for municipal renewables, and \$650,000 for municipal energy efficiency programs. Previously the municipal programs were funded at \$10 million per year and GoSolarSF was funded at \$5 million per year. This rate increase is a crucial first step toward achieving cost of service rates.

¹⁰² BOS Resolution 431-04

¹⁰³ "Prop B" authorized issuance of up to \$100 million in revenue bonds with Board approval for solar, energy conservation, or renewable energy facilities and equipment. The triggering authorization is limited to having costs that City departments incur over the life of the project being no greater than their costs prior to project implementation, such that bonds can only be repaid by revenues generated or costs avoided by funded projects. "Prop H" amended the City Charter to allow renewable energy and energy conservation revenue bonds to be approved by the Board of Supervisors, without voter approval pursuant to Section 9.107. Because Proposition B and H are "revenue bonds", any renewable energy projects financed with them must be able to fully recover their costs from their own revenue. Given the current SFPUC rate of service of about \$0.08/kWh, it is not possible to build revenue-neutral (or revenue-positive) solar PV projects. For more discussion of the barriers to using Prop B and H bonds, see SFPUC, *San Francisco's 2011 Updated Electricity Resource Plan*, March 2011, pp 85-87, <http://sfwater.org/modules/showdocument.aspx?documentid=40>.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Enabling	Local Government	Near-to- midterm	SFPUC, Board of Supervisors

RECOMMENDATION 30:

Expand Municipal Deliveries of 100% Renewable Power

The SFPUC is committed to procuring 100% renewable energy to serve any new municipal loads. The City should support the SFPUC in its efforts to increase the number of customers served by the SFPUC, require all electrical loads located on City-owned property be served by the SFPUC (e.g., Airport and Port tenants), and expand the number of SFPUC-powered electric vehicle charging stations.

The City’s Administrative Code should be revised to allow the SFPUC to be the default provider, with first right of refusal, for all major construction projects within San Francisco, not just for redevelopment projects. SFPUC should also seek to provide power for public transportation agencies and institutional customers such as hospital and school campuses.

Over 99% of SFPUC’s electricity supply currently comes from the Hetch Hetchy hydro system, which also provides water for San Francisco. The remainder comes from renewable resources, including biogas at the City’s wastewater treatment facilities and solar from the SFPUC’s eleven solar PV arrays in San Francisco. The SFPUC is committed to meeting all non-Hetch Hetchy electricity demand with RPS-compliant power, as required by the CPUC, which means that its power supply will continue to be 100% renewable. Increasing the number of San Francisco customers served by SFPUC will therefore help meet the 100% renewable goal.

The Hetch Hetchy system is operated under a “water first” policy, which gives priority to the production and protection of water supply over electricity production. This means that the system rarely operates at full capacity (about 400 MW); average annual output is closer to half that, at 200 MW.¹⁰⁴ Still, as operated, the system actually has excess electricity generation potential above what is used for municipal power or provided to the Modesto and Turlock

¹⁰⁴ During the spring run-off, the power generation facilities of the Hetch Hetchy system have a maximum capacity of approximately 400 MW. However, the average annual output is closer to 200 MW for a total yearly generation of 1.7 million MWh of electricity. Average generating capacity based on a seven-year historical average (1997–2003) is 201 MW. SFPUC, *San Francisco’s 2011 Updated Electricity Resource Plan*, 2011, p. 39

irrigation districts as required under the Raker Act.¹⁰⁵ The system currently produces about 1,700 GWh of power annually, of which roughly 1,000 GWh goes to San Francisco customers, and another 200 GWh to Turlock and Modesto for municipal use at cost of service rates.¹⁰⁶ The remainder is sold to Turlock and Modesto at retail rates, or to the broader wholesale electricity market.¹⁰⁷ Increasing provision of this surplus clean power, as well as additional RPS-eligible renewables, to San Francisco customers would directly and immediately increase the amount of renewable power used in San Francisco, covering up to 10% of private sector electricity demand.

The SFPUC should continue to serve all municipal facilities, as well as tenants in municipally-owned properties, including SFO and the Port. The SFPUC should also seek to become the power provider for public transit systems serving the city — namely San Francisco Bay Area Rapid Transit (BART) and Caltrain — thereby helping make our transportation system carbon neutral, and keeping energy payments in the local economy. BART is currently a Direct Access customer, and as such is allowed to switch electricity service providers (including to municipal utilities), and Caltrain recently announced plans to electrify its train system.¹⁰⁸ As the City prepares for greater electric vehicle use, the City should ensure that public electric vehicle chargers are powered with renewable SFPUC power.

