2011 Update
Of the
San Francisco Electricity Resource Plan
(2002 ERP)

Prepared by the San Francisco Public Utilities Commission

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EXECUTIVE SUMMARY

In 2009, the San Francisco Board of Supervisors urged the San Francisco Public Utilities Commission (SFPUC) to develop and update San Francisco's Electricity Resource Plan.1 The goal of the current plan, endorsed by the Board in 2002, is to "provide a long-term vision of the City's possible electricity future" through 2012 and to serve as a "policy guide to be used in proposing and implementing specific actions."

The original 2002 Electricity Resource Plan (2002 ERP) was a bold initiative for San Francisco to control its energy destiny and shape the future use of energy within the city. It was the result of a collaborative effort initiated by Supervisor Sophie Maxwell in early 2001 and was subsequently endorsed by the Board of Supervisors and signed by Mayor Willie Brown in December 2002.2

As a result of the adopted policies and actions it fostered, the 2002 ERP will have achieved its primary goal of closing down the Hunters Point and Potrero power plants3. The 2002 ERP also encouraged policies and actions that set San Francisco on a path to significant investment in renewable energy and energy efficiency.

The 2002 ERP also set broad energy goals for the City that are still applicable and relevant today.

[1] Ordinance 94-09.

[2] San Francisco Board of Supervisors' Resolution 827-02.

[3] Hunters Point Power Plant closed in May 2006. The Potrero Power Plant is scheduled to permanently cease operations on midnight, February 28, 2011.

ELECTRICITY RESOURCE PLAN GOALS (2002)
• **Assure Reliable Power** • **Maximize Energy Efficiency** • **Develop Renewable Power** • **Increase Local Control** • **Affordable Electric Bills** • **Improve Air Quality** • **Support Environmental Justice** • **Promote Economic Opportunities**

In urging the SFPUC to update the 2002 ERP, the Board of Supervisors reaffirmed their commitment that San Francisco should "**develop a plan to achieve the goal of San Francisco becoming fossil fuel free by 2030."** (Ordinance 81-08, emphasis added)

In updating the 2002 ERP, the SFPUC:

- Incorporated the requirements and guidance contained in other City ordinances and policies, including recent recommendations of the Peak Oil Task Force, and guidance from the Board of Supervisors on implementing CCA and recommendations from the Local Agency Formation Commission (LAFCO) regarding CCA implementation.
- Retained Rocky Mountain Institute (RMI), the authors of the original 2002 ERP, to develop electric resource scenarios to determine the feasibility of achieving a GHG-free electric system by 2030. RMI completed their draft report: "A Greenhouse Gas Free Electric Strategy for City of San Francisco" in May 2010;
- Incorporated requirements and guidance contained in State legislation and energy policies, including, for example, State Renewable Portfolio Standard (RPS) requirements, [AB32], the

Energy Action Plan which put energy efficiency first in loading order;
- Reviewed studies of renewable energy potential, energy efficiency estimates, and transmission line requirements developed by the California Public Utilities Commission (CPUC), California Independent System Operator (CAISO) and others;
- Convened a Green Technical Advisory Committee (Green TAC) composed of experts from the relevant green technologies, experts in public policy and renewable energy financing, and members of the Power Plant Task Force;
- Sought public input and comment through a series of meetings and opportunities for comment; and
- Incorporated new projections on electrical consumption in San Francisco.

This report synthesizes and combines the above activities into a single integrated document.

SHORT-TERM RECOMMENDATIONS

The major challenge in developing a city-wide electricity resource plan is the fragmented nature of the provision of electric service in San Francisco. Currently, the responsibility for purchasing and procuring San Francisco's electricity needs is divided between PG&E (78% of total usage), direct access providers (8%), and SFPUC's municipal load (14%). With the exception of public power services at Hunters Point and Treasure Island, PG&E owns and operates the electric distribution infrastructure system within San Francisco. With the exception of Trans Bay Cable, PG&E also owns all of the high-voltage transmission lines entering the City.

PG&E, Trans Bay Cable and the direct access providers are subject to extensive regulation by the California Public Utilities Commission (CPUC) with respect to retail transactions and electricity distribution, and the Federal Energy Regulatory Commission (FERC) with respect to applicable wholesale transactions and electricity transmission. This state and federal regulation pre-empts San Francisco from regulating terms and conditions for electric service by PG&E, Trans Bay Cable and direct access providers, and determines the rules under which San Francisco can use PG&E's distribution system and the transmission system serving San Francisco.

Given the limits on San Francisco's ability to directly regulate PG&E and the other electric service providers, this report recommends that, in the short-term, San Francisco focus its efforts on those activities where San Francisco not only has a strong ability to implement programs but also the legal ability (through incentives, ordinances, tax policies) to do so. Most of these activities fall into what are often called "Behind the Meter" programs in that they focus on activities that a customer can do without needing approval from state and/or federal regulatory authorities.

Behind the Meter programs include such activities as:

- Reducing a customer's energy demand through energy efficiency programs;
- Reducing peak energy usage through demand response and on-site storage; and
- Allowing customers to generate their own power on-site (for example through rooftop solar or on-site cogeneration).

Increasing energy efficiency efforts is perhaps the best approach for San Francisco to pursue. As Rocky Mountain Institute (RMI) noted in their report prepared for this update:

> It cannot be emphasized too strongly that continued *and increased* emphasis on energy efficiency is the least expensive lever to reduce San Francisco's GHG footprint. While accessing that opportunity is more complex than building or acquiring generation, it is well worth the effort and can dramatically help reduce system costs.[4]

There are also some areas of the City, such as at Treasure Island and Hunters Point for example, where the City can take a more active role because it serves all customers in those areas.

In most cases these activities can be carried out quicker than other longer-range activities. Thus they correspond to the Board's direction that the SFPUC develop short term goals that can be implemented quickly.

[4] RMI Draft Report, p. ES-14

An advantage of these local, behind-the-meter activities is that they promote local economic development and should improve the reliability of the local electric system. Many of the technologies that would be used to achieve this goal, such as energy efficiency and combined heat and power could also save customers money by reducing their overall energy costs over the life-of-the-project, although up-front costs are usually higher. A potential down-side, as noted in the RMI report, is that some of these local technologies, particularly roof-top solar and small-scale wind, are currently significantly more expensive than other energy resources and are thus not likely to constitute a significant part of San Francisco's resource mix unless their costs drop and/or extensive rebates/subsidies can be identified to promote their development.

RECOMMENDATIONS

EMPOWER CUSTOMERS AND LEVERAGE SAN FRANCISCO'S EXISTING CAPABILITIES WITHIN THE CITY TO PROMOTE ZERO-GHG REDUCTION TECHNOLOGIES

1. Develop San Francisco as a 'Green Test Bed' to promote and encourage the deployment of new energy technologies within the City as well as attracting green energy firms to locate within the City.

2. Improve and expand Energy Efficiency (EE) programs in San Francisco

3. Promote the development of Behind the Meter resources to encourage the optimal combination of energy efficiency, on-site generation (e.g. on-site wind or solar as well as efficient, low-emitting cogeneration) and load-shifting and demand response capability through smart-grid technology and energy storage.

4. Improve Building Standards to promote energy efficiency

5. Advance and support Community Scale Energy systems, both privately-owned as part of new development and through increased use of City-provided electric infrastructure where possible.

6. Promote Back-Up Storage deployment as an alternative to the existing use of diesel- and natural gas powered back-up generation.

LONG-TERM RECOMMENDATIONS

In order to significantly affect San Francisco's electricity usage and the renewable and GHG content of San Francisco's electricity supplies, San Francisco must either directly participate in the wholesale energy market or affect the wholesale procurement choices currently made by PG&E and other energy service providers, who currently provide 86% of San Francisco's electricity needs. Wholesale procurement choices refer to alternatives for sourcing electricity supplies from the broader Western U.S. electric grid (either through ownership of generating facilities or through purchase contracts) and not just from within San Francisco's boundaries. Absent increased means to influence and affect the procurement choices of PG&E and other third-party providers, it will be difficult for San Francisco to meet its goals of a zero-GHG electric system by 2030.

Fortunately, on-going efforts at the state level have significantly increased the percent of renewable energy that these entities will need to include in their deliveries to San Francisco. Recently the California Air Resources Board approved adoption of regulations that create a Renewable Electricity Standard (RES). The RES regulations, as approved, will expand the existing Renewable Portfolio Standard (RPS) such that PG&E and other energy service providers will be required to source 33% of their energy sales by 2020 from renewable resources classified as "RPS compliant."

In addition, Community Choice Aggregation (CCA) offers an opportunity for San Francisco to provide electricity supplies directly to customers that are currently served by PG&E and other third-party suppliers, so that San Francisco would have direct responsibility and control over the GHG and renewable content of those supplies. Towards that end, San Francisco has created its CCA Program – CleanPowerSF. The goal of CleanPowerSF is that 51% of the energy procured by the CCA will be from renewable resources by 2021. Wide participation in CleanPowerSF could serve as a significant component of GHG reductions as compared to continued reliance on PG&E and third party suppliers.

Further, San Francisco is also studying the construction of a City-owned transmission line that would finally connect San Francisco to the City's Hetch Hetchy electric generation and could provide improved access to renewable resources outside the City.

Finally, San Francisco intervenes in appropriate regulatory proceedings to ensure that PG&E and other energy service providers maximize their use of zero-GHG energy.

RECOMMENDATIONS

INCREASE AND EXPAND THE AMOUNT OF ZERO-GHG ENERGY PURCHASED FROM THE LARGER (WESTERN U.S.) WHOLESALE ENERGY MARKET FOR USE BY SAN FRANCISCO

7. Implement Community Choice Aggregation (CCA) consistent with guidance from the Board of Supervisors and LAFCO

8. Evaluate and develop new city-owned transmission projects to increase the delivery of Hetch Hetchy and renewable power to San Francisco.

9. Develop an optional "green pricing" option (through CCA and/or PG&E) allowing San Francisco customers to voluntarily commit to electric energy procured from zero-GHG energy sources.

10. Participate in regulatory proceedings before the CPUC and FERC to encourage state and federal policies to promote the use of GHG reduction strategies and encourage the development of CCA.

Regardless of the energy policies adopted by San Francisco, the SFPUC will remain responsible for providing electric service to municipal facilities. The following recommendations ensure that the SFPUC continue to provide reliable, reasonably-priced, and environmentally sensitive electric service.

ENSURE THE SFPUC CONTINUES TO PROVIDE RELIABLE, REASONABLY-PRICED, AND ENVIRONMENTALLY SENSITIVE ELECTRIC SERVICE

11. Develop a rate structure for the SFPUC that reflects the cost-of-service, promotes the efficient use of energy, and provides the SFPUC with the financial capability to use long-term financing to develop new energy sources.

12. Increase the use of municipal load electric energy from Hetch Hetchy to displace fossil-fuel use (e.g. shore side docking, recharging electric vehicles in City-owned parking lots).

13. Renegotiate the Interconnection Agreement (IA) with PG&E that governs the transmission and distribution of Hetch Hetchy energy to San Francisco that expires in August 2015.

14. Continue to implement the SFPUC's recently adopted Environmental Justice and Community Benefits policies.

FUNDING CONCERNS

Critical to achieving the goals of the ERP is identifying funding sources for the efforts needed to be undertaken to meet the goals of this plan, particularly given the City's current financial condition. Accordingly, a wide range of funding alternatives, including both public and private sector options, will need to be exploited to fully realize the City's goals. This update identifies potential funding alternatives.

ACHIEVING SAN FRANCISCO'S ZERO-GHG GOAL

In updating the 2002 ERP, the Board of Supervisors reaffirmed their commitment that San Francisco should "**develop a plan to achieve the goal of San Francisco becoming fossil fuel free by 2030."** (Ordinance 81-08, emphasis added)

The conclusions of the RMI draft report is that it is feasible to achieve this goal by 2030, but as noted above, is contingent on procuring an ever increasing amount of zero-GHG energy from the wholesale energy market. Almost all of the

lowest-cost renewable energy sources, according to RMI, are located outside San Francisco while small-scale in-city solar and wind are among the most expensive sources. Thus achievement of the zero-GHG goal requires influencing San Francisco's energy purchases from the wholesale market, either through implementation of CCA, or by using the regulatory process to encourage PG&E and other direct access energy providers to continue to move towards a zero-GHG electric supply.

Even without the CCA and regulatory efforts, however, GHG emissions from the electric sector should decrease significantly, for several reasons:

- The closure of the Potrero Power Plant should reduce GHG emissions from the electric sector by almost 25% from 1.7 million tons per year to 1.25 million tons.

- Implementation of California's 33% RPS requirements by 2020 should further reduce GHG emissions from San Francisco's electricity consumption.

- GHG reductions occurring as a result of any "cap-and-trade" programs for GHG emissions currently being developed by CARB

The following chart, prepared by RMI, shows forecasted GHG emissions from San Francisco's electric sector.

The SFPUC's GHG emissions are forecasted to be zero over the length of the RMI study, with SFPUC load being met primarily by Hetch Hetchy generation and remaining needs acquired from renewable energy sources.

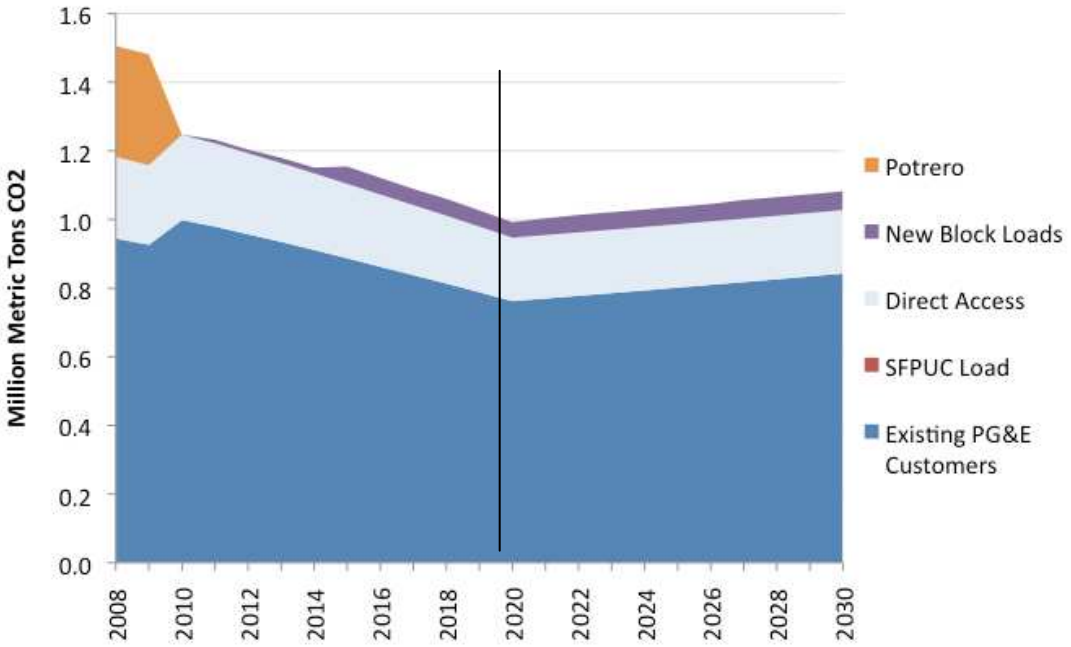
Post-2020, the RMI draft report forecasts GHG emissions from the electric sector increasing due to continued load growth (forecasted at 1.3%/year). However, this forecast does not assume any further improvements post-2020 in California's RPS requirements.[5] It also does not include any GHG reductions occurring as a result of any "cap-and-trade" programs for GHG emissions currently being developed by CARB.

[5] For example, CARB, in their AB32 Scoping Plan, discuss the possibility of further raising the RPS requirement post-2020, perhaps to 50%, in order to meet AB32's long-term goal of an 80% reduction in GHG emissions by 2050.

Successful implementation of CCA would also result in significant GHG reductions. The overall effect on San Francisco GHG emissions will be dependent upon the number of San Franciscans who choose CCA as their supplier.

The short- and long-term recommendations contained in this report will also reduce GHG-emissions.

Business as Usual Emissions in San Francisco's Electric System



NOTE: SFPUC GHG emissions are assumed to be zero by RMI
SOURCE: RMI Draft Report, Page ES-3

NEXT STEPS

This update, similar to the original 2002 ERP, should be considered as a living document, setting the broad goals for San Francisco and identifying opportunities. For each of the recommendations outlined, significant work remains to be done in order to achieve San Francisco's goal of zero-GHG emissions.

Fortunately, San Francisco already has on-going programs underway that are beginning to address, and implement, many of the recommendations contained in this report.

Achievement of San Francisco's goals cannot be done by the City and County of San Francisco (CCSF) alone. The 2002 ERP realized that:

> Implementation of the Plan will require the cooperation of many organizations, including but not limited to the California Public Utilities Commission (CPUC), the California Independent System Operator (CAISO), the California Energy Commission (CEC), the California Power Authority6, Pacific Gas and Electric Company, independent power developers, energy service companies and other departments and agencies of the City and County of San Francisco. (preface, p. iii)

Chapter 4 focuses on shorter-term options, recognizing the limitations that San Francisco faces in influencing energy choices made by PG&E and direct access providers. Chapter 5 provides longer-term options that seek to affect the broader wholesale energy market from which San Francisco businesses and residents obtain most of their electricity needs. Chapter 6 addresses the unique issues that the SFPUC must address in its provision of electric service to its municipal customers.

