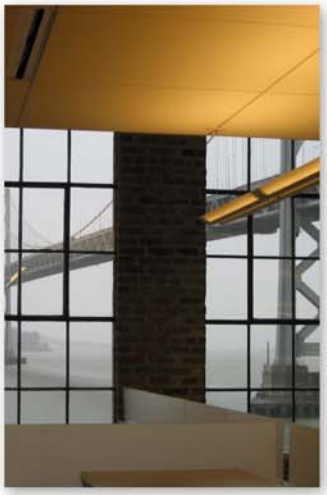
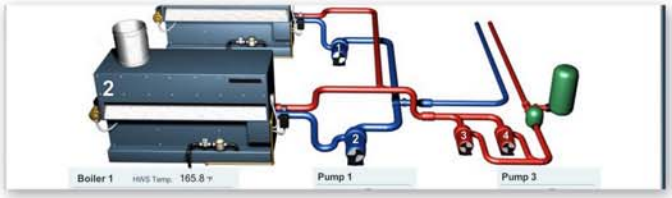


Mayor's Task Force on Existing Commercial Buildings

Final Report and Recommendations For The City and County of San Francisco

December 2009



Mayor's Task Force on

Existing Commercial Buildings:

Report to the City and County of San Francisco

December 2009

Cover art, clockwise from upper left:

- Demand controlled ventilation, 301 Battery Street
- Direct/Indirect lighting. Photo courtesy of Gensler Architecture
- LED Exit sign
- Financial district exterior
- Daylit conference room, 301 Battery Street
- Boiler control loop. Image courtesy of Integrated Building Solutions
- Mechanical system in action
- Financial district exterior

Photos courtesy of SF Environment unless otherwise noted.

Contents

The Honorable Gavin Newsom, Mayor
San Francisco City Hall
Room 220
1 Carlton B. Goodlet Place
San Francisco, CA 94102

December 7, 2009

Dear Mayor Newsom,

On behalf of the members of your Existing Commercial Buildings Task Force, we wish to express our gratitude for inviting use to serve on the City and County of San Francisco. Please find enclosed our recommendations for improving energy efficiency among existing commercial real estate and reducing the carbon footprint of the City.

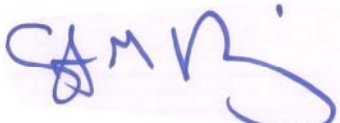
The Task Force dedicated hundreds of hours to come to consensus on the best approach to reduce the use of energy, water and resources within San Francisco's existing commercial building sector. The Task Force unanimously agreed that our great City has served as a leader in innovation, technology, and social progress and will continue to. We also must insure that the recommendations of this Task Force are implementable and will yield measurable savings.

The recommended Existing Commercial Buildings Strategy is a first step: establishing baseline energy usage and understanding our carbon footprint at all scales – from individual buildings to citywide. Once this foundation is in place, programs, incentives, and outreach can be delivered in a way that is effective, accessible, and administratively viable.

The Task Force agrees that despite great progress over many years, we are in the early stages of building a sustainable city. With this in mind, the Task Force offers this recommended path to achieve the goals established by previous City legislation and strategic guidelines.

We look forward to further dialogue, clarifications, or questions.

Respectfully submitted,



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Green Building Consultant

Mission

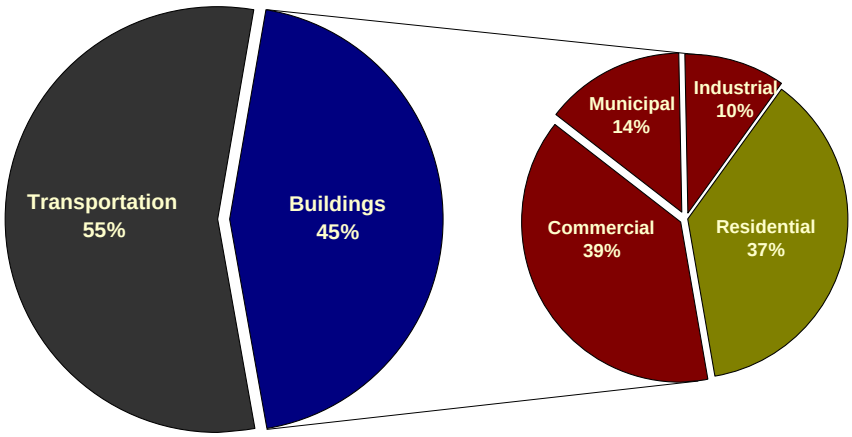
The San Francisco Existing Commercial Buildings Task Force was convened to recommend policies, actions, and partnerships that will meet local and state goals to improve energy efficiency in buildings in order to reduce greenhouse gas emissions, conserve resources, enhance electricity reliability, and improve the competitiveness of commercial buildings in the City.

II. Executive Summary

Mayor Newsom convened the San Francisco Existing Commercial Buildings Task Force (ECBTF) to identify the policies, partnerships, and actions necessary to maximize energy efficiency in commercial buildings. The goal of the process was to reduce greenhouse gas emissions, conserve resources, enhance electricity reliability, and improve the competitiveness of commercial buildings in the City.

At least 75% of greenhouse gas emissions in the U.S. are attributable to urban centers[i] and the activities that support urban life.[ii] As such, cities need to work with state, national, and international institutions in minimizing climate change, the effects of which are already being felt locally,[iii,iv,v] particularly as it affects the clean water, hydroelectric generation, and the agriculture that support our city.[vi] Similarly, electricity reliability in San Francisco presents a complex long-term challenge for the local economy and public health.

Figure 1: San Francisco Greenhouse Gas Emissions, eCO2, 2005



The operation, construction, and demolition of buildings accounts for almost half of San Francisco's greenhouse gas emissions (Figure 1.) Commercial, industrial, and municipal buildings account for 63% of building-sector emissions.

The City has established high standards of environmental performance for new construction. However, at the historic rate of 0.8% new buildings per year, it could take more than sixty years to 'green' even half of San Francisco. Clearly, we need to address San Francisco's existing buildings. They are not only essential to the history and economy of our city, but crucial to its sustainability.

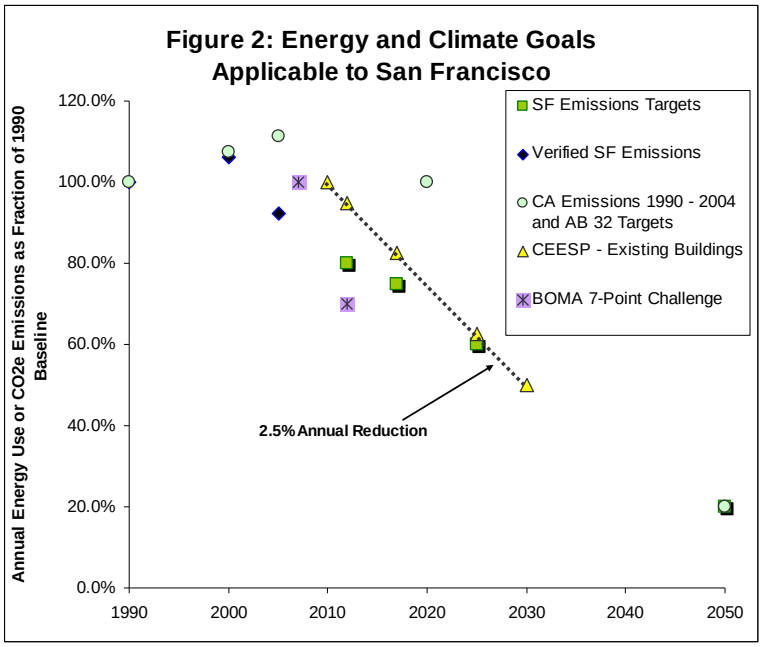
Goal

The ECB Task Force recommends that the City and County of San Francisco adopt a voluntary goal: **Cut total energy use in existing commercial buildings 50% by 2030, or an average net reduction of 2.5% per year** (Figure 2.) This target is based on San Francisco's established greenhouse gas reduction goals, California's *Global Warming Solutions Act* (AB 32), President Obama, Architecture 2030, and the *California Energy Efficiency Strategic Plan* goal for existing buildings.

Policy Context

San Francisco needs to design an effective commercial energy efficiency policy for the mid to long term. However, conditions currently are difficult for commercial real estate. The situation is similar for the city government, which has been forced to prioritize services as budgets have declined. Clearly, new policy must rely upon creative use of existing resources; requirements and incentives must be fundable to be credible. To reduce energy use by 2.5% per year, it will be necessary to navigate the challenges of limited public understanding, diverse lease contracts, access to capital constrained by the current economy, and finite city resources.

Figure 2: Energy and Climate Goals Applicable to San Francisco



The Task Force proposes an Existing Commercial Buildings Strategy (ECB Strategy) for San Francisco that will reduce energy use in commercial buildings and grow the energy efficiency services sector by systematically identifying and eliminating the factors that limit local energy efficiency. The ECB Strategy consists of seven proposals for the city, complemented by support from state, federal, and private sector partners, which will enable the City, with modest resources, to meet and exceed its sustainability and economic goals.

There is currently little information available about the amount of energy that commercial buildings use, so the first priority for policy development is to gather and report data. Information is a critical tool in an integrated, effective program to transform the local built environment and capture all available cost-effective efficiency improvements. At the leverage points we have targeted in our proposals, improving access to information will help building stakeholders – particularly owners, managers, and tenants – to track, value, and implement energy saving capital improvements and operational practices. The City will be responsible for tracking and publicly reporting the impact of the ECB Strategy. In the process, the city and stakeholders will have the necessary data to develop additional approaches, such as performance standards and targeted incentives. Our community will gain the information necessary to identify the barriers, opportunities, and policy tools needed to keep San Francisco on the path to energy optimization.

Summary of Existing Commercial Buildings Strategy

	Idea	Mechanism	Benefits
Transform Market with Information	**Identify Cost-Effective Savings in Every Commercial Building**	**Require** businesses to conduct an energy audit every 5 years for business license renewal, including identifying and listing applicable efficiency measures.	Ensure building owners, managers, and tenants know exactly how much energy – and money – they can save.
	Disclose Energy Performance Information	**Require** building owners and managers to share energy performance data with the City. Publish database to inform stakeholders.	**We manage what we measure.** Tracking helps identify key factors in building performance, including occupant behavior. Monitoring and reporting provides a "miles per gallon" metric that enables tenants and buyers to identify efficient buildings.
	Resolve "Split Incentives"	**Provide** a Green Tenant Toolkit. Make submetering a policy priority.	Help landlords and tenants mutually benefit from reduced utility costs and sustainable operations.
	Make Incentives Easy	**Develop** a web-based tool that finds all incentives, rebates, and financing	Offset the cost of improvements and streamline the payment of incentives for energy improvements.
	Educate, Train, Mentor, and Market Energy Efficiency	**Promote** programs, **facilitate** mentorship, and **partner** with institutions.	Enhance workforce capacity. Engage stakeholders to improve energy efficiency
Lead	**Lead By Example in Public Facilities**	**Benchmark** and disclose energy performance for city facilities. **Budget** to pilot local uses of clean technology.	Leadership inspires others to act. The City uses a fraction of overall energy, but is the largest consumer. Clean tech demonstrations save energy and promote the economy.
Capital	**Provide Financing**	**Launch** the San Francisco Sustainable Financing ($SF^{2)}$ Loan Program. **Require** efficiency prior to receiving funds for renewables.	Financing enables cost-effective energy use reductions through voluntary tax liens. Lowest cost carbon reduction is achieved by prioritizing efficiency.

Expected Results

A 50% reduction in commercial building energy use in 20 years will have the same effect as taking 50% of commercial building stock to zero-net energy, but at lower cost[1]. Tripling the pace and coverage of energy audits – combined with strategic actions to maximize implementation of cost-effective projects – is estimated to reduce climate emissions by at least 64,000 tons per year.

Scenario	Fraction of Commercial Stock Audited per year[2]	Net Annual Energy Reduction[3]	Maximum Annual Incentive Budget[4]	10-Year Net Present Value to Private Sector[5]	Direct Job Creation
Current Policy - Voluntary Audits And Public Goods Incentives	10% (Totals 50% over 5 years)	1.3%	$24 Million	$382 Million	357 Jobs
Implement Full ECB Strategy	20% (Totals 100% over 5 Years)	4.2%	$39 Million	$612 Million	578 Jobs

> "Energy is… this generation's great project. That's why I've set a goal for our nation that we will reduce our carbon pollution by more than 80 percent by 2050. … Now, the nation that leads the world in 21st century clean energy will be the nation that leads in the 21st century global economy. I believe America can and must be that nation."
>
> *President Barack Obama*[6]

[1] Based on the much lower cost of efficiency compared to renewables, bringing half of buildings to "net-zero energy" would be more costly than achieving the same aggregate result by improving the performance of the entire stock.
[2] Estimated fraction of buildings larger than 50,000 square feet receiving a thorough audit approximately equivalent to an ASHRAE Level II evaluation, plus estimated fraction of buildings smaller than 50,000 square feet receiving the equivalent of an ASHRAE Level I evaluation.
[3] Estimate includes all savings attributable to implementation of recommendations from ASHRAE Level I and Level II audits. All estimates have been reduced by 0.8% to compensate for projected annual increase in local commercial building stock.
[4] Incentive budget refers to ratepayer funds (both Public Goods Charge and energy procurement) regulated by the California Public Utilities Commission and used by investor owned utilities for energy-related pubic benefit programs. The estimate above includes but is not limited to San Francisco Energy Watch. Each incentive budget estimate is conservatively high because all energy savings reduce ongoing energy costs, but some of the net annual energy reduction will be attributable to California's Title 24 Part 6 energy code requirements.
[5] Present value is estimated as the sum of total construction costs, incentive rebates, and energy savings. This estimate is based on 9% discount rate (which is the rate applied by SF Department of Finance.)
[6] Address by President Obama (April 27, 2009) to the National Academy of Sciences Annual Meeting http://www.whitehouse.gov/the_press_office/Remarks-by-the-President-at-the-National-Academy-of-Sciences-Annual-Meeting/