In addition to municipal properties, SFPUC should expand service to new developments and institutional customers. PG&E’s franchise agreement with the City is a non-exclusive agreement, meaning PG&E’s right to serve electric customers within San Francisco is not exclusive — the SFPUC has the legal authority to serve end-use customers. As noted in the 2011 Updated Electricity Resource Plan, the City’s Administrative Code requires that for new redevelopment projects, the City conduct a feasibility study to assess whether the SFPUC should be the public electricity provider.¹⁰⁹ In light of its existing authority to serve customers directly, the SFPUC should expand its service offering beyond redevelopment areas. The revenues from these customers would help the City to fund energy efficiency and renewable energy programs that would directly support the 100% renewable goal.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Moves the Market	Local Government	Near-to-midterm	SFPUC, Board of Supervisors

¹⁰⁵ The SFPUC’s Water First Policy gives priority to the production and protection of water supply over the production of hydropower generation in the operation of the Hetch Hetchy system. The Raker Act (1907) requires that Hetch Hetchy generation be made available to Turlock and Modesto Irrigation Districts for pumping and irrigation needs after SFPUC municipal loads have been served. If there is further excess generation, current agreements require it be made available to the irrigation districts before being sold to retail customers.

¹⁰⁶ Based on SFPUC data, “Class 1” sales to MID and TID for municipal use averaged a combined 195 GWh per year from 2007-2011. Over the same time period, another 50 to 244 GWh per year has been sold to TID at retail rates under a contract set to expire in mid 2015.

¹⁰⁷ SFPUC, *San Francisco’s 2011 Updated Electricity Resource Plan*, 2011, p. 88.

¹⁰⁸ Caltrain, “Regional Agreement Advances Caltrain Modernization,” March 2012, www.caltrain.com/about/news/Regional_Agreement_Advances_Caltrain_Modernization.html.

¹⁰⁹ See 2011 ERP recommendation 4. SFPUC, *San Francisco’s 2011 Updated Electricity Resource Plan*, 2011, pp. 59-60.

RECOMMENDATION 31:

Pursue Third-Party Ownership Structures with Private Sector Partners

The City should explore and expand the use of power purchase agreements (PPAs) and lease ownership models to finance municipal renewable energy projects, in order to take advantage of federal tax incentives and minimize the City's capital requirements, while also leveraging municipal funding opportunities to reduce financing costs and increase project returns.

The high up-front cost of renewable energy systems has traditionally the largest barrier to their adoption. Power purchase agreements (PPAs) are fast becoming the most commonly used financing model for overcoming this barrier. Under a PPA, a renewable energy developer installs and owns the generating equipment, and the site host pays for the power from the system over time as it is produced. The developer may bring in third-party financiers or tax-equity investors to finance the project and take advantage of tax credits. This model allows residents, business owners and utilities (including municipal utilities) to install projects with little or no up-front capital costs while also reducing technology and operation and maintenance risks, as they pay only for the power produced.

Like power purchase agreements, solar leases are third-party ownership structures that help overcome the high up-front cost barrier of investing in solar. A solar lease is very much like a car lease, where you lease the equipment for a set period of time and benefit from the electricity it produces during that lease period and all the way through its useful lifetime. The lease model allows residents, businesses owners and utilities to pay fixed monthly equipment lease payments, and benefit from reduced monthly utility bills. This ownership structure has been particularly popular in the residential market, but can also be attractive for businesses, for example, by structuring the lease to move the solar project off balance sheet using an operating lease structure.

In 2011, solar PPAs represented a small but significant and growing portion of systems installed in California, across the residential, commercial, and utility sectors, and are expected to continue gaining market share. This type of ownership model was used for the SFPUC's 5 MW Sunset Reservoir PV project. Further, "Pre-pay PPAs" could be used to take advantage of federal tax credits and depreciation, while using the City's favorable credit, bonding abilities, or capital budgets to pre-pay a portion of the PPA electricity payments, reducing the cost of the solar power by reducing the solar developer's need to use high-cost financing, which would otherwise be passed on to the City in the PPA rate.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial	Enabling	Local Government	Near-to-midterm	SFPUC

RECOMMENDATION 32:

Utilize Energy Bonds

The City should advocate for the issuance of more Clean Renewable Energy Bonds by the U.S. Department of Treasury and take greater advantage of this option, and explore the use of Qualified Energy Conservation Bonds to help finance municipal solar PV and solar thermal installations.

The federal Energy Policy Act of 2005 established Clean Renewable Energy Bonds (CREBs) as a financing mechanism for renewable energy projects, mainly in the public sector. The list of qualifying technologies is generally the same as that used for the federal renewable energy production tax credit. CREBs differ from traditional tax-exempt bonds in that the tax credits issued through CREBs are treated as taxable income for the bondholder. CREBs may be issued by governments, such as cities and counties, and by certain lenders. The borrower pays back only the principal of the bond, and the bondholder receives federal tax credits in lieu of the traditional bond interest.

