

Summary of recommendations:

Update San Francisco's Green Building Ordinance.

Require that all new development be energy-positive.

Include all new construction activity.

Laundry list of items to include.

Retrofit existing building stock for better energy performance.

Mandate commissioning of all buildings every two years.

Direct building operators to publish their energy performance.

Adopt best practices from other jurisdictions.

"In general, the cost of commissioning new buildings ranges from 0.5 percent of the total construction cost for relatively simple projects such as office buildings to 1.5 for complex laboratories and medical facilities¹. ... For an existing building, the cost of commissioning can range from 3.0 to 5.0 percent of the total operating cost."

"PG&E believes that the building commissioning process as outlined in ASHRAE Guideline 1-1996, when properly applied to buildings, can result in buildings with superior systems, efficiency, and occupant comfort."

"The California EPA Headquarters Building in Sacramento—with systems calibration, monitoring, and maintenance for energy performance—delivers annual savings of nearly \$200,000. And after-hours heating and lighting controls as well as the building's exterior lighting systems add another \$110,000 of yearly savings. ... Overall, \$500,000 was invested in efficiency upgrades, operations, and employee practices. A total of \$610,000 is now generated in annual savings. The initial investment was recovered in less than one year!"

(<http://www.energyandcapital.com/articles/investing-green-building/738>)

"The dynamic nature and complexity of commercial building HVAC systems makes them the perfect target for periodic optimization. Issues such as temperature, humidity, outdoor air percentages,"

"Energy use reduction is a natural consequence of improved performance, as are improved equipment life, improved indoor air quality and comfort, and reduced maintenance issues. ... Upgrades to more efficient equipment and systems can certainly be a recommendation resulting from the performance analysis but should be treated as a separate action."

"For an existing building, commissioning typically results in energy savings of 15 percent in less than one year."

<http://greenerbuildings.com/feature/2008/05/08/green-your-facility-boost-your-bottom-line>

Recommendation: Commissioning required of all buildings every two years.

The standard definition of *commissioning* is "... a systematic process for investigating, analyzing, and optimizing the performance of building systems ... ensuring their continued performance ... and provid[ing] the tools to support the continuous improvement of system performance over time ..." [<http://www.bcxa.org/>]. Commissioning buildings is frequently analogized to tuning up cars or pianos, since the goal is to recalibrate or repair them so that they function better.

Commissioning is a quality assurance process that starts by determining whether a new building's envelope and its heating, ventilating, air conditioning, electrical, security, plumbing, lighting, elevator, fire, security, and other systems are performing at their optimum levels. If any of them are not, then an assessment is made regarding what type of repair, maintenance, or replacement is required. Then any problems that have been detected are fixed

Researchers at Texas A&M University concluded that the average commercial building wastes 20% of its total energy consumption due to problems associated with poorly functioning systems that would be corrected by commissioning, and studies conducted by the Lawrence Berkeley National Lab have shown that the energy savings achieved by commissioning are significant. (<http://www.lbl.gov/Science-Articles/Archive/EETD-college-curriculum.html>)

The value of commissioning is undisputed. The remaining question is how frequently it should be required. Since no helpful data are available at this time, we have examined the decisions others have made. The Sacramento Municipal Utility District is one of the few agencies that has a useful policy about

I would like to hear the group's thinking about this:

In the post-carbon era, buildings over seven stories are likely to become public nuisances. Without elevator service*, their upper floors will be inaccessible to anyone who is not a skilled athlete. Without pumps, water cannot be delivered to upper story units.—The shadows thrown by tall structures will reduce nearby residents' ability to use sunlight to generate electricity, heat water, grow food, and provide warmth to indoor spaces.

[Ask opinions about arguing against highrises even though doing so is a futile pursuit. Also ask about making recommendations regarding taking them down when they become a public nuisance. The good news there is that it should be possible to re-use some of their materials.]

The City of Portland Peak Oil Task Force report, titled *Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas*, recommended preventing infrastructure investments that would not be prudent given fuel shortages and higher prices (page 43). The same holds true of buildings. However, at this time there is not sufficient political consensus to prevent proposals for additional high-rise buildings from receiving permits. Since they are going to be built regardless, let's build them as well as possible.