ECB Strategy: Implementation Timeline

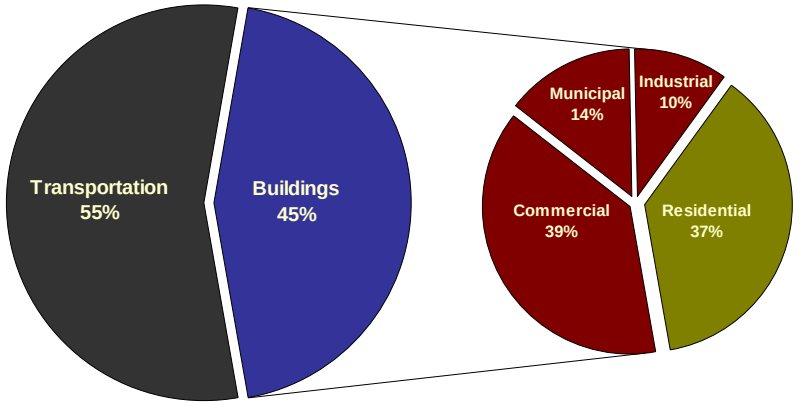
Year	2010	2011	2012	2013	2014	Beyond… to 2030
Identify Cost-Effective Savings	Require 1/5 of all buildings greater than 5k square feet to get an energy audit. Encourage smaller facilities – particularly energy intensive uses such as markets and restaurants - to voluntarily audit.					
Disclose Energy Performance	Educate property owners about upcoming requirements. Support early action	Require all buildings >25k square feet to benchmark	Require all buildings >10k square feet to benchmark	Require all buildings >5k square feet to benchmark	Continue benchmarking. Re-evaluate options for buildings <5k sq. ft.	Maintain public access to data.
Split Incentive Solutions: Green Tenant Toolkit	Develop and launch green tenant toolkit	Promote and maintain Green Tenant Toolkit				Update as needed.
Split Incentive Solutions: Submetering	Submeter new construction and single tenant build-outs/ improvements (TI's) in buildings >50k square feet	Submeter TI's >10k sq ft which are in buildings >100k sq ft.	Submeter TI's >7.5k sq ft which are in buildings >75k sq ft	Submeter TI's >5k sq ft which are in buildings >50k sq ft	Submeter TI's >3k sq ft which are in buildings >30k sq ft	Continue policy
Make Incentives Easy	Identify technology partners, refine business model, begin development	Launch Financial Optimization Tool	Maintain Financial Optimization Tool; use data to enhance targeting and delivery of local incentives.			
Educate, Train, Mentor, and Market Energy Efficiency	(2009: Engage with partners, and seek State Energy Program funding support.) Publicize education, attract resources, communicate ECB Strategy.	Collaborate and support workforce education. Promote efficiency with contests, incentives, and social marketing.				
Lead By Example in Public Facilities	Benchmark and make public energy performance of all significant city facilities	Maintain information on public environmental performance "dashboard." Continue performance enhancement and communication of excellence. Achieve zero-net energy in significant number of city facilities				
Provide Financing	Launch and deliver San Francisco Sustainable Financing (SF^2) Loan Program					

Measurement and Evaluation	**Launch ECB Strategy Begin monitoring**	**Measure performance toward metrics and goals**	**Evaluate program efficacy. Adjust approach if needed**	**Continue to measure. Maintain and enhance successful elements.**	**Refine approach with partner support.**
Impact	**Energy use reduction of at least 2.5% per year on average, with >4% initial pace of annual reduction anticipated. Average 70k+ tons CO2 year-to-year reduction. Significant net positive cash flow relative to status quo for commercial building sector.**				

1. Introduction

San Francisco has long recognized that cities are essential to the resolution of environmental challenges. Cities must directly address sustainability at all scales, from challenges entirely within the purview of local government (such as land use), to issues that require regional and state collaboration (such as reliable electricity) as well as providing a laboratory for solutions to the national and global challenge of climate change. The most direct, measurable, and cost-effective path for the citizens, businesses, and City of San Francisco to do our part to both ensure energy security and be a steward of the climate is by improving the resource efficiency of our building stock.

Figure 1.1: San Francisco Greenhouse Gas Emissions (eCO2, 2005)



Sources: Pacific Gas and Electric, San Francisco Public Utilities Commission, California Department of Transportation, Metropolitan Transportation Commission, Municipal Transportation Agency (SF Muni), Bay Area Rapid Transit

In 2002 San Francisco publicly recognized that because at least 40% of greenhouse gas emissions occur in urban centers,[7] and an additional 35% to 40% are attributable to activities that support urban life,[8] cities are essential partners to state, national, and international institutions in minimizing the worst effects of climate change. While climate change is global, its effects are already felt locally. Documented phenomena in California include warming temperatures, precipitation disruptions, reductions in average Sierra snowpack and changes in timing of spring runoff.[9] Projections for the remainder of the century continue to grow more ominous,[10,11] with profound implications for the provision of clean water, hydroelectric generation, and the agriculture that feeds our city.[12] As a City bounded by water on three sides, coastal inundation is a continuing threat to our community, real estate and infrastructure.

Similarly, electricity reliability in San Francisco is a series of complex and long-running political and technical issues involving infrastructure, grid resilience, insufficient supply, and public health. Grid

[7] Satterwaithe (2008) “Cities' contribution to global warming: notes on the allocation of greenhouse gas emissions,” *Environment and Urbanization* Vol. 20, pp. 539-549.
[8] Clinton Climate Initiative, C40 Cities Climate Leadership Group http://www.c40cities.org/news/news-20070516.jsp.
[9] California Energy Commission (2009) *The Future is Now: Update on Climate Change Science Impacts and Response Options in California.*
[10] IPCC (2007) Summary for Policymakers In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Intergovernmental Panel on Climate Change Fourth Assessment Report.*
[11] US Global Change Research Program (2009) *Global Climate Change: Impacts in the United States*
[12] California Climate Change Center (2009) *Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment.*

reliability and city-scale electricity supply are beyond the scope of this report; we instead focus exclusively on reducing strain on the grid through efficiency and conservation in commercial buildings.

Mayor Newsom convened the Existing Commercial Buildings Task Force to recommend how the City and County of San Francisco can achieve three goals in existing commercial buildings: reduce climate emissions, improve electricity reliability through efficient management of building systems, and enhance the competitiveness of commercial real estate in the City. Commercial buildings are the present focus for two reasons: they are less numerous than residential buildings yet have greater overall climate emissions; and when presented with the business case for cost-effective energy efficiency improvements, commercial building owners and managers are more likely to take action.

In 2007, the Mayors Task Force on Green Buildings recommended that the minimum standards for most new buildings in San Francisco – commercial and residential - require design and construction to credible third-party verified performance standards which are maintained through open, consensus-based processes and wherever possible rely on common industry standards. These recommendations – enacted into the San Francisco Building Code – will dramatically reduce the megawatt-hours consumed, gallons of water used, and tons of waste generated by new buildings, while saving both money and greenhouse gas emissions.

It is no accident that San Francisco continues to focus on the performance of buildings. As of 2005, 45% of the climate emissions from our community result from the operation, construction, and demolition of buildings (Figure 1.1). Commercial and industrial buildings account for 48% of building-sector emissions, and municipal buildings and facilities account for an additional 14% of emissions from buildings. New buildings are a logical starting point for policies to reduce climate emissions from the built environment; good design and construction practices in new construction afford the greatest opportunity to improve long-term performance at little or even no added up front cost. On the other hand, standards for new construction by definition affect new buildings.[13] With the exception of redevelopment in Treasure Island, Mission Bay, and Hunter's Point, the San Francisco of the future has been built. Omitting the 2001 peak of the dot-com real estate boom, office square footage in San Francisco has increased at average of 0.8% per year over the past decade.[14] At that pace, new construction alone could require sixty years to 'green' half of San Francisco. While new buildings are important, existing buildings are crucial to the sustainability, history, and economy of our city.

Goal

What we measure, we manage. In 2002, San Francisco set a target to cut citywide climate emissions 20% below 1990 levels by 2012. Last year, the City followed up by recognizing longer term targets – culminating in an 80% reduction in climate emissions by 2050 - to match current state policy and scientific recommendations.[15] The acts of setting a specific target and measuring progress have signaled San Francisco's intent to cut emissions from municipally operated facilities and infrastructure, and similar objectives are implied for private sector buildings. The ECB Task Force recognizes that finite natural, human, and economic resources are available to meet this challenge. Great improvements in energy efficiency can only be realized when each action we take has multiple benefits, when the private sector is recognized as a partner, and when policies and programs are implemented in a manner and at a pace that sustains and enhances the economic health of our city.

Rather than propose new goals for reducing energy use or carbon emissions, the ECB Task Force recommends that San Francisco accept the goal for existing commercial buildings in California's *Long*

[13] San Francisco's Green Building Ordinance also applies to a limited set of large renovation projects. For details, visit http://www.sfdbi.org/index.aspx?page=268

[14] Between 1998 and 2007, rentable office square footage increased by an average of 1.5% per year; if the distortion of the dot-com boom is omitted, the long term average is 0.8%. – Source: San Francisco Planning Department *2008 Commerce & Industry Inventory*.

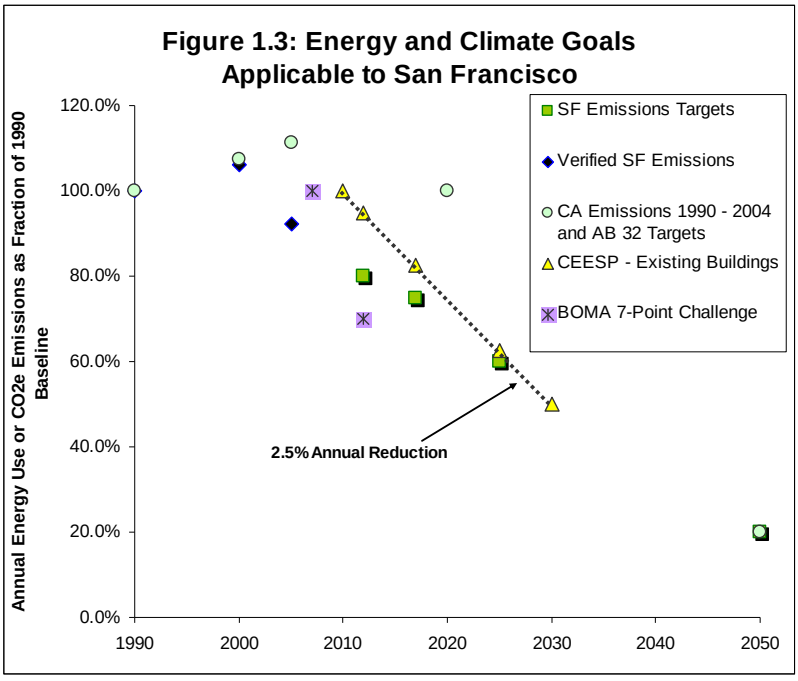
[15] IPCC (2007) Summary for Policymakers In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Intergovernmental Panel on Climate Change Fourth Assessment Report.*

Term Energy Efficiency Strategic Plan (CEESP).[16] The CEESP's goal for existing commercial buildings should inspire the voluntary target for San Francisco's commercial sector:

> *"Fifty percent of existing [commercial] buildings will be equivalent to zero net energy buildings by 2030 through achievement of deep levels of energy efficiency and clean distributed generation."*

The term "zero net energy" is defined as buildings connected to the grid that generate on-site renewable energy equal to annual energy use. While distributed renewable energy will play an increasingly important role in local supply and individual buildings will meet this criteria, the ECB Task Force does not find the zero net energy goal achievable as written due to the tall, dense urban form of San Francisco (i.e. low roof-to-floor area ratios), as well as issues relating to the preservation of historic resources. However, the same impact would be achieved by reducing average energy use in existing commercial buildings 50% by 2030. To realize this ambitious goal, commercial buildings would need to reduce annual net energy use by 2.5% on average from 2010 through 2030, through a combination of better energy management, efficiency retrofits, and gradual installation of renewable energy systems.

Figure 1.3: Energy and Climate Goals Applicable to San Francisco



Though the challenge of reducing net energy use in the commercial sector by 2.5% per year should not be underestimated, it is consistent with other existing goals. (Figure 1.3) The emissions reduction goals set by San Francisco's *Environment Code* (Chapter 9), California's *Global Warming Solutions Act of 2006* (AB 32), the CEESP, and Architecture 2030[17] differ in their details, but the trends are aligned. Each of the goals is related to scientific recommendations that an 80% reduction in climate emissions is necessary by 2050 in order to stabilize carbon dioxide and avoid the worst potential effects of a damaged climate. Federal and international proposals under consideration at the time of writing are similar. While a 2.5% annual net energy use reduction - sustained for a generation - is unprecedented, ambitious short term goals with similar implications have been set by industry leaders. For example, the Building Owners and Managers Association (BOMA) 7-Point Challenge calls for all member-managed buildings to reduce energy use by 30% between 2007 and 2012, equivalent to a 5% annual net energy use reduction. If the

[16] California Public Utilities Commission (2008) Long Term Energy Efficiency Strategic Plan - www.californiaenergyefficiency.com.

[17] Architecture 2030 is an architect-led non-profit which has challenged new and renovated buildings in the United States to achieve a set of criteria culminating in carbon-neutral development no later than 2030, in order to slow or reverse climate change. http://www.architecture2030.org/

organization met this goal and members did nothing further through 2020, the effect would be equivalent to a 2.3% annual net energy use reduction.

Climate change threatens to our environmental, social, and economic sustainability. Goals to meet this challenge have already been set. The challenge is to achieve these goals while providing the best possible conditions for San Francisco to continue to attract companies, talent, and jobs to the Bay Area.

> In this report, "energy" refers to the sum of all energy sources used to operate buildings – electricity, gas, steam, and on-site renewables. Efficient management of natural gas and steam reduces the demand on these energy resources; since natural gas accounts for about 44% of electricity generation, using either electricity or natural gas more efficiently helps to control exposure to long term price increases and supply shortages.

The Challenge

It is the professional opinion of the ECB Task Force that the ambitious goals set before us by science and policy are achievable – to the betterment of the city, the environment, and our local economy – but it will be easy. State and local governments can enact legislation such as San Francisco's new "Lighting Efficiency Measures in Commercial and City Buildings" Ordinance,[18] while complementary voluntary programs such as utility retro-commissioning incentives, the U.S. Green Building Council's LEED for Existing Buildings rating system and the BOMA 7-Point Challenge are producing impressive case studies of success. The Federal government has resumed a leadership role in energy efficiency through funding allocations (such as in the American Recovery and Reinvestment Act, or federal stimulus), and by increasing equipment efficiency standards (such as lighting standards under the Energy Policy and Conservation Act.) These prolific initiatives, while helpful in charting direction, are also easily confusing, and require constant monitoring to understand their local implications. The ECB Task Force posits that a sustained 2.5% annual net reduction in energy use can only be achieved if the City of San Francisco is both an active leader and a genuine partner with the private sector.

Deep and sustained energy use reduction in an economically healthy commercial sector is largely unprecedented, though there have been impressive achievements. Over the past 30 years economic output per unit of energy consumed in the United States has increased 87%.[19] In the same period, due to building codes, energy efficiency programs, and appliance standards, California's energy use per capita has been constant, while the nation's per capita energy use has nearly doubled. As a result, from 1974 through 2013, Californians will have saved more than $79 billion in avoided energy costs.[20] By rough extension, benefits to San Francisco's economy exceed $1.6 billion, and potential for substantial cost-effective savings remains.[21] However, despite improvements in *per capita* and *per dollar* metrics, total energy use has increased nationwide and within California. Expanding populations of our nation, state, and city have outweighed the effect of efficiency improvements, (though the increase would have been more rapid in the absence of codes, standards, and incentives). Without game-changing action, total energy use is expected to continue to increase.[22]

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[18] The lighting performance ordinance amended the San Francisco Building Code Chapter 13D and Environment Code Section 705 to require all fluorescent lighting in commercial and municipal facilities to emit at least 81 lumens per watt or be controlled by an occupancy sensor by December 31, 2010.

[19] US Energy Information Administration (2009) *Total Primary Energy Consumption and Energy Intensity Summary*, http://www.eia.doe.gov/emeu/mer/pdf/pages/sec1_16.pdf.

