San Francisco Peak Oil Preparedness Task Force Report

March 2009

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Report to the Board of Supervisors City and County of San Francisco

March 2009

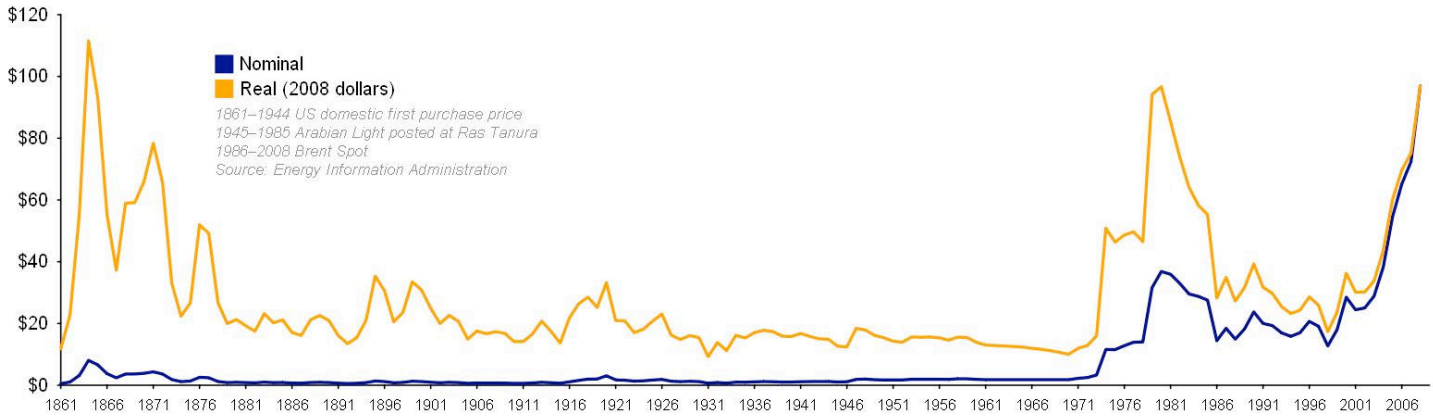
Chapter 1
EXECUTIVE SUMMARY

San Francisco was born at the beginning of the oil age, and the city has flourished during an era in which fossil fuels became the foundation of our economy and society. Petroleum and natural gas heat our homes and light our offices; they fuel the trucks that bring us our food and the cars and buses that move us around; they drive our industries and power the information technologies that marvel the world. Today, the City and its inhabitants are utterly reliant on fossil fuel energy: 84% of the energy consumed in San Francisco comes from oil and natural gas.

Because petroleum and natural gas are finite resources, this situation cannot last. If San Francisco is to thrive in the 21st century and remain a world-class city, it must begin planning today for how to maintain itself in a post-fossil fuel age.

The rate at which the globe consumes oil is unsustainable. There is about as much petroleum in the ground as has been pumped out and used up to date - which means we are roughly at the halfway point, or the peak, of global supplies. Much of the remaining half is more difficult and expensive to extract than what has already been pumped. Except during the oil embargoes of the 1970s and their lingering effects, from the 1880s until 2005, enough oil was produced to keep the price of oil between $15 and $30 per barrel (adjusted for inflation, in 2007 dollars). Since 2005, however, worldwide oil production has been on a plateau, leading to a sudden sharp increase in the price of oil to record-high levels, dropping only because of (and contributing in no small part to) a contraction in the economy of the entire globe.

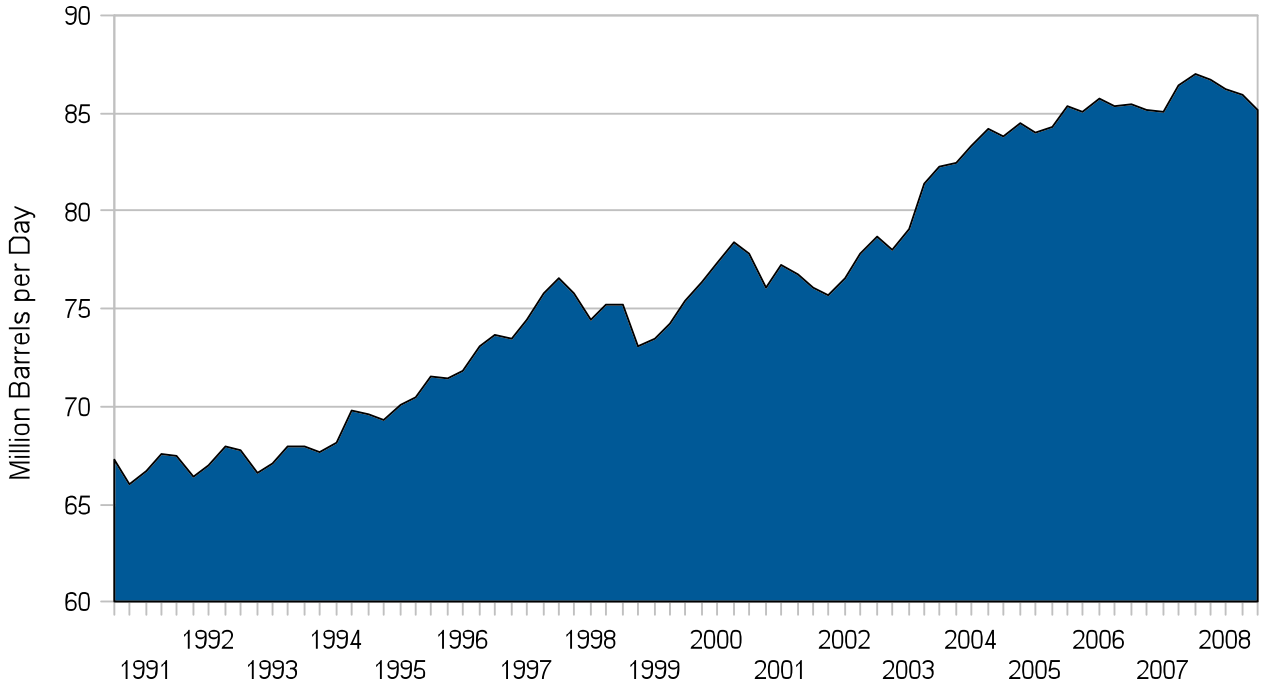
World Oil Prices Through 2008



Compiled by Tom Lamano from Energy Information Administration data

Eventually, this plateau will turn into an inexorable global decline in oil production. A number of major individual producers have already passed their production peak; the United States was once the largest oil producer in the world, but has seen falling domestic production since 1971 and now must import more than two thirds of its oil. Outside OPEC, oil production is falling about 3 percent a year. Eventually - regardless of how much effort is put into extracting the oil from their fields - OPEC too will be unable to resist a steady production decline. It is the prospect of this inexorable decline that is referred to as Peak Oil.

World Oil Supply, 1991 - Present



Source: Oil Market Reports, International Energy Agency, Organization for Economic Cooperation and Development

The world faces similar challenges with natural gas, which is also finite. The global peak of natural gas production is believed to be farther away than that of oil, but natural gas is difficult and increasingly expensive to extract and transport. To ship natural gas by tanker, it must be liquefied, a dangerous and costly process. For this reason, the proximity of the supply of the remaining natural gas is far more relevant than the distance to the supply of oil, which is routinely shipped from the other side of the world. In North America, natural gas production was in decline for several years, but rising prices combined with enhanced recovery techniques have led to a recent surge in production. It is unclear how long this surge will last, but one thing is clear: The new production methods, which release gas trapped in non-porous rock, are much more expensive than conventional well-drilling. In the long run, regardless of what techniques are employed, the supply of natural gas will also begin an unstoppable descent.

