*Assessment of Vulnerability*

The *x-number* of buildings in San Francisco account for approximately half of the city's total energy use. In their current state, they will not serve us well when the fossil fuels on which they and their accoutrements rely become scarce, increasingly expensive, and occasionally unobtainable

San Francisco's buildings use 5,000 – 6,000 gigawatt-hours (GWh) of electricity in a typical year. ~~*In 2000, we used 5,660 GWh.*~~ Approximately 58-61% of this is consumed in commercial buildings, 25-27% in homes, and the rest in municipal and industrial buildings. In 2002, San Franciscans used 23.3 billion cubic feet of natural gas in our buildings, of which approximately two-thirds is used for water heating, cooking, and space heating in our 141,271 residential structures. These energy inputs allow us to enjoy first-world lifestyles.

In San Francisco's commercial building sector, office buildings are the largest users of electricity; they consumed 1,901 GWh in 2001. That year, hotels and motels used 261 GWh, restaurants 221 GWh, retail establishments 218 GWh, grocery stores 181 GWh, hospitals 151 GWh, and all other commercial structures combined 296 GWh.

It is foreseeable that as we continue to transition into the post-peak age, there will be occasional times when San Franciscans will have no energy other than the electricity we manufacture ourselves. Our ability to generate electricity without the use of fossil fuels, by using solar gain, wind, or other renewable resources, will be a major determinant of our quality of life, and most of the best places to site new generating equipment are on our buildings.

An additional vulnerability is the prevailing attitude toward real estate development. Short-term financial considerations have dominated the decision-making process; generally to the detriment of life-cycle analysis that prioritizes a building's total performance. This approach worked acceptably as long as energy was abundant and cheap. However, it will prove to be a liability in the post-peak era.

*Why Bother?*

This Task Force recognizes that better buildings cost more. The relevant question is whether the City should view that cost as an investment in San Francisco's future that repays itself not only in lower utility bills and reduced operating costs, but also by improving our quality of life when energy is scarce. If society does not invest in improved buildings now, while the option of doing so still exists, the opportunity may be lost. Availability of the money, materials, and energy needed to make improvements has already started to diminish, and the rate of their disappearance will increase over time. By acting now, our ability to upgrade our built environment will be decreasing while our desire for the benefits that San Franciscans would derive from such an effort will be increasing.

The issue of costs also raises the question, "Cost to whom?" Buildings have been the longest-lived of humankind's creations to date*, and they are likely to be the longest-lived part of the legacy we leave to those who will outlive us and those who will come after them. Since this Task Force's mandate requires us to address the future, we cannot dismiss the impact that a failure to invest in upgrading our built environment will have on San Franciscans who follow us. The dollar cost of doing so may seem high today, but the results will be invaluable tomorrow.

The "business as usual" model is not a useful guide for planning to cope with low-energy scenarios. Because it assumes that future patterns of energy flow will be a reflection of past patterns, it views the costs of lessening our built environment's need for energy as too expensive to be worthwhile. However, continually escalating energy prices alter that analysis; every dollar we invest now in demand destruction will have a shorter payback period and a higher rate of return. Additionally, the costs of energy-saving, energy-generating, and energy-obviating measures have been falling. The "business as usual" bias ~~also~~ fails to acknowledge the likelihood of intermittent interruptions in the availability of fossil fuels, in which circumstance our comfort and ability to function at a high level will be compromised in proportion to how well all of the city's components, including its built environment, continue to perform without these inputs.

Since electricity is likely to become the universal energy *type* and since there will be occasional times when the only electricity we will have is that which we generate ourselves, we must start installing generating capacity that does not rely on fossil fuels as quickly as possible. Many of the best places to site generating equipment in a built-out city such as ours are on our structures. By producing as much of our own energy as possible, we will not only be able to provide light, cook food, run computers, and otherwise enjoy our living and working spaces, but also create greater potential for operating transportation systems, maintaining communications networks, and otherwise enriching our lives above the level of mere subsistence. This will also have a direct impact on the level of economic activity we are able to maintain (see Section x).

Smart risk management dictates that we cannot start installing generating equipment and improving the energy performance of our buildings soon enough.

*[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)

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.)

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