[20] Bernstein et al (2000) The public benefit of California's investments in energy efficiency. Prepared for the California Energy Commission. RAND Monograph Report MR-1212.0-CEC. http://www.rand.org/pubs/monograph_reports/MR1212.0/index.html

[21] Itron et al. (2006) *California Energy Efficiency Potential Study Vol. 1.*

[22] US EIA (2008) *Forecasts & Analyses* http://www.eia.doe.gov/oiaf/forecasting.html.

An inexorable increase in total energy use is at odds with numerous sources documenting the vast potential for cost-effective energy efficiency. For example, independent macroeconomic analyses by McKinsey and Company and California's state Climate Action Team identify energy efficiency measures as opportunities where financial savings outweigh costs of carbon reductions.[23] This isn't news in California, where state law has for more than a decade identified cost-effective energy efficiency as the highest priority in the "loading order" for energy supply. The California Public Utilities Commission regulates billions of dollars in energy efficiency incentive program spending on the basis that funds may only be spent for projects that are cost-effective to both the recipient and to ratepayers; with few exceptions, programs funded under these criteria continue to grow in scope, expertise, and demonstrated success.

A 2006 *California Energy Efficiency Potential Study* conservatively estimated that the incentives and programs offered at that time could cost-effectively reduce energy use in commercial buildings by 11% in the service territory of Pacific Gas and Electric Company (PG&E.)[24] This implies current energy efficiency programs – while essential motivators and among the most effective in the world – will not solve the problem on their own. Second, commercial asset owners seeking a return on investment are not fully exploiting potential profits from energy efficiency. Why? Those making decisions don't always stand to gain from the energy savings, and uncertainty devalues potential returns. Lease structures, split motivations between tenant and landlord, uncertainty about the relative performance of buildings or equipment, vendor credibility, lack of actionable proposals for retrofits, access to capital, disparities between decision-maker tenure and payback period… A litany of challenges (many real and a few imagined), derail the identification and implementation of projects that are outwardly cost-effective.

The ECB Task Force recommends that San Francisco strategically reduce and eliminate barriers to cost-effective energy savings, nurturing the energy efficiency sector and reducing energy use. We recommend an Existing Commercial Buildings Strategy, based on the following themes:

1. **Maximize Transparency:** Challenge San Francisco to excel. Applaud both improvement and sustained excellence in energy management. Make every decision-maker aware how their performance stacks up against peers, and how many dollars they are wasting

2. **Partner with the Private Sector:** Help us measure and track progress, not only as a community but down to the level of individual buildings, so that services can be targeted to the greatest opportunities for improvement. Engage the experience and expertise of the community through education and mentorship.

3. **Attract Game-changing Capital:** Utilize powers available to the city to provide access to capital for improvements and energy-related preventative maintenance. Tie the debt to the property rather than to the credit rating of the tenant or owner.

4. **Lead by Example:** Continue to enhance energy performance in municipal facilities. Be transparent, publicizing success, progress, and opportunities for improvement. Benchmark and disclose energy performance of city facilities just like the private sector.

The Task Force strongly recommends maximizing publicity for this effort, including a "real-time" dashboard highlighting City and community progress in meeting performance targets related to the Existing Commercial Buildings Strategy, as well as obligating the Mayor to report on San Francisco's carbon footprint annually.

[23] McKinsey (2008) *The Carbon Productivity Challenge: Curbing Climate Change and Sustaining Economic Growth* *http://www.mckinsey.com/mgi/publications/Carbon_Productivity/index.asp*.
[24] Itron et al. (2006) *California Energy Efficiency Potential Study Vol. 1.* Since these findings were dependent upon the goals, technology, programs, and incentive levels in place at that time, and these factors are subject to negotiation at least every 3 years, this statistic does not represent the maximum possible cost-effective savings.

Why focus on ENERGY STAR?

ENERGY STAR® is joint voluntary program of the U.S. Environmental Protection Agency (EPA) and the Department of Energy introduced in 1992 to identify and promote energy efficient products such as computers and monitors while reducing greenhouse gases. The ENERGY STAR label is now on many additional products as well as new homes, buildings and plants. As part of the labeling effort, ENERGY STAR provides Portfolio Manager, an interactive energy management tool that allows commercial building owners and managers to track and assess energy and water consumption for a single building or across an entire portfolio of buildings. Portfolio Manager can calculate the Energy Use Intensity (EUI) for any building. There are thirteen categories of commercial buildings representing over 50% of U.S. commercial building floor space that, when benchmarked in Portfolio Manager, are eligible to receive a rating (1-100) based on how their energy performance compares to similar buildings in similar climates. Buildings that score a 75 or higher use an average of 35% less energy and are eligible to apply for the ENERGY STAR label.

California Public Resources Code Section 25402.10 (Assembly Bill 1103 passed in 2007) requires Portfolio Manager EUI's and ratings, if available, to be disclosed in nonresidential real estate transactions (sale, lease or refinance) In October 2009 Governor Arnold Schwarzenegger signed AB 531, directing the California Energy Commission to develop regulations and timelines for the implementation of AB 1103. While necessary, this action ironically had the effect of postponing the start date for the state's disclosure policy. Requirements will likely go into effect in 2011,

The ECB Task Force recommends actions that build upon the momentum of AB 1103 as well as the commercial real estate industry's recognition of the ENERGY STAR label. We recommend using Portfolio Manager as a platform for tracking the energy use of buildings in the City – both individually and as a whole.

Portfolio Manager is used to track the performance of more than 11.5 billion square feet – 1.2 billion in California alone. As of 2008, more than 6,200 facilities in the U.S. have earned the ENERGY STAR label, representing savings of more than $1.7 billion in utility bills and avoided greenhouse gas emissions equivalent to taking more than 2 million cars off the road.

In 2008, San Francisco ranked second nationwide on EPA's 2008 Top 25 list of U.S. metropolitan areas with the largest number of buildings that have earned the ENERGY STAR. As of July 2009, there are 194 ENERGY STAR-labeled buildings in the Bay Area, saving more than $87 million and reducing emissions equivalent to 35,800 households' electricity use.

For a list of ENERGY STAR buildings and plants: energystar.gov/buildinglist. For info about ENERGY STAR for buildings and plants: energystar.gov/labeledbuildings. For info about Portfolio Manager: http://www.energystar.gov/portfoliomanager

2. Task Force Membership

Co-Chairs

Steven M. Ring RPA, CPM, LEED AP, Director of Client Solutions
Cushman & Wakefield of California

San Francisco Board Member, Building Owners and Managers Association
Member, Cushman & Wakefield National Energy and Sustainability Task Force
Member, Curriculum Development on Sustainable Management, National Association of Realtors/IREM
Past Board Member, Northern California Certified Commercial Investment Managers
Past San Francisco Chapter President & Regional Vice President, Institute of Real Estate Management
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Members

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Professional Advisory Group Member, California Energy Commission Development of Title 24 Standards
Advisory Board Member, California Commissioning Collaborative
Advisory Member, Alameda County New Construction Energy Standards

Lisa Michelle Galley, Managing Principal and Founder
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Liaison, PG&E and EPA ENERGY STAR Portfolio Manager Benchmarking Initiative
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Member, Sustainable Silicon Valley, and Business Council on Climate Change (BC3)
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Phil Ting, City and County of San Francisco Assessor-Recorder

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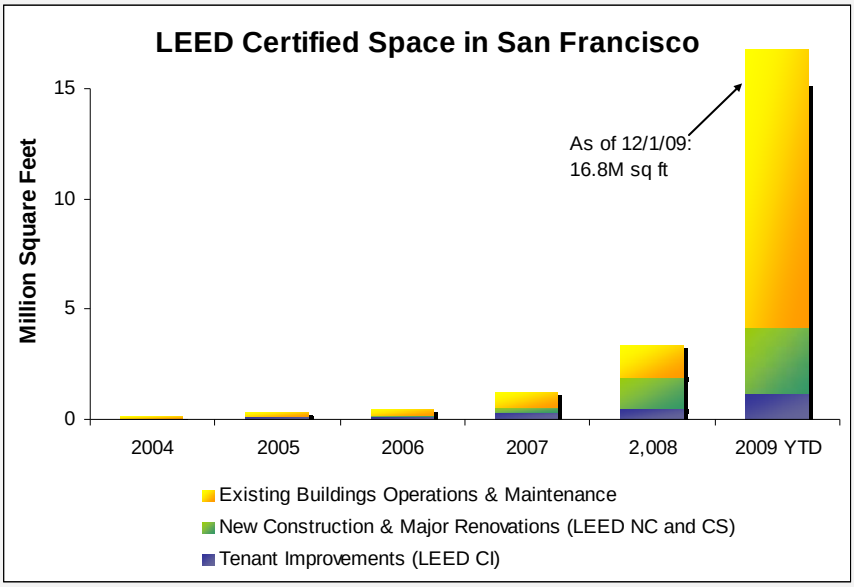
Leadership in Energy and Environmental Design (LEED)

The U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) rating systems identify facilities and neighborhoods that have been verified by a third party to meet environmental performance criteria such as reduced energy use, water consumption, and carbon dioxide emissions; improved indoor environmental quality, and stewardship of resources. LEED for Existing Buildings: Operations and Maintenance (LEED-EBOM) the rating most relevant to the ECB Strategy, helps building owners and operators target, track, and document that their projects meet strict performance criteria.

The City of San Francisco amended its building code in 2008 to require new construction to be built green. From January to December 2009, voluntary LEED certified square footage in San Francisco increased an astounding 500% (see figure.) Certification of existing buildings accounts for nearly 75% of local activity. We anticipate this emphasis on greening existing buildings to continue, partly due to competition among Class A office properties.



Sources: GBCI records and SF Department of Environment Analysis

However, LEED-EBOM is a comprehensive standard with an exceptionally rigorous certification process. While it has been successfully applied to multi-tenant buildings, the system is most accessible to single-tenant and owner-occupied buildings. The ECB Task Force commends LEED-EBOM as a voluntary standard of excellence in building operations, but LEED EBOM would not be the best policy tool at this time to maximize efficiency across the entire existing commercial sector. For example, LEED-EBOM requires a minimum ENERGY STAR rating of 71 – i.e. energy performance in the 71st percentile among similar facilities. While buildings in San Francisco may – with intense focus – outperform their peers, it is unlikely that all buildings in the city would reach the 71st percentile in our climate zone. Similarly, the prerequisite ASHRAE 62.1 (2007) ventilation standards represent a baseline for good practice, but would be a hardship for some older Class B and C properties.

Remaining focused on our mission, the ECB Strategy builds upon existing efforts (such as AB 1103) and recommends ENERGY STAR as the standard for building energy efficiency. (See ENERGY STAR sidebar, page 6). Note that benchmarking with ENERGY STAR is the basis for evaluating energy performance with LEED-EBOM; the two standards are complementary.

3. Methods

In order to promptly and thoroughly investigate opportunities for improving the performance of existing commercial buildings in San Francisco, the ECB Task Force met biweekly starting February 13, 2009. Meetings were open and transparent, with no closed-door sessions. Visitors were allowed access to sessions and meetings, where members reviewed all ideas and suggestions.

After agreeing upon a mission, guiding principles and parameters for our work, sub-committees were formed as needed to focus on specific scales of buildings, programmatic goals, and measures under consideration. The sub-committees held detailed discussions at *ad hoc* meetings and then drafted policy recommendations. Drafts were reviewed by the entire group, which formed a consensus for the final recommendations.

City staff acted primarily as technical and logistical support for the Task Force, and also contributed to group discussions by providing expertise and resources about existing energy and sustainability incentive programs, capacity for additional services, codes, and other City processes.

The ECB Task Force recognized that there are many opportunities to improve the sustainability of existing commercial building in San Francisco. However, based on the scope of the task and the group's expertise, recommendations were limited to existing commercial buildings, excluding residential multifamily. Principles guiding the Task Force's recommendations are:

1. Actions to reduce environmental impacts should also improve cost effectiveness of operation and maintenance of existing commercial buildings in San Francisco.
2. Recognize variation in capital resources, scale, vintage, and owner/manager engagement; encourage high-efficiency operation, maintenance, retrofit and capital improvement best practices to proliferate beyond early adopters.
3. Ensure building owners & managers, lessors, buyers, and the City are informed about the energy performance of their building(s) and portfolio(s).
4. Reduce financial or institutional barriers to investment in physical retrofits.
5. Develop a flexible strategic framework emphasizing measurement, incentives, education, and –when necessary – practical and enforceable requirements.
6. A comprehensive approach to incorporating efficiency into the built environment in San Francisco can contribute to the elimination of non-renewable energy sources within the city.
7. To be effective, the effects of implemented recommendations must be monitored and reported.
8. Issues and building types not addressed specifically by this Task Force should be taken up by future committees with the expertise to do so.
9. The Task Force should employ existing, recognized metrics.
10. Education of the public, training of City staff, and outreach to the property management, engineering, owner, and tenant are essential to successfully impact San Francisco.

4. Existing Commercial Buildings Strategy

The ECB Task Force recommends that San Francisco facilitate growth in the energy efficiency sector and reduce energy use in commercial buildings by systematically identifying factors limiting local energy efficiency, and eliminating them. Inhibitions to the widespread implementation of cost-effective energy performance opportunities include: lease structures that do not align the tenant and landlords' mutual interest in minimizing operating costs; unfamiliarity with facilities or equipment; uncertainty if facility performance is on par with peers; capital availability; lack of communication between operators and financial decision-makers; lack of knowledge of available subsidies, and ratepayer funded incentives; and unknown credibility of service providers. California has led the nation in energy programs and policies for more than three decades, yet all of these and many other challenges remain.

Transparency, measurement, leadership, and capital are the best tools available to San Francisco to transform its built environment, create jobs funded by avoided energy costs and existing incentives, and capture all available cost-effective efficiency improvements. The following proposals are recommended as an integrated strategy to empower building owners, managers, tenants, and the City to track and manage energy use, and to help the City prioritize services, policies, and funding. While state and utility efforts have laid a solid foundation of energy programs and policies, the City of San Francisco will need to partner directly with the private sector to achieve unprecedented levels of large scale, cost-effective energy use reduction, while attracting the development of service-delivery technologies to streamline these deep energy savings, and providing a consistent, clear, credible voice communicating our status, course, and destination toward economic and environmental sustainability.

This chapter lays out an Existing Commercial Buildings Strategy (ECB Strategy) with four basic themes:

1. **Maximize Transparency**
2. **Partner with the Private Sector**
3. **Attract Game-changing Capital**
4. **Lead by Example**

> "Whether we are trying to overcome the dual challenges of climate risk and energy scarcity in California or China, the solution lies in technology innovation, diffusion, and adoption. The Promethean gift of carbon technology vaulted the western economies to unprecedented prosperity. So too can technology overcome limited natural endowments with ever greater productivity, conferring higher living standards at more sustainable rates of resource use."
>
> *– David Roland-Holst*

Energy Benchmarking and Disclosure

Proposal

Require commercial building owners and managers to use the U.S. Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager tool to document their building's energy consumption, and disclose summary data annually via a City-maintained database. Targeted recipients of energy data include those in a position to affect performance (operations staff and tenants), and those making decisions where energy use is relevant - or should be (tenants, prospective buyers, appraisers, and lenders), as well as the public. Disclosure of energy use will encourage improvement of local existing building stock and enhance the ability of market actors to precisely value operating and energy costs.