As production of oil and natural gas eventually begin to decline, San Francisco will face a painful adjustment - unless it prepares in advance. Experts are divided on exactly when the decline will begin, with some arguing that the peak of production may not occur until as late as the 2030s, and others positing that the peak has, in fact, already happened. Regardless of the exact date of the peak, what is clear is that the sooner the City of San Francisco addresses this looming threat and prepares for the difficult transition ahead, the better off the City and its residents will be.

It is the job of the Peak Oil Preparedness Task Force to assess the degree and nature of San Francisco's vulnerability to an eventual, inexorable rise in fuel prices, and ultimately a scarcity in oil and natural gas. Because this report addresses both fuels, it refers to the issue as **Peak Oil & Gas.**

Impacts

Petroleum and natural gas have become essential to existence as we know it; their scarcities threaten to severely disrupt our quality of life. The most important impacts of Peak Oil & Gas on San Francisco will be:

- Violent fluctuations in energy prices.
- Rising food prices; possible food shortages.
- Damage to the overall national and local economy.
- Spreading poverty, as the economy contracts.
- Loss of confidence in the future.
- Increasing cost of travel and freight, especially by air; declining air traffic.
- Increasing pressure on public transit.
- Exacerbation of other problems such as climate change and credit contractions.
- Increasing gentrification as the affluent move to the City from the suburbs, displacing those who cannot afford to stay.
- Declining city government revenue, due to
    - generally lower level of economic activity
    - fewer conventioneers and tourists
    - lower revenue-sharing from state and federal governments.

Strategies

Addressing these impacts will not be easy. The challenges of reducing our overall reliance on energy from fossil fuels and finding new sources of energy are so enormous that they will require an array of adaptive strategies at every level of government. The most important strategies for the City to pursue are:

Energy:

- Instruct City agencies and departments that planning must include a scenario of energy decline.
- Implement our city energy buying cooperative, Community Choice Aggregation, and move ahead with the planned efficiency programs and development of electricity based on renewables.
- Encourage the installation of local, renewable, distributed electric generating facilities.
- Pursue the conversion of the electric system to a smart grid.

Food:

- Convert vacant and underutilized public and private properties to food gardens.
- Vastly expand urban agriculture programs and services.

Transportation:

- Expand passenger capacity of all mass transit.
- Avoid infrastructure investments which are predicated on increased auto use.
- Convert City equipment, buses, and trucks to 100% biodiesel from reclaimed lipids, as feasible.
- Discourage private auto use by disincentivizing car travel and ensuring that alternatives (walking, bicycling, public transportation) are competitive with driving.
- Expand the potential for rail and water transport, for both passengers and freight.

Recycling:

- Encourage local manufacturing that utilizes recycled material as feedstock.

Buildings:

- Retrofit the building stock for energy conservation, efficiency and on-site generation.

Societal Functioning:

- Begin an education plan, to inform San Francisco residents about Peak Oil & Gas and its implications.

And most importantly, with all of these policies, **start now.** Conditions will be far better in the long run if the City begins addressing this unfolding challenge immediately. The transition cannot be done quickly; the City faces a limited window of opportunity to begin, after which adaptation will become enormously difficult, painful, and expensive. **There is no time to lose.**

Chapter 2
INTRODUCTION

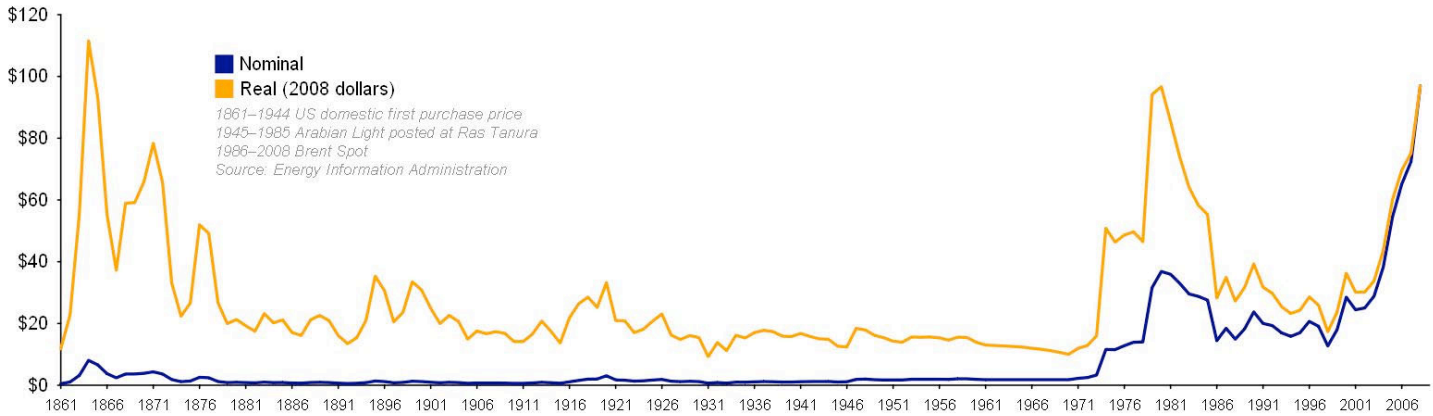
The San Francisco Peak Oil Preparedness Task Force was created by the Board of Supervisors on October 5, 2007. Its charge is to assess the impact of declining supplies and rising prices of fossil fuels, create a plan to mitigate the ill effects, and recommend actions to the Board.[1] Because this report addresses both oil and natural gas, it refers to the issue as "Peak Oil & Gas". The Task Force consists of seven members, whose backgrounds are summarized in Appendix I.

2.1 Petroleum

Oil is a finite resource. It is the linchpin of all modern economies: in addition to serving as the fuel for 95% of all transportation, tractors, and other heavy equipment, it is used as a feedstock for plastics, chemicals, fabrics, cosmetics, and pesticides. Like most commodities, its price is determined by the market forces of supply and demand. Demand for oil has been rising sharply, as developing economies of China and India grow.

The future of oil is a classic case of too much demand chasing too little supply. Except during the oil embargoes of the 1970s and their lingering effects, from the 1880s until 2005 enough oil was produced to keep the price of oil between $15 and $30 per barrel (adjusted for inflation, in 2007 dollars – see graph below)[2]. Since 2005, however, worldwide oil production has been on a plateau, leading to a sudden sharp increase in the price of oil to record-high levels, which subsequently dropped only because of (and contributed in no small part to) a contraction in the economy of the entire globe. When the economy begins to right itself, it is virtually certain that the price of oil will resume its upward march. Another historical feature of the price of oil is its extreme variability. The Task Force expects the price of oil to oscillate around an upward trend.