Related recommendations:

Update the laws regarding the means by which the city gains control over abandoned properties.

Expand the definition of "nuisance property" to include more than health and safety considerations.

* Counterweight elevators do exist, but they will not solve this problem.

Recommendation: The City and County of San Francisco should require that all new development be energy-positive.

“Energy-positive buildings” generate more energy than they and their accoutrements consume. This concept is not new, but it has only recently been looked at in earnest, as public concern over environmental threats has grown. Several European, Asian, and Middle Eastern nations currently lead the United States in efforts to have their buildings achieve energy-positive status.

Two steps are necessary to create an energy-positive building. First, the building’s energy use must be minimized to the greatest extent possible. Where possible, it is obviated; for example, if heavy-duty insulation is placed inside walls and high-performance windows are properly installed, the amount of energy needed to maintain comfortable indoor temperatures can be reduced to zero in most climates. When this is not an option, energy consumption is reduced as sharply as the available technology allows; for example, low-wattage lamps can provide as many lumens as occupants expect while burning less electricity than older lighting equipment. Second, energy-positive buildings are outfitted with enough generating capacity to (1) account for the amount of energy they require for their operation and (2) manufacture excess energy to feed into the grid. Since diesel motors and other generators that rely on hydrocarbon inputs will become idle for lack of fuel in the post-carbon era, reliance on them is unadvisable. Instead, the sensible choices are solar, wind, and other carbonless forms of generation. In a built-out city such as San Francisco, where it is not always possible to provide on-site generation, there may be instances in which it becomes necessary to allow developers to generate their building’s compensating electricity off-site [*but within the city limits?*]

The means to achieve energy-positive buildings already exist and have been shown to be effective. The new Reichstag (parliament building) in Berlin stands as an example of an energy-positive building. [*List others?*] The example closest to San Francisco is the Z² Design Facility in San Jose, California, which hopes to achieve zero carbon emissions as well as zero net energy usage.

It is foreseeable that as we transition into the post-peak age, there will be occasional times when San Franciscans have no energy other than whatever they generate themselves. In the post-peak age, such times will be perpetual rather than occasional.

Since we wish to retain as much of our current first-world lifestyle as possible – and since conveniences and creature comforts may become more valued in future years than they are today – we recommend that the City and County of San Francisco require that all newly constructed buildings be energy-positive.

Recommendation: All new construction activity should be covered.

When the City Office of Economic Analysis issued its 17 September 2007 evaluation of the initial draft of the Green Building Ordinance, titled *Green Building Construction Requirements: Economic Impact Report*, it determined that “38% of all annual construction activity in the city would be covered under the proposed ordinance” (page 10). The final version of the bill exempts so-called “laboratory” buildings, effectively removing the Mission Bay projects from any green building requirements. We estimate that this change reduces the amount that would be covered to 28%. *[I have asked Ross’ office to help me get an official estimate.] [It appears that the final language regarding mixed-use buildings may also change the percentage, though it is difficult to know exactly how.]*

Buildings that are not independently sustainable will not be useful in the post-carbon era. Therefore, we should strive to have fewer of them in San Francisco.

Update San Francisco's Green Building Ordinance.

[Laundry list of improvements to current standard.]

Better windows, doors, skylights, ducts, and anything else that breaches a wall. Better walls and windows mean fewer electrical and mechanical devices, which will be necessary in the post-carbon age.

No leaks. According to S.F. Commissioner Debra Walker, President of the Building Inspection Commission, the current building inspection procedure does not reveal whether windows, doors, pipes, etc. have been properly installed. Since leakage is thought to account for around 10% of home energy consumption nationwide, fixing this should help to move us forward. Use IPMVP until/unless something better comes along.