Problem Statement

The nonresidential building community and the public do not have a good frame of reference to understand building energy performance. Most people readily understand "Miles Per Gallon" figures for vehicles, which affect the purchase decisions of both consumers and fleet owners. California has begun the process of institutionalizing similar energy performance metrics for buildings, requiring disclosure of energy usage data in all significant commercial real estate transactions beginning in 2010. The ECBTF proposes to build upon this existing state law, as well as the energy performance tracking and benchmarking capabilities provided by the U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager tool.

US EPA Portfolio Manager is a free online energy management tool that enables users to efficiently track and assess energy and water consumption, cost, and climate emissions from building operations. This widely used tool provides the opportunity to compare energy use intensity (energy used per square foot per year) across a portfolio of buildings. However, buildings are very different from vehicles. Even most engineers are hard pressed to understand whether a building that uses 78 thousand BTU's per square foot per year is performing well or poorly, because the amount of energy a building uses is a function of what it's used for. Restaurants require almost twice as much energy per square foot as offices, so it's necessary to compare similar buildings to one another. Portfolio Manager can benchmark all buildings generating an Energy Use Intensity Index (EUI) in the process. There are thirteen categories of commercial buildings representing over 50% of U.S. commercial building floor space that, when benchmarked, are eligible to receive a rating (1-100) based on how their energy performance compares to their peers. A rating of 50 indicates that the building performs better than 50% of similar buildings in similar climates. Buildings that score a 75 or higher are eligible to apply for the ENERGY STAR label. Portfolio Manager is being used to track approximately 16% of commercial square footage in the US, including a sizeable fraction of large buildings in the City; the San Francisco metropolitan area is home to the second highest number of ENERGY STAR buildings nationwide, and by far the highest per capita among large cities.

California's AB 1103 requires the energy use intensity, and ENERGY STAR rating (if available), to be disclosed in nonresidential real estate transactions (sale, lease or refinance) effective January 1, 2010. In October 2009 Governor Arnold Schwarzenegger signed AB 531, directing the California Energy Commission to develop regulations and timelines for the implementation of AB 1103. While necessary, this action ironically had the effect of postponing the start date for the state's disclosure policy. Requirements will likely go into effect in 2011, When the state law is implemented, a growing fraction of buildings would be benchmarked each year; however,

under AB 1103 disclosure of the performance data would only occur between the parties to a financial transaction (sale, lease, or refinance.) For San Francisco, we recommend that:

- Apply the disclosure requirement equally to *all* non-residential buildings, not just buildings completing a financial transaction,
- Require energy performance summary data to be disclosed to the City which should in turn make the data accessible to the public, and
- Disclose energy performance data for each building to the building occupants.

EPA's Portfolio Manager is positioned to be an effective tool that the City can utilize to inventory and assess the *energy performance* of its local public and private building stock. Such an inventory would be useful first for establishing a citywide baseline of building performance and enhancing understanding of carbon emissions, and then for subsequent policy formulation, goal refinement and monitoring. Further, such a system helps to create common language, expectations and aspirations around energy use and carbon emissions, and would serve as a cornerstone of City efforts to encourage, recognize, and reward superior performance.

Objectives

The objectives of this proposal are to measure, manage and improve the energy performance of the existing nonresidential private and public buildings, and to use transparency to enhance the ability of and real estate markets to incentivize better energy performance. This objective builds upon and enhances existing State of California initiatives (under the Governor's *Green Building Initiative*) and law (AB 1103).

Implementation

Require, through a City ordinance, that all building owners annually submit their Energy Use Intensity Index (EUI) and ENERGY STAR score (for building types where the score is available) to a City database. ECBTF recommends housing these activities in the Department of the Environment to maintain coordination with citywide energy efficiency incentive programs and climate change goals. The benchmark information would be accessible by the public, and owners would also be required to communicate the information annually to occupants to engage them in the effort to save energy, for instance through a letter to tenants, email, posting in break rooms, etc.

Proof of submittal of energy benchmark data would be required for renewal of the owner's commercial property business license by the Office of the Tax Collector, in the same way that operating permits are required for restaurants from the Department of Public Health or from the Entertainment Commission for nightclubs. We propose the business license mechanism rather than a building code requirement because citywide energy use reduction requires engagement with all buildings - not just those already planning construction projects.

Larger buildings would be required to submit their benchmark scores first. ECBTF recommends that buildings over 25,000 square feet be required to submit their benchmark scores within 1 year from the date of adoption of the ordinance, followed by buildings of 10,000-25,000 square feet within 2 years, and then buildings under 10,000 square feet within 3 years. (ECB Strategy timelines are summarized in Chapter 5.)

As this initiative makes extensive use of US EPA's ENERGY STAR Portfolio Manager tool, San Francisco should partner with US EPA to promote the tool, train building owners in its use, and improve the city's capacity to validate data from Portfolio Manager. A city "champion" should be assigned as a key point of contact for US EPA in development of this partnership with the ENERGY STAR Program.

Two non-trivial challenges for the City include:

- **State regulation:** California regulations require customer consent for utilities to share some data, but it is not explicit which data are protected. In our professional opinion, there is a legitimate privacy concern regarding *account numbers*, which are attached to private information and should not be disclosed. Transparency with regard to annual aggregate energy use is in the public interest in order to effectively address greenhouse gas emissions and infrastructure reliability. Limited exceptions are necessary in cases of demonstrable trade secrets such as in manufacturing facilities. We have reason to believe that the city is capable of requiring disclosure of annual carbon emissions due to energy use, annual energy use per square foot, and similar output from Portfolio Manager.
- **Data collection and management:** For the building owner or manager, data collection is relatively simple because PG&E provides automated uploading of energy data to Portfolio Manager upon request. For reporting to the city, an automated option will be necessary. The ECB Task Force has advised city staff about several mechanisms in existence and under development. As a result, this proposal is administratively feasible, and the investment required by the City is likely reasonable.

Evaluation

This recommendation would initially be judged successful based on the City's success in implementation. Subsequently, data derived from this initiative would be used to track success of the SF ECB Strategy overall.

> "Today there is all too often a disconnect, or performance gap, between the energy modeling done during the design phase and what actually happens during daily operation after the building is constructed, …Ongoing monitoring and reporting is the single best way to drive higher building performance because it will bring to light external issues such as occupant behavior or unanticipated building usage patterns, all key factors that influence performance."
>
> *Scot Horst, Senior Vice President of LEED, U.S. Green Building Council*

Energy Audits

Proposal

Require building owners and managers to complete an energy audit of every commercial building in San Francisco within five years from the date of adoption, and every five years thereafter. Use the existing industry standard American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) *Procedures for Commercial Building Audits*, and require reasonable qualifications for energy auditors, thus providing building owners with a reliable catalog of opportunities to cost-effectively improve energy efficiency.

Problem Statement

Benchmarking provides perspective about how a building performs relative to its peers but it does not identify specific efficiency improvements, or their costs and benefits. In order to identify real savings opportunities and prioritize investments, performing an energy audit is necessary. The challenge of reducing energy use across an entire sector requires broad participation; based on experience of energy programs targeting “hard to reach” customers, businesses ostensibly uninterested in reducing energy costs are much more likely to implement cost-effective capital and operational improvements once the opportunities have been identified and quantified by a qualified professional.

Owners, managers, bond holders under a tax-lien financing program (See San Francisco Sustainable Financing/SF^2 section), investors, and in many cases tenants need credible evidence their dollars are being directed towards projects yielding a reliable return, based upon established analytical standards.

Energy audits will enhance opportunities for engineers and technicians employed in the City to develop their skills, and for additional energy auditors to be employed - enhancing the pool of talent serving our city and the Bay Area.

Objectives

Identify all cost-effective opportunities to improve energy efficiency in San Francisco's commercial buildings. Secondary objectives include expanding workforce proficiency in energy efficiency services, job creation, and development of data to target incentive funding, services, outreach and future programs where each is most valuable.

Implementation

The complexity of an energy audit varies with the scale and intricacy of the building. Larger facilities tend to require the robust skills of a professional engineer, while smaller facilities with relatively simple systems can generally be thoroughly evaluated by qualified building maintenance professionals. As summarized in Table 4.1, the ECB Task Force recommends that larger buildings (50,000 square foot gross floor area or greater) meet a high standard of energy

audits, the ASHRAE Level II Energy Survey and Engineering Analysis.[25] This rigorous evaluation is commensurate with the complexity, scale, and energy savings of larger buildings.

Audits meeting this standard that are undertaken within current utility incentive programs typically cost on the order of $0.10/square foot. Existing public benefit program funding will not cover the entire cost of auditing every large commercial building in the city, but significant subsidies for audits and energy efficiency retrofits are expected to remain available over the period covered by this proposal and after. As this initiative is in accord with stated goals of the *California Energy Efficiency Strategic Plan*, it may be possible to attract supplementary funding.

Large, complex, or energy intensive facilities should be encouraged to take the additional step of retrocommissioning, which is the systematic, detailed testing of all systems and operations in a building to ensure they are well designed and operating properly. However, at this time such evaluations are most appropriate for voluntary best practices, particularly in buildings seeking LEED certification or ENERGY STAR recognition.

Facilities between 5,000 and 49,999 square feet are typically less complex, with fewer resources and less access to professional staff, but are nonetheless significant in their aggregate square footage and energy use, representing about a third of commercial square footage of the city. These smaller facilities should therefore be included in this initiative, but with simpler audit requirements. We recommend requiring an ASHRAE Level I "walk-through" audit for commercial buildings between 5,000 and 50,000 square feet.

Table 4.1: Recommended Audit Requirements

Building Size	Audit Requirement	Timeline	Number of Buildings[26]	Estimated Square Footage[27]
50,000 sq ft or more	ASHRAE Level II	Rolling deadline; all buildings to be audited within 3 years	611	113,000,000
5,000 to 49,999 sq ft	ASHRAE Level I	Rolling deadline; all buildings to be audited within 5 years	4530	60,000,000
Under 5,000 sq ft	Voluntary audit	N/A	>10,000	23,000,000

Utilizing the same administrative and data management mechanisms required for the "Energy Benchmarking and Labeling" proposal, the city should require building owners to provide proof that an energy audit has been completed in the previous 5 years prior to renewal of a business license for commercial property. Similarly, facilities which were recently comprehensively audited should be exempted from repeating the audit in less than 5 years under this proposed policy. The database for tracking submittal of benchmark and audit requirements should be developed and maintained by Department of the Environment. A similar database exists and is

[25] American Society of Heating, Refrigeration, and Air-Conditioning Engineers (2004) *Procedures for Commercial Building Energy Audits.*
[26] Source: San Francisco Assessor-Recorder data. The "Number of Buildings" is a count of developed commercially zoned parcels. Parcels containing more than one building or with primarily commercial mixed uses will increase the building count, estimated square footage, and estimated energy savings.
[27] San Francisco Assessor-Recorder.

maintained by the Fire Department for high-rise life safety certification, tracking annual inspections. We estimate that an audit filing fee of approximately $15 per building would be sufficient to cover city costs for maintaining records and enforcement.

To ensure the utility and credibility of this proposal, auditors must hold acceptable qualifications. The Director of the Department of the Environment should maintain a list of acceptable qualifications, including but not limited to: Building Operator Certification, Certified Energy Manager, or state-licensed Professional Engineer. Since larger (>50,000 square feet) and smaller (5,000 to 49,999 square feet) facilities are generally served by different energy professionals and service providers, the workforce capacity required to implement this recommendation is maximized by addressing the larger buildings as a separate market in parallel to smaller facilities. Because of large number of buildings to be evaluated, it will be necessary to use a “rolling deadline” for citywide compliance rather than establishing a single hard deadline. (Rolling deadlines could be tied to quasi-randomized criteria to be determined by city staff, such as the final digit of a business license number, etc.)

Increasing the pace of audit activity will nonetheless increase demand for qualified expertise. The City and commercial building industry should partner directly with Stationary Engineers Local 39, local building service companies, and educational partners to offer training and the appropriate recognized certifications, increasing workforce capacity to perform audits.

Many measures require maintenance to deliver persistent savings, and technology changes over time. The ECB Task Force recommends requiring subsequent comprehensive audits every five years.

Integration with ECB Strategy

The scale of this proposal represents roughly a 6-fold increase in the pace of comprehensive energy audits in San Francisco. As a result, expedited implementation will require the best available tools to automate audit data entry and submittals. Success will hinge in part upon the ability to easily upload energy data to a secure website, including:

- Building information
- ENERGY STAR Benchmark and Energy Use Intensity Index (EUI)
- Cost-effective measures identified in the audit, and anticipated savings
- Responsible individual and verification of qualifications

The ECB Task Force recommends seeking state and federal efficiency program funding, and establishing partnerships with public and private technology leaders to develop, refine and apply tools to complete audits, report recommendations, and implement projects efficiently. To ensure that owners, managers, and tenants understand the best possible financial case to undertake comprehensive improvements, audits should be required to summarize which measures are eligible for incentives, preferably by integrating the submittal website with the proposed financial optimization tool. (See “Financial Optimization Tool” proposal)

This proposal is dependent upon enhanced marketing of PG&E’s retrocommissioning rebate program(s), and the San Francisco Energy Watch program. Financial incentives and technical assistance like those provided by these programs will be necessary for a sufficient fraction of property owners to implement projects identified by energy audits.

While renewable energy is critical to achieving the goals cited in Chapter 1, it will be necessary to encourage efficient allocation of our financial resources. Financing for commercial photovoltaic installations under the Clean Energy Loan Program (See “Clean Energy Loan Program” proposal), should be limited to projects on buildings that have an approved energy audit and are committed to implementing all identified efficiency projects with a payback period less than the proposed solar project.

Ultimately, well informed requirements will be necessary to ensure that we all do our part to take all available cost-effective action, but well crafted policy must be informed by high quality data. As the ECB Strategy is implemented, the City will be able to refine energy conservation targets for specific building uses and commercial zones. The overall target of reducing net annual energy use in commercial buildings by 50% by 2030 would be met by a 2.5% average decrease in each building every year, but realistically some variation from facility to facility will be necessary. Energy intensive uses, such as restaurants, may have greater opportunity for efficiency improvement per square foot by optimizing lighting, ventilation, and refrigeration than less energy intensive uses, such as offices. Similarly, there is room for improvement everywhere, but exceptionally well managed facilities have less dramatic opportunity for cost-effective savings than facilities with significant deferred maintenance.

Evaluation

Audit, benchmarking, and financing activity are recommended to be the focus of evaluation and measurement for the ECB Strategy. Each should be evaluated for its effect as an initiator of energy saving capital and operational improvements. Metrics for evaluation are:

- Number of buildings audited, and number initiating recommended improvements
- Cost-effective energy efficiency and greenhouse gas reductions identified:
    - Electricity use reduction (kilowatt-hours)
    - Electricity demand reduction (kilowatts)
    - Natural gas use reduction (Therms)
    - Steam use reduction (pounds of delivered steam)
- Energy savings and greenhouse gas emissions avoided

The above metrics should be evaluated annually through publicly available analysis of the recommended ECB Strategy compliance tracking database.