World Oil Prices Through 2008

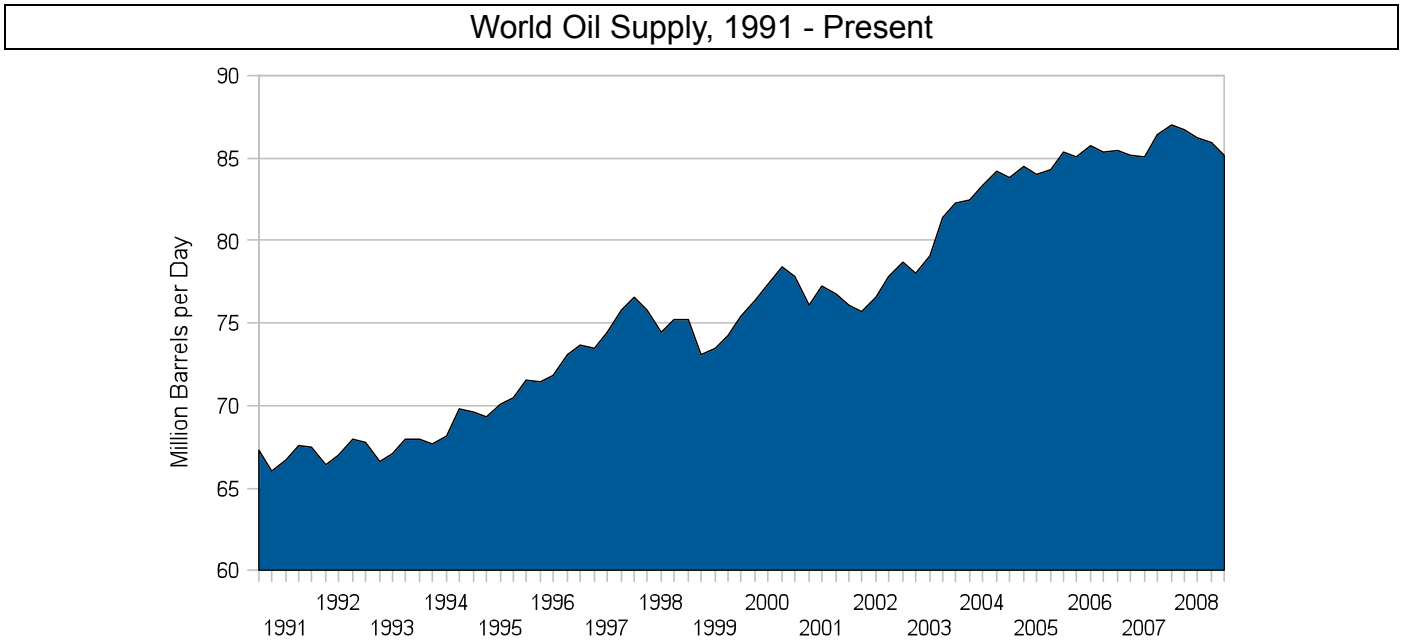


Compiled by Tom Lamano from Energy Information Administration data

There are still vast reserves of oil in the ground. What matters to the world's economy, however, is not the oil in the ground, but rather how much can be extracted in a given time – that is, oil production. This is conventionally measured in millions of barrels per day. Today, worldwide production of petroleum liquids is about 86 million

barrels per day.[3] The production of oil is limited by both geological obstacles that constrain the speed with which it can be pumped from the ground, and by human constraints, such as political decisions and wars.

Many analysts believe that the world is at or near the physical limit to how fast oil can be produced. Any given oil field produces oil at a flow rate that roughly follows a bell-shaped curve over time. When you add up all the bell curves of all the fields in the world, total worldwide production forms a big global bell curve.[5]



Source: Oil Market Reports, International Energy Agency, Organization for Economic Cooperation and Development

Though not all production curves are exactly bell-shaped, certain key features are present in the production curve for an oil reservoir: Production increases over time, reaches a peak when approximately half the available oil has been pumped, and begins a steady and inexorable decline thereafter. The first half of the available production is the oil that is the easiest and cheapest to extract. As oil in a particular field is depleted, it costs more, in money and in energy expended, to bring the oil to market. Eventually, it costs more energy to extract the oil than the oil is worth, and then the field is abandoned.

Oil production in the United States peaked in 1970, in the North Sea in 1999[6], and in Australia in 2000.[7] (See list of countries and dates of peak in Appendix II.) Worldwide, oil production has been flat since 2005.[8] Unconventional sources of oil have kept the total production of petroleum liquids at a plateau as conventional production has wavered. Global oil discoveries have been declining since 1964, with consumption exceeding discoveries since 1982.[9] No one knows exactly when worldwide oil production will begin its unstoppable decline; the stagnation in production rate of the past four years implies that it will be soon.

But total production is not the most relevant statistic for San Francisco and the United States. For major importers, the salient issue is the amount of oil available to purchase on world markets. As time passes, oil producing nations gradually use more oil domestically, thus leaving less for export, even if their production is unchanged. They may also withhold production, believing that prices will be higher later on, or to ensure their own future supply of oil. Thus, even without a production decline, oil exports may fall.

The US is now bidding against China and other importing nations for a shrinking pool of oil available for export. Worldwide, net oil exports reached a maximum in late 2005, and have been trending downward since then. Exports are currently 3% below their peak,[10] and this is only the beginning. Production from existing post-peak oil fields is falling 6 to 9 % per year, according to the International Energy Agency of the OECD.[11] That means that *each year* the world will need to add new fields with annual production of at least 5 million barrels per day just to offset the decline of existing fields. To put this in context, the Athabaskan tar sands in Canada, perceived as an answer to the growing shortfall, are currently producing only 1 million barrels per day with a goal of 3 million per day within a decade.[12]

> *"Current trends in energy supply and consumption are patently unsustainable – environmentally, economically, and socially – and they can and must be altered . . . One thing is certain. While market imbalances will feed volatility, the era of cheap oil is over."*
>
> - Nobuo Tanaka, Executive Director, International Energy Agency of the Organization for Economic Co-Operation and Development, from World Energy Outlook 2008[4]

Getting back to price: As the peak of production approaches, there is still oil, but much of it is hard to extract and therefore costly. Regardless of the quantity of oil existing beneath the surface of the Middle East, in deep water, or in tar sands, it will be increasingly expensive to pump and process, resulting in a continuing trend of rising prices.

Wild gyrations in price will almost certainly continue, but the trend will be upward. Until recently, energy has been extraordinarily cheap, cheap enough that we have been able to use it wastefully. That is changing before our eyes, and we need to change our attitude to match the new reality. In the summer of 2008, the world got a taste of how fast and how far oil prices can skyrocket, and of the resulting economic and social pain. Try this: imagine gasoline at $10 a gallon.

2.2 Natural Gas

Historically, the United States has supplied its own natural gas or purchased it from Canada. However, natural gas production in North America is also close to peak. Conventional production of natural gas is already in decline and has been since 2003.[13] Total North American natural gas production has been buoyed up by a surge in unconventional natural gas production (shale gas). Shale gas is gas trapped in non-porous rock. Releasing it requires drilling many more wells per unit of output (which is why it was not harvested before), and therefore it is significantly more expensive to produce than conventional gas. As unconventional natural gas makes up an ever greater percentage of total production, the average cost of natural gas will climb.

Another form of natural gas is liquefied natural gas (LNG). LNG is actually the same as the natural gas once in abundance in North America. It is different only because it is imported from overseas – but at great expense of money and energy because it must be liquified, shipped on specialized vessels, and then reprocessed at LNG plants here. The strategy of using LNG to make up the difference between growing demand and stagnant North American gas production has been unsuccessful thus far, since the world price of LNG is higher than the North American price. Over the past twenty years, the price of natural gas has been 86% correlated with the price of oil, meaning that variations in the price of natural gas are 86% explained by movements in oil prices.[14] Natural gas is frequently sold under long term contracts in which the price is based on the price of oil. In many applications, such as heating (outside of the northeastern United States) and industrial processes, it has replaced oil. Given all these factors, natural gas will increase in price and decline in availability, just as oil will.

2.3 Electricity

Electricity prices will follow the price of natural gas, especially in California. In 2008, approximately 44% of electricity sold by Pacific Gas and Electric (PG&E) was generated from natural gas.[15] In March 2008, PG&E asked for a 6.8% increase in electric rates, specifically citing the rise in natural gas costs.[16]

Looking ahead, many Americans expect the United States to replace energy from fossil fuels with electricity generated by renewable sources. However, the magnitude of the fossil fuel energy which must be replaced will make this goal virtually unattainable. Electricity peak reduction strategies and energy efficiency measures can help, but transportation will be a large hurdle to surmount. A study by the Pacific Northwest Energy Center estimates that only 15% of California's light vehicle fleet can be run off today's electric grid.[17] Another example: Imagine that San Francisco's vehicle fleet were magically transformed to all-electric plug-in vehicles. The electricity to power vehicles for current driving *within the city limits alone* would exceed all electricity now used in San Francisco for all purposes.[18]

Meanwhile, despite our best efforts, the electricity generated from wind, solar, geothermal, and small hydroelectric combined adds up to only 1% of energy used in San Francisco. See Chapter 3 on energy for more details on energy use in San Francisco.