Airtight façade

Encourage integrated design

Means and criteria to add new techno-gizmos as they become available

Passive heating and cooling

Room-by-room temperature controls for active systems

Daylighting

Natural ventilation, operable windows, open/close windows using computerized sensors that monitor the outside air and the indoor CO2 level

Sensor-based light controls, sometimes referred to as occupancy sensors

([http://www.cbe.berkeley.edu/Wireless Lighting Controls: Pilot Test Shows 65% Energy Saving](http://www.cbe.berkeley.edu/Wireless_Lighting_Controls_Pilot_Test_Shows_65%_Energy_Saving))

Ventilation systems that include a heat recovery component

Other energy management controls

Fans in HVAC systems should have variable speed motors

Tankless water heaters

Waterless toilets, or at least waterless urinals and dual flush toilets

The most efficient pumps, fans, and elevators

Photocells, occupancy sensors, daylight sensors, and dimmable ballasts for lighting

High thermal mass

Increase ASHRAE 90.1 savings by some defined percent, perhaps 40%

Thermal scan required for issuance of certificate of occupancy and repeated every two years (cf. Sacramento Municipal Utility District) to ensure continuing high performance over time.

Require IPMVP (International Performance Measurement and Verification Protocol) for energy efficiency of fan and pump motors, water savings, and renewable energy generation for retrofits as well as new construction. (Currently used primarily when payments to contractors are based on the savings that result from energy conservation. Recommend that it be made mandatory for all.)

Performance audits - evaluate the actual energy performance of buildings after they are in operation. Among other benefits, this would provide the sort of reality-based feedback that we will need if we are to improve future versions of S.F.'s green building requirements.

Meet energy, water, water disposal, and waste disposal requirements on-site to greatest extent possible

We recommend adopting dynamic standards rather than prescriptive ones. They should incorporate new gizmos and techniques as they become available and should be monitored continually and, as a result of lessons learned, evolve to generate ever-better energy savings.

Update San Francisco's Green Building Ordinance.

Stop using LEED, which was designed to address climate change and is not strong enough for peak oil considerations. Why we recommend moving away from LEED:

It is "light green" rather than "deep green"; peak oil mitigation requires deep green
Today it has more to do with PR and marketing than with enviro improvement
Does not make energy efficiency primary, which peak oil considerations necessitate
Incentivizes a checklist rather than building as green as possible
Falls short of what is possible. The Architecture 2030 initiative sets a goal of a 50% improvement in energy efficiency by 2030

My favorite example of a LEED failure is Seattle's new City Hall, which earned a LEED Gold plaque. It uses more energy per square foot than the old City Hall, which was criticized as "less efficient."

LEED grants a point for having a measurement evaluation plan for the building envelope that follows the IPMVP protocols. You don't have to follow through and do any actual measuring or evaluating in order to score this point; you just have to submit a plan. The IPMVP are writing to LEED about this.

Points are not weighted, though some have greater enviro benefit than others.

This helps to incentivize pointmongering

This also facilitates designing for PR value rather than for enviro considerations; PR can drive the design process

Documentation and certification are so overly expensive that for small projects it is smarter to use the money to go greener (e.g. Park City, Utah)

Until last June, a building could become LEED certified with **no** energy points; now only two of ten are required

No bioregional adjustments. For example, here in S.F., heat islands are not a problem. However, a building here that has a reflective roof gets one point, same as in areas where heat islands matter

No life-cycle analysis or assessment

Does not address the potential gap between design and performance; does not care whether anything is built/installed/operating properly

Caps innovation at four points

Heavy reliance on modeling and nothing more than modeling. "The potential inaccuracies of energy modeling are well known, yet seem to persist. Most energy modeling tools are very good at modeling standard HVAC systems, but struggle to model advanced green building systems such as: natural ventilation, atria, displacement ventilation, chilled beams, double facades, and more."

LEED Certified (26 of 69 points) is inadequate, to say the least. Almost any building anywhere in the country that is up to code will merit 20 – 22 of LEED's points, and here in S.F. the code may make that number larger. Since almost every location inside the City limits fits LEED's definition of transit-friendly, add another point. For \$395, you can buy the type of bike rack that LEED likes and get one more point; on a \$40 million project, that is slightly less than 0.00001%.