Split Incentive Solutions

The ECB Task Force has identified many situations where the incentives of the building owner, manager, and tenant are not aligned to minimize overall cost of operating and maintaining a building. Among the many opportunities to minimize these "split incentive" barriers to energy efficiency in leased space, we propose that the City implement two solutions chosen because they are implementable with modest resources, yet have the potential for significant impact: clearly supporting submetering in new and existing buildings through key policy changes, and development of an educational toolkit to help tenants and owner/managers align their mutual interests toward sustainable operations. As the ECB Strategy is implemented, additional opportunities to eliminate split incentives are likely to be identified.

Split Incentive Solution #1: Green Tenant Toolkit

Proposal

Require the Department of the Environment, in cooperation with the private sector, to develop a Green Tenant Toolkit (GTT) - a document which will inform commercial tenant and owner/manager about lease language, facility features, and operational practices that align the interest of tenants and owner/managers to build, maintain, and operate their spaces more sustainably. A GTT should include: best practice recommendations, a model green lease, a standardized checklist to identify green features of spaces for lease, and a statement of support from the Mayor.

Problem Statement

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

The two most common types of lease are: *gross* and *triple net*.

- In a *gross lease,* which is commonly used for office space, the lessor provides and pays for all services including utilities. In return, the tenant pays a proportionate share of operating and capital expenses. It is nearly impossible to know the exact energy use of one tenant office unless a submeter is present.
- In a *triple net lease*, common in the retail and industrial sectors, the tenant is directly responsible for utility costs. In this case, the owner or manager is rarely motivated to pay for energy efficiency upgrades because savings accrue to tenants. Tenants have little incentive to install equipment or lighting upgrades if the period required to recoup the investment through savings is longer than their lease term.

These "split incentives" make it difficult for owners, managers, and tenants to come to clear, mutually beneficial terms about the costs and benefits of energy efficiency.

Green leases motivate both parties entering into a lease to save energy and other resources by providing clauses that minimize split incentives. An informed building owner that can boast –

and market – a building with lower utility costs has a competitive advantage, while tenants empowered by clear goals and cost allocation procedures can reduce operational expenses by controlling energy use, recycling, and using water efficiently.

Table 4.2: Selected Example Green Leasing Practices

Item	Green Leasing Practice
Daylighting	If a building shell is designed for daylighting (with skylights, window placement, light shelves, and design to control glare), the lease may consider requiring tenant improvements to maintain this design feature with interior glass walls or other treatments to provide for the comfort and well-being of occupants.
Energy Cost	Operational procedures and control/measurement systems that allow tenants to be charged for disproportionate energy usage, supported by appropriate lease language.
Capital Investment	Lease language allowing the landlord to amortize the cost of utility-saving improvements that reduce operating costs, and to treat the cost of the improvement as operating costs, provided that utility savings equal or exceed the improvement cost.
Commissioning	A "Right of Entry" provision should explicitly allow access for testing and calibration of energy-related systems, in addition to standard access for repair and maintenance. In many cases, a pro-rata share of additional soft costs of commissioning should also be shared with the tenant.
Light Pollution Abatement	Lease clauses may require tenants to shut curtains or blinds in the evening to minimize light pollution, and similarly may define how exterior lighting is managed to minimize light trespass.

The ECBTF recognizes the goals and obligations that a responsible owner should set and meet. However, tenants should be aware of their own obligations and goals as they utilize a space. Such opportunities and responsibilities include:

- **Initial Design & Occupation** – If engaged early in the search for space to lease, architects and space designers can advise on space selection, identifying opportunities for sustainability as well as limitations. If a space is improperly selected or a standard triple net lease signed, the financial burden to the tenant of improving energy efficiency can dissuade them from making improvements.
- **Utilization of Green Lease Language** – Green lease clauses can be incorporated into an owner or occupier's standard lease form to promote sustainable design and practice. These clauses define the cost allocations of capital expenditures that promote energy efficiency or sustainable practices. Through a higher awareness of the existence of these clauses, either party can negotiate their incorporation into the final lease. It is critical that occupiers, their representatives, and legal counsel are educated about sustainable design and practices to ensure these items are considered early in lease negotiation. Table 4.2 lists example green practices that would be difficult to consistently implement if they are not addressed in the lease.

- **Ongoing Redesign and Best Practices** – Once occupied a space is likely to be reconfigured due to workforce expansion or contraction, as well as changing needs and work tasks. To maintain or enhance energy performance, reconfiguration must consider both tenant needs and the energy-using systems that serve the space. Improper location of thermostats or lighting sensors, for example, can reduce occupant comfort while compromising the performance of a previously highly efficient HVAC system. Reconfiguration aside, ongoing best practices - from purchase of ENERGY STAR labeled equipment to turning off unnecessary lighting - need to be emphasized to all occupants.

Objectives

The Green Tenant Toolkit will aid the selection, negotiation and design of commercial space by accelerating the adoption of green lease language. The toolkit will enable and enhance partnership between owners, managers, brokers, and tenants to minimize costs, manage energy, save water, minimize waste, and reduce carbon emissions. All parties – including the city – will benefit from reduced cost and enhanced desirability of locating in San Francisco.

Implementation

The ECB Task Force recommends that the San Francisco Green Tenant Toolkit be developed at minimal cost to the City and County of San Francisco by convening a public/private partnership. Suggested partners for GTT development include representative large commercial tenants, leasing firms, major real estate owners, utilities (including both PG&E and the San Francisco Public Utility Commission), real estate industry organizations, architectural or space planning experts, and legal firms. San Francisco's Department of Environment should be the lead, with support from pertinent departments within the City. By providing the stakeholders who will benefit from a well crafted toolkit, with the opportunity to guide the development of this living document, promotion and printing costs are anticipated to be the primary expenditures.

The ECBTF does not recommend legislation to require the utilization of green lease language or other elements of the GTT due to the nature of the leasing transaction and legal implications. Furthermore, enforcement of leasing requirements would be difficult because lease transactions are not required to be reported to, or recorded by, the City and County of San Francisco.

The ECBTF recommends publication of a Green Tenant Toolkit addressing the topics listed in Table 4.3 (following page) within 6 months of adoption of the ECB Strategy. After publication, the GTT should be viewed as a living document and be reviewed no less than annually for updates in technology, energy saving strategies, and case studies.

Evaluation

The Green Tenant Toolkit should be evaluated by regular market surveys in concert with evaluation of other informational measures (Financial Optimization Tool, Education). At a minimum, the survey should track:

- Familiarity rate with green lease clauses
- Utilization of tenant disclosure survey

Table 4.3: Green Tenant Toolkit Recommended Content (minimum)

- Mayor's Call for Green Leasing in San Francisco
- Climate impacts of building operations
- Green owner and tenant practices
    - Reduce Energy Usage
    - Reduce Water Usage
    - Reduce Waste
    - Improve and maintain good Indoor Air Quality
    - Utilize Sub-metering
    - Building Operations and Management
- Tenant's Contributions to Sustainability
    - Build out and Design Considerations
    - Office Management and Practices
- Model Green Lease Guidelines
- Tenant Checklist for Space Evaluation

Split Incentive Solution #2: Unilateral Submetering

Proposal

A. In new occupancies, require that requests for submetering in commercial spaces be honored – at the expense of the requestor - within 5 years of implementing the ECB Strategy. (This proposed practice is termed “Unilateral submetering.”)

B. Provide existing leaseholders the opportunity to submeter.

C. Require submeters in new multi-tenant buildings and large tenant build outs.

Problem Statement

It is common practice to pass through the cost of electricity to a commercial tenant. Costs in excess of the base year (typically the first year of the lease) are passed through in proportion to the square footage leased by each tenant. This practice does not incentivize owners and managers to invest in energy saving measures because savings accrue to tenants; and reduces the incentive for tenants to conserve because savings are shared with the entire building. This problem, commonly referred to as “split incentives,” was partly addressed by Decision 07-09-004 of the California Public Utilities Commission (CPUC), which allows submetering electricity usage. However, submeters are rarely installed as retrofits, partly because of the same disconnection between who makes the financial investment and who benefits. By allowing either the tenant or landlord to unilaterally implement submetering at their own expense, the split incentive barrier will be reduced equitably.

Objective

Provide mechanism for both tenants and owners to measure and manage energy efficiently.

Implementation

To reduce split incentives through submetering, the ECB Task Force recommends that San Francisco:

1. Encourage electricity submetering for individual commercial tenant spaces, and encourage electricity costs to be passed through in proportion to measured use, making tenants financially responsible for electricity use and savings.
2. Require via ordinance that by January 1, 2014, either tenant or landlord shall have the right to request submetering downstream of the master meter, obligating installation of the submeter at the expense of the requesting party.
3. Modify the San Francisco Building Code to require billing-quality submeters as outlined in Table 4.4, below:

Table 4.4 Proposed thresholds for requiring submetering in permitted construction

Year	New Construction		
2010	All new construction designed for multitenant use (submeter floor-by-floor)		
	Existing Buildings		
	Space Type	Tenant Space Size Threshold	*And* Building Size Threshold
2010	Single tenant build out	Full Floor Only	Buildings >50,000 square feet
2011	Any tenant build out	>10,000 square feet	> 100,000 square feet
2012		>7,500 square feet	> 75,000 square feet
2013		>5,000 square feet	> 50,000 square feet
2014		>3,000 square feet	> 30,000 square feet

Evaluation

- Annual submeter electrical permit activity in existing buildings.
- Market survey: Has end-user energy use been curtailed? Are energy decisions made on the basis of how the monthly bill may be impacted? Do tenants institute energy efficiency programs and insist on the greenest technologies in the workplace? Most importantly, has submetering decreased the energy use and carbon footprint of the city?

Education, Training, and Marketing

Proposal

Promote benchmarking, auditing and energy-efficiency strategies; assist commercial property owners in accessing funding sources for efficiency projects; and assist service providers such as building engineers and energy auditors to increase their expertise.

Communication outlets are recommended to include (but are not limited to): public and private stakeholder partnerships promoting ongoing professional and technical training; mentoring and recognition programs for building energy efficiency; developing and maintaining internet-based resources; designing promotional and outreach collateral.

Problem Statement

The primary obstacles to widespread investment in efficiency projects are frequently identified as a lack of awareness of efficiency opportunities, a low priority placed on efficiency compared to other building objectives, and cash flow constraints (for undercapitalized building owners, commonly holders of smaller buildings). Education and outreach can help to lessen these first two obstacles, and also lead owners to financial resources to reduce the third (see "Financial Optimization Tool" proposal).

The ECB Task Force emphasizes that its recommendations are a comprehensive set of initiatives; each proposal serves to enhance the others, and should not be viewed independently. To plan for their successful adoption, significant outreach must be provided to ensure that: owners are aware of new requirements far enough in advance to comply without minimal difficulty; technical service industries receive the best training for conducting audits and implementing energy efficiency measures; and building tenants understand their role in achieving energy efficiency through the "Green Tenant Toolkit" and other educational efforts.

Many existing organizations already engaged in outreach and training on energy efficiency are ideal partners for the City to collaborate on further outreach and development.

Objectives

Support the ECB Strategy by developing a comprehensive outreach, marketing and outreach campaign, applying appropriate resources to specific interest of every key stakeholder group (owners, facilities managers, service contractors, tenants, brokers, City policy makers, and the general public), and deliver high quality training and mentoring to ensure that the marketplace accepts the program.

Implementation

- Create a five-year comprehensive educational and outreach plan that makes building owners and tenants aware of the city's energy efficiency goals, prepares owners to meet the requirements, and supports the workforce necessary to deliver services. The outreach plan will be comprised of actions in the areas of Education, Technical Training, and Marketing, and will cover all aspects of the ECB Strategy.

Table 4.5: Outreach Plan for ECB Strategy proposals

	Bench-marking and Disclosure	Energy Audits	Sub-metering	Green Tenant Toolkit	Financial Optimization Tool	Lead by Example	SF^2 Loan Program
Education	X	X	X	X	X	X	X
Training	X	X	X				
Marketing	X			X	X		X

- Designate a Commercial Energy Efficiency Champion to oversee the development of tools to support the success of these recommendations.
- Partner to direct the development of education and outreach tools and to manage the tools and data hosted on the City's website.
- Work with Local 39 to develop a mentorship program whereby experienced engineers can help younger engineers learn best practices for energy efficiency.
- Promote on-line tools for ENERGY STAR benchmarking training found on www.energystar.gov.
- Make Mayor Newsom's 24x7 Energy Challenge an annual event. (www.sfenvironment.org/247)
- Provide tools/resources for the City's 311 call center to assist commercial property owners with benchmarking and auditing requirements.
- Design educational templates that can be customized by individual building owners, managers, brokers, and tenants for outreach in existing facilities.
- Develop on-line webinars and live educational presentations.
- Use public service announcements to reach small property owners, especially those in non-English speaking communities.
- Host a competition to generate innovative ideas in energy efficiency, along the lines of the Buckminster Fuller Challenge: http://challenge.bfi.org/.

Partnerships

- Partner with the **U.S. Environmental Protection Agency** on Portfolio Manager training, data management, streamlining benchmarking, and data verification.[28]
- **PG&E Pacific Energy Center**: Assist with development and delivery of new curriculum for workshops, classes, mentorship, and training to support ECB Strategy.
- **USGBC-NCC**: Co-deliver workshops, web marketing support, and outreach.

[28] Note that EPA may only share energy performance data from Portfolio Manager when directed to do so by the account holder.

- **Existing Trade Groups** (Stationary Engineers, IBEW, SWIA, PPI): Professional training, energy analysis support, mentorship

- **Existing Trade Associations** (BOMA, IREM, IFMA, NECA, CA Commissioning Collaborative): Outreach support, educational support

- **Existing Trade Suppliers** (Mechanical, Electrical, etc.): Education for suppliers and manufacturers

- **Educational establishments** (City College of San Francisco, UC Berkeley Extension, Building Operator Certification program): deliver early curriculum, develop and sustain long term interest

Evaluation

Progress of the educational and outreach campaign shall be measured and monitored to determine success and/or needed improvements. Metrics for success include:

- Number of trainings completed
- On-time completion of ENERGY STAR benchmarking and audit submissions to the City
- Number of trained professional technical staff to accommodate demand for ASHRAE Level I and II energy audits

Lead by Example
In Municipal Facilities

Proposal

San Francisco should lead by example. The City should: comprehensively benchmark energy use of its municipal building portfolio and disclose this information to the public; provide direct education to the community regarding energy and climate issues; partner with other organizations and industry to create robust tools for the benefit of improving energy management, and implement demonstration technologies that enhance energy efficiency.

Problem Statement

Although much has been done by the City recently to communicate, educate, and track San Francisco's environmental sustainability, the opportunity remains to do much more, particularly with regard to energy efficiency in City facilities. For example, the San Francisco Public Utilities Commission Power Enterprise has been auditing city facilities to find and implement energy efficiency improvements for years, but few know about this initiative at all, let alone its scope or results.

If the City is serious in its commitment to managing and minimizing its energy use and greenhouse gas emissions, the "benchmark and disclose" approach outlined by the ECB Task Force should apply to City buildings and operations as well. One of the City's greatest strengths is the "bully pulpit" and its regular connections to our business operations. These communications resources are powerful tools that can spur us to excel, in part by demonstrating that the City and County of San Francisco takes performance and transparency seriously in its own facilities.