2.4 Climate Change

There is a great concurrence of interest between mitigation strategies for Peak Oil & Gas and for Climate Change. The core concept for addressing both issues is the need to reduce and eventually eliminate the use of fossil fuels.

> *"Climate change makes moving off of oil necessary; peak oil makes it inevitable."*
>
> - Richard Heinberg[19]

2.5 Relation to Other Issues

We are embarking upon a new epoch in world history. Tightening supplies of oil and natural gas are part of a larger matrix of ecological overshoot that will pose a growing challenge. Western industrial civilization is built on energy, not just energy, but *cheap* energy - and cheap commodities in general. That era is coming to an end. Our society is in a race against time, the time that is required to make the transition to a lower energy society. In the medium term, there are likely to be serious economic and social dislocations, and there is the possibility of eventual catastrophe.

2.6 Economic Impact

The leading edge of peak oil will be its economic impact. When the Federal Reserve Bank of Philadelphia did a comprehensive study of the effect of oil price changes on the economy, it found a profoundly negative relationship. According to its report, the 2008 doubling of oil prices will reduce 2009 US economic output by 11% from what it otherwise would have been. It doesn't even matter that the price spike was temporary; the damage to the economy will be long-lasting.[20] We may not even recognize the connection, but oil constraints will hobble economic growth. For more, see Chapter 4, Economy.

2.7 Transportation

When we think of oil, we tend to think of gasoline and cars. Though vehicle fuel will be severely affected, cars won't be the only victims. Freight shipment and heavy equipment used in construction and agriculture are equally vital to the economy and more difficult to replace or conserve away. Cheap air travel will be another casualty of Peak Oil & Gas, with a huge impact on San Francisco's vital tourism sector. For more, see Chapter 4, Economy and Chapter 6, Transportation.

2.8 Food

Food production will be impacted both through rising costs of oil- and gas-based fertilizers and pesticides, and the increasing fuel costs of equipment and transporting to market. Though the Bay Area is rich in food resources, supplying food to San Franciscans of all economic strata will be a growing issue. For more, see Chapter 5, Food Security.

2.9 City Services and Infrastructure

San Francisco is relatively well situated in terms of providing basic city services because of the electric power flowing from the O'Shaughnessy Dam at Hetch Hetchy. The biggest stressor on the City and County of San Francisco (the City) will be the economic impact on City revenues. Between the struggling economy, rising food prices, the increasing cost of transportation, and the growing number of people needing assistance, the strain on the City budget will intensify just at the moment when City revenues will be adversely affected by the bad economy. For more, see Chapters 7 through 9 on infrastructure including water, wastewater, and waste disposal; Chapter 4 on the economy (for a discussion of City revenues); and Chapter 12 on protection of vulnerable populations.

2.10 Emergency Services

The supply chains for oil and gas are long and complex. As demand outstrips supply, the possibility of disruptions in energy delivery becomes ever greater. In the 1970s, we saw the havoc that can be wrought by even brief interruptions. More recently, the American south experienced shortages and long queues after the damage from Hurricane Ike closed some refineries temporarily. Planning for emergency situations should take the possibility of energy shortages into account, both as emergency events in their own right and as complications in coping with other emergency situations. For more, see Chapter 10, Emergency Services.

2.11 Goals and Strategies

There is no road map for the bumpy future. Though oil and natural gas availability will decline, that doesn't necessarily mean we will go back in time to old-fashioned ways of living. The challenge is to find a new way forward. Whatever shape the low-carbon future will take, there are certain basic strategic concepts that will underlie the recommendations in this report.

Start now. Many of the transitions will take a long time, such as developing the transit system to be ready to handle an influx of riders. If we wait, the most vulnerable people will be hurt.

Be flexible. Peak Oil is an unprecedented situation, especially in combination with economic recession, climate change, and general environmental overshoot. This Task Force has attempted to make broad-based recommendations, but given the complexity of the situation, the City will need to be prepared to adjust its response to changing circumstances.

Focus on conservation. The scale of the energy that needs to be replaced is so huge that only large-scale conservation projects combined with a variety of alternative energy generation can prevent wrenching dislocations.

Focus on electricity. Due to price volatility, price signals are likely to come too late to stimulate an adequate supply of alternatives for transportation, heating, cooking, and so on through the operation of the market. Government needs to intervene to ensure that when San Franciscans want to move away from fossil fuels, alternatives exist in sufficient quantity. The City will need to take control of its own energy supply in order to push ahead fast enough. In moving away from fossil fuels, the primary alternatives all produce energy in the form of electricity; therefore, a successful transition will require electrification of transit and other current fossil fuel users.

See Chapter 14, Vision of Low-Carbon San Francisco, for a positive vision of post-peak San Francisco, circa 2050.

2.12 Damage to social fabric

It is possible that events will unfold so badly that unemployment, hunger, and crime are prevalent, and the basic structure of society is unable to function. While the Task Force acknowledges the possibility of such a scenario, it would not be constructive to focus on it. Instead, the Task Force is recommending strategies that will reduce the likelihood that such a collapse will occur. See Chapter 13 for more on the effect of Peak Oil & Gas on society.

2.13 Goal of the Peak Oil Preparedness Task Force

The evolving energy limitations will pose a tremendous challenge to San Francisco, and San Francisco will not be able to solve the problem of peak oil on its own, though it can respond. Adaptation strategies must be pursued at every level: municipal, regional, state, federal and international. Finding policies to meet this challenge will be difficult, but the effort will pay off. The Peak Oil Preparedness Task Force was created to identify these policies.

This is also an opportunity for San Francisco to take the lead in building on more than a decade of progress toward a low-carbon future. San Francisco is uniquely suited to move ahead because of its aware and active residents and its progressive tradition in government – and aggressive action here can point the way for California and the United States.

Moreover, with a challenge like Peak Oil & Gas, requiring long-term thinking and a major socio-economic paradigm shift, strictly market-based coping cannot be counted upon to arrive at the best course of action. The city must step forward to set priorities and plan how to move toward the best resolution for all its citizens. It is the mission of the Task Force to assist the City in making such a plan.

Chapter 3
ENERGY

3.0 INTRODUCTION

At its core the issue of Peak Oil is about energy, and in that sense, this entire report is about energy, so it raises the question, why have a distinct energy section and what should be in it? The Resolution establishing the Peak Oil Preparedness Task Force specifically directed the Task Force to assess "current modes of electricity generation and transmission, and the feasibility of distributed generation alternatives."[1] This section embodies a response to that directive. Further, limitations in petroleum fuels will likely have impacts across the entire energy sector; therefore, the Task Force has endeavored to take a holistic approach to the problem of Peak Oil.

Electricity generation, transmission, distribution, and end use is an enormous issue. This section does not attempt to address every aspect of the energy sector. Rather, it will focus on the impacts that Peak Oil and peak natural gas will have on San Francisco and the practical, constructive measures the City and County government (City) may choose to implement in response.

In order to adequately address issues such as electricity generation, the two primary fossil fuels involved in electricity generation, natural gas and coal, must be included in the analysis. Natural gas is also used widely in cooking, and in space and water heating in San Francisco. Therefore, this section assesses the degree to which the city depends on natural gas for those purposes, for electricity generation, and for other energy-related purposes, and the risks associated with that dependency. The term "Peak Oil & Gas" is used to express this broader assessment. Since a small amount of coal is used for electricity generation, coal is included briefly in the analysis as well.