Qualified Energy Conservation Bonds (QECCBs) are qualified tax credit bonds, and in this respect are similar to new CREBs. In contrast to CREBs, QECCBs are not subject to a U.S. Department of Treasury application and approval process. The definition of “qualified energy conservation projects” is fairly broad and contains elements relating to energy efficiency capital expenditures in public buildings, green community programs (including loans and grants to implement such programs), renewable energy production, various research and development applications, mass commuting facilities that reduce energy consumption, several types of energy related demonstration projects, and public energy efficiency education campaigns.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial	Enabling	Local Government	Near-to-midterm	SFPUC

RECOMMENDATION 33:

Clarify Labor Requirements

The City should continue to work with the California Department of Industrial Relations to clarify prevailing wage rates for solar projects and explore other options to minimize jurisdictional disputes among labor unions and provide clarity to contractors on the appropriate prevailing wage rates that should be paid for construction work on solar projects.

Growth in this relatively new sector is also raising questions about who is best qualified to work on renewable energy projects. By law, workers on all government funded construction projects must be paid prevailing wages. In California, the Department of Industrial Relations (DIR) sets the prevailing wage rate for each craft. The Board of Supervisors has adopted these rates for City funded projects. The SFPUC’s municipal solar projects have been delayed in recent years due to ongoing labor jurisdictional disputes between various unions. In order to move forward with municipal solar projects the City has been working with DIR to determine the correct prevailing wage rate for the various tasks performed in constructing a solar project. This may help resolve the jurisdictional disputes among the various unions and provide contractors clarity on the correct prevailing wage rate when bidding on solar projects, and help the City move forward with new municipal solar projects.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Regulatory	Enabling	Local and State Government	Near-term	SFPUC, California Department of Industrial Relations

RECOMMENDATION 34:

Implement 100% Renewable Community Choice Aggregation Program

The City should offer a 100% renewable electricity supply to San Francisco residents and businesses through a CCA program. Renewable energy for the program should be procured, to the maximum extent technically and economically feasible, from local projects or projects on City-owned property, and the rest from RPS-eligible resources.

The City should explore options to cost-effectively encourage and leverage private renewable energy project development, for example through appropriately-priced power purchase agreements or feed-in tariffs to procure

generation for the CCA program, development of public-private partnerships, and/or use of municipal bonds to support low-cost financing for local renewable energy projects.

The City should target broad participation in the CCA program, including by integrating CCA participation into eligibility requirements for energy-related municipal incentives and recognition programs, and identifying ways to encourage businesses' participation in CleanPowerSF or other green power purchasing programs.

As authorized under California AB 117 (Migden, 2002)¹¹⁰ CCA enables greater local control of the power supply by allowing city and county governments to procure electricity generation for its residents and businesses, while delivering the power using the existing transmission and distribution system to deliver those supplies. San Francisco is considering its own CCA program, CleanPowerSF, which would allow San Francisco to set and act on local priorities, such as reducing GHGs and supporting local economic development by providing electricity with high renewable and GHG-free content – thereby helping meet the city's climate targets and 100% renewable goal.

CleanPowerSF's Implementation Plan was certified by the CPUC in 2010, and the SFPUC is currently in the process of identifying potential service providers to support the program.¹¹¹ While initially conceived as a 50% renewable product at equal rates to PG&E power, the SFPUC is now proposing a plan to the Board of Supervisors to implement a 100% renewable program at a cost premium PG&E rates (currently estimated at \$6 per month for the average residential customer). CleanPowerSF provides one path toward assisting the City in meeting the City's energy and climate goals by providing 100% renewable power to San Francisco's private sector electricity customers.

CCA, if approved, could help spur renewable energy investment and development in and around San Francisco, by acting as a guaranteed off-taker of renewable power on behalf of its customers. The CCA can offer long-term contracts to purchase renewable power, for example in the form of PPAs, standard offer contracts or feed in tariffs. The City could also make suitable municipal properties (such as school roofs and land along the Hetch Hetchy transmission right-of-way) available for renewable energy development, with that power then sold and delivered to SF customers through the CCA. The City could also pursue public-private partnerships to develop renewable energy projects in and around San Francisco, such as the Oceanside wave power project currently under study or eventually off-shore wind projects, which could then provide local renewable power to the CCA. The CCA can also be used to support community solar, as discussed in Recommendation 10, either by directly purchasing power from solar projects in San Francisco for sale to CCA customers, or working with

¹¹⁰ California AB 117 (Statutes of 2002, chapter 838).