Finally, building and renovating in San Francisco remain a time-consuming endeavor, and permit challenges can be deterrent to implementing projects. Occasionally, emerging technologies that offer substantial efficiency gains may be perceived with equal skepticism by the market and city code officials. At the same time, the City continues to be a hub of innovation, particularly in the technology sector; "green tech" companies located in the Bay Area producing the next generation of energy efficiency technologies could benefit from enhanced support from local government. The City should take steps to assist and attract new green businesses to the area by installing and testing new clean technologies.[29]

Objectives

While the overall ECB Strategy generally targets the private sector, the objectives specific to Lead by Example are:

- Measure, manage, and disclose energy use in municipal buildings.
- Communicate the progress of the City's municipal and private sector efforts towards climate and energy efficiency goals.

[29] In the interest of public safety and liability, demonstration technology installations in municipal facilities should generally be limited to products that have attained Underwriters Laboratory (UL) listing or equivalent.

- In anticipation of increased volume of permits for building upgrades, establish a standardized means to process certain energy-related permit requests, similar to the streamlined solar photovoltaic permitting procedures.
- Partner with the private sector to promote and use new technologies that will lead to direct energy savings, and will also assist in creating robust reporting and financing tools.

Implementation

- Require, by ordinance, benchmarking all city buildings using ENERGY STAR Portfolio Manager within 1 year, and to disclose that information to the public on a regular basis, preferably through a single "dashboard," tracking and reporting on private sector efforts as well.
- Regularly report progress and results of the City's environmental and energy programs and goals, including a near-"real-time" environmental dashboard accessible via the Internet.
- Using existing processes (i.e. Code Advisory Committee), the Department of Building Inspection should identify gaps and opportunities to prioritize permits for building upgrades related to the ECB Task Force proposals, including amending codes to facilitate high performance building construction and operations.
- Create and budget for pilot projects using local technology. Partner with technology leaders to provide and identify technology-based solutions to streamline implementation of the strategy, including efficient data collection, reporting, and refinement of benchmarking, building audit information, and other recommendations in this report.
- Partner with the Mayor's Office of Economic and Workforce Development to provide access to no-interest loans for local businesses providing energy efficiency and conservation services.

Partnerships or recommendations to other entities:

- US Environmental Protection Agency Region 9 and EPA National can each be essential partners in support of the communications, validation, and benchmarking recommendations in this proposal.
- Local green technology/clean energy companies should be solicited for opportunities to use municipal facilities as demonstration installations.

Evaluation

Metrics include:

- Benchmarking of municipal buildings completed within one year, or rolling time frame (50% after 6 months, 50% 6 months later, etc.)
- Demonstration that city facilities (or at a minimum, city occupied office facilities) are meeting the proposed commercial sector goal: reducing annual average energy use 2.5% per year.
- Delivery of Annual Municipal Energy Efficiency Report
- Establishment of citywide energy reporting dashboard within 12 months of adoption of the ECB Strategy.

Financial Optimization Tool

Proposal

To support the effectiveness of all proposals, the ECBTF recommends that the City of San Francisco – possibly with a private sector partner – create a financial tool that will assist property owners in quickly identifying and accessing all applicable energy efficiency rebates and incentives, reducing transaction costs.

Problem Statement

Governments have used financial and non-monetary incentives to encourage private market adoption of energy efficiency measures since the early 1980's, when states used federal monies from Petroleum Violation Escrow (PVE) fines on oil companies to pay energy efficiency programs.[30] Yet many professionals familiar with energy efficiency programs – including ECBTF members – observe that property owners do not often seek or include incentives within their budgeting for energy efficiency retrofits, despite the open publishing of thousands of federal, state, local and utility incentives on the internet on websites such as the Database of State Incentives and Renewable Energy (www.dsireusa.net), the US Department of Energy - Energy Efficiency & Renewable Energy Newsletter (EERE Network News), and Flex Your Power (www.fypower.org). Lack of knowledge about financial incentives fuels the perception that energy efficiency measures are "too expensive."

Typically, the property owner's perception of efficiency costs and their use of incentives fit within a complex set of financial and contractual variables – some within and others outside their control – which together determine the success or failure of energy efficiency retrofits. Key variables include energy prices, initial and life cycle costs of specific technologies, legal feasibility, access to debt financing, length of the owner's hold period, and tax code changes, among others.

Historically, better economic conditions, lower energy prices, easier access to capital and positive valuation trends have meant that owners have not focused intently on bottom line benefits of energy efficiency – and so many are unaware of the full extent of financial incentives available. In its 2007 Green Building Survey, National Real Estate Investor noted that 77% of corporate users and 72% of developers "had not taken advantage of government incentives for green building."

To obtain financial incentives, the property owner has to successfully manage internal and external issues:

- **Organizational Awareness:** In large facilities, major energy efficiency improvements typically take place as part of a long-term capital plan timed with the replacement of major equipment, so extensive retrofit projects usually take place once every few years. As a result, the owner does not assign permanent staff in house to maintain knowledge of available incentives, and project timing is not coordinated with incentive funds.

[30] Brown, M. (2008). *Brief #1: Funding Mechanisms for Energy Efficiency.* Retrieved 11 9, 2008, from Alliance to Save Energy: http://www.ase.org/content/article/5057

- **Volume and Complexity:** Incentives available from federal, state, local governments and utilities number in the thousands and their details are spread across hundreds of websites and publications. The increased national focus on energy efficiency has perversely led to an exponential growth in the number of sites publicizing incentive details, and to remain current they must now be updated almost weekly. The recent passage of the American Recovery and Reinvestment Act has compounded the volume and complexity of incentive data. It is difficult for property operations and management staff to remain up to date on major incentive changes and properly time their capital repair plans to take maximum advantage of incentive benefits available.

- **Difficulty of Assessment:** Incentives come in many different forms – from tax credits and deductions, to rebates, grants and special loans. Some incentives may be combined to increase the reduction in retrofit costs. However, the use of some incentives precludes the use of others. Property owners must, therefore, be able to quickly calculate which set of "competing" incentives will yield the best financial outcome. There are guides that are specific to certain incentives; however, there is no means to obtain a comprehensive comparison in real-time of the cost impact of incentives upon a retrofit project.

Objectives

Develop a tool that will help San Francisco property owners identify efficiency rebates available to them, based on the specifics of their building and financial position. Developing the proposed tool would help increase energy efficiency by:

- Increasing the level of awareness of incentives among property owners.
- Providing a source of education for other financial providers such as property lenders.
- Increasing property owners' adoption of energy efficiency measures by enabling them to use all eligible incentive funds to offset the costs of energy improvements.

Implementation

The main resources from the City of San Francisco that are required for this proposal are: the cost to develop the tool, and sufficient promotion to ensure the commercial real estate community is aware of the tool.

Other Considerations:

- **Cost effectiveness**: The development and operational costs of this tool could be offset with the use of partnerships (e.g. with technology providers, other governments, PG&E, etc.), coordination with other similar portals, and/or advertising. A web tool developed by private business venture would be most cost-effective for the city, provided the information was as comprehensive as envisioned by this proposal.

- **Challenges**: Ongoing support and refinement of the tool once it is in place should be planned and budgeted, based upon tracking data outcomes and actual user results. The tool's success in the property owner market will also be affected by how closely the tool is connected to the implementation of related task force recommendations (benchmarking, education, etc.).

- **Economic Impacts**: Enhanced access to rebates will yield a larger number of efficiency projects in the City, proportionately expanding both avoided costs and the energy efficiency workforce. Greater energy savings over time will result in greater discretionary income remaining with San Francisco businesses for other spending.

Evaluation

Website usage statistics are the most direct measure of success for the financial optimization tool. Incentive applications generated by the tool should also be tagged and tracked to understand how frequently recommended projects are implemented with the assistance of incentives and assistance identified by the tool.

San Francisco Sustainable Financing (SF^2) Loan Program

Proposal

The ECB Task Force supports and endorses the San Francisco Sustainable Financing (SF^2) Loan Program, with recommendations that the City establish minimum prerequisites to receive funding for energy efficiency and renewable energy projects.

Problem Statement

Energy upgrade opportunities can be primarily identified in four areas: lighting, heating & cooling, process or plug loads, the building envelope, and on-site renewable energy generation. While lighting retrofits can be relatively inexpensive, major capital projects can be cost-prohibitive.

Traditional methods of financing energy improvements include:

1. Trust deed or mortgage
2. Equity financing using the real estate as collateral
3. Performance-based contracts where the equipment supplier or vendor finances the cost of the energy efficiency improvement and repayment is made through utility or cost savings
4. Subsidies through ratepayer funded programs implemented by investor-owned utilities such as Pacific, Gas and Electric and their local government partners (SF Energy Watch)
5. Cash generated through operational revenues
6. Cash provided by the ownership

In the current economy, the two lender-based financing methods listed above (#1 and 2), have been extremely difficult or unattainable for many owners due to the tight credit market and the recent lack of equity due to decreasing property values. Prior to the recent crisis, studies have indicated that most building owners are reluctant to add additional debt onto their property for energy efficiency projects. Furthermore, case studies have shown past programs have failed due to poor implementation, insufficient outreach to the market and an owner's general reluctance to select a loan over a rebate. An example of this was the California Energy Efficiency Loan Fund (CEELF) launched in October 2004 and closed in December 2005. During this limited time, CEELF produced only three audits and no loans due to poor implementation methodology.

Performance-based contracts (#3) are being used on a limited basis due to their complexity and because these contracts are evaluated on the credit of the borrower. This methodology has been successfully applied to government buildings and a limited number of owner-occupied corporate facilities, but very rare in multitenant real estate primarily because occupancy rates and tenant credit are uncertain over the long term. As a result, energy services companies are typically unable to offer attractive terms to multitenant property owners.

Local government-based and IOU incentive programs (#4) play an important role in encouraging energy efficiency, but typically pay the incremental cost necessary to achieve an end, which is rarely the entire capital cost of a project. Generally, the larger a project is, the smaller the fraction of total project costs are offset by incentive payments. Remaining capital must be supplied by cash on hand or debt financing. Additionally, some rebate programs are perceived as difficult to access, understand, or implement by building owners.

Finally, cash generated through operational revenues (#5) has declined recently for many real estate owners due to loss of rental income through falling rents and increasing vacancies. Cash is limited to the generated revenue minus the operating, debt, and capital expenses of a building. Cash financing (#6) of large energy efficient equipment and upgrades is difficult for many building owners and, usually, budgeted over a period of years to accommodate fluctuations in the cash flow stream. In years of less cash flow, these types of projects tend to be postponed until cash flow increases again.

Objectives

The objective of the SF^2 Loan Program is to create a non-traditional financing option for energy efficient improvements, utilizing the Mello-Roos Act in a framework similar to that outlined in recently approved California legislation AB 811.

The City of Berkeley piloted the first successful Mello-Roos-based financing district for energy improvements in 2008 ("Berkeley FIRST"), which was fully subscribed within ten minutes of accepting applications. Also in 2008, the California legislature passed AB 811, which provided another mechanism for local jurisdictions to create an "assessment district" in order to finance energy efficient improvements and distributed generation renewable energy sources that are attached permanently to real property. Both approaches allow participating cities to obtain funding through any available source, including the issuance of bonds.

Participants voluntarily agree to add a tax assessment to their parcel (typically for 20-year term at fixed interest) to repay capital costs of energy efficiency and renewable energy improvements to their real property. This voluntary assessment constitutes a lien against the parcel until repayment is completed, and is transferable upon sale of the parcel. This approach directly addresses two financial hurdles for clean energy projects: up-front capital costs and uncertainty the net value (including remaining debt, if any) will transferred if the property is sold before an improvement pays for itself.

SF^2 aims to create a similar structure piloted by the City of Berkeley and outlined in AB 811, whereby the City provides the up-front costs for energy efficiency improvements to a property owner, based on verified prerequisites, and allows the repayment method as a special assessment on the property tax bill.

Implementation

City staff indicate that the SF^2 program is being prepared for launch in 2010. In addition to the final administrative guidelines yet to be developed by the City, the ECBTF recommends setting minimum requirements for applicants to qualify for funds. The following suggested prerequisites are consistent with two other key recommendations in this report:

- *Benchmarking*: applicants should be required to benchmark their building using ENERGY STAR Portfolio Manager, or an equivalent tool.
- *Energy Audit*: applicants should be required to conduct an energy audit that meets City standards. Performing the audit will ensure that SF^2 funds are optimally invested.
- Energy efficiency projects should be implemented either before or simultaneously with use of SF^2 funds to develop on-site renewable energy generation.

Evaluation

The measures of success will be the number of projects financed and the energy reduction produced through financed energy efficiency improvements.

Summary of Existing Commercial Buildings Strategy

	Idea	Mechanism	Benefits
Transform Market with Information	**Identify Cost-Effective Savings in Every Commercial Building**	**Require** businesses to conduct an energy audit every 5 years for business license renewal, including identifying and listing applicable efficiency measures.	Ensure building owners, managers, and tenants know exactly how much energy – and money – they can save.
	Disclose Energy Performance Information	**Require** building owners and managers to share energy performance data with the City. Publish database to inform stakeholders.	**We manage what we measure.** Tracking helps identify key factors in building performance, including occupant behavior. Monitoring and reporting provides a "miles per gallon" metric that enables tenants and buyers to identify efficient buildings.
	Resolve "Split Incentives"	**Provide** a Green Tenant Toolkit. Make submetering a policy priority.	Help landlords and tenants mutually benefit from reduced utility costs and sustainable operations.
	Make Incentives Easy	**Develop** a web-based tool that finds all incentives, rebates, and financing	Offset the cost of improvements and streamline the payment of incentives for energy improvements.
	Educate, Train, Mentor, and Market Energy Efficiency	**Promote** programs, **facilitate** mentorship, and **partner** with institutions.	Enhance workforce capacity. Engage stakeholders to improve energy efficiency
Lead	**Lead By Example in Public Facilities**	**Benchmark** and disclose energy performance for city facilities. **Budget** to pilot local uses of clean technology.	Leadership inspires others to act. The City uses a fraction of overall energy, but is the largest consumer. Clean tech demonstrations save energy and promote the economy.
Capital	**Provide Financing**	**Launch** San Francisco Sustainable Financing (SF2) Loan Program. **Require** efficiency prior to receiving funds for renewables.	Financing enables cost-effective energy use reductions through voluntary tax liens. Lowest cost carbon reduction is achieved by prioritizing efficiency.

Why Focus On Energy? Why Not Green Buildings?

The ECB Task Force strongly endorses comprehensive, whole-systems solutions for sustainable design, construction, operations, and maintenance that are the foundation of green building rating systems. We are encouraged by dramatic increases in use of tools such as LEED rating systems for new and existing buildings. The ECB Strategy is focuses on energy for two reasons:

- San Francisco has taken dramatic policy steps in support of waste reduction, water conservation, public transportation, a targeted energy standard, and reduction of toxic materials in recent months which need time, resources, and broad collaboration to fully implement. The ECB Strategy complements these efforts by offering a targeted approach to comprehensively reducing energy use and carbon emissions from commercial buildings; taken together, San Francisco has developed a *de facto* green building policy framework for existing buildings.
- Energy use, industry expertise, and stakeholder motivations are complex; it was helpful that the Mayor limited the scope of our focus in order to obtain the depth of analysis necessary to identify and communicate a path to surmount the energy challenges before us.