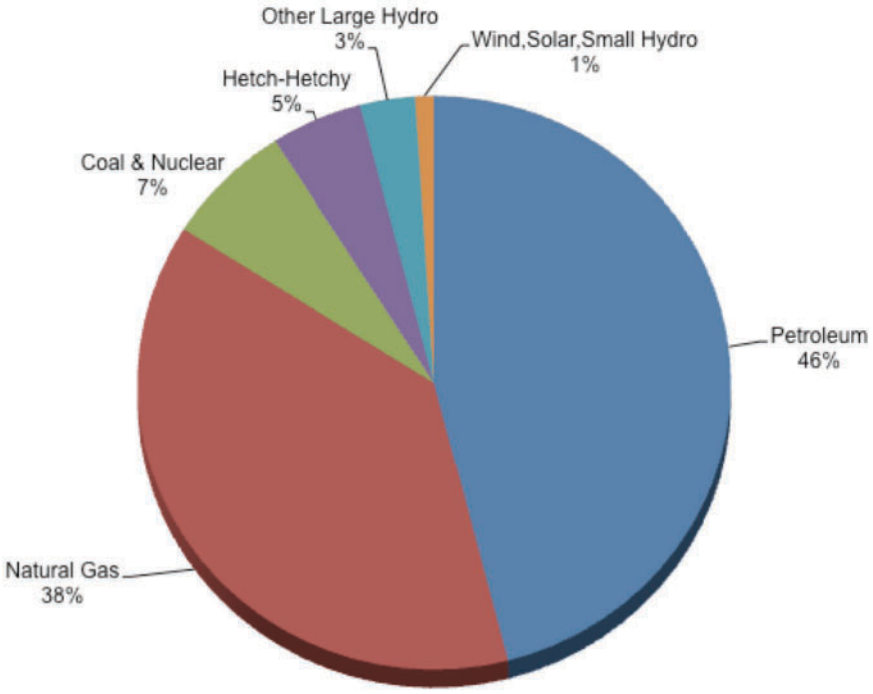
In recent years, San Francisco and many other cities have adopted programs aimed at reducing greenhouse gas emissions. Responses to concerns about the peaking of fossil fuel supplies must not counteract these programs. Fortuitously, there is a confluence of interest in this matter in that the primary response that most effectively addresses both problems is the same: reduce and eventually eliminate fossil fuel use. However, this seemingly common sense response is not necessarily embraced by all energy analysts. There do exist strong proponents of a coal-based approach to mitigating declines in petroleum and natural gas supply. It is the position of the Task Force that the City should avoid strategies that conflict with other environmental goals; therefore, the Task Force does not view an increase in coal use as an appropriate response to decreases in other fossil fuels.

3.1 ASSESSMENT OF CURRENT SITUATION

The picture of current energy use in San Francisco is painted in broad swaths with fossil energy. Approximately 86% of total primary energy sources for all purposes are fossil – petroleum, natural gas, and a small amount of coal.

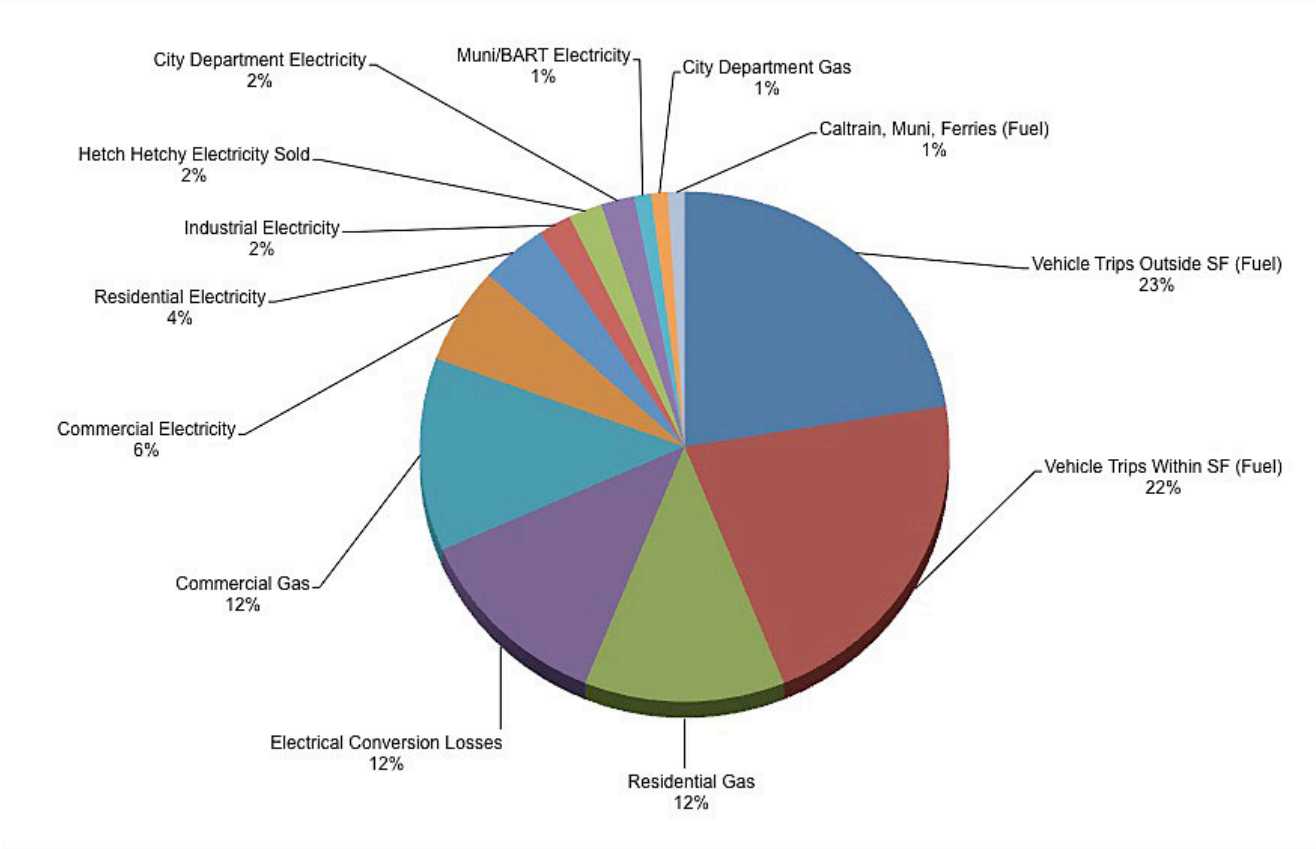
The following chart indicates the major primary energy sources for San Francisco for all purposes, including transportation.[2]

San Francisco Primary Energy Sources



The following chart indicates the end usage of all energy sources in San Francisco.[3]

Total San Francisco Energy Usage



3.1.1 Three Principal Energy Sinks

The three energy sinks are vehicle fuel, direct use of natural gas, and electrical generation:

3.1.1.1 Vehicle Fuel ~45%

Over 95% of the petroleum fuels used in San Francisco are used in transportation as vehicle fuel, primarily gasoline and diesel. Please refer to Chapter 6, Transportation, for a discussion of transportation policy. A few modes of transportation depend on grid electricity. Some scenarios for future mobility include substantial increases in the availability and use of plug-in hybrid electric vehicles (PHEVs) and pure electric vehicles (EVs), as well as electrification of currently non-electrified transit lines. In these scenarios, significant increases in the electrical load on the grid are projected. The City must anticipate this potential increase in its forecasts.

3.1.1.2 Direct Use of Natural Gas ~25%

Total residential use for 2007 was 152.2 million therms, up from 148.1 million therms in 2006.[4] Total non-residential use for 2007 was 104.2 million therms, down from 115.1 million therms in 2006. Natural gas is used for space heating, water heating, and cooking in the residential sector, and for industrial processes, space heating, water heating, and cooking in the commercial sector. Currently it is not possible to know what the specific breakdown is with any precision for each of these end uses, since this would require installing individual meters on thousands of systems and appliances throughout the city.