¹¹¹ State law governing community choice aggregation requires the successful certification of a implementation plan by the California Public Utilities Commission. On May 18, 2010, the Implementation Plan for CleanPowerSF was certified, in accordance with Public Utilities Code, Section 366.2 (c). The certification letter can be found at <http://cleanpowersf.org/documents/implementation-plan-certification>.

community solar organizations to coordinate billing and generation credits for community solar participants.

Full rollout of CleanPowerSF and strategic public engagement to foster broad participation in the program would help ensure the program’s success and directly contribute to meeting the City’s 100% renewable goal. In addition to public education and outreach campaigns, the City can further encourage participation in the CCA (and thus consumption of 100% renewable power) by tying related local incentives and recognition program eligibility to CCA participation, including for example SF Green Business certification and GoSolarSF incentive eligibility. Businesses are larger energy consumers (accounting for roughly half of the city’s electricity demand) and particularly price-sensitive to utility costs, which makes them important partners in achieving the 100% renewable goal, but less likely to participate in CleanPowerSF due to the premium for renewable power. The City should identify ways to encourage their participation in the CCA or other green power purchasing options, such as contracting with 100% renewable direct access ESPs.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial Awareness	Game Changing	Local Government	Near-to- midterm	Board of Supervisors, SFPUC, Department of Environment

RECOMMENDATION 35:

Encourage Robust PG&E Green Power Purchasing Option

The City should work with PG&E to offer a green power product to their customers that will allow them to purchase 100% renewable electricity and spur additional new renewable energy development beyond state RPS requirements.

Providing all electricity customers with an option to purchase 100% renewable power is a central strategy to meeting San Francisco’s renewable goal, and can have a much larger impact if offered throughout California by the state’s IOUs. In late April, 2012, PG&E announced plans to ask state regulators for approval to offer customers a “green option”. If approved, the proposed program could start in late 2013, and would allow customers to voluntarily pay a price premium on their monthly electricity bill for the benefit of having all of their electricity offset with Renewable Energy Certificates (RECs). The task force recommends that the CPUC and stakeholders (including the City) continue to work with PG&E to ensure that the program is designed to provide GHG benefits, spur new renewable energy development

(additional to what is already required under state law), and help drive economic development and green job growth in California.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Regulatory Financial	Moves the Market	State Government	Mid-term	Department of Environment, CPUC, PG&E

RECOMMENDATION 36:

Encourage Renewable Energy–Based Direct Access

The City should make San Francisco’s direct access customers (including BART) aware of the availability of 100% renewable electricity service providers (ESPs), including SFPUC power service, and encourage their procurement of 100% renewable power.

There are only about 600 Direct Access electricity customers in San Francisco (out of about 35,000 total commercial and industrial customer accounts, and 326,000 residential accounts), but they account for about 8% of electricity demand in the city.¹¹² While the CPUC has tightly regulated and restricted the size of the direct access market since 2001, there have been new enrollment opportunities in the past three years, and a small capacity allocation remains for 2013. Historically, direct access ESPs have provided some of the dirtiest, most GHG-intensive power to San Francisco, but there are ESPs who specialize in providing renewable power. Encouraging direct access customers in San Francisco to contract for higher levels of renewable energy could help meet the 100% renewable goal and significantly reduce GHG emissions. One of the largest direct access customers is BART, and the City should, through its representatives on the BART board of directors, encourage BART to transition to 100% renewable power for the transit organization, for example from the SFPUC as discussed in Recommendation 30.¹¹³

¹¹² The 600 DA accounts include 60% of San Francisco’s largest electricity customers (such as downtown office buildings, large department stores, and industrial customers). SFPUC, *San Francisco’s 2011 Updated Electricity Resource Plan*, March 2011, p.36-38.

¹¹³ This is supported by BART’s sustainable energy supply strategy in section (8.3.2), San Francisco Bay Area Rapid Transit, *BART Greenhouse Gas Inventory Report*, December 2008, pp 45-46, www.bart.gov/docs/BART_Greenhouse_Gas_Inventory_Report.pdf.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Awareness	Moves the Market	Local Government	Near-to-midterm	Department of Environment, SFPUC, BART, CalTrain

RECOMMENDATION 37:

Support Enabling Statewide Renewable Energy Policies

The City should support steadily increasing the statewide Renewable Portfolio Standard (RPS) while also recognizing those utilities that already have minimal or zero-GHG emissions, such as the SFPUC. The City should support the successful implementation of the SB 32 feed-in tariff program to stimulate private sector investment and financing for mid- to large-scale renewable energy projects.