Key recent legislation that supports a green built environment in San Francisco (and can contribute to voluntary LEED EBOM certification) includes:

Waste Minimization

The construction, operation, renovation, and dismantling of buildings generates substantial waste; unless managed properly, this material will end up in landfills, where greenhouse gas emissions - primarily methane - result from the breakdown of organic material such as wood, paper, and food waste. San Francisco has set the goal of sending “zero waste” to landfills by 2020; ordinances supporting this objective include:

- Requiring restaurant ‘to-go’ containers to be compostable or recyclable.
- Requiring all construction and demolition debris to be either separated at the point of generation or processed by registered recycling facilities.
- In addition to requiring third-party green building certifications for most new commercial and residential construction projects, 2008’s Green Building Ordinance rewards projects for re-using and maintaining existing architecturally significant building elements, while it raises the bar for projects that include demolition of entire buildings. The ordinance also requires all affected projects to accommodate the storage and collection of recycling, organics (compostables), and trash.
- In 2009, San Francisco adopted a Mandatory Recycling and Composting Ordinance requiring commercial and multifamily building owners or managers to maintain appropriately labeled and color-coded containers (blue for recyclables, green for compostables and black for trash) in convenient locations. It also requires education of tenants, employees and contractors, including janitors, on how to separate materials. The Department of the Environment and collectors provide free consultation, labels, signage, and other assistance to support compliance.

The ECB Task Force supports San Francisco’s extensive existing efforts to publicly track – and succeed in – the minimization of waste. As of 2009, more than 72% of overall waste in the City is recycled or composted, and there are a number exemplary facilities maintaining greater than 90% diversion.

Water Conservation

Droughts, changing snowpack conditions, and projected long term growth in San Francisco necessitate responsible management of water, our most essential resource. Ordinances passed in 2009 require retrofitting residential and commercial properties with water efficient plumbing fixtures, including high efficiency showerheads, faucet aerators, toilets, and urinals, as well as repairing leaks. Commercial buildings may be required to complete retrofits at the time of additions and tenant improvements greater than $150,000 in value, and all commercial buildings in the City must be retrofitted by January 1, 2017.

(continued)

The ECB Task Force encourages commercial building owners to make any necessary upgrades and install water conservation measures in their buildings as early as possible; early adoption maximizes the dollar value of rebates which are often available from the San Francisco Public Utilities Commission, and early implementation also helps maximize water and sewer cost savings over time.

Lighting Efficiency

Lighting improvements are one of the quickest and most cost-effective ways to reduce electricity use. In San Francisco, lighting accounts for approximately 40% of total electricity consumption in commercial buildings, partly because our mild climate minimizes air conditioning loads. San Francisco Energy Watch (www.sfenergywatch.org) has helped over 9,000 small businesses and commercial and multifamily residential buildings in San Francisco, providing free energy audits matched with subsidies to upgrade lighting and other systems to save energy. These efforts have shaved 18 megawatts from overall peak demand, which is further bolstered by numerous other rebate programs and services delivered by PG&E. Despite these successes, many pre-1990 nonresidential buildings continue to rely upon inefficient and obsolete types of fluorescent lighting.

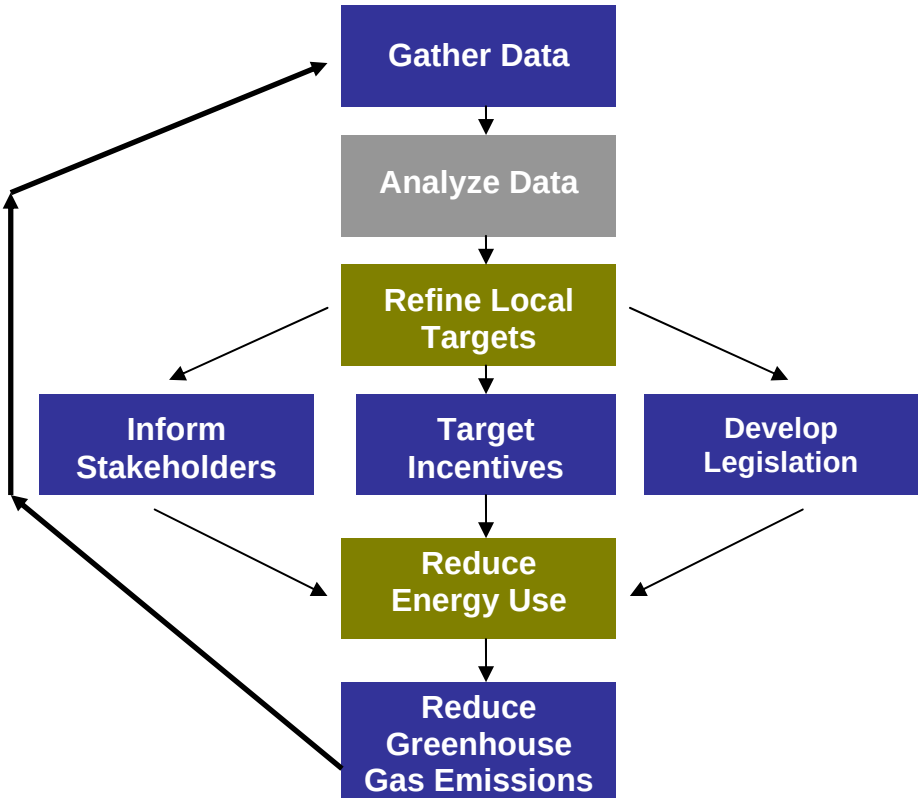
The proposed ordinance, “Requiring Lighting Efficiency Measures in Commercial and City Buildings,” would amend the San Francisco Building and the Environment Codes to require commercial buildings, private schools, multi-family building common areas, and City facilities to upgrade 4’ and 8’ fluorescent lighting by December 31, 2010. The proposal sets a local performance standard of at least 81 lumens per watt for common linear fluorescents, and prohibits lamps with greater than 5 milligrams of mercury for 4’ tubes, or 10 mg for 8’ tubes. There are exemptions for lighting in refrigeration, retail display cases, and fixtures controlled by occupancy sensors in small areas (250 square feet or less.)

Combined with existing financial incentives, this legislation will reduce commercial building energy use and the associated costs to owners, operators, and tenants. The ECB Task Force endorses this proposed ordinance.

5. Expected Results

By implementing the recommended ECB Strategy, San Francisco will realize cost-effective, high return-on-investment opportunities in existing commercial building energy efficiency. The ECB Strategy balances new requirements with outreach, technical assistance, and financial support to ensure all stakeholders benefit from the move to increased efficiency. We focus first on gaining information about building energy performance through benchmarking and auditing; this information is the key piece needed to guide and motivate investments. Data will also guide the City (and other incentive providers using public goods funds, such as PG&E) in developing more focused policy and better targets incentives to support building owners. The education and outreach proposal coordinates City efforts and existing resources around supporting building owners in compliance with the new requirements and lays a roadmap for developing an energy efficiency workforce. The financial proposals resolve some the key obstacles to cost-effective investments in building energy efficiency such as the potential sale of a building before investments are recouped and the identification of sources for up-front funding of efficiency projects. Finally, we address building tenants as significant stakeholders in commercial properties and make sure that they understand and are able to benefit from their critical role as the end-users of energy consumption in buildings.

From the perspective of the City, implementation of the proposed strategy is outlined as follows:



Gather Data

San Francisco's information about energy usage is in the form of aggregate data with limited granularity. Aggregate energy use, as well as energy use of broad market classes (municipal, industrial, commercial and residential) or geographic groupings (citywide, or zip code) are made available every few years by PG&E (private sector) and the San Francisco Public Utilities Commission (municipal buildings). Very little is known beyond these broad metrics, with the exception of state and national averages for building performance.[31]

To implement a methodology for energy efficiency we must start with a clear understanding of what is the current baseline and what contributes to this baseline. Benchmarking all commercial buildings in the city will give a comprehensive picture of how local buildings compare, individually and as a group, to local, state, and national peers, as well as to greenhouse gas reduction targets. The proposed energy audits take this information a step further by identifying the most cost-effective opportunities for energy investments.

Once this baseline is defined, analysis can be applied to develop a "roadmap" based on high quality, verifiable data. This "roadmap" will have direct benefits to property owners, by providing them with high-return energy investment opportunities, and for the City at large, by providing the basis for policy development. The proposed requirement for annual updating of benchmarks and five-year updating of audits will provide continual tracking of improvement and progress towards the City's goals. Simply put, *we must measure what we intend to manage.*

Analyze Data

The energy benchmarking and auditing proposals will create the ability for stakeholders to understand their level of energy efficiency within the relevant comparison group (e.g. other players in the same market sector, potential targets for incentive programs, etc.) Key stakeholders include:

- Building Owners
- Building Occupiers
- Real Estate Managers
- City and County of San Francisco
- SFPUC
- Utility Companies

As new tools of measurement become available, the data gathered can be easily adapted. Currently, some of the market accepted tools include EPA ENERGY STAR® Portfolio Manager, ASHRAE standards for design and operation, and LEED rating systems. To ensure that they reflect current best practices and performance metrics, as well as to facilitate increasing efficiency over time, these tools are under continual review and revision. These tools will continue to be improved, developed, and utilized for the foreseeable future, and it is highly likely that additional tools will be developed as well.

[31] Federal performance data are maintained by the U.S. Department of Energy in the Commercial Building Energy Consumption Survey (CBECS) and by the California Public Utilities Commission in California Commercial End-Use Survey (CEUS.) Both databases are useful for broad estimation at state and national scales.

Furthermore, continual tracking of data enables tracking progress towards goals and targets, as well refinement of this strategy.

Refine Local Targets

The ECB Strategy provides a firm grounding for tracking and achieving the robust citywide energy efficiency target, as well as informing our approach to specific end uses and measures, helping to make San Francisco a leader in energy efficiency. Retrofits and enhanced management practices produce private-sector benefits including avoided costs spent on utilities and a leadership position in attracting and developing the energy-efficiency industry and workforce of the future.

Utilizing the analysis of the data gathered, the City, utility companies, owners, occupiers, and vendors can help identify resources that help meet their goal of greater energy savings. Examples of available resources are public goods utility rebate programs, tax-based incentives, enterprise zones, and energy efficient equipment financing programs.

Owners and managers will continue to develop internal targets for their buildings and portfolios. Industry leaders already develop their capital budgets for equipment upgrades using energy audits and benchmarking; under the ECB Strategy, this investment planning will be informed by required data collection, training of engineering staff and outside vendors, and improved access to financial resources for energy investments.

Inform Stakeholders

Benchmarking with ENERGY STAR® Portfolio Manager provides immediate feedback to building owners, showing how their building fits into a percentile ranking of energy use in comparable buildings and providing a dollar figure for expected cost savings at higher target levels of efficiency. One key factor in motivating new investments in energy efficiency is simply raising the level of awareness of the opportunities available, as building owners generally do not think of themselves as “energy investors,” despite the key role played by commercial buildings in energy consumption and the importance of utility costs to building owner and manager bottom lines. The “Energy Audit” proposal deepens the information available to owners by presenting them within specific, cost-estimated efficiency projects. This works together with the “Education, Marketing, and Outreach” proposal to help owners understand their opportunities, and ensures that the technical staff necessary for successful benchmarking and auditing are available. The proposed “Financial Optimization Tool” and “San Francisco Sustainable Financing (SF2) Loan Program” will help building owners identify available funding appropriate to their building type and equipment. Finally, the proposed “Split Incentive Solutions” will inform tenants and building occupiers how to ensure their investment costs and the benefits of energy improvements are familiar to all parties and shared equitably.

Target Incentives

Another result and benefit to developing targets is to identify energy waste and develop future programs that incentivize building owners and occupiers to reduce this waste. Incentives can be in many forms including monetary rebates for equipment upgrades (i.e. the SF Clean Energy Loan Program), or non-monetary incentives such as priority permitting, or recognition programs

for highly energy efficient buildings. Incentives can be targeted to match the best program for the specific equipment need or type of building. An example of poor incentive design is the offering of administratively complex incentives to customers unlikely to be open to complicated processes, such as B and C class office and retail. Current and future programs can avoid this mismatch of programs through informed analysis of more detailed data. Matching the complexity of an incentive program to the interest and capacity of recipients is critical to success.

Furthermore, owners and managers informed by whole building data are more likely to prioritize projects based on opportunity cost rather than awareness of specific technologies. At the most basic level, a building that has many means of creating energy efficiency should focus on these measures *before* looking to create new renewable energy (i.e. solar) on-site. Alternately, a building intent on leading by pursuing renewable energy will enjoy greater total energy cost reduction by including all efficiency measures with a lower cost per kWh than solar photovoltaics, or lower cost per therm than solar hot water.

Develop Legislation

Generally, early adopters of energy efficiency upgrades and operational changes are larger Class A building owners and operators with a higher level of awareness, as well as professional management and engineering. To reduce total energy use, it will be necessary to engage with owners and operators slow to implement these upgrades ("later adopters") through a combination of outreach, incentives, and ultimately legislation. ECBTF recommends developing a formula for required greenhouse gas emissions or energy use intensity reductions in commercial buildings based on an analysis of the data collected in the first 5 years after the adoption of this proposal.

Legislation can only be effective and equitable if it is developed based upon detailed understanding and informed analysis of the necessary change to be made. Verifiable data can justify necessary legislation.

Reduce Energy Use

Reduce Greenhouse Gas Emissions

The goal of the proposed strategy is to reduce energy use. Through implementation of the outlined proposals, all stakeholders will be able to assess where they are and how they will get to the goal.

As summarized in Table 5.1, the ECB Task Force finds that with current technology and continuation of incentives, the proposed 250% increase in the pace of comprehensive energy audits for commercial buildings can reasonably be expected (based on experience serving both large facilities and "hard to reach" small business customers) to increase energy efficiency activity proportionately, yielding annual energy savings of 2%. Implementation of the full proposed Existing Commercial Buildings Strategy – including energy use disclosure, reducing split incentives, a Clean Energy Loan Program, education, and financial optimization assistance, we are confident that San Francisco will meet the voluntary 2.5% annual energy reduction target for at least the next 5 years, acquire the information necessary to track exactly how the program (and city) is performing, and will be prepared to work with the private sector on the policies,

programs, and requirements which will eventually be necessary to sustain these improvements through 2030 and beyond.

Table 5.1: Impact of Proposed City of SF Existing Commercial Buildings Strategy

Scenario	Fraction of Commercial Stock Audited per year[32]	Net Annual Energy Reduction[33]	Maximum Annual Incentive Budget[34]	10-Year Net Present Value to Private Sector[35]	Direct Job Creation	Annual Greenhouse Gas Emission Reduction (Tons CO_2e)
Current Policy - Voluntary Audits And Public Goods Incentives	10% (Totals 50% over 5 years)	1.3%	$24 Million	$382 Million	357 Jobs	35,000 Tons CO_2e
Implement Full ECB Strategy	20% (Totals 100% over 5 Years)	4.2%	$39 Million	$612 Million	578 Jobs	70,800 Tons CO_2e

[32] Estimated fraction of buildings larger than 50,000 square feet receiving a thorough audit approximately equivalent to an ASHRAE Level II evaluation, plus estimated fraction of buildings smaller than 50,000 square feet receiving the equivalent of an ASHRAE Level I walkthrough.