3.1.1.3 Electrical Generation and Use[5] ~30%

Total electricity consumption for the city in 2007 (the latest year in which figures are available) was 5.5 gigawatt-hours (Gwh).[6] Total usage in the city peaks at about 900 megawatts (MW, equal to one million watts)[7] A gigawatt is one billion watts, or one thousand megawatts.[8]

The electricity produced for and used by the city falls within three categories: that provided by PG&E to residential and commercial ratepayers (~78%); that provided by the San Francisco Public Utilities Commission (SFPUC) mostly for powering municipal buildings and services (12-16%); and that which is provided to large commercial customers via "direct access[9]," a holdover from the deregulation experiment of the late 1990s and early 2000s (6-10%).[10,11]

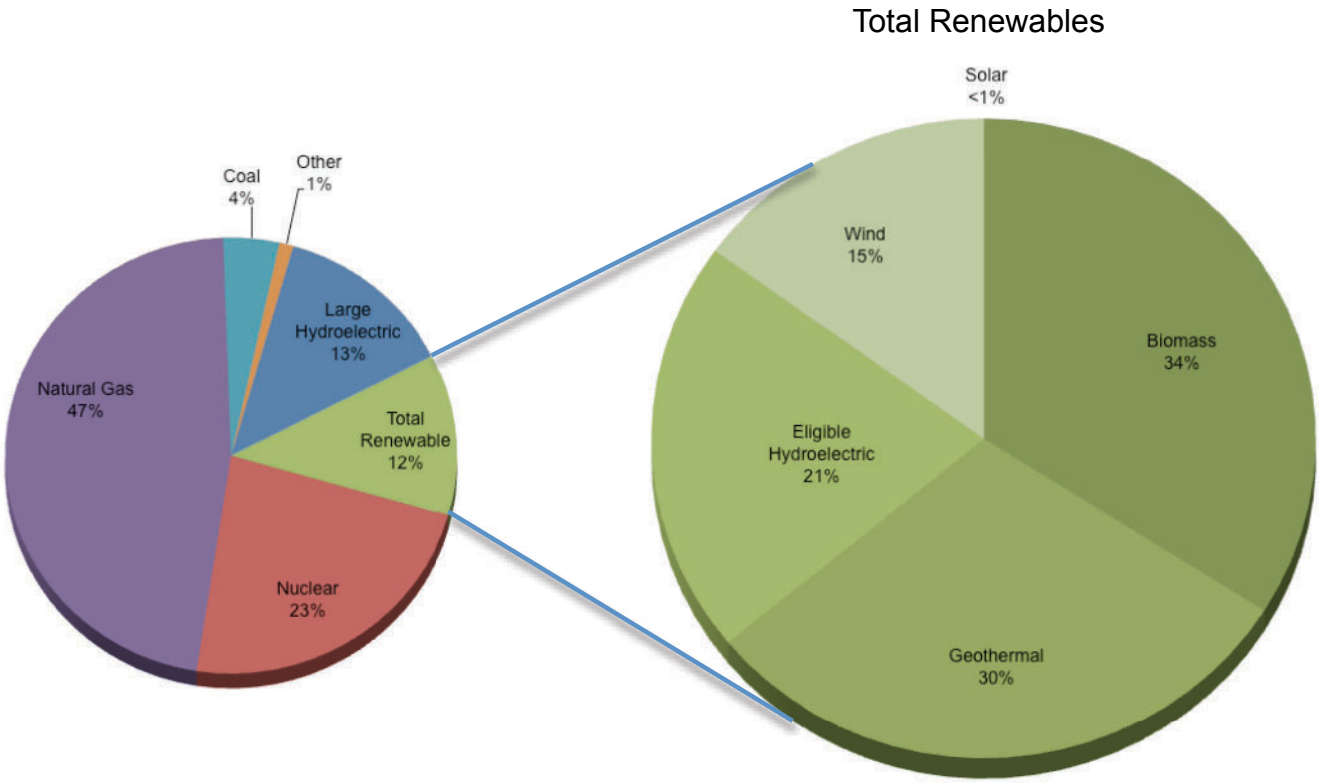
Petroleum is not currently used for direct generation of power in San Francisco; however, oil is necessary in the *platform* that allows non-petroleum energy systems to function. For example, petroleum fuels are used in vehicles that deliver supplies and help maintain infrastructure, and many components of systems and infrastructure currently require petroleum inputs. In follow-up studies, the City should assess the degree to which its non-petroleum energy sources depend on a petroleum platform.

Pacific Gas & Electric

Pacific Gas & Electric (PG&E) is a privately held corporation that provides natural gas and electric service to approximately 15 million people in a 70,000 square mile service area in northern and central California that includes San Francisco, but excluding power for municipal buildings, Muni, streetlights, and other City services.[12]

Action that may be required to rapidly adapt to Peak Oil & Gas impacts may include measures, such as a robust program to increase and expand distributed generation, that would probably not be in the best interest of shareholders and salary recipients in the PG&E for-profit model. As long as the major portion of power-provision to the city remains in the hands of a privately held corporation, the ability of the City to take meaningful action will be significantly limited.

PG&E Power Mix – 2007[13] (Refers solely to electricity generation)

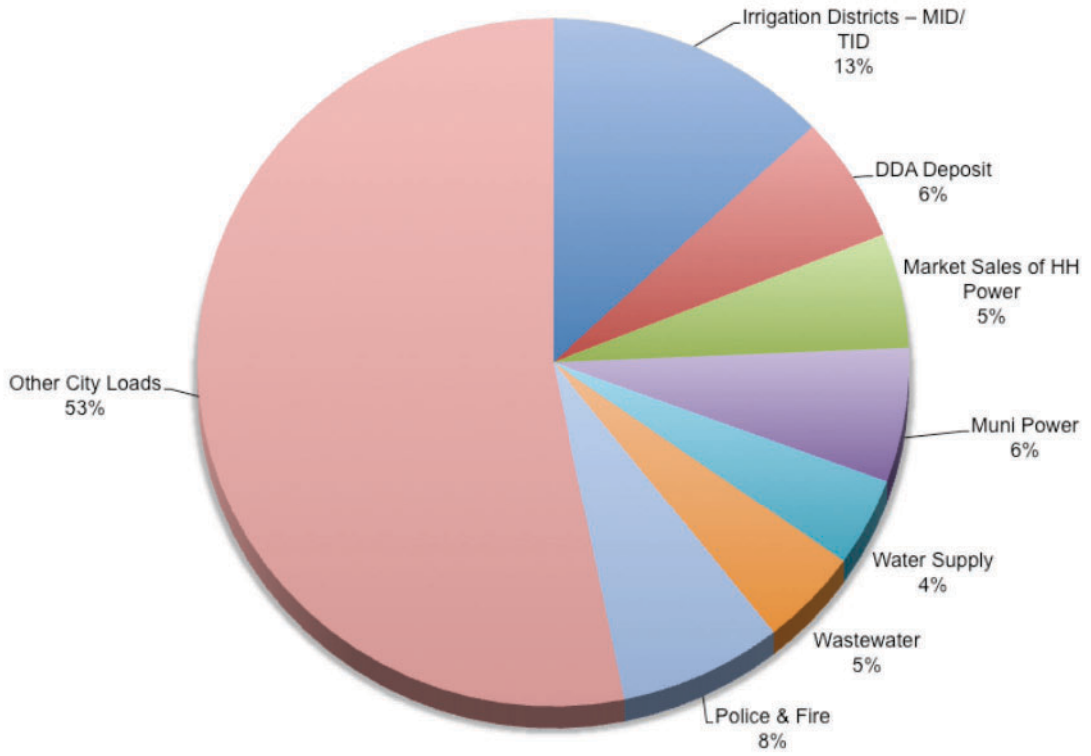


The chart on the left represents all of the primary sources for PG&E's generation of electricity. The chart on the right is the breakdown of the turquoise "Total Renewable 12%" wedge, indicating the primary energy sources that comprise that wedge.