The State is the main actor for regulating utilities in California, and state policy will have the greatest impact on supporting large-scale renewable energy development in California. As mentioned above, the key driver of renewable energy generation in California is the statewide RPS, and it is likely to continue to be the main driver for increasing the renewable content of the IOUs, like PG&E.

Policies which stimulate private sector investment and financing for renewable energy are also important, including the SB 32 feed-in tariff for mid- to large-scale renewable energy projects, and community solar legislation to clear the way for community-scale renewable energy (as discussed in Recommendation 10).

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Regulatory	Game Changing	State Government	Mid- to long-term	Department of Environment, CPUC, California Legislature, PG&E

RECOMMENDATION 38:

Advocate for State and Federal Incentives

The City should advocate for the continuation or extension of state and federal renewable energy grant and incentive programs, including the Investment Tax Credit, Production Tax Credit, and accelerated depreciation, and seek funding and technical assistance to support implementation of the City’s renewable energy plans and fulfillment of the 100% renewable goal.

Federal tax credits (including the Investment Tax Credit (ITC), Production Tax Credit (PTC), and accelerated depreciation) have played a major role in stimulating renewable energy development across the country. The ITC is in place through 2016, but the 1603 Treasury grant in lieu of the tax credit (which allowed project developers to receive the tax credit in the form of an up-front grant) expired in 2011, which many say will make financing more difficult. The PTC for wind expires at the end of 2012 and for geothermal at the end of 2013, which will have implications for utility-scale renewable energy development. Long-term certainty with these programs will help ensure continued market growth and deployment of renewable projects.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Policy Financial	Moves the Market	State and Federal Government	Near-to- midterm	Department of Environment, SFPUC, Federal Legislature

RECOMMENDATION 39:

Engage Public Pension Funds to Support Renewable Energy Deployment

The City, through the San Francisco Employees’ Retirement System (SFERS), should investigate opportunities to invest in clean energy to promote local economic development and renewable energy deployment while meeting the fund’s investment goals.

Public employee retirement funds, such as those managed by the San Francisco Employees’ Retirement System (SFERS), represent a large pool of patient capital that could be leveraged to advance the City’s clean energy goals, while promoting local economic development and providing a stable source of returns to the funds. The long-term investment horizon faced by pension systems fits perfectly with investments in clean energy assets, which generate returns for 20 years or more. SFERS could lend directly to approved infrastructure projects maturing

through a clean energy procurement process, agree to purchase bonds financing those projects, or some combination of the two.

Some public employee pension funds are already actively supporting renewable energy development as part of a diversified, socially-conscious portfolio. For example, the California Public Employees’ Retirement System (CalPERS) has approved a process for integrating environmental, social, and governance issues as a strategic priority. As part of its effort to address the risks and opportunities of climate change, CalPERS has invested significantly in solar, wind, and biomass companies. In all, by October 2011, CalPERS had \$1.2 billion of aggregate exposure to the alternative energy sector.¹¹⁴ The City should support SFERS in investigating clean energy investment opportunities that can help SFERS meet its fiduciary duty to retirees and help the City reach its renewable electricity goals.

Recommendation Type	Level of Impact	Decision-Making Level	Timeframe	Responsible Agencies
Financial Awareness	Enabling	Local Government & Private Sector	Near-to-midterm	Department of Environment, SF Employees’ Retirement System

¹¹⁴ CalPERS, *Toward Sustainable Investment*, 2012, pg 21.

CHAPTER 6

Reaching 100%: Next Steps, Timeline, and Responsibilities

Strategies to Achieve 100% Renewable Goal

In summary, in order to achieve the 100% renewable goal, San Francisco needs to undertake the following strategies:

Shrink the pie. Reducing total electricity demand through energy efficiency and conservation will reduce the amount of renewable energy needed to meet San Francisco's electricity demand.

Maximize on-site renewable generation where possible. San Francisco may not be able to source all of its electricity locally, but making use of the resources we do have will reduce transmission needs, improve local energy security and resiliency, and keep our energy dollars in the local economy. This requires ensuring that enabling policies and fair compensation structures are in place to support local DG, and that technical barriers are identified and addressed.

Expand access to community-scale renewable generation. Many San Francisco residents and businesses are unable to install on-site renewable energy, due to space, ownership, or financial barriers. Addressing barriers for tenants to take part in the renewable energy economy are particularly important given San Francisco's high percentage of renters and commercial tenants. The City should help provide options for all San Franciscans to access renewable energy in their community, whether through virtual net metering, district energy, community solar, or other investment opportunities.