For each recommendation, potential concerns that would affect implementation are recognized, the need for changes to City Ordinances and potential funding sources are identified, and next steps proposed. For each of the broad recommendations contained in this report, we have referenced back to the relevant corresponding recommendations contained in the RMI draft report.

Chapter 7 provides a longer-term view of San Francisco's GHG emissions and the resources available to assist San Francisco in reaching its zero-GHG goal.

Finally, it should be noted that this report is only a planning document, laying out a vision of how San Francisco's energy future could evolve. Prior to implementation of many of the concepts identified in this report, the necessary approval of the SFPUC and/or the Board of Supervisors will be sought. Some concepts proposed may also require appropriate environmental review and approval under guidance from CEQA7.

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[6] Although legally this agency still exists, the Governor's Office has chosen neither to fund nor appoint board members to this agency, making it essentially inactive.

[7] The California Environmental Quality Act.

The timeline that identifies next steps over the next two years for each of the recommendations can be found in the adjoining document titled Implementation Timeline.

List of Abbreviations

CAISO	California Independent System Operator
CARB	California Air Resources Board
CCA	Community Choice Aggregation
CEC	California Energy Commission
CHP	Combined Heat and Power
CPUC	California Public Utilities Commission
DG	Distributed Generation
DR	Demand Response
EE	Energy Efficiency
ESP	Energy Services Provider
ET	Electrified Transport
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse Gas
HHWP	Hetch Hetchy Water and Power
IOU	Investor-Owned Utility
LSE	Load Serving Entity
LCOE	Levelized Cost of Energy
MPR	Market Price Referent
RE	Renewable Energy

RES	Renewable Energy Standard
RPS	Renewable Portfolio Standard
PG&E	Pacific Gas & Electric Company
PGC	Public Goods Charge
SFPUC	San Francisco Public Utilities Commission
WDT/SA	Wholesale Distribution Tariff/Service Agreement

TERMINOLOGY

ZERO GHG RESOURCES generate electric energy without directly releasing greenhouse gases. Both the RMI report and the California Air Resources Board definition of zero-GHG resources includes power from solar, wind, geothermal, biomass, hydroelectric and nuclear sources. However, for purposes of this study, it is assumed that the use of power from large hydroelectric and nuclear is limited to generation from existing sources.

GHG REDUCING TECHNOLOGIES improve the efficient use of fossil fuels and thus reduce their overall usage and associated GHG emissions. Cogeneration,, where it is more efficient to generate electric energy and thermal heat (e.g. steam and/or hot water) at the same time rather than have this performed as two separate processes is an example of a GHG reducing technology. Electric vehicles (EVs) are another example. Even though there may be GHG emissions associated with the electric energy needed to power the EV, these GHG emissions are significantly less than the GHG emissions from the automobile that is being replaced by the EV

CHAPTER 1
MANDATE FOR THIS REPORT

UPDATING SAN FRANCISCO'S ELECTRICITY RESOURCE PLAN

In 2009, the San Francisco Board of Supervisors urged the San Francisco Public Utilities Commission (SFPUC) to develop and update San Francisco's Electricity Resource Plan.[8] The goal of the current plan, endorsed by the Board in 2002, is to "provide a long-term vision of the City's possible electricity future" through 2012 and to serve as a "policy guide to be used in proposing and implementing specific actions."

The original 2002 Electricity Resource Plan (2002 ERP) was a bold initiative for San Francisco to control its energy destiny and shape the future use of energy within the city. It was the result of a collaborative effort initiated by Supervisor Sophie Maxwell in early 2001, when she introduced an ordinance to address the health and environmental consequences of electric generation in the City[9]. The Plan was subsequently endorsed by the Board of Supervisors and signed by Mayor Willie Brown in December 2002.[10]

A major impetus for the 2002 ERP was the desire to close the Hunters Point and Potrero power plants. In 2002, all of the electric transmission lines serving San Francisco ran up the Peninsula, creating transmission constraints that required these two power plants to remain in operation to maintain reliable electric service within San Francisco. As the 2002 ERP stated:

> Both of the[se] power plants…are older, relatively inefficient fossil-fueled power plants. Both plants are also located within the Southeastern portion of San Francisco, an area subject to abnormally high rates of asthma and other environmental problems.

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[8] Ordinance 94-09

[9] The Human Health and Environment Protections for New Electric Generation Ordinance (Ordinance 124-01) required the city to adopt a plan to "…implement all practical transmission, conservation, efficiency, and renewable alternatives to fossil fuel generation in the City and County of San Francisco."

[10] San Francisco Board of Supervisors' Resolution 827-02.

The 2002 Electricity Resource Plan will achieve its goal of shutting down San Francisco's legacy power plants at Hunters Point and Potrero and has spurred significant investments in renewable energy and energy efficiency programs.

As a result of actions taken pursuant to the 2002 ERP, the Hunters Point power plant shut down in May 2006 and the Potrero power plant is in the process of being shut down by no later than February 28, 2011.

The 2002 ERP provided the framework for the City to work with the California ISO to identify the transmission upgrades[11] that, once completed, allowed for the Hunters Point Power Plant to be shut down in 2006.

Pacific Gas & Electric Company (PG&E), pursuant to a 1998 agreement with the City, has dismantled the plant and is restoring the site for other uses, including potential residential development.

The Potrero power plant is being shut down now that the $505 million12 Trans Bay Cable has begun commercial operation. The Trans Bay Cable is a 53-mile high-voltage direct current transmission line that runs underneath the San Francisco Bay from a substation located in the City of Pittsburg to the Potrero substation in San Francisco. Once operational it will increase the ability to deliver power into San Francisco by 400 Megawatts (MW) equal to about 40% of

[11] In order to close the Hunters Point power plant, the 2002 ERP set a goal of adding 100 MW of new transmission capacity by 2005 and an additional 350 MW of capacity by 2006. This was achieved through ;

- A planned upgrade from 60 Kv to 115 Kv of the sixth overhead transmission line running from San Mateo to Martin substation (the other five overhead transmission lines were already at 115 kV) which was completed in 2005; and
- The construction of the 230 kV Jefferson–Martin underground transmission line that runs from PG&E's Jefferson substation (near Redwood City) to Martin that was completed in 2006.

[12] This is the cost reported by Trans Bay Cable in their filing before FERC to recover, through electric rates paid by all transmission users of the California ISO, the costs of the project. FERC has yet to issue a decision as to how much of this cost is reasonable and should be recovered from ratepayers.

San Francisco's peak electric usage of 950 MW. Prior to Trans Bay Cable commencing operation, the California ISO had determined that the Potrero plant needed to remain in operation in order to ensure reliable electric service to San Francisco. Once the Potrero power plant is shut down, the site will be remediated and then be redeveloped in conjunction with the planned redevelopment of Pier 70.

The 2002 ERP originally proposed that the SFPUC construct 200 MW of new in-city generation that would have allowed for the retirement of the Potrero Power Plant.13 The SFPUC pursued this project (known as the San Francisco Energy Reliability Project or more informally as "the peakers") until the Trans Bay Cable project (along with other transmission system improvements) was identified as an alternative approach to closing the Potrero power plant.

The Trans Bay Cable project was not part of the 2002 ERP but was identified as part of a stakeholder process, begun in February 2004 by the California ISO, to develop long-term solutions to the reliability of San Francisco's electric system. This stakeholder process was a follow-up to the initial stakeholder process that identified the needed transmission upgrades, included in the 2002 ERP that allowed for the closure of the Hunters Point power plant.

SAN FRANCISCO'S ENERGY GOALS AS OUTLINED IN THE 2002 ERP HAVE NOT CHANGED

The 2002 ERP, after extensive public discussion, adopted eight broad goals for San Francisco's energy policy in addition to its goal of closing the Hunters Point and Potrero power plants.

Although each of these goals represents important on-going commitments (such as supporting environmental justice) the relative importance of some of these goals has changed since the time of the original 2002 ERP. When San Francisco prepared the 2002 ERP, for example, reliable service was a major concern as San Francisco was facing rolling blackouts in the midst of the California energy crisis and PG&E, the major provider of electric service to San Francisco, was in bankruptcy.

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[13] In late 2002, San Francisco obtained four gas-fired combustion turbine generators along with funds to develop the facilities) through a legal settlement with Williams Companies, Inc. to resolve complaints about market manipulation during the California energy crisis.

SAN FRANCISCO'S ENERGY GOALS
(AS ADOPTED BY SAN FRANCISCO IN 2002 AND INCORPORATED INTO THE SFPUC BUSINESS PLAN)

ELECTRICITY RESOURCE PLAN GOALS (2002)

- **Assure Reliable Power**
- **Maximize Energy Efficiency**
- **Develop Renewable Power**
- **Increase Local Control**
- **Affordable Electric Bills**
- **Improve Air Quality**
- **Support Environmental Justice**
- **Promote Economic Opportunities**

Today, the significant investments in new transmission projects such as Trans Bay Cable and various PG&E upgrades since 2002 have created a much more robust transmission system, although PG&E's aging in-city distribution system continues to create local reliability problems at the distribution level.

The new investments in transmission infrastructure, along with in-City demand reduction and supply resources precludes the need for any large-scale, central generation to be built in the City in the foreseeable future.14 As discussed in Recommendation #7, the SFPUC is studying additional transmission projects to

[14] An additional concern at the time of the 2002 ERP was Mirant's proposal in 2000 to re-power the Potrero power plant by constructing a new and larger (540 MW) plant at the existing site. Extensive opposition to this proposal, both from San Francisco's elected leaders as well as neighborhood groups resulted in Mirant canceling its proposal in 2003

the City (as directed by Resolution 414-07 and 299-08) to ensure over the even longer-term that there will continue to be no need for large-scale generation within the City. The SFPUC is also examining, as is PG&E, potential upgrades to further improve the reliability of the higher voltage (230 kV) transmission system that serves downtown San Francisco.

STATE AND LOCAL ACTIONS SINCE 2002 HAVE PROMOTED ENERGY EFFICIENCY AND RENEWABLE ENERGY DEVELOPMENT AS PART OF EFFORTS TO REDUCE GREENHOUSE GAS EMISSIONS

With the passage of ordinance 81-08, the Board of Supervisors laid out a clear path for San Francisco's energy future, requiring that the city **"…develop a plan to achieve the goal of San Francisco becoming fossil fuel free by 2030."**

In many ways, the 2002 ERP could be considered prescient and ahead of its time. The 2002 ERP advocated reducing greenhouse gases (GHG), developing renewable energy, and promoting energy efficiency back in 2002. Many of these same goals have subsequently been adopted by the State of California, albeit not until the years 2005 and 2006. Recently, the Board of Supervisors directed that San Francisco should develop a plan to achieve the goal of San Francisco becoming fossil fuel free by 2030. (Ordinance 81-08). Perhaps the most important change since the 2002 ERP has been California's groundbreaking commitment to develop renewable power and energy efficiency as the cornerstone of the state's energy policy and the state's efforts to reduce GHG emissions.

In 2002, California adopted, via legislation, the Renewables Portfolio Standard (RPS) that requires both PG&E, as well as all Energy Service Providers, to meet at least 20% of their energy needs by 2012[15] from renewable energy sources other than large hydroelectric sources (also known as RPS-renewable resources). In September, 2010, the California Air Resources Board (CARB) approved adoption

[15] The legislation adopted a 2010 compliance target for achieving the 20% goal but allows two years for utilities to make up any shortfalls essentially creating a 2012 compliance deadline. Legislation currently being proposed would establish 2012 as the date to achieve 20% compliance.

of regulations establishing a Renewable Electricity Standard (RES)[16] that increased this requirement to 33% by 2020.[17]

The CARB's Renewable Electricity Standard, allows the SFPUC to meet all of its energy needs that are not met by its existing GHG-free Hetch Hetchy power with RPS-eligible renewable resources. This will make San Francisco the largest public utility in the state to have zero-GHG emissions for its electric generation.

In 2006, California also adopted the California Solar Initiative, providing $2.8 billion in incentives between 2007 and 2016 to spur the installation of 3,000 MW of rooftop solar installations. To complement this program, San Francisco adopted its GoSolarSF program, operated by the SFPUC, which provides additional incentives to San Francisco residents and businesses to install rooftop solar. This program is funded through 2016 at the rate of $5 million per year.

In 2005, the state adopted an Energy Action Plan (EAP) that established state policy that future energy needs should be met first with energy efficiency and demand response, secondly with distributed generation and renewable energy, and then finally with low-emitting fossil fuels (i.e. natural gas).[18] As a result statewide funding of energy efficiency has significantly increased to over $1 billion per year. .

In 2006, with the passage of AB32, California's Global Warming Solutions Act, California has now committed to reducing its greenhouse gas (GHG) emissions to 1990 levels by the year 2020. This will require approximately a 25% reduction

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[16] Since both the CARB's RES program and the RPS program have similar goals and mechanisms, for ease of reference "RPS eligible" resources will include resources eligible under both the RES and RPS programs.

[17] CARB implemented its RES standard under its regulatory authority in response to an Executive Order issued by Governor Arnold Schwarzenegger after he vetoed AB64/SB14, two pieces of legislation that would have expanded the state's existing renewable portfolio standard (RPS) from 20% to 33%. SB722, which also would have established a 33% RPS failed to clear the Legislature prior to the end of the last session in August, 2010 but has been reintroduced (as SB22) in the just started new legislative session.

[18] In Resolution 227-08, San Francisco "adopt[ed] the State's Energy Action Plan and the priorities held therein", adopting the same priorities of "energy efficiency and demand response first, then renewable and lastly clean burning fossil generation." As Resolution 227-08 also noted, The State's Energy Action Plan "also includes additional policies that the City may want to consider further before endorsing. (for example, evaluating so-called "clean coal."

from current levels. This goal is similar to, although not as strict as, San Francisco's Climate Action Goals adopted in 2002.

THE SFPUC HAS MADE SUBSTANTIAL PROGRESS IN ACHIEVING THE GOALS SET FORTH IN THE 2002 ERP.

Since the 2002 ERP, the SFPUC has made substantial progress on the goals set forth in the plan.

The SFPUC installed over 7 MW of new solar photovoltaic generation on municipal facilities both within San Francisco and at the Airport. This includes the 5 MW Sunset Reservoir scheduled to come on-line in 2011.

In the private sector, San Francisco residents have also actively installed roof-top solar photovoltaic projects, most of them taking advantage of the rebates available at the state level through the California Solar Initiative, as well as supplemental payments from the SFPUC's GoSolarSF program. As of August 2010, there were over 2.000 installed PV sites with an installed capacity of 8.3 MW.

In total, San Francisco has installed over 13 MW of solar photovoltaic capacity since the 2002 ERP.

SOLAR PHOTOVOLTAIC INSTALLATIONS IN SAN FRANCISCO

SFPUC

Generator Plant	Size (kW)	Cost ($) Millions[19]	Date in Service
OWNED BY SAN FRANCISCO			
Moscone	675	4.7	Oct 2003
Southeast	255	1.9	Oct 2005
Pier 96	245	2.3	Jan 2007
CDD	134	1.9	Dec 2007
North Point	241	2	Dec 2007
Maxine Hall	32	0.35	Dec 2007
China Town	10	0.15	Dec 2007
SFO	492	5.5	Feb 2008
Sub-Total - owned	**2,084**	**18.8**	
UNDER LONG-TERM CONTRACT			
Sunset Reservoir[20]	5,000	23.5 c/KWh	1st. Qtr. 2011
Total	**7,084**		

[19] Costs shown include available rebates.

[20] Generation from the Sunset Reservoir photovoltaic project is purchased by the SFPUC under a long-term Power Purchase Agreement (PPA) at an initial price of 23.5 c/KWh escalated for inflation beginning in July 2009.

SOLAR PHOTOVOLTAIC INSTALLATIONS IN SAN FRANCISCO BY SAN FRANCISCO RESIDENTS AND BUSINESSES

SOURCE: SF Solar Map (www.sf.solarmap.org)

Although not a renewable energy source, the 2002 ERP also advocated for the increased use of Combined Heat and Power (CHP) also known as cogeneration. Cogeneration units generate both electricity (either for use on-site or to be sold to others) with the waste heat produced by the generator then being used to heat the facility, generate steam, or provide hot water. Although cogeneration consumes fossil fuels, the combined use of the fuel for both electric generation and heating purposes results in a highly-efficient system and reduces the use of fossil-fuels (such as natural gas) that would otherwise be needed for heating.

San Francisco currently has over 27 CHP installations with a total capacity of 60 MW. One-half of this capacity is located at the San Francisco International airport. Since the 2002 ERP, almost 7 MW of new cogeneration capacity was built in San Francisco between 2003 and 2007,or approximately 1.5 MW per year[21]

Energy Efficiency Programs have also been Reinvigorated

Along with the State of California's enhanced commitment to renewable energy, the State has also made a corresponding commitment to maximizing the use of energy efficiency. The Energy Action Plan, adopted by the State, now establishes a "loading order" that requires investor owned such as PG&E to perform all feasible energy efficiency activities prior to procuring new energy resources.

The SFPUC, through the Sustainable Energy Account[22] sets-aside at least 5% of gross revenues from Hetch Hetchy power sales to fund energy efficiency and renewable energy projects for municipal facilities. Over the past five years, the SFPUC has spent over $35 million on energy efficiency projects at 140 locations.