Hetch Hetchy

The SFPUC provides electric power derived from the water impounded at Hetch Hetchy (HH) to meet the municipal requirements of the City, including power to operate Muni streetcars and electric buses, street and traffic lights, municipal buildings, the San Francisco Airport (SFO), the San Francisco Unified School District (SFUSD), City College of San Francisco, and other City facilities. This totals about 140MW and comprises between 12 and 16% of total electrical power use in San Francisco.[14]

Hetch Hetchy Power



In the pie chart above, "Irrigation Districts" are Modesto and Turlock[15], DDA (Deferred Delivery Account) deposits represent excess energy that HH banks with PG&E under the terms of its interconnection agreement, and which can be withdrawn at later date for City loads or to sell to the market. DDA withdrawals are for all intents and purposes considered Hetch Hetchy power. "Norris" refers to Norris Industries, a federal munitions factory in Riverbank, CA, and APT refers to San Francisco Airport tenants.[16]

Total power generated via HH averages about 1.6 billion kWh per year with a peak capacity of about 410MW. The SFPUC depends on and pays PG&E for transmission and distribution. The SFPUC operates first as a water project. In the dry season, HH stops "spilling" water and the SFPUC purchases power, primarily geothermal, until spilling resumes during the rainy season. It may be possible for the City to increase its capacity from this resource to accommodate increased transit electrification and/or EV battery charging.

3.1.2 Conservation, Energy Efficiency, and Renewable Energy: Existing Programs and Plans

In the early 2000s, the City produced an Electricity Resources Plan (ERP), developed with assistance from the Rocky Mountain Institute, and commissioned the SFPUC and the San Francisco Department of the Environment (SFE) to carry out the Plan. Many of the objectives in the ERP have been met and many other factors have emerged since the early 2000s. Also true is that many of the goals, such as those for renewably-generated power,

have not been achieved. These two documents remain the plans under which the City operates with respect to electrical resources. The City should direct the SFE and the SFPUC to work together to produce an updated, integrated long term energy/electricity resource plan that takes the downside of the peak into consideration.

The City has a wide variety of conservation, energy efficiency, and renewable energy programs and plans underway. Most of them can be reviewed at the City's and the SFPUC's websites. Rather than listing them all here, many of them will be referenced as part of the mitigation strategies proposed later in this chapter. Their significance to Peak Oil & Gas is that rapidly increasing conservation, energy efficiency, and renewable energy in the city is a key meaningful response to the problem.

3.2 VULNERABILITIES

The principal vulnerability is that approximately 86% of the sources of energy that San Franciscans use to power their lives are fossil fuel sources – petroleum, natural gas, and coal. None of these sources are derived from within the City's boundary. In fact, San Francisco has limited capacity to generate any kind of power within its political boundary due to the fact that it is "built out" and very little developable land remains within the city. This leaves rooftops, parking areas, and a few areas of open space as possibilities for energy generation within the city. It is not realistic at this time, given the current technology and current demand, to meet the demand with renewable power generated within the city; therefore, San Francisco will continue to depend on transmission of power generated elsewhere.

San Francisco is perched at the end of a long, narrow peninsula. This presents vulnerabilities for the city relative to transmission of electricity into the city, since conventional transmission is land-based, requiring that power transmitted through the grid must enter the city from the south. Land-based transmission lines are the least costly way to move power. It is possible however, to bring power to San Francisco via undersea transmission cables. The new Trans-Bay Cable from Pittsburg, currently under construction, will bring up to 400MW of electricity to the city via a transmission line beneath the San Francisco Bay.[17] The source of power transmitted via the cable remains an issue of concern. Although currently challenging in the transmission context, the fact that the city is surrounded by water may be advantageous in some respects, because of the potential for electricity generation from offshore wind, tides, ocean waves, and marine currents.

A third general vulnerability, but not the least by any means, is a populace that is woefully unaware of the predicament that the city and society at large faces as the global extraction peak is passed, and we are forced to learn to live in a contracting energy environment.

The following are vulnerabilities specific to our three main energy sinks:

3.2.1 Vehicle Fuel

Supply: The estimates of respected petroleum geologists range from calculations that put global oil production at peak now or within the decade, to a very few optimists who predict that production will peak some time around 2030.[18] Even if the 2030 estimate is closer to the truth, it is not too early to begin adapting. The total planetary endowment is conventionally estimated at 2 trillion barrels prior to commercial extraction, with about 1 trillion remaining (the more difficult-to-extract trillion) and global production has been roughly flat since 2005 at about 87 million barrels per day. It is unlikely that any single type of alternative to gasoline will rise to prominence above all others within the next two decades. In fact, it is unlikely that any combination of fuel types will be sufficient to support a vehicle fleet comparable to the current one. Probably a smaller number of vehicles, using a variety of fuels, will coexist on the streets of San Francisco.

Price: Oil prices are currently very volatile and difficult to predict. In August 2008 the price of oil was at about $150/barrel and at the time of this writing it is at about $45/barrel and slowly rising. Price of oil at a given time is not necessarily an indicator of the proximity of the peak, although this kind of volatility has been predicted as a part of the experience of living through the peak. Daily oil price is a micro-measurement; Peak Oil is a macro problem. It is a mistake to think that the peak is not an immediate problem, merely because the current price of oil is relatively low. An analogy would be arguing that climate change is not a problem because we are having some cold weather.

> *"Last summer's [2008] $4-a-gallon gas was no anomaly, it was a brief glimpse of our future. We must address the inevitability of peak oil by developing vehicles powered by alternatives."*
>
> - Irv Miller, Vice President, Toyota USA
> News Release of 1/10/09

End Use: Over 95% of petroleum fuel is used for transportation purposes. There are about 373,000 registered vehicles in San Francisco.[19] Some part of the petroleum which is converted into gasoline can be replaced through transition to renewable sources of energy, but the sheer scale of petroleum use and physical limits come into play, making simply replacing these fuels on a one-to-one basis highly unlikely. In addition, some petroleum diesel is used for emergency back-up generators in hospitals and other facilities that cannot afford blackouts. If sustainably-produced biodiesel is not available, these generators will be vulnerable.

3.2.2 Direct Use of Natural Gas

Supply: The Natural gas production peaked in the U.S. in 1973.[20] However, in recent years, production has increased nearly to the level of this historic peak due to an increase in the production of unconventional resources and improvements in natural gas drilling technology. The fact that unconventional resources and methods are being employed should be taken as an indicator that production from easy-to-access conventional reserves and discovery are not keeping pace with demand. California and San Francisco increasingly rely on natural gas imported via pipeline. Supplies from overseas can be liquefied and shipped then returned to the gaseous state for end use, but this system is dangerous, controversial, expensive, and unreliable, and requires significant long-term infrastructure investment for supply that cannot be guaranteed. Even so, liquified natural gas will undoubtedly be traded more and more on the international market in the coming years.

Price: It is likely that the price of natural gas will become a limiting factor before economically significant shortages of supply become a reality. The eventual high prices due to competition for a dwindling resource,

and other factors, will render natural gas effectively unavailable. In addition, because prices are notoriously difficult to predict with accuracy, the Task Force recommends that the City adopt a general policy of erring on the side of high price estimates when conducting forecasts. For the periods when high estimated prices do not materialize, the City and consumers will benefit by unexpectedly lower prices. If prices are at or above anticipated estimates, the City will be better prepared than if lower estimates had been used.

End Use: Primarily cooking, space heating, and water heating. All direct consumers of natural gas will be vulnerable to price hikes.

3.2.3 Electrical Generation and Use

Electrical generation and use is an extremely complex matter that does not lend itself well to simplified statements of price, supply and end use. The main vulnerability in this arena is that about ¾ of the electricity provided by PG&E to the city is derived from three vulnerable and/or undesirable sources: natural gas, coal, and nuclear.

3.2.3.1 Natural Gas

Electrical ratepayers will remain very vulnerable to natural gas price increases as long electrical generation remains so dependent on natural gas. Gas, like oil, is ultimately a finite resource. It would be prudent to begin the process of transitioning away from these resources now.