LEED can lead to missed opportunities: "The energy impacts of better fan systems in climates where economizers are used can result in 20 to 50 percent lower HVAC energy use! We have often found that designers are overlooking these options because they are not rewarded with additional LEED points. Once a building is built these things are often impossible to retrofit. This represents a huge lost opportunity."

Recommendation: Retrofit existing building stock for better energy performance.

[Wording needs to be changed.]

Existing structures should be brought up to the latest and greatest standards. The tricky part is figuring out how to finance this. In general, we probably want to recommend paying for the improvements out of the savings they deliver – but the devil is in the details on that one, and I am not sure how to proceed.

PG&E is an obvious candidate for financing, as every kWh we save reduces the pressure for them to build new capacity (beyond the mandated 20% green by 2012, which they claim they may be able to achieve a year or two late) – which is an **extremely** expensive and complicated process. Also, the lower the overall load, the easier it will be for PG&E to achieve that 20%.

Berkeley approved a solar assessment district, which allows the city to finance the cost of solar panels for homeowners, with repayments made through property assessments over a period of 20 years.

Green mortgages recognize that owners who pay less in energy costs are more credit-worthy, and therefore entitled to lower rates.

Several companies, including Solar City, offer leasing programs for solar photovoltaic panels, which entail less initial outlay than purchase agreements. The leasing company retains the 30% federal tax break.

“At REgrid Power they are offering a solar loan option over a 15-, 20- or 25-year term. It guarantees that people’s solar bill will be less than their current electric bill. So if they are paying \$100 monthly for electricity, they can save \$20 or more with the solar financing program,”

Fireman’s Fund Offers Green Insurance for Homeowners.

Split Incentives: No one else has solved this problem either. Short of compelling recalcitrant property owners to undergo an IQ transplant and/or force-feeding them a wiser set of values, I’m not sure what could be done. *[This is an aspect of the “business as usual” problem.]*

Energy Star programs under the Energy Policy Act currently enable owners or designers of new or existing commercial buildings to take a tax deduction of up to \$1.80 per square foot if they save at least 50 percent of the heating and cooling energy of a building that meets ASHRAE standards for energy-efficient design.

Recommendation: Adopt best practices from other jurisdictions.

Several forward-thinking approaches to raising the caliber of the built environment have been adopted or proposed in other jurisdictions. We recommend that the City and County of San Francisco draw inspiration from the following and emulate or improve on them:

Austin's Homes and Buildings Plan mandates that new single family homes be zero net-energy capable by 2015. It further requires a 75% increase in energy efficiency in all new construction by 2015 and disclosure of a property's energy use history at the time of sale. Their Energy Efficiency Retrofit Task Force meets bi-weekly.

Dekalb County, Georgia, will no longer hook up water service to newly sold homes that do not have low flow toilets. San Francisco could refuse to hook up any structure that does not include waterless toilets (*or waterless urinals and dual-flush toilets?*), greywater systems, and rainwater catchment.

Albuquerque and Santa Fe have adopted the Architecture 2030 challenge, *which calls for buildings to use no external energy by the year 2030*. They also have Green Code Committees.

West Hollywood's new development standards apply to all proposals, including remodels and tenant improvements as well as new construction.

Throughout Germany, the development community has long understood the importance of requiring that solar photovoltaic (pv) systems be installed on all new construction. In Marburg, an ordinance further requires that pv be installed on existing buildings when their roofs or heating systems are replaced. Marburg city officials not only faced down resistance on the part of some property owners, but gave the law force by including a fine of 1,000 euro for those who do not comply. In San Francisco, we would be wise to lengthen the list of improvements that trigger a requirement for *upgrading* to include any extension or addition to be attached to an existing building and any rehabilitation whose value exceeds 10% of the property's pre-improvement value. [*Perhaps add more to the list.*] We should also ensure that compliance will be less costly than non-compliance.

Switzerland is discussing mandating that a portion of the total cost of any renovation, perhaps 18%, be spent on improving the energy efficiency of the buildings. This is projected to save a minimum of 15% of the building's energy requirement.

Spain and Israel already require rooftop solar water heaters on all new buildings. [*Spain also requires "solar collectors" on renovations, but I'm not sure what type.*]