SFPUC has developed a Ten Year plan of energy efficiency improvements and projects which has been budgeted as part of the SFPUC's 10-year Capital Improvement Program (CIP) at $42 million over the next ten years. The 10-year Capital Improvement Program will also spend $16 million over the next two years (FY2011-12 and 2012-2013) to convert 3/4ths (75%) of San Francisco's street light fixtures (18,000 out of 24,000) to more energy-efficient and longer-lasting LED lighting that will be combined with a smart controller system to optimize their operation.

To further improve energy efficiency, San Francisco has revised its building code to require all new construction in San Francisco to require increasingly stricter "green building" standards that minimize energy usage and encourage the use of renewable power. The new standards will require all new buildings in San Francisco to meet and exceed California's existing energy standards[23] by 15%, regardless of size or occupancy, as well as requiring larger commercial buildings to meet 1% of their energy needs from renewable power.

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[21] Perea, Philip M. 2007. An Assessment of Cogeneration for City of San Francisco. Prepared for Department of Environment and City and County of San Francisco. June. Table 2. Cogeneration Facilities in San Francisco.

[22] This account was previously called the Mayor's Energy Conservation Account (MECA)

[23] Known as Title 24 and established by the California Energy Commission.

2002 ELECTRICITY RESOURCE PLAN
MAJOR ACCOMPLISHMENTS

Closing the Legacy Plants

- *Hunters Point Power Plant closed in 2006.*
- *Mirant Potrero Power Plan in process of being closed by February 28, 2011.*

Renewable Energy and Energy Efficiency

- *SFPUC has developed over 7 MW of solar projects on city-buildings.*
- *Over 2,000 residences and businesses will have installed over 8 MW of solar photovoltaics, many of which have taken advantage of incentives provided by the SFPUC's GoSolarSF program.*
- *Significant reduction in energy usage through enhanced energy efficiency.*
- *New building standards adopted to enhance energy efficiency.*

Reliable Service

- *Significant investments in new transmission projects such as Trans Bay Cable and various PG&E upgrades since 2002 have created a much more robust transmission system in San Francisco even with the retirement of the Hunters Point and Potrero power plants.*

Increasing Local Control

- *SFPUC is pursuing Community Choice Aggregation.*
- *SFPUC is providing distribution service within San Francisco at Hunters Point and Treasure Island giving San Francisco increasing control over its utility infrastructure.*
- *SFPUC is pursuing new transmission projects to ensure the reliability of San Francisco and increase its access to renewable energy sources.*

SAN FRANCISCO IS ALSO INCREASING ITS LOCAL CONTROL OF ITS ENERGY FUTURE

One of the other main goals of the 2002 ERP was to increase San Francisco's direct control over its energy future. One way to achieve this goal is through Community Choice Aggregation (CCA). Assembly Bill (AB)117 (Migden) created the concept of CCA, whereby a city or local government could take over

the procurement of energy for its residents. Under CCA, San Francisco would be the provider of energy to all customers within San Francisco other than those who opt-out of the program and remain with either PG&E or an Energy Service Provider (ESP). PG&E would continue to provide distribution and transmission service for the CCA program, transmitting the CCA's energy to CCA customers over PG&E's wires.. The CCA customers would continue to receive energy efficiency services funded through the Public Goods Charges (PGC).

Since 2002, San Francisco has created its own CCA program, CleanPowerSF, and is currently in the process of identifying an energy supplier. One goal of the San Francisco CCA is to offer a portfolio of energy resources that will be 51% renewable by 2021, significantly higher than the 33% that PG&E should have achieved by that time. (See Recommendation #5).

Another option for San Francisco to better control its energy future is to increase the amount of San Francisco's load that is under SFPUC control. In 1999, the Board of Supervisors amended the San Francisco Administrative Code[24] to require the City to evaluate the provision of electric service to any new City developments, including military base reuse projects, redevelopment projects, and other City projects. In compliance with this directive, the SFPUC has become the provider of electric distribution services to both the Treasure Island and recently the Hunters Point redevelopment projects. Both of these sites were previously military installations.

The SFPUC is also examining new City-owned transmission lines to deliver Hetch Hetchy power to San Francisco.

[24] The Ordinance added Chapter 99, Public Power in new City Developments to the San Francisco Administrative Code.

CHAPTER 2
THE PROCESS OF UPDATING THE ELECTRICITY RESOURCE PLAN

Ordinance 94-09 urged the SFPUC to update San Francisco's Electricity Resource Plan and directed the SFPUC to identify both the short term and long-term goals needed to meet the City's energy needs. In developing these goals, the SFPUC was to consider the transmission and distribution needs of the City, energy resources (including energy efficiency and renewable energy) needed to meet the City's energy needs, evaluate cost-effective options to reduce greenhouse gas emissions from the electric sector, and identify how meeting these needs interacts with the City's existing workforce development initiatives.

The Board's desire to update the ERP also provided the SFPUC the opportunity to examine the necessary steps to "…develop a plan to achieve the goal of San Francisco becoming fossil fuel free by 2030" as requested by Ordinance 81-08.

ORDINANCE 94-09
Closing Potrero Power Plant and Updating the Electricity Resource Plan

The Board of Supervisors urges the PUC to produce, within six months of the effective date of this resolution Ordinance, an update to the Electricity Resource Plan. The process of updating the Electricity Resource Plan should include public outreach to citizens, businesses, and all potentially interested groups including the Power Plant Task Force. The update should identify the most effective and economic means of implementing the goals of this Ordinance over the short and long term, and shall consider, without limitation, the following:

(i) Transmission needs to transport Hetch Hetchy generation and cost-effective clean resources into the City, and alternatives for meeting those needs, including, construction of City-owned transmission lines, contracts or joint transmission projects with other municipalities, and participation in the ISO transmission markets; and

(ii) Transmission and distribution needs within the City to support reliability and facilitate distributed generation and renewables, including without limitation connections between substations and the 115 and 230 kV transmission systems within the City, and transmission and distribution needs to meet new City developments; and

(iii) Resources needed to meet municipal electric loads, Community Choice Aggregation loads, other potential City loads, and the City's resource adequacy capacity obligations, including (i) options to maximize cost-effective energy efficiency and demand-reduction, and local and remote renewable and clean resources, and (ii) an analysis of alternatives for use of renewable fuels, clean and flexible resources, and storage alternatives; and

(iv) Cost-effective options to reduce greenhouse gas emissions from the electricity sector and to offset greenhouse gas emissions from other sectors; and

(v) Participation in existing City workforce development initiatives with respect to jobs related to the operation, acquisition, reconstruction, replacement, expansion, repair, or improvement of energy facilities under the jurisdiction of the Public Utilities Commission; and

(vi) Specific projections of electric demand, conservation and energy efficiency achievements, and clean and renewable resource development, and

(vii) Recommendations for updated clean energy goals for the City.

In response to the Board's request, the SFPUC undertook the following actions.

Incorporation of Guidance from Other City Ordinances and Policies

SFPUC staff included within the report the requirements and guidance contained in other City ordinances and policies. This includes the recent recommendations of the Peak Oil Task Force25. For Community Choice Aggregation, the report includes guidance given to the SFPUC by the Board of Supervisors on implementing CCA and appropriate recommendations from the Local Agency Formation Commission (LAFCO) in their consultative role to the Board.

Retaining Rocky Mountain Institute (RMI)

The SFPUC retrained Rocky Mountain Institute (RMI), the authors of the original 2002 ERP, to develop electric resource scenarios to determine the feasibility of achieving a GHG-free electric system by 2030. RMI completed their draft report; "A Greenhouse Gas Free Electric Strategy for City of San Francisco" in May 2010. RMI determined that it was feasible to reach the zero GHG goal by 2030 through the extensive deployment of renewable energy, smart grid/storage technology, distributed generation, and energy efficiency. RMI also assembled a number of recommended actions to help San Francisco achieve this goal. Many of these recommendations were based on discussions/interviews with San Francisco's energy stakeholders. RMI's recommendations are contained in Appendix #1 to this report.

Reviewing California Energy Policy and Other Studies

The SFPUC reviewed applicable state and federal energy policies and regulations for their effect on San Francisco. This included reviewing studies of renewable energy potential, energy efficiency estimates, and transmission line requirements developed by the California Public Utilities Commission (CPUC), California ISO and others;

[25] Recommendation 3.4.3 of the Peak Oil Task Force is itself a recommendation for San Francisco to "Produce an Updated Electricity Resource Plan.

Creation of a Green Technical Advisory Committee (Green TAC)

In conjunction with the Power Plant Task Force[26], the SFPUC convened a Green Technical Advisory Committee (Green TAC) composed of experts from the relevant green technologies (solar, wind, energy efficiency/demand response, combined heat and power, energy storage), experts in public policy and renewable energy financing, and members of the Power Plant Task Force. Appendix #2 lists the member of Green TAC and their affiliations.27 The Green TAC met four times between August and September and reviewed the draft RMI report. Additionally, the Green TAC provided valuable input into prioritizing the recommendations.

One of the main purposes of the Green TAC was to provide an additional "set of eyes" and an expert peer review of the RMI draft.

Seeking Public Input and Providing an Opportunity to Comment

Ordinance 94-09 directed that "The process of updating the Electricity Resource Plan should include public outreach to citizens, businesses, and all potentially interested groups including the Power Plant Task Force."

In response to this guidance, the SFPUC has held numerous meetings in a variety of forums to present the report's findings and seek public input. A full listing of these efforts is contained in Appendix #3.

This report synthesizes and combines into a single integrated report all of the above inputs.

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[26] The Power Plant Task Force was created by Board of Supervisors Resolution No. 119-04 to be the on-going successor to the Potrero Power Plant Citizens Advisory Task Force (Resolution 362-99). Originally charged with providing the Board with input regarding the potential sale of Hunters Point Power Plant and Southern Company's (Mirant) purchase of the Potrero Power Plant, the current role of the Task Force is to advise the Board on issues related to the construction of new power generating facilities in the Southeast portion of San Francisco, power demand management, and an energy policy for the City.

[27] Affiliations are provided for identification purposes only and do not represent endorsement by the listed entity for Green TAC's recommendations.

CHAPTER 3 – BACKGROUND ON SAN FRANCISCO'S ELECTRIC USAGE

Total energy usage in San Francisco is approximately 6,000 gigawatt hours (GWh) per year, and is forecasted by RMI to grow at the rate of 1.3% per year to approximately 8,000 GWh per year by 2030[28].

ENERGY VOCABULARY

A typical incandescent light bulb uses 100 watts of power per hour or 1/10th of a kilowatt/hour (KWh).

An average home uses about 1 Kilowatt of energy per hour (1 KWh) or about 500 KWh per month or 6,000 KWh per year. This is equal to 6 Megawatt/hours.

A Megawatt (MW) is 1,000 Kilowatts. Average electric demand in San Francisco is about 700 Megawatts per hour (MWh) and peak demand (the highest hourly demand) is about 970 MWh.

A Gigawatt is 1,000 Megawatt hours (MWh) or 1,000,000 kilowatt hours (KWh).

Three primary providers serve the electricity needs for the City. Pacific Gas and Electric Company (PG&E) is the energy provider for retail customer loads serving about 75% (4,500 GWh) of the electric energy used in San Francisco. The San Francisco Public Utilities Commission (SFPUC) Power Enterprise serves all municipal facilities and selected other customers. The SFPUC provided about 17% (1,000 GWh) of San Francisco's energy usage.[29] The remaining 8% of energy

[28] This is the baseline forecast that already includes the effects of on-going energy efficiency efforts to reduce demand. One of the goals of this report, and a recommendation of both RMI and GTAC, is to maximize the use of cost-effective energy efficiency to reduce this growth rate further.

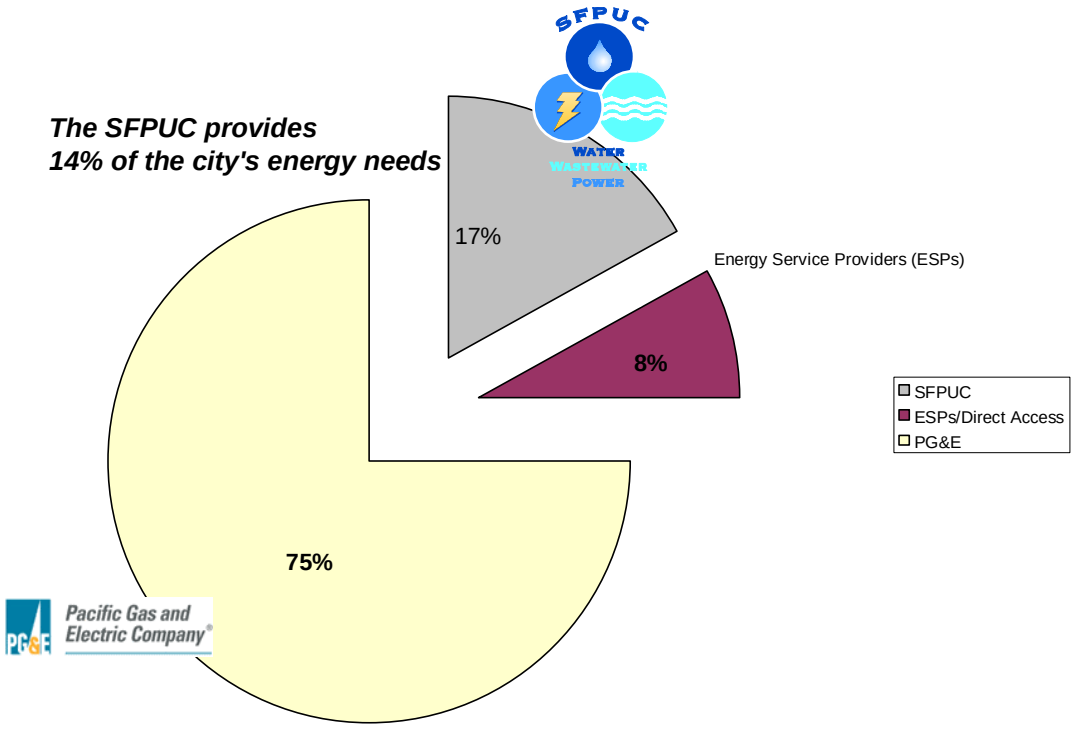
[29] For purposes of this report the SFPUC's provision of electric service to San Francisco International Airport (SFO) is included in total energy usage for the City.

is supplied by third-party electric service providers (ESPs) that serve direct access customers. Direct access customers are those customers who can choose to buy their energy from a third party via direct bilateral contracts[30].

[30] Direct Access, created as a result of California's restructuring of its electric industry in 1998 through AB1890, allowed individual customers to purchase their electric energy directly from generators or other suppliers while PG&E would continue to be responsible for the energy's transmission and distribution. Although the State Legislature suspended direct access during the energy crisis in 2001, existing direct access customers were grandfathered and allowed to remain in the program. In San Francisco, although fewer than 800 customers use direct access, given their large size they constitute about 10% of total energy usage in the city and include about 60% of San Francisco's largest customers (such as downtown office buildings, large department stores, and industrial customers). As a result of SB695, passed by the Legislature in 2010, large customers will again be able to choose direct access, subject to the total amount of direct access load being capped at a set percentage of the utility's total load. Residential and small commercial customers will not be eligible for direct access.

RESPONSIBILITY FOR PROCURING ELECTRIC ENERGY TO SAN FRANCISCO IS DIVIDED AMONGST THE SFPUC, PG&E AND ENERGY SERVICE PROVIDERS

(% OF SAN FRANCISCO ELECTRIC ENERGY USE SERVED BY PROVIDER)



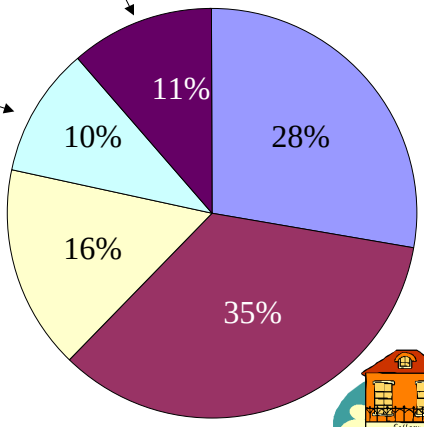
Source: SFPUC 2005 CCA Implementation Study, SFPUC Business Plan, PG&E 2005 Martin Substation Load Data

ELECTRIC ENERGY USAGE IN SAN FRANCISCO
BY VOLUME
TOTAL USAGE: 6,000 GWH

Municipal

Residential
326,000 accts

Direct Access
600 accts



Large Commercial
Industrial
800 accts

Commercial
34,000 accts

OUTSIDE SAN FRANCISCO

SF International Airport
(Served by SFPUC)
500 Gwh/year

ELECTRIC USE BY END-SECTOR

	2008	
	GWh	% of Consumption
Commercial Lighting	1,200	20%
Commercial Other	1,000	16%
Commercial HVAC	830	14%
Commercial Refrigeration	460	8%
Residential Lighting	570	10%
Residential Other	510	8%
Residential Refrigeration	230	4%
Residential Heating	100	2%
Residential AC	-	0%
Municipal	1,000	17%
Industrial	130	2%

SOURCES: RMI Draft Report, p. 11, SFPUC 2005 CCA Implementation Study, SFPUC Business Plan, PG&E 2005 Martin Substation Load Data

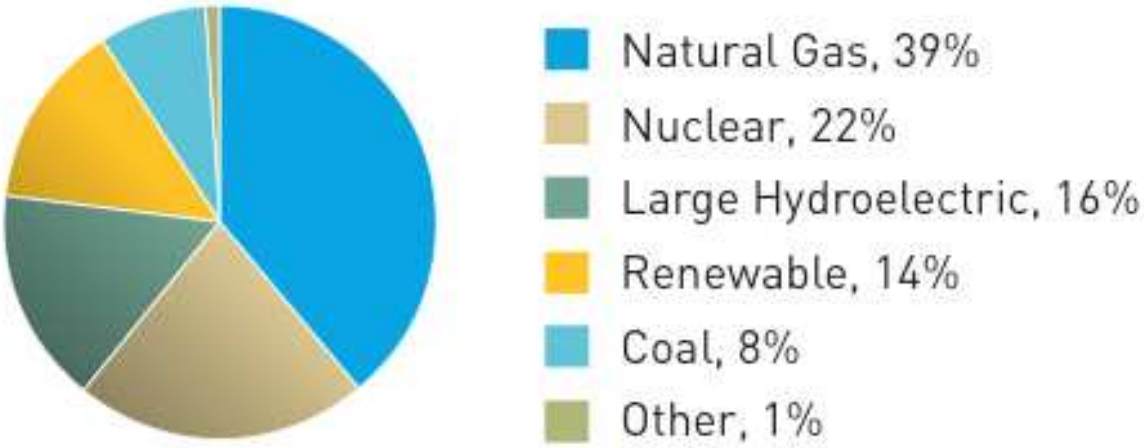
GHG emissions from the electric sector represent about 1/4th (24%) of San Francisco's total GHG emissions (1.7 million tons out of 7 million tons) with transportation responsible for about ½ (53%) of total emissions and natural gas and steam usage accounting for the remainder (24%).