Provide 100% renewable power purchasing options. In order to meet the remainder of the electricity demand that can't be supplied locally, there must be a way for San Franciscans to purchase renewable energy from local utilities. This can happen through full rollout of the CleanPowerSF program to San Francisco residents and businesses, PG&E implementing a green pricing program, increased delivery of SFPUC power to municipal tenants, public transit agencies, and new developments, and direct access customers contracting for renewable power from eligible ESPs.

Encourage private sector investment in renewable energy projects. Creating demand for renewable energy is the first step to developing a sustainable renewable energy market, but private sector investment is needed to ensure renewable energy projects are built to meet that demand. The City can facilitate and encourage the expansion of low-cost financing options

for renewable energy by supporting standardization to lower transaction costs, engaging potential lenders, and leveraging its own resources, both financial and operational.

Roles, Responsibilities, Timelines, and Impact Summary

The recommendations outlined in this report call for action by a number of City agencies, and for maximum impact, many must be undertaken in coordination with other government agencies and stakeholders. Several recommendations advocate for action at the state or federal level to drive renewable energy market development. Others enable informed consumer choice, and as such will ultimately require action by residents and businesses to have an effect on meeting the 100% goal.

Given the long-term nature of the topic under study, the report takes an extended view of the actions that policy makers can undertake that may contribute to meeting the City's desired goal of 100% renewable power, including both near- and long-term policies. Some of these longer-term recommendations require ongoing partnerships or programs that do not currently exist, may be costly, or may require additional research to implement. This report is not intended to provide a thorough analysis of each recommendation. Depending on what recommendations the Mayor and Board of Supervisors decide to pursue, further assessments of cost and other factors will likely be needed. However, it is important to include these types of recommendations in the report to ensure that they are thoroughly discussed and vetted in the public process.

The following table summarizes the recommendations from this report, along with the primary agencies responsible for implementing the recommendation (San Francisco agencies unless otherwise noted), the timeframe for action (near-term (2012-2015), mid-term (2015-2020), or long-term (2020-2030)), the ultimate level where decision-making must occur to achieve an impact on the 100% renewable goal, and finally what the potential impact of each recommendation is.

Key to Summary Recommendations Table:

Level of Impact

E = Enabling
 MM = Moves the Market
 GC = Game Changing

Decision-Making Level

I = Individual (consumer, resident or business action)
 SF = City & County of San Francisco (local government action)
 CA = State-level (legislative or regulatory decision)

Time-frame

N = Near-term (2012-2015)
 M = Mid-term (2015-2020)
 L = Long-term (2020 and beyond)

Responsible Agencies - Acronyms

BOS = San Francisco Board of Supervisors
 DBI – San Francisco Department of Building Inspection
 Planning = San Francisco Planning Department
 SFE = San Francisco Department of Environment
 SFERS = San Francisco Employees’ Retirement System
 SFPUC = San Francisco Public Utilities Commission
 BC3 = Business Council on Climate Change
 CPUC = California Public Utilities Commission
 DIR = California Department of Industrial Relations
 PG&E = Pacific Gas & Electric

Recommendation	Type	Level of Impact	Decision-Making Level	Time-frame	Responsible Agencies
Energy Efficiency					
1. Update Planning and Permitting Process	Policy	MM	SF	N	Planning, DBI, SFE
2. Strengthen Retrofit on Resale Rules	Policy	MM	SF	N	BOS, Planning, DBI, SFE
3. Promote Energy Audits	Awareness	MM	I, SF	N	SFE
4. Integrate Energy Labeling of Real Estate	Awareness	E	I, SF	N-M	Assessor-Recorder, SFE
5. Provide Outreach and Support for Property Owners	Awareness	E	I, SF	N	SFE
6. Facilitate Access to Energy Data	Awareness Regulatory	E	I, CA	N	SFE, SFPUC, CPUC
7. Undertake Building Energy Data Study	Technical Awareness	E	SF	N-M	SFE
Distributed Generation					
8. Support Expanding Net Energy Metering	Regulatory Financial	E	CA	N	SFE, SFPUC, CPUC
9. Support Expanding Virtual Net Metering	Regulatory Financial	MM	CA	N-M	SFE, SFPUC, CPUC
10. Support Community Renewable Energy Policies	Policy Financial	GC	CA	N-M	SFE, SFPUC, CPUC