[33] Estimate includes all savings attributable to implementation of recommendations from ASHRAE Level I and Level II audits. All estimates have been reduced by 0.8% to compensate for projected annual increase in local commercial building stock.

[34] Incentive budget refers to ratepayer funds (both Public Goods Charge and energy procurement) regulated by the California Public Utilities Commission and used by investor owned utilities for energy-related pubic benefit programs. The estimate above includes but is not limited to San Francisco Energy Watch. Each incentive budget estimate is conservatively high because all energy savings reduce ongoing energy costs, but some of the net annual energy reduction will be attributable to California's Title 24 Part 6 energy code requirements.

[35] Present value is estimated as the sum of total construction costs, incentive rebates, and energy savings. This estimate is based on 9% discount rate (which is the rate applied by SF Department of Finance.)

Table 5.2 Existing Commercial Buildings Strategy: Implementation Timeline

Year	2010	2011	2012	2013	2014	Beyond… to 2030
Identify Cost-Effective Savings	Require 1/5 of all buildings greater than 5k square feet to get an energy audit. Encourage smaller facilities – particularly energy intensive uses such as markets and restaurants - to voluntarily audit.					
Disclose Energy Performance	Educate property owners about upcoming requirements. Support early action	Require all buildings >25k square feet to benchmark	Require all buildings >10k square feet to benchmark	Require all buildings >5k square feet to benchmark	Continue benchmarking. Re-evaluate options for buildings <5k sq. ft.	Maintain public access to data.
Split Incentive Solutions: Green Tenant Toolkit	Develop and launch green tenant toolkit	Promote and maintain Green Tenant Toolkit				Update as needed.
Split Incentive Solutions: Submetering	Submeter new construction and single tenant build-outs/ improvements (TI's) in buildings >50k square feet	Submeter TI's >10k sq ft which are in buildings >100k sq ft.	Submeter TI's >7.5k sq ft which are in buildings >75k sq ft	Submeter TI's >5k sq ft which are in buildings >50k sq ft	Submeter TI's >3k sq ft which are in buildings >30k sq ft	Continue policy
Make Incentives Easy	Identify technology partners, refine business model, begin development	Launch Financial Optimization Tool	Maintain Financial Optimization Tool; use data to enhance targeting and delivery of local incentives.			
Educate, Train, Mentor, and Market Energy Efficiency	(2009: Engage with partners, and seek State Energy Program funding support.) Publicize education, attract resources, communicate ECB Strategy.	Collaborate and support workforce education. Promote efficiency with contests, incentives, and social marketing.				
Lead By Example in Public Facilities	Benchmark and make public energy performance of all significant city facilities	Maintain information on public environmental performance "dashboard." Continue performance enhancement and communication of excellence. Achieve zero-net energy in significant number of city facilities				
Provide Financing	Launch and deliver San Francisco Sustainable Financing (SF2) Loan Program					
Measurement and Evaluation	**Launch ECB Strategy Begin monitoring**	**Measure performance toward metrics and goals**	**Evaluate program efficacy. Adjust approach if needed**	**Continue to measure. Maintain and enhance successful elements.**		**Refine approach with partner support.**
Impact	**Energy use reduction of at least 2.5% per year on average, with >4% initial pace of annual reduction anticipated. Average 70k+ tons CO2 year-to-year reduction. Significant net positive cash flow relative to status quo for commercial building sector.**					

Footnotes to Executive Summary

[i] Satterwaithe (2008) “Cities' contribution to global warming: notes on the allocation of greenhouse gas emissions,” *Environment and Urbanization* Vol. 20, pp. 539-549.
[ii] Clinton Climate Initiative, C40 Cities Climate Leadership Group http://www.c40cities.org/news/news-20070516.jsp.
[iii] California Energy Commission (2009) *The Future is Now: Update on Climate Change Science Impacts and Response Options in California.*
[iv] IPCC (2007) Summary for Policymakers In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Intergovernmental Panel on Climate Change Fourth Assessment Report.*
[v] US Global Change Research Program (2009) *Global Climate Change: Impacts in the United States*
[vi] California Climate Change Center (2009) *Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment.*

Appendix:

Excerpts from: ASHRAE Procedures for Commercial Building Energy Audits (2004) RP-669, SP-56.

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Levels of Effort

Depending on the physical and energy-use characteristics of a building and the needs and resources of the owner, these steps can require different levels of effort. A commercial building energy analysis can generally be classified into the following levels of effort.

OVERVIEW

Preliminary Energy Use Analysis

Analyze historic utility use and cost. Develop the Energy Utilization Index (EUI) of the building. Compare the building EUI to similar buildings to determine if further engineering study and analysis are likely to produce significant energy savings.

Level I—Walk-Through Analysis

Assess a building's energy cost and efficiency by analyzing energy bills and conducting a brief on-site survey of the building. A Level I energy analysis will identify and provide a savings and cost analysis of low-cost/no-cost measures. It will also provide a listing of potential capital improvements that merit further consideration, and an initial judgment of potential costs and savings. A walk-through analysis of a facility will utilize all the forms in this publication except those in the section on "Building and Systems Report."

Level II—Energy Survey and Analysis

This includes a more detailed building survey and energy analysis. A breakdown of the energy use within the building is provided. A Level II energy analysis will identify and provide the savings and cost analysis of all practical measures that meet the owner's constraints and economic criteria, along with a discussion of any changes to operation and maintenance procedures. It may also provide a listing of potential capital-intensive improvements that require more thorough data collection and engineering analysis, and a judgment of potential costs and savings. This level of analysis will be adequate for most buildings and measures.

Level III—Detailed Analysis of Capital-Intensive Modifications

This level of engineering analysis focuses on potential capital-intensive projects identified during the Level II analysis and involves more detailed field data gathering as well as a more rigorous engineering analysis. It provides detailed project cost and savings calculations with a high level of confidence sufficient for major capital investment decisions.

Discussion

There are not sharp boundaries between these levels. They are general categories for identifying the type of information that can be expected and an indication of the level of confidence in the results. It is possible that while performing an energy analysis in a particular building, various measures may be subjected to different levels of analysis.

Some readers of an energy analysis report may be unable to comprehend the technical analysis involved, while others may demand a full presentation of the analysis for critique. Consequently, technical material should be presented in an appendix to the report, while the body of the report guides the reader through the technical material and summarizes the findings.

Information presented here outlines the engineering procedures that should be followed while performing an energy analysis. It is assumed that the analyst is a knowledgeable and competent individual. No attempt is made in this publication to prescribe specific methods of data gathering or data analysis.

To assist with the organization of the data collected and the calculation procedures, this publication contains guideline forms that suggest the type of data to be gathered and its organization. It is recommended that the analyst develop and use appropriate data collection and organization forms specific to the size and type of building(s) being analyzed.

The forms presented in the first two sections are building characteristic forms on which basic building information and energy use can be recorded. Use of these forms by all engineering analysts will result in a uniform procedure for reporting the results of an analysis. It is recommended that these forms be completed without modification.

PRELIMINARY ENERGY USE ANALYSIS

Before any level of energy analysis is begun, it is valuable to perform a preliminary energy use analysis to determine a building's current energy and cost efficiency relative to other, similar buildings. This is normally done by calculating the energy use and cost per square foot per year, which can indicate the potential value of further levels of analysis. This preliminary analysis generally includes the following steps.

1. Determine the building's gross conditioned square footage and record this on the building characteristics form. Classify the primary use of the building. Ensure that the standard definition of gross area is used.
2. Assemble copies of all utility bills and summarize them for at least a one-year period, preferably three years. Review the monthly bills for opportunities to obtain a better price through taking advantage of different utility rate classes. Review the monthly patterns for irregularities. Note if a bill is missing or if it is estimated rather than actual consumption.
3. Complete the energy performance summary to develop the energy index and the cost index for each fuel, or demand type, and their combined total using ASHRAE Standard 105 methods.
4. Compare the Energy Utilization Index (EUI) and the cost index with buildings having similar characteristics. The owner of the subject building may have similar buildings for this comparison. Comparison should also be made with publicly available energy indices of similar buildings. In all cases, care should be taken to ensure that comparison is made with current data, using consistent definitions of building usage and floor area.
5. Derive target energy, demand, and cost indices for a building with the same characteristics as this building. A range of methods are available for this work:
    - Pick from any database of similar buildings those buildings with the lowest energy index.
    - Pick an index based on the knowledge of an energy analyst experienced with this type of building.
6. Compare the energy and cost savings for each fuel type if the building were to reach the target Energy Utilization Index. Using these value(s), determine if further engineering analysis is recommended.

LEVEL I—WALK-THROUGH ANALYSIS

This process includes all of the work done for the preliminary energy use analysis, plus the following.

1. Perform a brief walk-through survey of the facility to become familiar with its construction, equipment, operation, and maintenance.
2. Meet with owner/operator and occupants to learn of special problems or needs of the facility. Determine if any maintenance problems and/or practices may affect efficiency.
3. Perform a space function analysis, guided by the forms in the "Walk-Through Data" section. Determine if efficiency may be affected by functions that differ from the original functional intent of the building.
4. Perform a rough estimate to determine the approximate breakdown of energy use for significant end-use categories, including weather and non-weather-related uses.
5. Identify low-cost/no-cost changes to the facility or to operating and maintenance procedures, and determine the savings that will result from these changes.
6. Identify potential capital improvements for further study, and provide an initial estimate of potential costs and savings.

The report for a Level I analysis should contain the building characteristics and energy use summary as well as the following.

1. Quantification of savings potential from changing to a different utility price structure.
2. Discussion of irregularities found in the monthly energy use patterns, with suggestions about their possible causes.
3. The energy index of similar buildings. Report the source, size, and date of the sample used in this comparison. The names of comparable buildings should be given if known.
4. The method used to develop the target indices. Where comparison is made to other buildings, state their names. Where the experience of someone other than the author is used to develop the target, provide the source. Where the target is developed by calculation, show the calculation or quote the name and version of software used and include both input and output data.
5. Total energy and demand cost by fuel type for the latest year and preceding two years if available. Show potential savings in dollars using the energy index format of ASHRAE Standard 105.
6. The fraction of current costs that would be saved if the energy index were brought to the target level.
7. A summary of any special problems or needs identified during the walk-through survey, including possible revisions to operating and maintenance procedures.
8. A preliminary energy use breakdown by major end uses.
9. The listing of low-cost/no-cost changes with the savings for these improvements.
10. The potential capital improvements, with an initial estimate of potential costs and savings

LEVEL II—ENERGY SURVEY AND ENGINEERING ANALYSIS

This analytical procedure is guided by Level I analysis and includes the following additional work:

1. Review mechanical and electrical system design, installed condition, maintenance practices, and operating methods. Where drawings have been kept up to date, this task will be much easier.

2. Review existing operating and maintenance problems. Determine planned building changes.
3. Measure key operating parameters and compare to design levels, for example, operating schedules, heating/cooling water temperature, supply air temperature, space temperature and humidity, ventilation quantities, and light level at the task. Such measurements may be taken on a spot basis, or logged, manually or electronically.
4. Prepare a breakdown of the total annual energy use into end-use components, as illustrated in the *1999 ASHRAE Handbook—Applications*, Chapter 34, Figure 4, or as shown in the section "Energy Analysis Summary and Recommendations." A number of calculation methods are available, ranging from simplified manual calculations to fully detailed computer simulation of hour-by-hour building operations for a full year.
5. List all possible modifications to equipment and operations that would save energy. Select those that might be considered practical by the owner. List preliminary cost and savings estimates.
6. Review the list of practical modifications with the owner/operator and select those that will be analyzed further. Prioritize the modifications in the anticipated order of implementation.
7. For each practical measure, estimate the potential savings in energy cost and its energy index. To account for interaction between modifications, assume that modifications with the highest operational priority and/or best return on investment will be implemented first. A number of calculation methods are available, ranging from simplified manual calculations to rerunning computer simulations, if performed in Step 4, above.
8. Estimate the cost of each practical measure.
9. Estimate the impact of each practical measure on building operations, maintenance costs, and non-energy operating costs.
10. Estimate the combined energy savings from implementing all of the practical measures and compare to the potential derived in the Level I analysis. It should be clearly stated that savings from each modification are based on the assumption that all previous modifications have already been implemented and that the total savings account for all of the interactions between modifications.
11. Prepare a financial evaluation of the estimated total potential investment using the owner's chosen techniques and criteria. These evaluations may be performed for each practical measure.
12. Following submission of the report of the Level II analysis, meet with the owner to discuss priorities and to help select measures for implementation or further analysis.

The report for a Level II analysis should contain at least the following.

1. A summary of energy use and cost associated with each end-use. Show calculations performed or quote the name and version of software used and include both input and output pages. Provide interpretation of differences between actual total energy use and calculated or simulated end-use totals.
2. A description of the building, including typical floor plans and inventories of major energy-using equipment. (This information may be included as an appendix.)
3. A list of measures considered but felt to be impractical, with brief reasons for rejecting each.
4. For each practical measure, provide
    - a discussion of the existing situation and why it is using excess energy;
    - an outline of the measure, including its impact on occupant health, comfort, and safety;

- a description of any repairs that are required for a measure to be effective;
- the impact on occupant service capabilities, such as ventilation for late occupancy or year-round cooling;
- an outline of the impact on operating procedures, maintenance procedures, and costs;
- expected life of new equipment, and the impact on the life of existing equipment;
- an outline of any new skills required in operating staff and training or hiring recommendations;
- calculations performed or provide the name and version of software used and include both input and output data.

5. A table listing the estimated costs for all practical measures, the savings, and financial performance indicator. For the cost of each measure, show the estimated accuracy of the value quoted. This table should spell out the assumed sequence of implementation and state that savings may be quite different if a different implementation sequence is followed.
6. A discussion of any differences between the savings projected in this analysis and the estimated potential derived in the Level I analysis.
7. Overall project economic evaluation.
8. Recommended measurement and verification method(s) that will be required to determine the actual effectiveness of the recommended measures.
9. Discussion of feasible capital-intensive measures that may require a Level III analysis.

LEVEL III—DETAILED ANALYSIS OF CAPITAL-INTENSIVE MODIFICATIONS

This analytical procedure is guided by Levels I and II analyses and the owner's selection of measures for greater definition. It must follow such Level I and II work.

1. Expand definition of all modifications requiring further analysis.
2. Review measurement methods, and perform additional testing and monitoring as required to allow determination of feasibility.
3. Perform accurate modeling of proposed modifications. Ensure that modeling includes system interaction.
4. Prepare a schematic layout of each of the modifications.
5. Estimate the cost and savings of each modification.
6. Meet with owner to discuss/develop recommendations.

The report for a Level III analysis should include the following, as a minimum.

1. Include text, schematics, and equipment lists necessary to completely describe all proposed changes to physical equipment. Matters of a final design nature may be left to subsequent engineering as long as the cost of such engineering is included in the budget. Firm price contractor quotations for key parts of any measure may be included. Cost estimates shall show contingencies separately and report the expected accuracy of the budget.
2. Prepare a financial evaluation of the estimated capital investment and projected savings. Use the owner's chosen techniques and criteria.