RMI's calculations are based on examining the underlying resource portfolio for each of three main energy providers in San Francisco.

PG&E's resource mix (which is the same for its City customers as it is for the rest of its system) includes a significant amount of large hydroelectric power and nuclear generation (38%)[31]. Another 14% of its generation mix consists of renewable generation. Together, these carbon-free generation resources total over 50% of PG&E's portfolio. The remaining half (48%) of PG&E's supply mix consists of fossil-fired power plants, mostly natural gas. PG&E is required to increase its renewable generation to 33% of electricity sales by 2020 to comply with CARB's RES standards and California's renewable portfolio standard.

[31] RMI's definition of zero-GHG energy resource includes nuclear and hydroelectric generation and is similar to the definition recently adopted by the California Air Resources Board for existing resources.

PG&E's 2008 Electric Power Mix Delivered to Retail Customers[32]



Energy supplies for the SFPUC come almost completely from the three hydroelectric power plants that the SFPUC owns and operates associated with San Francisco's Hetch Hetchy system.

Under the City's "water first" policy, the primary purpose of the system is to provide water to over 2.5 million customers, including all San Francisco residents. The availability of hydroelectric power in a given year varies depending upon the operation of the water system.

During the spring run-off, the power generation facilities of the Hetch Hetchy system have a maximum capacity of 400 megawatts per hour. Average electric generation over the course of a year is around 200 MW per hour for a total yearly generation of 1.7 million MWh of electricity.33.

While this quantity of power exceeds San Francisco's average municipal power demand of 140 MW per hour and total annual consumption of around 900,000

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[32] PG&E. 2008. *Corporate Responsibility Report*. Page 57. Notes: The continued drought conditions in California have reduced hydroelectric generation. As a result, PG&E purchased more electricity than usual from the wholesale market in 2008. California regulators require PG&E to assume that a certain portion of these market purchases comes from coal-fired generation and renewable resources. As a result, the chart shows an increase in coal-fired generation, although PG&E's direct purchases of coal, which PG&E is required to buy from small power producers, remain minimal at 1.7%. Additionally, 12% of PG&E's delivered energy came from renewable portfolio standard (RPS)-eligible resources; the chart shows 14%, reflecting an additional 2% from open-market purchases that do not count toward the state's RPS target. Source: April 2009 Power Content Label, consistent with PG&E's submittal to the CEC on March 2, 2009.

[33] Average generating capacity based on a seven-year historical average (1997–2003) is 201 MW.

MWh on an annual basis, the City needs to supplement its power sources to meet municipal demand and its contractual obligations during the summer and fall months when hydroelectric generation is reduced so that water can be stored. Depending upon hydrological conditions, Hetch Hetchy generation typically meets 90% to 100% of the SFPUC's energy needs. Any shortfall is typically purchased from the marketplace.

For purposes of its draft report, RMI assumes that all of the SFPUC's power will come first from its GHG-free Hetch Hetchy power with any remaining energy needs coming from RPS-renewable resources[34].

Energy Service Providers, who provide power to selected customers under the CPUC's Direct Access rules are also subject to the state's RPS requirements and will need to procure 33% of their energy from renewable sources by 2020.

[34] The RMI report "assume[s] in this report that in the 2010–2030 timeframe, emissions from serving SFPUC load are assumed to be zero as a result of the City procuring only renewable energy to serve load not met with Hetch Hetchy generation."

CHAPTER 4
EMPOWERING CUSTOMERS AND LEVERAGING SAN FRANCISCO'S EXISTING CAPABILITIES TO PROMOTE ZERO GHG ENERGY

In directing the SFPUC to update the 2002 ERP, the Board directed the SFPUC to propose both short-term and longer-term options. Chapter 4 focuses on shorter-term options, recognizing the limitations that San Francisco faces in influencing energy choices made by PG&E and direct access providers. Chapter 5 provides longer-term options that seek to affect the broader wholesale energy market in which San Francisco procures most of its energy needs.

The 2002 ERP realized that:

> Implementation of the Plan will require the cooperation of many organizations, including but not limited to the California Public Utilities Commission (CPUC), the California Independent System Operator (CAISO), the California Energy Commission (CEC), the California Power Authority35, Pacific Gas and Electric Company, independent power developers, energy service companies and other departments and agencies of the City and County of San Francisco. (Preface, p. iii)

And that:

> …SFE and SFPUC will work with each sector of the San Francisco economy to promote efficiency, renewable energy and distributed technology for their facilities and to develop specific objectives and timelines. (p. 7)

The major challenge in developing a city-wide electricity resource plan is the fragmented nature of energy procurement decisions for San Francisco. Currently, there are three distinct energy providers that have decision authority

[35] Although legally this agency still exists, the Governor's Office has chosen neither to fund nor appoint board members to this agency, making it essentially inactive.

for procurement objectives: PG&E (78% of total usage), direct access providers (8%), and SFPUC's municipal load (14%).

PG&E, Trans Bay Cable and the direct access providers, are subject to extensive regulation by the California Public Utilities Commission (CPUC) with respect to retail transactions and electricity distribution, and the Federal Energy Regulatory Commission (FERC) with respect to applicable wholesale transactions and electricity transmission. State and federal regulation largely pre-empts San Francisco from regulating terms and conditions for electric service by PG&E, Trans Bay Cable and direct access providers as well as determining the rules under which San Francisco can use PG&E's distribution system and the transmission system serving San Francisco.

In order to serve it municipal load, for instance, San Francisco entered into an Interconnection Agreement (IA) with PG&E where PG&E agrees to transmit Hetch Hetchy electric generation from Newark to municipal loads using PG&E's transmission and distribution system. Under this agreement, the SFPUC is limited to providing Hetch Hetchy power almost exclusively to municipal load customers and PG&E has opposed efforts by SFPUC to extend this service to other customers.

When San Francisco chose to provide electric service to Hunters Point, it needed to enter into a FERC-approved Wholesale Distribution Tariff/Service Agreement (WDT/SA) with PG&E defining how San Francisco's distribution system would access to and interconnect with PG&E's system.

Given these limitations, the consensus of the Green TAC was that San Francisco should focus its efforts on those activities where San Francisco not only has a strong ability to implement programs but also the legal ability (through incentives, ordinances, tax policies, etc.) to do so. Most of these activities fall into what are often called "Behind the Meter" programs in that they focus on activities that a customer can do without needing approval from state and/or federal regulatory authorities.

Under the regulatory structure established by the CPUC that governs investor-owned utilities such as PG&E, there is a significant difference between activities that occur on the customer-side of the meter (known as Behind the Meter) and those that occur on the utility-side of the meter. The net effect of all of these activities is to reduce the amount of energy the customer needs to procure from the incumbent utility, such as PG&E. San Francisco should encourage cost-

effective "Behind the Meter" activities that reduce the amount of energy needed to be procured from the grid.

Behind the Meter programs include such activities as;

- Reducing a customer's energy demand through energy efficiency programs;
- Reducing peak energy usage through demand response and on-site storage; and
- Allowing customers to generate their own power on-site (for example through rooftop solar or on-site cogeneration), provided that they meet applicable safety standards in connecting to the utility system.

There are also some areas of the City, such as at Treasure Island and Hunters Point for example, where the City can take a more active role and serve all customers in that area.

In most cases these activities can be carried out quicker than other longer-range activities. Thus they correspond to the Board's direction that the SFPUC develop short term goals that can be implemented quickly.

An advantage of these local behind the meter activities is that they promote local economic development and should improve the reliability of the local electric system. Many of the technologies that would be used to achieve this goal, such as energy efficiency and combined heat and power could also save customers money by reducing their overall energy costs over the life of the project, although upfront costs are often significantly higher. A potential down-side, as noted in the RMI report, is that some of these local technologies, particularly roof-top solar and small-scale wind, are currently significantly more expensive than conventional electric service.

Using behind-the-meter activities also avoids the requirement to pay departing load or exit fees to PG&E. Under the CCA rules as developed by the CPUC, for example, a customer who chooses to take electric service from San Francisco's CCA, will still end up paying PG&E a "departing load" charge embedded in a "Procurement Charge Indifference Account (PCIA) charge. The purpose of this PCIA charge, as defined in state regulation, is to compensate PG&E for the previous investments in electric generation that it made on behalf of the customer. The Green TAC estimated these charges at about 18% of an average bill. Thus a customer who chooses to buy renewable energy from CCA will have

to pay PG&E a departing load charge, while the same customer would not pay any departing load charge if he/she installed an on-site solar photovoltaic that provided the equivalent amount of renewable energy.

The Green TAC focus on behind the meter programs is similar to two of the four scenarios of future trends that were modeled by RMI in their draft report.[36] These two scenarios also assume that San Francisco is limited in its ability to directly influence the energy purchasing decisions of PG&E and other direct access providers.[37]

As the RMI draft report concluded;

> If the status quo level of [local] control remains in the near term, San Francisco focuses on CHP and "behind-the-meter" efficiency and renewables in city [to meet its GHG reduction goals]. 38

Given this limited ability, the RMI draft report proposed a series of "no regrets" recommendations that San Francisco should pursue regardless of whatever policy direction San Francisco chooses to ultimately adopt for its energy industry.

[36] These two scenarios are the Status Quo Declining (Technology) Cost and the Status Quo Constant (Technology) Cost

[37] The RMI draft report believes, perhaps incorrectly, that this will be particularly true between now and 2020 as PG&E focuses on meeting its own renewable portfolio standards established by state law.

[38] RMI Draft Report, p. 64

No Regrets Resource Options

Given the similarities in the long-term resource portfolio[s developed by RMI as part of their analysis] and slight differences in the [cost and availability of resources in the] short term, San Francisco has a number of "no regrets" resource options that it should pursue. These include:

- Aggressively pursuing demand-side efficiency for reducing GHG emissions and load management to enable increased solar and wind adoption;
- Promote distributed and building-scale supply-side renewable resources "behind the meter";
- Continuing to operate Hetch Hetchy, including ongoing maintenance and refurbishment to maintain reliability, performance, and power output; and
- Actively develop sources of indirect CO_2 reductions such as electrified vehicles and CHP that San Francisco can generate internally to offset limited fossil imports.

SOURCE: RMI Draft Report, p. ES-11

Another concept advocated by the Green TAC was to be "technology neutral." As the RMI draft report stated;

> [A] number of potential zero-GHG technologies could meet San Francisco's energy needs, and predicting their future price and relative availability is difficult.

And that;

> Especially in the medium (2015–2020) and long term (2020–2030), the actual composition of San Francisco's resource portfolios will deviate from those we have created [in their scenarios] based on a number of factors, including future technology costs; financing costs and ability of energy providers to secure favorable contracts; and additional purchases of capacity and energy. These factors…imply that San Francisco is not rigidly bound to the resource selections identified in this analysis[39].

[39] RMI Draft Report, p. 86

Accordingly, San Francisco's policies should focus on setting specific goals, and then allowing customers and end-users to identify the optimal mix of technologies to meet this goal. This is similar to the approach currently used by the state for building energy efficiency standards, setting an overall goal and letting the builders trade-off the various technologies (e.g. more insulation vs. a more efficient furnace vs. triple-paned windows) to meet the goal.

Based on the input received from the Green TAC and RMI the following broad short-term goals are proposed for San Francisco. For each recommendation next steps are identified.

RECOMMENDATION 1 -- SAN FRANCISCO TEST BED

Develop San Francisco as a 'Green Test Bed' to promote and encourage the deployment of new energy technologies within the City as well as attracting green energy firms to locate within the City.

Background

Achievement of San Francisco's long-term goal of a zero-GHG electric system by 2030 will require not only significant improvements in the cost, feasibility, and ease of use of existing technologies but also the potential development of new technologies not yet envisioned. San Francisco has already committed itself to actively participating in the development of new cleantech industries in San Francisco and leveraging the significant technical and venture capital expertise within the Bay Area, including Silicon Valley, major research universities, and national research laboratories. San Francisco has already created a reputation as a City open to new environmental technologies and has actively recruited and fostered cleantech firms to choose San Francisco as a headquarters location**,** San Francisco is home to over 250 cleantech companies,[40] with a strong emphasis on solar companies.

In 2008 San Francisco instituted a Clean Technology Payroll Tax Exclusion, which excludes clean technology companies of less than 100 employees from local business taxes for 10 years, accommodating this industry's longer research and development cycle and resulting longer path to revenue and profitability.

Proposal

San Francisco should take all necessary steps to establish San Francisco as an innovative "Green Test Bed" City," working with the California Energy Commission and U.S. Department of Energy, among others, to establish funding relationships to demonstrate emerging technologies at San Francisco residences and businesses. By declaring San Francisco a city open to the demonstration and deployment of new clean technologies, the City will benefit from increased investments in research and development, an increase in cleantech companies choosing to locate in San Francisco (thereby generating jobs and increased tax

[40] Mayor's Accountability Index, Dec. 2010

revenue) and a reinforced reputation as a cutting edge municipality for environmental policy and implementation and early adoption of innovative technologies.

There are several variants of this proposal that could be adopted. First, this proposal could be adopted on a city-wide basis, with San Francisco committing to work with research institutions, government agencies, and private businesses to encourage the development and deployment of new technologies anywhere in the City.

A second variant would establish clearly defined areas of the City as the "Green Test Bed." Newly developing areas, such as Treasure Island and Hunters Point, for example, could serve as test beds for the development of local on-site technologies. Using housing projects, such as those being developed by HopeSF, is another alternative. This approach could be structured to include the residents to participate in the testing process, not only using the technology but also being involved in its permitting, construction, and operation, thus learning marketable job skills in a growing industry. RMI, in its draft report, also proposed "municipal demonstration sites" that would be well-suited for evaluating particular generating technologies such as Twin Peaks (for wind) and Ocean Beach (for wave/tidal energy).

Potential Concerns

- San Francisco will need to compete against other cities/states also seeking to promote development of GHG-reduction technologies.
- Other municipalities such as Sacramento and Los Angeles operate integrated electric utilities (owning generation, transmission, and distribution assets) that serve their entire city.

Need for Changes to Existing City Ordinances

- Adopt City Ordinance identifying methods to streamline the process for clean energy vendors participating in demonstration projects.

Next Steps

1. Identify potential demonstration sites such as;
    - Redevelopment areas under city control such as Hunters Point and Treasure Island.

- Civic Center (as part of the on-going Civic Center Sustainability Project)
- Sites targeted to specific generation technologies (e.g. Twin Peaks for wind, Ocean Beach for wave/tidal, large warehouse districts for roof-top solar).
- HopeSF and other housing project development sites

2. Identify and seek out research and funding opportunities for demonstration projects (on-going)

3. Leverage existing spending on GHG-reduction technologies to access funding for new demonstration/research/test projects.

4. Coordinate with existing incentives offered by the Office of Economic and Workforce Development for cleantech development such as the Clean Technology Payroll Tax Exclusion.

GREEN TEST-BED

(Applicable RMI Recommendations)

RE-6	The Office of Economic and Workforce Development, SFE, and SFPUC should collaborate to establish a formal pipeline that will streamline the process for clean energy vendors who would like to set up demonstration projects.
RE-7	SFE and SFPUC should proactively solicit opportunities to partner with private business, national research and development labs, and other institutions dedicated to the advancement of renewable technologies..
RE-8	SFPUC should construct a plan to establish municipal demonstration sites at locations around the City. Several locations have been identified, including Twin Peaks, Ocean Beach, and the San Francisco Zoo.
RE-10	The Mayor's Office should consider leading a stakeholder process to inform a master plan identifying San Francisco's most promising sites for large-scale renewable energy development
ET-1	BOS and Mayor should consider providing incentives for companies engaged in battery and electric vehicle research that are located in San Francisco.