11. Support Robust and Sustainable Feed-In-Tariffs for Local Renewables	Regulatory Financial	GC	SF, CA	M	SFE, SFPUC, CPUC
12. Streamline and Standardize Renewable Energy Permitting Processes	Policy	E	SF	N-M	SFE, DBI
13. Adopt a Solar-Ready Policy	Policy	E	SF	M	SFE, BOS
14. Address Solar System Shading	Policy	E	SF	M	SFE, DBI, Planning
15. Encourage Green Leases	Awareness Financial	E	I	N-M	SFE, BC3
16. Enable Energy Efficiency and Renewable Energy Pass-Throughs under Rent Control	Financial Policy	E	SF	N	BOS; SF Rent Board; SFE
17. Expand Clean Energy Financing	Financial	E	SF	N-M	SFE
18. Expand On-Bill Financing	Financial Regulatory	MM	CA	N-M	SFE, SFPUC, PG&E, CPUC
19. Recognize Solar Energy Installations as Real Property	Financial Policy	E	SF	N-M	Assessor- Recorder; SFE
20. Support Standardization and Expand Lending	Financial Awareness	E	SF, Private Sector	N-M-L	SFE, SFPUC, DOE
21. Fully Fund GoSolarSF	Financial	MM	SF	N	SFPUC, BOS
22. Prioritize Workforce Development	Policy	E	SF	N	SFPUC
23. Upgrade Distribution Grid Citywide	Technical Regulatory	E	SF, CA	M	PG&E, SFPUC, CPUC
24. Enable Distributed Generation on Downtown Network	Technical Regulatory	E	SF, CA	M	PG&E, SFPUC, CPUC
25. Support Energy Storage Market Development	Financial Technical Policy	E	SF, CA	M	SFPUC, SFE, CEC
26. Support Emerging Clean Technologies	Financial Technical Awareness	E	SF	N-M-L	SFE, SFPUC, CEC, DOE
27. Increase Use of Solar Water Heating	Awareness Policy Technical	E, MM	SF	N-M	SFE, DBI, Planning, SFPUC
28. Increase District Energy	Policy	GC	SF	N-M-L	Planning, SFPUC, SFE
Utility-Scale Generation					
29. Align Municipal Electricity Rates	Policy Financial	E	SF	N-M	SFPUC, BOS
30. Expand Municipal Deliveries of 100% Renewable Power	Policy Financial	MM	SF	N	SFPUC, BOS
31. Pursue Third-Party Ownership Structures with Private Sector Partners	Financial	E	SF	N-M	SFPUC
32. Utilize Energy Bonds	Financial	E	SF	N-M	SFPUC

33. Clarify Labor Requirements	Regulatory	E	SF, CA	N	SFPUC, DIR
34. Implement 100% Renewable Community Choice Aggregation Program	Policy Financial Awareness	GC	SF	N-M	BOS, SFPUC, SFE
35. Encourage Robust PG&E Green Power Purchasing Option	Regulatory Financial	MM	CA	M	SFE, PG&E, CPUC
36. Encourage Renewable Energy-Based Direct Access	Awareness	MM	SF	N-M	SFE, SFPUC, BART, CalTrain
37. Support Enabling Statewide Renewable Energy Policies	Policy Regulatory	GC	CA	M-L	SFE, CPUC, CA Legislature, PG&E
38. Advocate for State and Federal Incentives	Financial Policy	MM	CA, US	N-M	SFE, SFPUC, Fed'l Legislature
39. Engage Public Pension Funds to Support Renewable Energy Deployment	Financial Awareness	E	Private Sector (Banks, Renewables Industry)	N-M	SFE, SFERS

APPENDIX A: Glossary

AB – Assembly Bill

BART – Bay Area Rapid Transit

BC3 – Business Council on Climate Change

BOS – Board of Supervisors

CAISO – California Independent System Operator

CalPERS – California Public Employees' Retirement System

CCA – Community Choice Aggregation (CCA allows cities and counties to pool their residential, business, and municipal electricity loads, and purchase and/or generate power on their behalf. Electricity transmission, distribution, repair, and customer service functions remain with the incumbent utility. San Francisco's proposed CCA program is currently called CleanPowerSF)

CEC – California Energy Commission

CEUS – California Commercial End-Use Survey

CHP – Combined Heat and Power generation (a.k.a. cogeneration)

the City – the City and County of San Francisco

CO₂ – carbon dioxide

Cogeneration – Production of heat and power from one fuel source (a.k.a. CHP)

CPUC – California Public Utilities Commission

CREB – Clean Energy Renewable Bonds

CSI – California Solar Initiative (state solar photovoltaic incentive program)

CSI-Thermal – California Solar Initiative – Thermal (state solar water heating incentive program)

DA – Direct Access (a type of electricity customer class)

DBI – San Francisco Department of Building Inspection

DE - District Energy

DG – Distributed Generation

DOE – U.S. Department of Energy

ECB Ordinance – Existing Commercial Building Energy Performance Ordinance

ERP – San Francisco's Electricity Resource Plan

ESP – Electricity Service Providers (which sell power to DA customers)