(Applicable Peak Oil Task Force Recommendation)

3.4.5	Advance a Green Jobs workforce development program.

RECOMMENDATION 2 – INCREASE ENERGY EFFICIENCY PROGRAMS

Improve and expand Energy Efficiency (EE) programs in San Francisco.

Although energy efficiency is itself one of the "behind the meter" technologies that San Francisco should promote, it is listed separately here given its importance as perhaps the easiest and most cost-effective GHG-reduction strategy that San Francisco can pursue.

As RMI noted;

> It cannot be emphasized too strongly that continued and increased emphasis on energy efficiency is the least expensive lever to reduce San Francisco's GHG footprint. While accessing that opportunity is more complex than building or acquiring generation, it is well worth the effort and can dramatically help reduce system costs[41].

PG&E is responsible for providing energy efficiency services for all of the City's businesses and residences, subject to the oversight of the California Public Utilities Commission (CPUC) except for municipal buildings where the SFPUC is responsible.. As noted in Chapter #1, the CPUC has adopted an Energy Action Plan in 2005 that established state policy that future energy needs should be met first with energy efficiency, second with renewable energy, and then finally with low-emitting fossil fuels (i.e. natural gas). As a result statewide funding of energy efficiency has significantly increased[42] .

[41] RMI Draft Report, p. ES-14

[42] The CPUC recently issued a Long-Term Energy Efficiency Strategic Plan to guide the design of energy efficiency programs by California's Investor Owned Utilities

For 2011, PG&E is projecting to spend close to $450 million in Energy Efficiency measures[43]. PG&E's funding for its energy efficiency programs is split almost 50/50 between Public Goods Charges (PGC) and "procurement energy efficiency." PGC is a state-mandated component of rates that is used to fund such public purpose programs as energy efficiency, RD&D, renewables, low income energy efficiency and low income rate subsidies. After adoption of the Energy Action Plan in 2005, the CPUC significantly increased the funding levels for energy efficiency measures beyond the amounts legislatively mandated for the PGC, as well as allowing utilities to spend funds on energy efficiency as part of their procurement activities. The costs of these programs are collected through electric rates paid by all customers.

PG&E's Energy Efficiency Spending
Projected for 2011

Public Goods Charge	
Energy Efficiency	$120,701,518
Low Income Energy Efficiency	$93,478,228
Total Public Goods Charge EE	$214,179,746
Procurement Energy Efficiency	$233,408,114
Total Energy Efficiency	$447,587,860

PG&E estimates it now spends about $25 million per year in San Francisco on energy efficiency related activities. This is consistent with San Francisco representing about 5% of PG&E's electric load. Some of this money is spent in a partnership with the San Francisco Department of the Environment (SFE).

The statute that directs the collection of the public goods charge (PGC) expires on January 1, 2012. It's unlikely that either the CPUC or the state legislature would eliminate funding and budgeting for energy efficiency programs.

Another funding option, as noted in the RMI report, is the use of Property Assessment Clean Energy (PACE) bonds. San Francisco is implementing Property Assessment Clean Energy (PACE) bonds, also known as tax-lien

[43] See PG&E's Advice Letter 3727-E (September 1, 2010), Annual Electric True-Up, page 11, Projected 2011 Revenue Requirement

financing. This approach allows property owners to finance the cost of efficiency improvements through annual or semi-annual property tax payments. The measures are tied to the property, so that if the owner sells the property the new owner assumes responsibility for repayment of the loan. Implementation of this program is currently hindered by uncertainty over the effect of this tax assessment on the ability of the homeowner to repay any underlying mortgages associated with the property. Hopefully, this problem will be resolved soon.

A third funding option is the use of funds received from Trans Bay Cable as part of its licensing agreement with the City to lease Port property and right-of-ways needed for the project. Under this agreement, the City will receive a "SF Electric Reliability Payment" of $2 million per year for 10 years, starting in 2011 and adjusted yearly for inflation. Resolution 414-07 directs that this money should be used "specifically [for] renewable energy, conservation, and environmental health programs which benefit low income, at-risk, and environmentally disadvantaged communities." $2 million of these funds will also be set-aside for use by the Mayor's Office of Economic and Workforce Development on "green jobs training and placement programs which benefit low -income, at-risk, and environmentally disadvantaged communities." Prior to allocating these funds they should consult with the Department of the Environment, the Department of Public Health, and community members, including the Power Plant Task Force, in determining how to allocate the funds.

Proposal

The need for the State Legislature to reauthorize collection of the Public Goods Charge (PGC) before January 1, 2012 provides an excellent opportunity for San Francisco to advocate not only for continuation of the program at existing or enhanced levels but also to advocate for more fundamental changes in how the program is administered.

San Francisco could advocate that PGC funds be allocated and controlled by a third-party administrator, perhaps even San Francisco itself for funds expended within its jurisdiction, rather than have the existing utilities such as PG&E continue to administer the PGC program.

There are a number of problems with utility management of the PGC programs. First, a significant portion of the funds go towards the administration of the programs. Compounding this problem, the CPUC has adopted a risk/reward incentive mechanism that rewards the utilities if they exceed specified targets.

These factors make utility administration of energy efficiency programs costly. In addition, the shareholder incentives have generally biased utilities in favor of short term, easily obtained savings, rather than long term savings and comprehensive treatment. In addition, the Evaluation, Measurement and Verification (EM&V) programs, upon which the utilities' incentives are based have become extremely contentious.

Other energy efficiency program models exist in the United States with alternative program administration and governance structures. Having a non-profit or other type of third party administrator can better align policy goals with the programs and would harness economies of scale if done at the state level. Another option could be for local cities and counties to designate themselves as the administrators of PGC energy efficiency funding for their areas, thus providing increased local control of these activities and increasing the opportunity to link these programs with other city objectives such as job training, economic development, etc.

Even without the establishment of a third-party administrator to manage PGC energy efficiency programs, San Francisco might still get access to a portion of PGC funding through its CCA program. State law provides that, CCAs should be allowed to apply to the CPUC to become the administrator of these funds for its customers.[44] The CPUC is currently developing the rules that would govern this process, although utility proposals would result in no change to the existing structure.

Potential Concerns

The creation third-party administration of PGC programs;

- Could potentially be disruptive to the operation of existing Energy efficiency programs if not transitioned properly;
- Creation of a third-party administrator and/or an independent board of directors could take time and political will and resources; and
- Will require measures to ensure transparency and accountability.

[44] Thus, the CCA would only receive PGC energy efficiency funds in proportion to the number of customers who sign up for CCA and their corresponding energy usage, not the total amount of funds collected in San Francisco. Moreover, some upstream state programs would likely continue to be provided by the investor owned utilities.

Need for Changes to Existing City Ordinances

- None Identified. Should local governments be designated as eligible PGC administrators in the future, San Francisco would need to create the appropriate organizational structure to administer the program.

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Next Steps

1. Work with other local governments and stakeholders to advocate not only for continuation of the PGC program at existing or enhanced levels but also to advocate for more fundamental changes in how energy efficiency programs are administered.
2. Work with SFE, Department of Public Health, Power Plant Task Force, and OEWD to identify uses for the SF Electric Reliability Payment funds.

ENERGY EFFICIENCY /PGC FUNDING

(Applicable RMI Recommendations)

EE – 3	BOS should consider mechanisms for raising additional funds for energy efficiency implementation beyond monies already collected through PG&E's Public Goods Charge and the SFPUC's Sustainable Energy Account (5% of revenues).

(Applicable Peak Oil Task Force Recommendations)

3.4.7	Develop a better working relationship with PG&E to administer state (CPUC) energy efficiency funds in an effective way that is consistent with City goals.

RECOMMENDATION 3 – PROMOTE BEHIND THE METER ACTIVITIES

Improve and expand the development of distributed generation resources such as small-scale CHP and renewable energy.

Background

As noted in the introduction to this chaper, the advantages of behind-the meter resources are that they can reduce the amount of energy the customer needs to procure from the incumbent utility, such as PG&E, carried out by the customer, improve local reliability, and provide local economic and job opportunities. The following activities identify options to increase the use of small scale CHP and renewable technology within San Francisco. .

Proposal

Although many types of Behind the Meter activities actually save consumers money over the product's life-cycle, many of them have high up-front costs that act as a deterrent to their use. Therefore, identifying funding mechanisms to cover these costs need to be identified.

As noted in Recommendation #2, San Francisco is currently establishing the use of PACE bonds to allow home-owners to finance energy efficiency improvements over the long-term through an additional assessment on their property tax bill.

In addition to these activities, San Francisco can seek to develop and access all available funding to promote behind the meter activities.

Under various mandates and programs established by the CPUC, for example, there are a number of programs available that offer opportunities for small-scale distributed generation to either receive long-term contracts to sell their power or a clearly defined price they would be paid for their power. Under most of these program, PG&E is required to purchase the output from these distributed generation facilities at set prices. Available programs exist for small-scale

renewable energy (under 20 MW), combined heat and power facilities (under 20 MW), and a rebate program to encourage the use and development of fuel cells.

Several of these programs offer feed-in-tariffs (FIT) that pay the distributed generation resource the same price that it would otherwise have cost PG&E to acquire energy from a large-scale fossil-fueled power plant, currently in the range of $85 to $95 per MWh.[45] This price should be sufficient to support the development of small-scale CHP units within San Francisco.

San Francisco could assist San Francisco residences and businesses to maximize their participation in these programs. This could be done by educational and outreach programs, requiring new construction above a certain size to consider use of CHP technologies, and examining potential changes to building and zoning codes to encourage distributed generation development.

Use of these programs by San Francisco residences and businesses would provide local economic and job opportunities associated with the construction and operation of these facilities. They would also improve local reliability by increasing the amount of in-city generation.

The effect of these programs on increasing local control is mixed. Under all of these programs, the output of the distributed generation facilities would be provided to PG&E. This would mean these resources would not be available for participation in San Francisco's CCA program.

As the CCA resource procurement strategies develop, it too could access these same resources, however it will likely be doing so in competition with PG&E. . Essentially, the prices offered under these various state incentive programs set a floor price that CCA will now have to pay to acquire these resources. A small-scale distributed generator in San Francisco, for example, would be unlikely to sell its power to a CCA for less than the $85 to $95/MWh price it could receive from PG&E. This may affect the economics of the CCA program.

Provided a funding source could be found, San Francisco could choose to supplement the various incentives offered by the State to further encourage their

[45] As these tariffs are based on the utility's avoided costs, they are less generous than comparable feed-in-tariffs offered in countries such as Spain and Germany which contain a large subsidy of the renewable technology, the cost of which is made up for by increased rates paid for by all other non-participating customers.

development. This would be similar to San Francisco's GoSolarSF program, which supplements other state and federal rebates and incentives to install solar facilities is another example of using San Francisco dollars to leverage and maximize available funding. this 10-year solar incentive program benefits local residents, businesses and nonprofits.

In its 10-year Capital Improvement Program the SFPUC has budgeted $5 million per year for this program to provide incentives between $2,000 and $12,000 for residents and up to $10,000 for businesses to install solar on local rooftops. Higher incentives are given to low income households, to those living in areas historically impacted by pollution and for buildings that use installation companies that offer green jobs to disadvantaged residents. The program provides up to $250,000 for affordable housing providers.

In its first year, solar installations rose 450%, $6.3 million was requested and a total of 3MW of solar power was either installed or committed.

As noted in Recommendation #2, the funds that the City will receive from the TransBay Cable as part of the "SF Electric Reliability Payment" of $2 million per year over the next ten years can also be used for renewable energy development as well as for energy efficiency and environmental health programs.

Overall, programs such as the above will be essential to help develop smaller-scale on-site renewable energy technology that currently is not cost-effective. As the RMI draft report noted:

> In-city renewable resources—such as rooftop solar PV and wind—are among the most expensive, along with today's emerging efficiency and supply-side technologies, such as tidal and wave. These technologies exceed $300/MWh in cost [46]

[46] RMI draft report p. 36)

Cost of Small Scale (Non-Utility Sized) on-Site Generating Options

Technology	Capital Cost ($/kW)	Fixed O&M ($/kW-yr)	LCOE ($/MWh)	Source and Description
Solar PV (Residential)	10,500	75	300-330	CCA Task 1 Installed Costs
Solar PV (Commercial)	8,715	45	230-250	CCA Task 1 Installed Costs
Wind (Building Integrated – Residential)	6,400	50	350	CCA Task 1 Installed Costs
Wind (Building Integrated – Commercial)	6,400	50	360	CCA Task 1 Installed Costs
Wind (Small Scale)	5,000	50	170	Northern Power Northwind 100kW[47]
Offshore Wind	3,980	27	180-380	Avg. value from CEC Cost of Gen. 2009
Wave	3,100	124	90	URS SF Wave Study 2009
Tidal	10,592	416	950	URS SF Tidal Study 2008

SOURCE: Excerpted from RMI DRAFT Report Table 12, page 40

As the above chart, also shows, these technologies also have much higher up-front capital costs than existing technologies.

Another alternative to relying on PG&E to develop small-scale CHP projects could be to partner with NRG, the provider of steam services to the downtown San Francisco area.

[47] http://northernpower.com

San Francisco is one of the few cities in California with a thermal utility. NRG operates a network of steam pipes running through the downtown and civic center areas providing steam heat and hot water service to about 160 customers including office buildings, apartments, hotels, as well as City Hall and several other Civic Center municipal buildings.

NRG currently generates most of its steam from its boilers located near Union Square. While NRG has pursued converting its boilers to cogeneration, to date it has not been able to receive a contract from PG&E to purchase the electric output from a new cogeneration facility that is necessary for the project to be economically viable.

An alternative solution that would promote cogeneration within the City would be for NRG to develop a number of smaller cogeneration sites at its customer locations. While most cogeneration systems are sized to meet a location's thermal needs, with surplus electricity being sold to the grid, the presence of NRG's thermal steam system in San Francisco makes it possible for the opposite to occur, with cogeneration meeting only on-site electricity needs while providing surplus steam heat to NRG's system. An advantage of this approach is that many of the more desirable cogeneration sites within San Francisco are connected to PG&E's networked downtown grid which prevents them from exporting surplus power to the grid.

Potential Concerns

- Small-scale in-city renewable energy technologies such as roof-top solar and small-scale wind continue to be significantly more expensive than conventional resources, making their continued deployment (at least until their costs decline) contingent upon maintaining applicable state, federal, and local incentives and subsidies.
- Utilizing feed-in-tariffs and other programs offered by PG&E to promote distributed generation sets a floor price for these resources that a CCA provider would have to meet as well as making these resources unavailable for a CCA resource portfolio.

Need for Changes to Existing City Ordinances

- None identified at this time.

Next Steps

1. Continue funding of San Francisco's GoSolarSF program and on-going energy efficiency programs operated by SFE and SFPUC.
2. Identify additional funding opportunities for local behind-the-meter technologies.
3. SFPUC and City's energy service providers should evaluate the feasibility of non-traditional ownership models for CHP.

BEHIND THE METER ACTIVITIES

(Applicable RMI Recommendations)

CHP-2	SFPUC and City's energy service providers should evaluate the feasibility of non-traditional ownership models for CHP.

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(Applicable Peak Oil Task Force Recommendations)

11.4.6	Supports the creation of a solar assessment district to enable City residents to use long-term low interest financing to fund the cost of installing solar panels.

RECOMMENDATION 4 – COMMUNITY SCALE ENERGY SYSTEMS

Advance and support Community Scale Energy systems, both privately-owned as part of new development and through increased use of City-owned electric infrastructure where possible.

Background

"Community Scale Energy Systems" seeks to extend the use of "behind the meter" activities (as identified in Recommendation #3) and apply them beyond a single building to a larger geographical area. This is accomplished by identifying large single parcels of property that are either currently not served by PG&E or are under control of a single-entity. Examples of the first category include areas such as Hunters Point and Treasure Island, both of which the SFPUC is in the process of serving as well as future development projects in such areas as Pier 70, Port property, the Trans Bay Terminal, etc.

Examples of large-scale private developments include such proposed projects as the California Pacific Medical Center or UCSF- Mission Bay facilities) as well as renovations to large existing facilities (such as Park Merced). It could also apply to large existing facilities such as college campuses or hospital complexes.

Proposal

This proposal would encourage new development to become increasingly energy self-sufficient, and perhaps ideally to be able to operate substantially "off-the-grid" by requiring all new developments of a certain size to determine if it is economically and environmentally beneficial to meet most or all of their electric energy needs on-site.

This would be achieved by an optimal combination of enhanced energy-efficiency, on-site renewable energy and/or cogeneration, and controlling demand response through smart grid and/or storage technologies. Ideally and in the longer term, many of these projects would become either "zero energy" sites able to operate independent of the electric grid or net energy exporters to the

grid, selling excess energy generated on site back to the utility.[48] The concept is based on each project being self-sufficient to the maximum extent possible while minimizing reliance on the existing electric grid.

Development of Community Scale Energy Centers would require a new City Ordinance that would set the overall goal (i.e. for overall energy usage or the amount of energy needed from the grid) and then allow developers the flexibility to optimize the mix of technology needed to achieve the goal.

A related feature of this proposal could require that the SFPUC (rather than PG&E) should become the default provider of any remaining electric needs at these sites or facilities. Currently, the SFPUC is required to evaluate the feasibility of each new redevelopment project to determine if the SFPUC should offer service. Changing this proposal to make the SFPUC the default provider and extending this requirement beyond just redevelopment projects to all developments above a certain size would assist the SFPUC in providing additional electric service within San Francisco.

Potential Concerns

- Need to ensure any adopted requirements are cost-effective and do not discourage new projects within the City. Costs of developing the program for each area should be similar, or less than, the comparable life-cycle costs of taking service from the incumbent utility, although up-front costs may be higher.

Need for Changes to Existing City Ordinances

- Create City Ordinance defining the size threshold and appropriate energy usage targets for Community Scale-Energy Centers.
- Amend Administrative Code, Chapter 99 (Public Power in new City Developments) to designate the SFPUC as the default provider of electric energy and distribution services to all identified Community Scale-Energy Centers.

Next Steps

[48] This could be done either by on-site generation or by the use of on-site storage that would store energy during times of low demand and export it back to the grid during times of peak demand.

1. Explore feasibility of requirement and determine appropriate size threshold and appropriate energy usage targets for Community Scale-Energy Centers.
2. Develop and modify City Ordinances as necessary.

COMMUNITY ENERGY DISTRICTS

(Applicable RMI Recommendations)

EE – 10 (for larger projects)	SFE and SFPUC should work with the Mayor's Office of Housing (MOH) to develop and implement additional initiatives to further integrate efficiency into existing and new affordable housing.
RE-9 (for larger projects)	The Mayor's Office, SFE, and the San Francisco Planning Department should monitor the permitting process to ensure improved efficiency and consistently applied standards for renewable projects
CHP-1	BOS should consider amending the City Green Building Ordinance to include a requirement that a CHP feasibility study be conducted for all new large development projects and major renovations.

RECOMMENDATION 5 – IMPROVE BUILDING STANDARDS

Improve Building Standards to encourage more energy efficient buildings by the incorporation of the optimal combination of energy efficiency, on-site generation (e.g. on-site wind or solar as well as efficient, low-emitting cogeneration) and load-shifting and demand response capability through smart-grid technology and energy storage).

Background

One of the major ways to promote energy efficiency and promote behind the meter activities is through modifications to San Francisco's building standards.

Proposal

San Francisco has recently revised its building standards covering new construction and significant reconstruction of existing buildings. Under these new standards, new buildings will generally have to meet energy efficiency standards that are 15% higher than existing state standards set by the California Energy Commission (known as Title 24 standards. The standards will also require larger new buildings to have 1% of their energy needs met by renewable energy..

Future issues to be addressed include modifications to the building code to include provisions for the charging of electric vehicles (such as recharging equipment as well as the necessary upgrades to the electric wiring) and streamlining permitting issues for renewable energy technologies such as roof-top solar, solar water-heating, and small-scale wind are other areas to be considered.

Potential Concerns

- Need to coordinate proposed revisions to Building Code.

Need for Changes to Existing City Ordinances

- Any changes would be incorporated into City Building and Zoning Codes as appropriate.

Next Steps

1. Coordinate with the on-going process to revise Building Codes to identify additional changes that can be implemented without delaying final adoption of a newly revised Building Code.
2. Review RMI recommendations and goals outlined below for inclusion into future Building Code revisions as appropriate..

BUILDING STANDARDS

(Applicable RMI Recommendations)

EE – 6	The BOS should consider creating a "retrofit on resale" efficiency ordinance.
RE-9	The Mayor's Office, SFE, and the San Francisco Planning Department should monitor the permitting process to ensure improved efficiency and consistently applied standards for renewable projects
CHP-1	BOS should consider amending the City Green Building Ordinance to include a requirement that a CHP feasibility study be conducted for all new large development projects and major renovations. NOTE; Also addressed under Community Scale Energy Systems
CHP-3	SFE should consider offering support services for CHP installation such as publishing a list of qualified CHP suppliers and installation contractors, and assisting CHP owners with the permitting process.
ET-2	The City should continue its efforts to update and streamline the permitting processes to allow for installation of charging equipment. The SFPUC should develop and implement electric vehicle charging deployment guidelines. SFPUC should consider collaborating with PG&E, SFE, and a potential future CCA provider to do this.
ET-3	BOS should consider modifying or amending building codes to require 220-volt outlets installed in public and private garages of new buildings to accommodate PHEV and EV charging infrastructure, or at a minimum require that electrical conduits be installed in order to allow for the installation of 220-volt lines later.

(Applicable Peak Oil Task Force Recommendations)

11.4.1	Urges City departments to develop ultra-low energy building standards, consistent with the Passive House standard, and programs which encourage new and remodeled

	buildings to meet those standards.
11.4.3	Urges City departments to develop programs and incentives to improve energy conservation and efficiency, weatherization, and compliance with other building standards by the City's rental housing stock.
11.4.5	Urges City departments to require that certain energy conservation and efficiency improvements be completed when buildings are offered for sale.

RECOMMENDATION 6-- BACK-UP STORAGE

Promote Back-Up Storage deployment as an alternative to the existing use of diesel-powered back-up generation.

Background

A significant number of buildings and facilities in San Francisco currently have on-site back-up electric generation. This generation is installed to ensure that critical services (such as hospitals and fire stations) can continue to operate during power outages and/or to provide reliable and uninterrupted electric service for such functions as data centers and computer system, Almost all of these back-up power systems are either diesel or natural gas powered generators that are typically limited by air quality and City[49] regulations to operating only when actually needed and for necessary testing.[50]

Proposal

San Francisco should examine whether these existing natural gas and diesel back-up generators can beneficially be replaced with electric storage (such as electric batteries), and then networked to provide reliability and environmental benefits to the grid.

There are several hundred MW of installed back-up generation capacity in San Francisco, equivalent to a medium-sized power plant.

Converting fossil-fueled back-up generation to electric storage would not only eliminate air pollution emissions from this sector, but also (since there would be no limitations on their use) allow for this electric storage to be used continually around the clock.

Ideally, by networking these electric storage facilities together, building and facility owners would have the certainty of a back-up power supply when

[49] Ordinance 202-02, authored by Supervisor Sophie Maxwell required new back-up generators to have air emission control technologies, limit operation during non-emergency situations, and established reporting and enforcement mechanisms,

[50] Alternatively, many units are limited to operating no more than 100 hours per year.

needed, while the units could also be integrated into the electric grid to be used when needed to meet system-wide demands.

Converting even a portion of these units to a networked electric storage system, could provide a convenient source of local electric supply able to be used to meet peak demand and local reliability needs.[51] The ability of electric storage to absorb and discharge electric power quickly also make it an ideal technology to complement renewable energy resources such as wind and solar, whose output can fluctuate significantly both over the course of a day, and sometimes even within the hour.

An advantage to building and facility owners is that it could turn what is now a necessary but largely unproductive asset (the cost of the back-up generator) into a potential profit center as the owner would receive the new revenue stream from providing power and ancillary services to the electric grid from the electric storage unit.

Efforts to develop electric storage in San Francisco could be undertaken in conjunction with the requirements of AB2514 that went into effect in 2011. This legislation requires all public utilities to evaluate the use of electric storage technologies as part of their resource mix and identify cost-effective storage projects for potential development. The CPUC has just opened a proceeding to determine PG&E's requirements under AB2514.

Potential Concerns

- Current costs of electric storage may not be cost-effective for wide-spread use at the present time.
- Ability to network storage units and their operation to achieve large-scale operation needs to be developed.
- Rules under which electric storage could participate and get paid for providing services to the wholesale energy market are still being developed.

Need for Changes to Existing City Ordinances

[51] One of the advantages of electric storage is the ability to store power during off-peak hours when energy costs are lower, and then discharge that power back to the grid during peak times when prices are higher.

- If found to be cost-effective, San Francisco could adopt changes to Building and Zoning Codes to encourage use of electric storage as a back-up and electric supply and to discourage the installation of new fossil-fueled back-up generation within the City.
- Work with Bay Area Air Quality Management District (BAAQMD) regarding setting of emission limits for back-up generation,

Next Steps

1. Consider and evaluate Installation of a pilot electric storage project perhaps as part of the other recommendations for the San Francisco Energy Test Bed (Recommendation #1) and Community Scale Energy Districts (Recommendation 3(i)).
2. Coordinate with implementation of AB2514, which requires public utilities to evaluate the need for cost-effective electric storage technologies.

CHAPTER 5
INFLUENCING SAN FRANCISCO'S PROCUREMENT OF ENERGY RESOURCES AT THE WHOLESALE LEVEL

This chapter discusses the ability of San Francisco to affect the wholesale procurement choices of PG&E and energy service providers who provide 78% and 8% respectively of San Francisco's energy needs. Wholesale procurement choices refer to the buying of energy from the broader Western U.S. electric grid and not just from within San Francisco's boundaries. Absent increased means to influence and affect the procurement choices of PG&E and these energy service providers, it will be difficult for San Francisco to meet its goals of a zero-GHG electric system by 2030.

Fortunately, on-going efforts at the state level have significantly increased the percent of renewable energy that these entities will need to acquire. Under the Renewable Electricity Standard (RES) approved for adoption by the California Air Resource Board, PG&E and energy service providers will be required to meet 33% of their energy needs by 2020 from renewable resources classified as "RPS compliant. The state has also adopted a "cap-and-trade" proposal for carbon emissions that will likely provide a further incentive to reduce GHG emissions associated with electric generation. Post-2020, it is likely that the state will further increase the RPS standard in order to meet the state's goals of reducing GHG gases by 80% from 1990 levels by 2020. State efforts to promote energy efficiency and rooftop-solar (through the California Solar Initiative) have also significantly increased since the 2002 ERP.

There are three ways that San Francisco can directly influence wholesale procurement.

First, the City can pursue Community Choice Aggregation. The SFPUC is currently in the process of soliciting responses to a Request for Proposal (RFP) to provide energy services to the CCA. Under this RFP, it is expected that 51% of the energy procured by the CCA will be from renewable resources by 2021.. This approach is reflected in the other two scenarios modeled in the RMI draft

report.52 The ability of San Francisco to achieve this goal will depend on the resolution of ongoing issues pending before the California Public Utilities Commission that could significantly affect the economic viability of the aggressive CCA program currently envisioned.

[52] These two scenarios are the Increased Local Control Declining (Technology) Cost and the Increased Local Control Constant (Technology) Cost

Significance of the Level of Local Control

Meeting San Francisco's energy planning goals, which include a net GHG-free electric system by 2030, presents significant challenges because the City is not currently an energy portfolio manager on behalf of its citizens. As was the case in the 2002 ERIS report, the City's influence on energy resource decisions is limited to the following functions:

1. Operation of the Hetch Hetchy hydro system (mostly governed by water supply needs);
2. Serving the energy needs and implementing projects at municipal customers' facilities;
3. Providing marketing and information for residential and commercial energy efficiency programs (in collaboration with PG&E); and
4. Setting local policies and funding incentives.

Thus, implementation of the City's goals under these conditions will require strong cooperation among the City's system of electricity suppliers—SFPUC, PG&E, and direct access providers—as well as private third-party developers and investors.

Recognizing these constraints and other factors, San Francisco is actively exploring community choice aggregation (CCA) as a mechanism to increase the level of local control. Community choice aggregation would entail the City contracting with an energy service provider (ESP) to procure bulk power supplies. Provision of DSM, green energy and other services that would help fulfill City policy goals could be a condition of the City's contract with the ESP, or they could be acquired separately, leaving the ESP to focus on low-cost power procurement.

The focus and directive of this analysis is to assess the clean energy options that are technically and economically available to the City to fulfill its clean energy objectives by 2030, and recommend measures that key actors should take to make it achievable. While this report remains agnostic about the system that San Francisco could or should adopt, given this is a decision that should be left to the citizens and the political process, the issue is relevant to this analysis to the extent that these decisions materially impact the City's timing and access to potential energy supply and demand options.

Second, San Francisco could advocate for an expanded "green option" for City residents that would directly procure additional renewable and/or zero-GHG energy. Under this proposal, San Francisco residents could choose to pay an additional premium on their PG&E electric bill and PG&E would use these funds to purchase additional renewable energy beyond the amounts required under the state's RES standard.

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Third, San Francisco can advocate before the CPUC and FERC, the two regulatory bodies that oversee PG&E, to promote policies that will further reduce GHG emissions by increasing the amount of energy efficiency and renewable energy. Both the RMI report and the Green TAC have identified a number of areas where San Francisco should seek to affect state policy as it relates to PG&E.

The RMI draft report also examined the availability and price of renewable resources that are likely to be available in the Western United States energy market. The RMI draft report concluded that significant amounts of renewable energy should be available to meet expected demands at prices not significantly higher than those for conventional energy sources. This result is similar to the CPUC's recent report estimating the availability of renewable energy needed to meet a 33% RPS standard, although the CPUC report identified a number of potential transmission and siting problems, not considered by RMI in its report, that could delay the availability of renewable energy. Additionally, San Francisco (both the SFPUC and CleanPowerSF) will need to actively compete in this market against numerous other utilities that are also seeking to procure renewable energy to meet their own state-mandated renewable energy targets. Many of these utilities are significantly larger and better funded than San Francisco.

RECOMMENDATION 7 – IMPLEMENT COMMUNITY CHOICE AGGREGATION (CCA)

Implement Community Choice Aggregation (CCA) consistent with guidance from the Board of Supervisors and LAFCO.

The major lever in which San Francisco can influence its energy future is through CCA. As noted in Chapter 3, over 86% of energy used in San Francisco is delivered by either PG&E or direct access service providers. Almost all of this energy is procured from the wholesale energy market. Only by acquiring the right to directly serve and provide energy to San Francisco residences and businesses can the City influence the type of energy purchased, and create a revenue stream (through the customer's energy bills) to fund the development of renewable energy and energy efficiency activities.

CLEAN POWER SF GOALS

- To provide customers with a choice for their electricity supplies,
- To reduce the City's reliance on fossil fuels,
- To reduce pollution and greenhouse gas (GHG) emissions associated with electricity generation necessary to serve San Francisco's residents and businesses,
- To provide electricity supplies at rates that are competitive with PG&E service and to stabilize electricity rates for City residents and businesses enrolled in the program,
- To increase local control over electricity supplies, and
- To increase local green job opportunities.

Since 2002, San Francisco has created a CCA program – Clean Power SF – and has taken the necessary steps to be able to offer service to customers. Ordinances 86-04, 146-07 and 147-07 established the CCA program at the local level, and the SFPUC has provided $5 million in start-up funding. Pursuant to State law, the City developed a Community Choice Aggregation Implementation Plan and Statement of Intent (the "Implementation Plan") which was certified by the California Public Utilities Commission (CPUC) on May 18, 2010. The City executed a Community Choice Aggregation Service Agreement with PG&E on

May 27, 2010 which governs the business relationship between PG&E (which will still provide transmission and distribution services to deliver CCA's energy to its customers).

The goal of the CCA program is to offer an electricity supply portfolio such that by 2021, at least 51% of supplies will be provided by renewable and green resources at prices comparable to PG&E.

The CCA program has released a Request for Proposal (RFP) to identify an energy supplier, with a choice expected to be made sometime in late 2010/early 2011. .

Potential Concerns

- CleanPowerSF will need to address various implementation issues, identified in its operating plans, in order for CCA to begin operation.

Need for Changes to Existing City Ordinances

- None. The establishment, operation, and goals of CCA have been set by Ordinances 86-04, 146-07 and 147-07.

Next Setps

1. CleanPowerSF should continue its efforts to begin offering energy services to San Francisco residents and businesses as soon as practicable.

COMMUNITY CHOICE AGGREGATION
(Applicable Peak Oil Task Force Recommendations)

3.4.1	ImplementCommunity Choice Aggregation (CCA)

RECOMMENDATION 8 – DEVELOP CITY-OWNED TRANSMISSION PROJECTS

Evaluate and develop new city-owned transmission projects to increase the delivery of Hetch Hetchy and renewable power to San Francisco.

Background

Ordinance 94-09 directed the SFPUC to identify;

> (i) Transmission needs to transport Hetch Hetchy generation and cost-effective clean resources into the City, and alternatives for meeting those needs, including, construction of City-owned transmission lines, contracts or joint transmission projects with other municipalities, and participation in the ISO transmission markets.

This reconfirms the direction the Board previously gave the SFPUC in Resolution 414-07 that directed the SFPUC to study the feasibility of building a transmission line that would connect CCSF's Hetch Hetchy generation directly to San Francisco.

Currently, the SFPUC owns and operates two 115 kV transmission lines that run approximately 150 miles from CCSF's Hetch Hetchy hydroelectric generation units to PG&E's Newark substation. However, . San Francisco does not own any transmission lines connecting from Newark into San Francisco. Instead, PG&E owns all of the high-voltage transmission lines entering the City, with the exception of the Trans Bay Cable project..

This has required CCSF to enter into an interconnection agreement with PG&E to transmit electric power the remaining 30 miles from Newark to San Francisco over PG&E's transmission lines. For a number of years, extending this transmission line to San Francisco has been proposed, and the issue has been revived given the pending expiration of CCSF's agreement with PG&E in 2015.

With the retirement of the Hunters Point and Potrero power plants, San Francisco will be reliant on power brought into the City over transmission lines

to meet almost all of its energy needs.[53] Building additional transmission capacity into the City would further ensure that there will not be a need for any large-scale, central generation in the City.