FIT – Feed-In Tariff (A long-term, fixed rate contract for renewable energy generation)

GHG – Greenhouse gas

GW – gigawatt

GWh – Gigawatt-hours (Unit of energy equal to one billion watt-hours)

IOU – Investor-owned utility

ITC – Investment Tax Credit

kW – Kilowatt (A measure of electrical power, signifying the rate at which energy is generated or used)

kWh – Kilowatt Hour (A unit of energy equal to one kW of power used or generated over one hour)

MASH – Multifamily Affordable Solar Housing incentive program (part of CSI)

MMT – million metric tons

MW – Megawatt (Unit of electrical power equal to one million watts)

MWh – Megawatt hour (A unit of energy equal to one MW multiplied by one hour)

NEM – Net Energy Metering (Billing arrangement that provides customers with DG with credit for their system's generation)

OBF – On-Bill Financing

OBR – On-Bill Repayment

PACE – Property Assessed Clean Energy financing

PPA – Power Purchase Agreement (Financing option in which client pays a third party contractor for the energy produced by a renewable energy system)

PG&E – Pacific Gas and Electric (the IOU serving San Francisco)

PTC – Production Tax Credit (federal tax credit for renewable energy generation)

PV – Photovoltaic (a.k.a. Solar Electric)

QECB – Qualified Energy Conservation Bonds

REC – Renewable Energy Credit

RPS – Renewable Portfolio Standard (Percentage of electricity mandated to be sourced from renewables)

RECO – Residential Energy Conservation Ordinance

SB – Senate Bill

SFE – San Francisco Department of the Environment (also known as SF Environment)

SFPUC - San Francisco Public Utilities Commission

SFERS – San Francisco Employees' Retirement System

SPUR – San Francisco Planning and Urban Research Association

SWH - Solar Water Heating (Solar Thermal)

Therm – Unit of Heat Energy equal to 100,000 British Thermal Units

Trigeneration –Production of heat, cooling, and power generation from a single fuel source

VNM – Virtual Net Metering (Allocating the credit from one renewable energy system across multiple accounts without electrical hardwiring)

APPENDIX B: Task Force Meeting Schedule

The Mayor's Renewable Energy Task Force met from January 2011 through May 2012 to examine local and regional barriers to and opportunities for renewable energy, including policy, regulatory, technical, financial, and public awareness aspects. Most meetings included a presentation on a requested topic, followed by task force discussion. The schedule of meetings, meeting topics, and presenters follows:

Date	Topic(s)	Presenter(s)
February 9, 2011	Welcome Taskforce Scope and Goals Overview of San Francisco's electricity demand: baseline projections, and current efficiency and renewable energy initiatives	Mayor Edwin Lee Johanna Partin Danielle Murray
March 2, 2011	PG&E Renewable Energy Procurement	Ontario Smith, PG&E
April 5, 2011	SFPUC's 2011 Electricity Resource Plan and electricity rate structure Energy Efficiency Sub-committee presentation: building energy demand Local Renewable Electricity Opportunities	Manuel Ramirez, SFPUC Barbara Hale, SFPUC Sam Calisch, OtherLab Danielle Murray
May 5, 2011	SF Renewable Energy Programs, Policies and Research by Technology Energy Efficiency Subcommittee update on energy demand forecasts Break-out discussions: Large scale generation, distributed generation, and thermal energy	Danielle Murray Neal de Snoo
June 8, 2011	Overview of CPUC Renewable Energy Regulations and Programs	Sean Simon, CPUC
July 6, 2011	Distributed Generation Regulatory Issues and Opportunities	Adam Browning, Vote Solar
August 3, 2011	Renewable Energy Financing Opportunities	Dan Adler, CalCEF
September 26, 2011	Energy Data Subcommittee: Baseline & Forecasting	Chair: Neal de Snoo
September 26, 2011	Energy Efficiency subcommittee meeting	Chair: Carrie Byles
September 26, 2011	Utility scale generation subcommittee meeting	Chair: David Hochschild

APPENDIX B: TASK FORCE MEETING SCHEDULE

September 26, 2011	Distributed generation subcommittee meeting	Chair: Adam Browning
November 30, 2011	Energy Efficiency subcommittee meeting	Chair: Carrie Byles
November 30, 2011	Discussion of Task Force's Draft Recommendations: Energy Efficiency, Thermal & Utility-Scale Generation	Carrie Byles, SOM David Hochschild, Solaria
December 14, 2011	Discussion of Task Force's Draft Recommendations: Distributed Generation	Jeanine Cotter, Luminalt
May 8, 2012	Review and approval of Task Force draft recommendations report content	Danielle Murray