Proposal

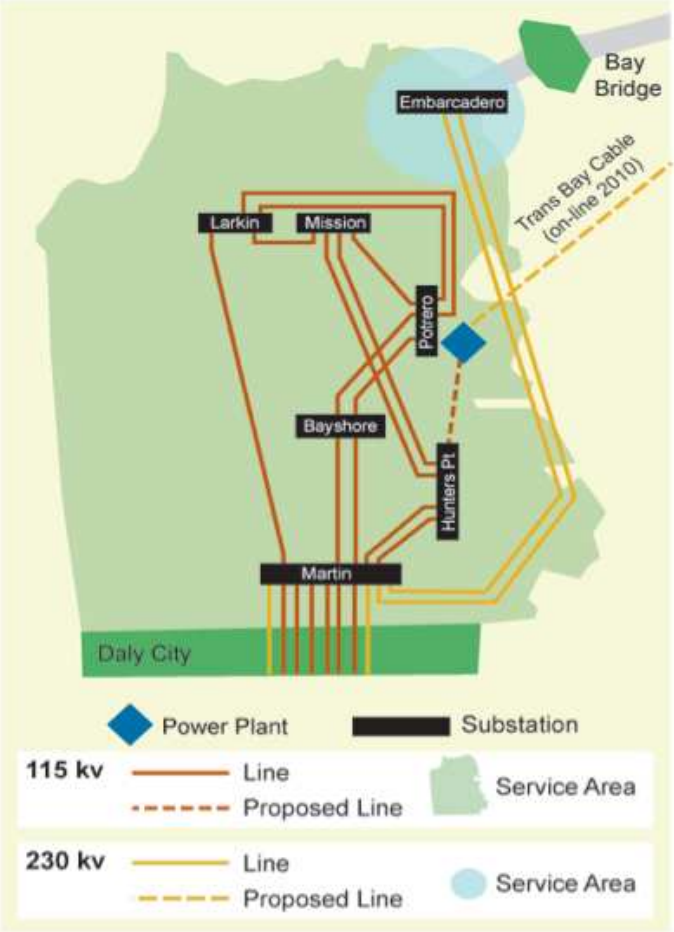
In response to Resolution 414-07, the SFPUC is currently examining the feasibility of an underwater transmission cable, using the same technology as Trans Bay Cable, that would run under the Bay from Newark to the Oakland/East Bay, and then over to San Francisco.

The SFPUC is also evaluating upgrading its existing transmission system from Hetch Hetchy to Newark. This transmission line parallels one of the three main corridors for electric energy to enter into the Greater Bay Area, and is the only transmission line in this corridor that is not owned by PG&E. Upgrading these lines would also increase the ability of the Greater Bay Area to access renewable energy sources being developed outside the Bay Area, including potential SFPUC renewable projects along the SFPUC's existing right-of-ways.

The SFPUC has retained consultants to evaluate these proposed projects and has requested the California ISO to study these proposals as part of its Transmission Planning Process. The SFPUC is also pursuing partnership and financing opportunities for this project from the Western Area Power Administration (WAPA) and other Bay Area municipal utilities.

[53] As noted above, there are approximately 30 MW of Cogeneration within the City and 13 MW of solar (including the Sunset Reservoir). This compares to a peak demand in San Francisco of about950 MW.

San Francisco's Transmission System



Within San Francisco, there are also essentially two different transmission systems. The first is a 230 kV transmission system consisting of two lines that serve PG&E's Embarcadero substation. The Embarcadero substation, in turn, serves the Downtown area. The second is a lower voltage 115 kV system that serves the rest of San Francisco.

Although Trans Bay Cable will improve reliability to the 115 kV system, it will not improve reliability on the 230 kV system that serves the Downtown area. Should there be a double outage of both of the existing lines serving Downtown, about 250 MW of Downtown load would be curtailed. This raises the concern that additional reinforcements to the 230 kV system may be in order.

One way to improve the reliability of the 230 kV system would be to add an additional connection to the Embarcadero station. Resolution 414-07 also directed the SFPUC to study the feasibility of a City-owned transmission line to

provide additional reliability to the Downtown area. This concern is also being addressed in the SFPUC's study of transmission alternatives.

Potential Concerns

- While PG&E owns almost all of the transmission system serving San Francisco, , under California's restructuring of the electric industry, PG&E has turned the daily operation and dispatching (who gets to use the system) over to the California Independent System Operator (California ISO). The California ISO's role is to serve as an impartial "traffic cop" ensuring that all generators and end-use customers (including San Francisco) receive the same "open, transparent, and non-discriminatory access to California's transmission system."[54].

- Project feasibility and financing currently being evaluated

- Construction of these transmission lines will require significant capital investment that the SFPUC will not likely be able to pay for on its own. As these transmission lines will benefit not only San Francisco but also improve reliability and access to renewable energy for the Greater Bay Area, the SFPUC is pursuing funding opportunities with the California ISO, Western Area Power Administration, and other Northern California municipal utilities.

Need for Changes to Existing City Ordinances

- None. Resolutions 414-07 and 299-08 directed the SFPUC to study the feasibility of these transmission projects.

Next Steps

1. The SFPUC has retained consultants to evaluate these proposed projects.

2. The SFPUC has requested the California ISO to study these proposals as part of its Transmission Planning Process.

[54] The California ISO as well as Trans Bay Cable and PG&E's transmission services are all subject to FERC regulation.

3. The SFPUC is also pursuing partnership and financing opportunities for this project from the Western Area Power Administration (WAPA) and other Bay Area municipal utilities.

CITY-OWNED TRANSMISSON
(Applicable RMI Recommendations)

RE-15	SFPUC should complete an evaluation of the cost of a transmission line to bring in renewable power and Hetch Hetchy power directly to the City. This evaluation should assess the cost benefits of the reduced transmission charges that the City would otherwise have to pay to either PG&E (prior to the expiration of the interconnection agreement (IA) in 2015) or the California ISO (after 2015) . .
RE-14	SFPUC should explore partnerships with other municipal utilities to evaluate and develop potential renewable energy sites either in close proximity to the City and/or Northern California

RECOMMENDATION 9 – GREEN PRICING

Develop an optional "green pricing" option (through CCA and/or PG&E) allowing San Francisco customers to voluntarily commit to purchasing 100% zero-GHG energy.

Background

"Green pricing" allows a customer to voluntarily pay a premium above the otherwise applicable electric rate with the premium being used by the supplier to purchase additional renewable energy. This allows individual San Francisco customers to voluntarily commit to purchasing 100% zero-GHG energy. Many municipal utilities, such as Palo Alto, offer this service. Under Palo Alto's program, customers voluntarily pay an additional 1.5 cents/KWh on their electric bills with the additional revenue used to purchase renewable energy credits (RECs) to offset the corresponding GHG emissions. The Sacramento Municipal Utility District (SMUD) offers a "solar shares" program where customers voluntarily pay higher rates to purchase a proportionate share of the output from a new solar facility.

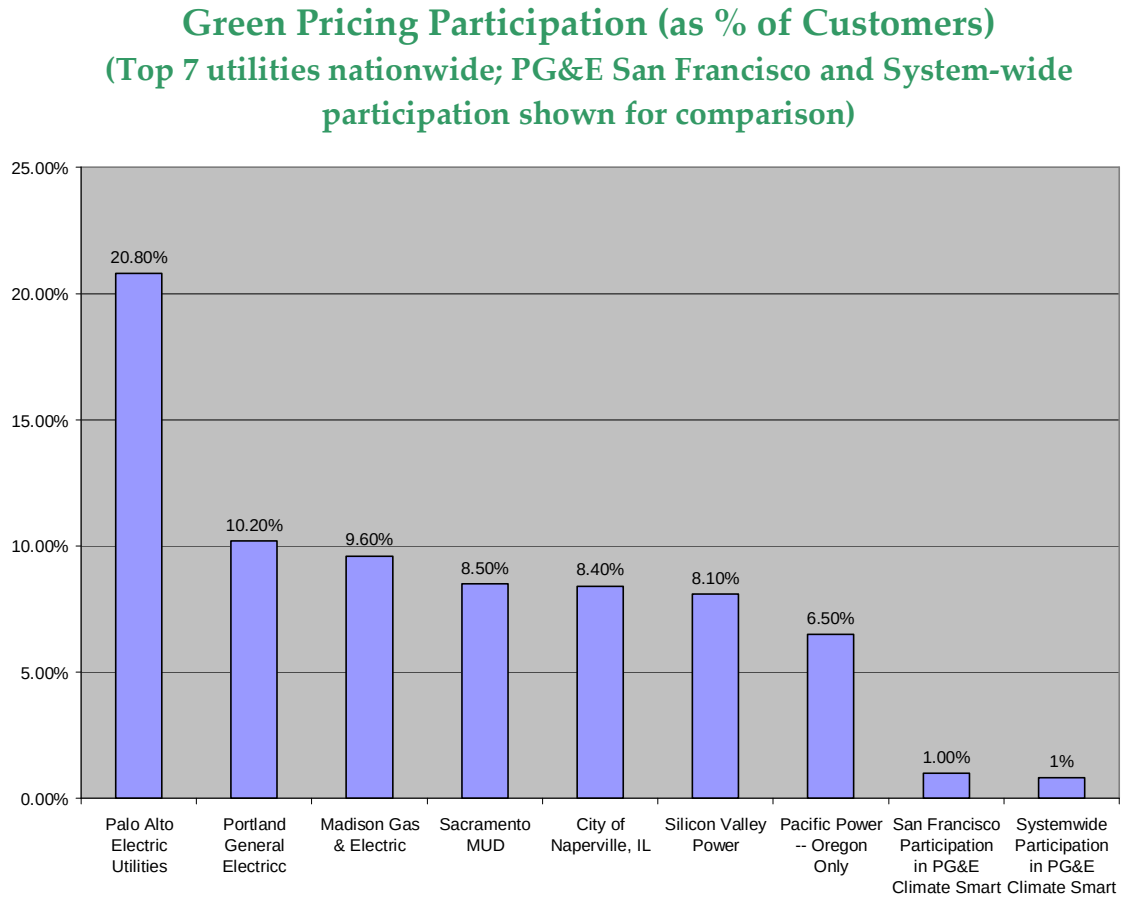
PG&E does not currently offer this service but does offer a ClimateSmart program that allows customers to pay extra (about ¼ cent per KWh or $3.00/month per participant to purchase GHG offsets equivalent to the GHG emissions from their energy usage.[55] These offsets tend to come from forest protection and agricultural programs[56] rather than from reduced GHG emissions from electric generation.

To date, only about 3,000 of PG&E's San Francisco customers participate in PG&E's ClimateSmart program. Program participation in San Francisco is somewhat higher (about 1%), than PG&E's system-wide participation rate of 0.8%. These figures do not include other voluntary GHG offset programs that businesses and residents can participate in. Other utilities have significantly higher participation rates but also are starting from rates that are significantly

[55] Information and data for PG&E's program is taken from PG&E's 2009 Climate Smart Annual Report (March 10, 2010)

[56] Such as reducing methane emissions associated with dairy operations.

below PG&E's rates[57], thus imposing less of a financial cost on participating customers.



SOURCE: National Renewable Energy Laboratory's annual assessment of leading utility green power program and PG&E' 2009 Climate Smart Annual Report

Proposal

San Francisco should develop a "green pricing" option available for all San Francisco residents and businesses. San Francisco could work with PG&E to make this option available to City residents and businesses or it could be offered as part of CleanPowerSF, San Francisco's CCA program.

RMI, in their draft report, believe that PG&E will have little incentive to offer such a program in the near-term, as it will be seeking to acquire all possible GHG-free energy to meet its state-mandated Renewable Portfolio Standards

[57] For example, Palo Alto's and Silicon Valley Power's electric rates are about 2/3rds of PG&E's rates.

(RPS). Nonetheless, San Francisco should continue to press PG&E to offer this service.

The green pricing option could also be incorporated into the service offerings of CCA.

Several variants of this program could be developed, with customers being able to designate some portion of their energy usage greater than the otherwise applicable RPS standard but less than 100% (e.g. a 50%, or 75% option). Another variant could focus on acquiring only in-city renewable energy or as the Sacramento Municipal Utility District (SMUD) offers, an option for customers to purchase a share of a solar facility equivalent to their energy usage. As noted above, both the pricing and length of commitment to the program need to be sufficient to recover the higher cost of acquiring renewable energy, particularly for any CCA offered program as customers retain the ability to leave the program if it becomes too expensive.

Potential Concerns

- Willingness of PG&E to offer a green option for its San Francisco customers.
- Ability of CCA to develop a green pricing option while it is also undertaking numerous other issues associated with its planned start-up.
- Pricing and length of commitment to any green pricing program need to be sufficient to recover the higher cost of acquiring renewable energy, particularly for any CCA offered program as customers retain the ability to leave the program if it becomes too expensive.

Need for Changes to Existing City Ordinances

- None identified.

Next Steps

1. Need to work with PG&E, and through the CPUC, to encourage PG&E to offer a green option.
2. Incorporate green option into the CCA program.

GREEN PRICING
(Applicable RMI Recommendations)

RE-13	PG&E and SFPUC should discuss and develop options for procuring outside city renewable resources for San Francisco in light of meeting California's RPS requirements.
RE-13a	Options include a voluntary green power pricing program where customers pay a premium rate on their bill for additional renewable energy.

RECOMMENDATION 10 – REGULATORY PARTICIPATION

Participate in regulatory proceedings before the CPUC and FERC to encourage state and federal policies to promote the use of GHG reduction strategies and encourage the development of CCA.

Background

The SFPUC serves as the City's designated expert on energy issues. The SFPUC extensively participates before state and federal regulatory agencies to represent San Francisco's interests usually in conjunction with the City Attorney. Past examples include advocating for the closure of the Potrero power plant, reviewing reliability and cost issues associated with PG&E's provision of gas and electric service to the City, and regulatory issues associated with implementing CCA.

Proposal

As noted in Chapter 3, over 4/5th of San Francisco's electric energy is procured by entities (PG&E and direct access providers) that are regulated by the CPUC. Participation by the City in these proceedings provides and opportunity to encourage regulatory agencies to adopt policies that promote GHG reduction strategies. Participation in PG&E's Long-Term Procurement proceeding and the CPUC's rulemaking on electric vehicle development are two examples.

The CPUC is also still in the process of developing the rules that will govern CCA. Major issues that still need to be resolved are the amount of exit fees that customers choosing CCA will be obligated to pay to PG&E, setting limits on PG&E's marketing efforts to prevent customers from choosing CCA, and the ability of a CCA to directly control and utilize the energy efficiency funds currently being collected through a utility's Public Goods Charge (PGC).

Finally, as noted in Recommendation #2, the State Legislature will soon need to reauthorize the state's Public Goods Charge. This provides an opportunity for the City to advocate both for increased funding for this program as well as increased control of the program's expenditures by the City or independent third-party administrators rather than by the utilities.

Potential Concerns

- Intervention in the legislative and regulatory process can be a time-consuming and resource-intensive process without any certainty of results.

Need for Changes to Existing City Ordinances

- None. The City Attorney is already designated to represent San Francisco before regulatory bodies, usually in conjunction with the SFPUC.

Next Steps

1. Identify and prioritize relevant proceedings that have a significant effect on San Francisco and its goals of GHG reduction and devote sufficient resources to participate in these proceedings as necessary.

REGULATORY INVOLVMENT
(Applicable RMI Recommendations)

EE – 3	BOS should consider mechanisms for raising additional funds for energy efficiency implementation beyond monies already collected through PG&E's Public Goods Charge and the SFPUC's Sustainable Energy Account (5% of revenues). NOTE: Also addressed in Energy Efficiency
EE - 12	The BOS should consider establishing an Efficiency Services Providers steering committee to facilitate a more frequent and consistent exchange of information on best practices, coordination, review and recommend new programs, and establish clear definition of roles. Members of the task force should include PG&E, SFPUC, and SFE, as well as low-income representatives, and efficiency contractors.
RE-4	PG&E should continue to find creative methods for providing critical funding for distributed renewable energy projects that would otherwise have trouble accessing capital markets..
RE-11	In collaboration with SFPUC, PG&E should evaluate geographically specific load-growth forecasts within San Francisco to anticipate and evaluate the impact of distributed generation on feeder lines, substations and transformers.
RE-13	PG&E and SFPUC should discuss and develop options for procuring outside city renewable resources for San Francisco in light of meeting California's RPS requirements.
RE-13a	Options include a voluntary green power pricing program where customers pay a premium rate on their bill for additional renewable energy.
ET-4	PG&E should continue to study the interaction between electric vehicles, smart metering, and the smart grid.

(Applicable Peak Oil Task Force Recommendations)

3.4.8	Seek ways to maximize the City's influence on primary energy resource decision-making.

CHAPTER 6
ENSURE THE SFPUC CONTINUES TO PROVIDE RELIABLE, REASONABLY-PRICED, AND ENVIRONMENTALLY SENSITIVE ELECTRIC SERVICE

Regardless of the energy policies adopted by San Francisco, the SFPUC will remain responsible for providing electric service to municipal facilities. The following recommendations ensure that the SFPUC continue to provide reliable, reasonably-priced, and environmentally sensitive electric service.

Critical to providing reliable service will be developing a rate structure that accurately reflects the cost of providing electric service and enables the SFPUC to be able to utilize long-term financing for its projects.

RECOMMENDATION 11 – DEVELOP A RATE STRUCTURE FOR THE SFPUC

Develop a rate structure for the SFPUC that reflects the cost-of-service, promotes the efficient use of energy, and provides the SFPUC with the financial capability to use long-term financing to develop new energy sources.

Background

The SFPUC provides electric power to all municipal facilities within San Francisco including the Muni railway; water and wastewater facilities; and San Francisco International Airport (SFO) and its tenants. The SFPUC also provides electric service to the San Francisco School District and Community College District.

The SFPUC's Municipal customers are classified as either General Fund or Enterprise Fund customers. General Fund customers pay SFPUC a lower subsidized cost for their electric usage (currently 3.75 ce/kwh for most customers although some customers pay nothing) that does not reflect the cost of producing and delivering the energy. Enterprise Fund customers who pay for power at costs comparable to what PG&E retail customers pay. Enterprise Fund customers thus provide SFPUC with incremental revenue to offset the subsidies provided to General Fund customers, fund necessary upgrades, and the opportunity to implement new city energy projects.

Since General Fund customers pay less than it costs to provide them service, they have less incentive to do energy efficiency programs that otherwise would be cost-effective if they were paying the full cost of the service they are receiving. Additionally, since General Fund rates do not vary by time-of-use (TOU), General Fund customers pay the same rate regardless of whether they are using energy during off-peak or on-peak times, thus muting any incentive to engage in demand response activities or shift energy usage to lower cost time-periods.

Perhaps most importantly, the lack of a clearly defined and enforceable rate structure does not make it possible for the SFPUC to satisfy credit rating agencies as to the certainty of its revenue stream. This precludes the SFPUC from being

able to issue bonds in order to finance large capital projects such as new renewable energy facilities.

Proposal

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The SFPUC Power Enterprise should establish a Rate Reform Plan that proposes a new ratemaking structure and process that satisfies credit rating requirements and supports the agency's energy efficiency and renewable energy goals. Once a credit rating can be obtained, Power Enterprise can bond finance renewable projects and blend these costs into its rate base.

Potential Concerns

- Past efforts to move rates for General Fund customers to rates based on cost-of-service have yet to be adopted.
- Current City budget crisis may make it more difficult to implement cost-of-service rates for General Fund customers.

Need for Changes to Existing City Ordinances

- None. Resolution 431-04 already establishes the policy that San Francisco should "transition to annually appropriate funds for each General Fund department sufficient to compensate HHWP for all electricity sales to such departments at a rate that reflects the same cost principles as outlined in the City Charter (Sec. 8B.125, Rates)"

Next Steps

1. SFPUC is undertaking the necessary cost-of-service studies, begun to develop rates, and will seek Board approval to implement changes.

RATE REFORM

(Applicable RMI Recommendations)

EE - 8	SFPUC and BOS should consider developing a new rate structure that encourages efficiency investment by setting rates at cost, making enterprise customers revenue neutral for energy efficiency improvements, and usng TOU rates.

RE-1	The SFPUC Power Enterprise should establish a Rate Reform Plan that proposes a new ratemaking structure and process that satisfies credit rating requirements and supports the agency's energy efficiency and renewable energy goals. Once a credit rating can be obtained, Power Enterprise can bond finance renewable projects and blend these costs into its rate base.

SFPUC POWER ENTERPRISE CREDIT RATING KEY TO REVENUE BOND FUNDING

To date San Francisco voters have authorized power bond and borrowing capacity through Propositions B & H both passed in 2001, as well as in the San Francisco Charter Section 9.107.

The Charter authorization provides for accessing capital project funding for the reconstruction or replacement of existing electric power facilities or combinations of water and electric power facilities under the jurisdiction of the SFPUC, subject to a three-fourths affirmative vote of all members of the Board of Supervisors.

Propositions B & H provided for additional authority for funding renewable energy projects. Specifically, these propositions did the following.

Prop B: Authorized issuance of up to $100M 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.

These propositions provide the SFPUC with flexibility, assuming access to capital markets. A key requirement to accessing capital markets for an entity like the SFPUC Power Enterprise is to have a standalone credit rating which enables competitively priced borrowing based on revenue bonds. Without it, the authorization mechanisms of Propositions B and H do not function efficiently, because the cost of borrowing would be imprudently high for an unrated entity like the Power Enterprise.

The SFPUC has been working to create the conditions necessary for the Power Enterprise to get a standalone credit rating and is currently on course to have this credit rating by FY 2011-12. To achieve that, it is recommended that the Power Enterprise have at least two years of audited financial statements. During FY 2009-10 the Hetch Hetchy Water & Power operations were disaggregated into their two component parts: 1) Hetch Hetchy Water and 2) Hetch Hetchy Power. This enables rating agencies and potential lenders to independently evaluate the creditworthiness of the SFPUC Power Enterprise. A separate, audited financial statement enables bond rating agencies and investors to better evaluate and fairly set the price of borrowing for the Power Enterprise. These audited financial statements online at:
https://infrastructure.sfwater.org/fds/fds.aspx?lib=SFPUC&doc=630585&data=242775225.

In addition to audited financial statements the SFPUC has also developed for the Power Enterprise 10-Year Capital Plans, 10-Year Financial Plans, and a Long-Term Strategic Plan. These items are reviewed by credit rating agencies as part of their evaluation of any entity issuing bonds. The SFPUC has successfully completed all of these plans and updates them annually as part of the budget cycle.

Other actions to facilitate the Power Enterprise's access to capital markets include the following.

- Completion of an updated Revenue Requirement Model, incorporated into the adopted 10-Year Capital Plans and projected power demands;
- Launch of the Power Enterprise's Electricity Retail Rates Study, which is now nearing completion, with proposed retail rates slated for upcoming Commission meetings.
- Successfully completed the entire Rate Fairness Board briefing and deliberation process regarding the Power Enterprise's operations, financial projections and rates. They will provide their report on our proposed Public Power Redevelopment Area retail rates to the Commission in early January 2011; and
- Held over ten meetings and discussions with investment bankers regarding financing options for Hetch Hetchy Power, associated capital needs, and financial constraints.

Solid progress has been made toward accessing revenue bonds through capital markets for the Power Enterprise, and the SFPUC continues to look for allocations though other types of bonds including Clean Renewable Energy Bonds and Qualified Energy Conservation Bonds. On both of those fronts the SFPUC has been successful in procuring $6-8M allocations; however, the need is much larger so revenue bonds must play a role.

The SFPUC is currently on course to secure a standalone credit rating for the Power Enterprise by FY 2011-12 which will enable revenue bond borrowing for key capital projects including the reconstruction and replacement of existing electric power facilities and the construction of new renewable energy

RECOMMENDATION 12.. – INCREASE THE USE OF MUNICIPAL LOAD TO DISPLACE FOSSIL FUEL USE

Increase the use of municipal load electric energy from Hetch Hetchy to displace fossil-fuel use (e.g. shoreside docking, recharging electric vehicles in City-owned parking lots).

Background

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Another issue the SFPUC must address is the effect of the Raker Act on the SFPUC's efforts to promote energy efficiency and renewable energy projects on municipal facilities. Under the provisions of the Raker Act of 1913, which authorized construction of the Hetch Hetchy system, as well as associated contractual commitments, electrical generation from the Hetch Hetchy system is used first to serve San Francisco municipal loads, and then is sold at cost to meet the agricultural pumping and municipal needs of the Modesto and Turlock Irrigation Districts (MID and TID)[58] Any excess power can be sold to public power agencies, although in practice, much of this power is sold to MID and TID based on market prices.

As a result of the Raker Act, in many cases if the SFPUC reduces its municipal load (through such activities as energy efficiency or renewable energy), the displaced Hetch Hetchy power must be sold at cost to MID/TID. A study in 2007 determined that for each 1 MWh the SFPUC saved, ½ of the saved Hetch Hetchy power had to be provided to MID/TID.

Proposal

One option from the Green TAC to minimize the effect of Hetch Hetchy energy that is displaced by energy efficiency or renewable energy development at

CCSF also provides electric service to the Riverbank Army Ammunition Plant, a former military facility currently scheduled for closure and potential conversion to non-military uses. [59] For example, CARB, in their AB32 Scoping Plan, discuss the possibility of further raising the RPS requirement post-2020, perhaps to 50%, in order to meet AB32's long-term goal of an 80% reduction in GHG emissions by 2050.

municipal facilities is to identify new uses for Hetch Hetchy power that both qualify as municipal load and have GHG-reduction benefits. The SFPUC's just completed shoreside power facility is an example of this., providing electric power to cruise ships docking in San Francisco, and thereby allowing them to shut down their on-board much higher-polluting fossil-fueled generators that they would otherwise use when they are in port. Increased use of electric vehicles by the City, as well as increased deployment of electric charging stations in City-owned parking lots are other examples.

Potential Concerns

- Need to ensure compliance with Raker Act and other contractual obligations are maintained.

Need for Changes to Existing City Ordinances

- None.

Next Steps

1. SFPUC should continue to identify and develop opportunities that allow it to grow its municipal load by displacing the inefficient use of fossil fuels through such activities as shore side docking and electric vehicle recharging at City-owned parking lots and facilities.

RECOMMENDATION 13.. – RENEGOTIATE THE INTERCONNECTION AGREEMENT

Renegotiate the Interconnection Agreement (IA) with PG&E that governs the transmission and distribution of Hetch Hetchy energy to San Francisco that expires in August 2015.

TEXT FORTHCOMING

RECOMMENDATION 14.. – IMPLEMENT ENVIRONMENTAL JUSTICE AND COMMUNITY BENEFIT PROGRAMS

Continue to implement the SFPUC's recently adopted Environmental Justice and Community Benefits policies.

The 2002 ERP identified among its major goals the "Support of Environmental Justice" and to "Promote Economic Opportunities." The closure of the Hunters Point and Potrero power plants represent an achievement of the goal of environmental justice. Other City energy actions, such as targeting low-income houseing projects for energy efficiency efforts and offering enhanced incentives under the GoSolarSF program for solar installations in economically disadvantaged communities are other examples of these efforts.

In order to formalize its commitment to environmental justice, the SFPUC has adopted an Environmental Justice policy. In this policy the SFPUC;

> affirms and commits to the goals of environmental justice to prevent, mitigate, and lessen disproportionate environmental impacts of its activities on communities in all SFPUC service areas and to ensure that public benefits are shared across all communities…The SFPUC defines environmental justice as the fair treatment of people of all races, cultures and incomes, and believes that no group of people should bear a disproportionate share of negative environmental consequences resulting from the operations, programs and/or policies of the SFPUC.

Following up on this initiative, the SFPUC has also adopted a Community Benefits policy in January, 2011 to ensure that SFPUC actions take into account their effect on adjoining communities and that the SFPUC promote economic development.

Potential Concerns

- None identifed.

Need for Changes to Existing City Ordinances

- None.

Next Steps

1. Ensure policy is implemented and enforced going forward.

SFPUC COMMUNITY BENEFITS POLICY
(Resolution 11-008, adopted January 11, 2011)

The SFPUC will devote sufficient resources and authority to SFPUC staff to achieve outcomes including:

1. Stakeholder and community involvement in the design, implementation and evaluation of SFPUC programs and policies;

2. Workforce development, including coordination of internal and external workforce programs and strategic recruitment, training, placement, and succession planning for current and future SFPUC staff to ensure a skilled and diverse workforce;

3. Environmental programs and policies which preserve and expand clean, renewable water and energy resources, decrease pollution, reduce environmental impacts, and reward proposals for innovative and creative new environmental programs;

4. Economic development resulting from collaborative partnerships which promote contracting with local companies, hiring local workers, and providing efficient, renewable energy at reduced costs;

5. Support for arts and culture related to the SFPUC's mission, goals and activities;
6. Educational programs;

7. Use of land in a way that maximizes health, environmental sustainability and innovative ideas;

8. Diversity and inclusion programs and initiatives;

9. In-kind contributions and volunteerism; and

10. Improvement in community health through SFPUC activities, services and contributions.

CHAPTER 7
FORECAST OF SAN FRANCISCO GHG EMISSIONS BETWEEN 2010 AND AND ENVIRONMENTALLY SENSITIVE ELECTRIC

GHG emissions from the electric sector represent about 1/4th (24%) of San Francisco's total GHG emissions (1.7 million tons out of 7 million tons) with transportation responsible for about ½ (53%) of total emissions and natural gas and steam usage accounting for the remainder (24%).

GHG emissions from the electric sector have fallen 20% from 2008, while City-wide emissions have fallen 6% during the same time frame.

As part of their draft report, RMI forecasted GHG emissions from the electric sector from 2010 to 2030 under a "Business as Usual" scenario.

Under RMI's methodology, which is similar to that used by San Francisco's Climate Action Plan, it is assumed that all in-city electric generation is assigned to meeting San Francisco's energy needs, with the remaining needs being met by the proportionate resource mix of San Francisco's energy providers (i.e. PG&E, SFPUC, and direct access providers). Under this methodology, all of the GHG emissions from the Potrero power plant are assigned to San Francisco.

As noted in Chapter #3, the resource mix for the SFPUC is estimated as coming from 100% GHG-free resources while PG&E has a resource mix of that includes 14% renewable, 15% hydroelectric, and 22% renewable. The mix of energy resources used by direct access providers is not readily available but tends to mirror the resource mix of the broader Western energy market.

Under this methodology, the closure of the Potrero power plant in 2011 should reduce GHG emissions from the electric sector by almost 25% from 1.7 million tons per year to 1.25 million tons as higher-polluting generation from Potrero is replaced by cleaner imported power.. Implementation of California's 33% RPS

requirements by 2020 should further reduce GHG emissions from the electric sector to 1 million tons by 2020. This is a 40% drop from 2008 levels).

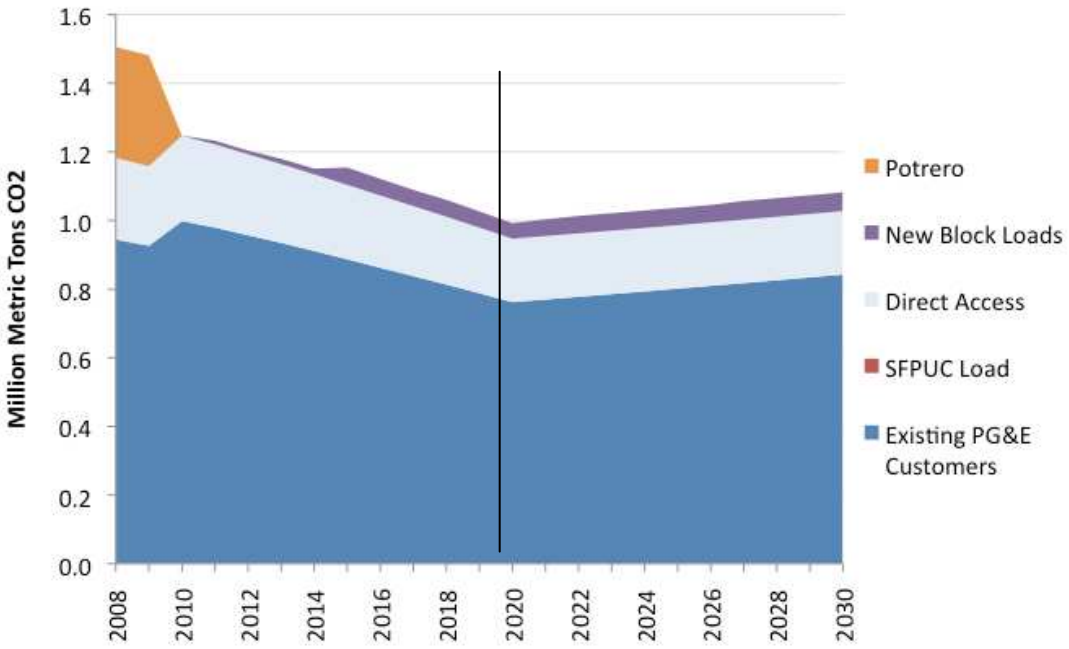
Post-2020, the RMI draft report forecasts GHG emissions from the electric sector increasing. This is due solely to continued load growth (forecasted at 1.3%). Average GHG emissions per MWh are expected to remain the same.

There are several problems with RMI's analysis, however, that tend to overstate forecasted GHG emissions. Perhaps most importantly, the analysis does not assume any further improvements post-2020 in California's RPS requirements beyond the 33% by 2020 target. [59] As the California Air Resources Board (CARB) has noted in its AB32 Scoping Plan, it is likely to consider the possibility of further raising the RPS requirement post-2020, perhaps to 50%, in order to continue to make progress towards AB32's long-term goal of an 80% reduction in GHG emissions by 2050

Second, it does not include any GHG reductions occurring as a result of CARB's recently adopted cap-and-trade" proposal. Under this proposal, CARB will issue a set number of allowances each year with each allowance allowing for the emission of one ton of GHG. Between now and 2020, the number of allowances issued each year will progressively decline. This will require emitters of GHG to either reduce their operations, operate more efficiently thus reducing GHG emissions per unit of output, or purchase allowances from another party with excess allowances. For the electric utility sector, the number of allowances issues will decline by about 16% between 2012 and 2020 raising the cost of electric energy generated from fossil fuels by $15 to $30 per MWh depending upon the allowance price and fuel source.. this is expected to raise the cost of programs for GHG emissions currently being developed by CARB.

It is assumed that the cap-and-trade program will primarily affect electric utilities that use significant amounts of coal-fired generation, something that neither the SFPUC or PG&E typically rely on for meeting their energy needs. Direct access providers, however, who purchase significant amounts of energy from the broader Western energy market, will likely be affected and will need to take action to reduce their GHG emissions. .

Business as Usual Emissions in San Francisco's Electric System



SOURCE: RMI Draft Report, Page ES-3