3.2.3.2 Coal

The City should avoid strategies that conflict with other environmental and climate change goals. Although coal is the largest single source of fuel for the generation of electricity worldwide, the city uses very little for this purpose, or for any other purpose. Therefore, the Task Force does not anticipate that coal prices or supply will be a significant factor in energy decision-making for the City in the foreseeable future. This does not imply that San Francisco will be immune to economic impacts in the broader U.S. and international context due to future coal price/supply fluctuations. The risk also exists that energy decision-making that is not in the hands of the City government may result in an increase in coal use to generate power in remote locations for wheeling to the city. Although coal exists in far greater quantity than oil or gas, extraction and combustion impacts – not the least being the impact to the global climate – will probably inhibit fully exploiting this resource. The Task Force urges the City to resist public policies that would facilitate increased coal use as a primary electricity generation source in nearby states and nationally. Similarly, and for identical reasons, coal-to-liquid fuel technology should not be considered as an option to mitigate declining petroleum supply.

3.2.3.3 Nuclear Power

(Specifically, nuclear *fission* power) The Task Force is unanimous in its support of policy responses that advance local, clean, renewable, sustainable, environmentally just and economically viable long range alternatives to fossil fuels.[21] These alternatives represent capital-intensive long-term infrastructure investments that will remain integral components of society for decades to come. Nuclear fission power poses unacceptable perils and costs at every step of the process. Based on economic, public safety, security, environmental, and environmental justice considerations, the Task Force is unanimous in opposition to nuclear fission power as a near-, mid-, or long-term mitigation strategy for addressing Peak Oil & Gas. The City should avoid strategies that conflict with other environmental goals.

3.3 GOALS AND STRATEGIES

3.3.1 Accelerate efforts to transition away from fossil fuels, while avoiding nuclear fission and coal based energy.

First, an explanation of what is prospectively being mitigated, because it is not the problem of Peak Oil & Gas that is being mitigated; there is no way for the City of San Francisco to influence the timing of the peak of global production of oil and gas. What the City is able to influence are the ways and the degree to which the peaking impacts the city. So these are *impact* mitigation strategies. Such impact mitigation will largely come in the form of reducing dependence on fossil fuels via conservation, efficiency, and deployment of non-fossil alternatives.

Vehicle Fuel – Accelerate efforts to improve pedestrian, bicycle and public transit options; impose disincentives on automobile use. For greater detail see the Chapter 6, Transportation.

Direct Use of Natural Gas – Accelerate conservation and efficiency programs; provide incentives for technologies that offset natural gas use such as solar water heaters and solar cookers.

Electrical Generation and Use – Accelerate conservation and efficiency programs on the demand side, accelerate implementation of renewable energy systems on the supply side. Oppose any further development of coal and nuclear fission power for San Francisco.

3.3.2 General Strategy: Predicate City planning on the expectation of rising energy prices and declining availability.

3.3.2.1 Plan for rising energy prices and possible shortages.

It is not important that the City attempt to predict what petroleum fuel and natural gas prices might be in the future. Such predictions are unlikely to be accurate no matter how sophisticated the models used. The important thing is to anticipate more than one scenario, and at least one scenario included should be the one where prices are high enough to render petroleum fuels and natural gas effectively inaccessible. As noted earlier in this section, in 2002 the City produced an Electricity Resource plan (ERP). This plan is now becoming out-of-date, particularly in light of looming fossil fuel supply limitations. The City should produce a new Plan, similar to the 2002 ERP, retaining consideration of the drivers of that effort (environmental justice, public health, and energy deregulation) but updated to take into account fossil fuel scarcity considerations, and explicitly incorporating the goal of ending dependency on fossil fuels. The Plan should also include a requirement that, once the report is published, follow-up public meetings in the months and years ahead should be held to address the status of implementation of the plan.

3.3.2.2 Advocate for sensible policies in light of Peak Oil & Gas at every level of government.

Local, state, national, and international mitigation strategies in response to the problem of Peak Oil will likely be subject to international mitigation strategies for global climate change and the global impact of Peak Oil, in that both problems are global in nature. This does not mean that the City's efforts are unimportant, but ultimately it will require concerted effort at the international level in order to respond effectively. For this reason the Task Force recommends that the City take steps that compel responses and action at the state, federal, and international levels.

3.3.3 Demand-Side Management: Make Demand Reduction a High Priority.

(Corresponds to recommendation 3.4.2) – Demand reduction may turn out to be the single most important response in addressing Peak Oil & Gas. The mission at hand is not to figure out how to meet the existing 900MW of inefficient demand with non-fossil sources, but how to first reduce the demand significantly. This is critically important in order to accommodate anticipated increased demand from transit electrification and increased use of electric vehicles (EVs). Because San Francisco gets approximately 84% of its energy from oil and natural gas, it will be virtually impossible to replace that fast enough watt for watt with renewable energy. All of the renewable energy possibilities discussed below will likely only fill a fraction of current energy demand before oil and gas supplies begin to fall, given current technology. Therefore, reducing demand is imperative. The Community Choice Aggregation (CCA) business plan lays out a road map for achieving an 11% reduction in electricity demand – 2% of total energy – through efficiency and conservation. The City should adopt and pursue at least that much. Below are several proposed strategies on the demand side.

3.3.3.1 Conservation and Energy Efficiency: Reduce use of energy in San Francisco through conservation and energy efficiency.

Strictly speaking, conservation and energy efficiency are two different things, but they are closely related. **Conservation** means reducing or eliminating energy use by the consumer. Examples of conservation are turning off a light or turning down a thermostat. **Energy efficiency** means receiving the same or equivalent service using less energy. Examples are low wattage compact fluorescent light bulb that puts out as much light as a higher watt incandescent bulb and "Energy Star" appliances.[22] New or expanded energy efficiency measures have the potential to give the city the greatest "bang for the buck" in terms of mitigating demand. The CCA plan mandates 107 "negawatts" or MW *not used* as a result of energy efficiency and conservation. This is not necessarily the maximum that can be achieved. At the time of this writing, PG&E is in negotiations with the California Public Utilities Commission (CPUC) for renewal of Section 381 funds. These funds are derived from a fee on ratepayer's bills, and are used for "public goods" including efficiency programs. The SFE has historically partnered with PG&E in implementing these programs in the city. Assuming this relationship continues, the SFE should develop much better working relationship with PG&E to administer the funds in ways that are consistent with accelerated demand reduction goals in light of Peak Oil & Gas. However, conservation comes first. It is the best way to adapt to limited resources of any kind. While most of what this report will recommend falls under the category of energy efficiency technology implementation, the Task Force feels that the City should not discount the value of promoting conservation as a public education imperative.

3.3.3.2 Smart Grid: Pursue creation of a "Smart Grid" to stretch available energy further.

(Corresponds to recommendation 3.4.4) – The "smart grid" concept is basically a way to transform the current conventional system of monolithic, centralized power generation with little ability for the generator to communicate with the consumer within the system, to what is essentially an energy Internet. The smart grid is a decentralized system where a web of interactive electronic communication exists between large generation centers, distribution nodes, smaller distributed generation, and end users, and it can be implemented at the local, regional and national levels. Smart meters that allow for two-way information flow are a good first step in this area. Advantages of the smart grid are increased efficiency, reduction in peak demand, and allowance for small, distributed renewable energy generators.[23] On December 9th, 2008,

the San Francisco Board of Supervisors passed Resolution 081562, making it City policy to support smart grid technology and protocols for City electric systems urging the Public Utilities Commission to prepare a study to identify the most effective and economic means to implement smart grid technology.[24] This is a step in the right direction.

3.3.3.3 Green Workforce: Develop a green workforce to retrofit buildings for efficiency.

(Corresponds to recommendation 3.4.5) **-** Another critical component for implementing demand side mitigation measures is having the trained workforce available to do the actual work of retrofitting buildings and installing cleaner more energy efficient systems. Powerful momentum is building on a national level to inaugurate a "green economy" that will be comprised of thousands of newly trained people for "green collar jobs." Such jobs include, for example, retrofitting existing homes and businesses with weather-stripping, water heater jacketing, and installing the latest energy efficient technologies. The City can take a lead in this area by establishing a green jobs workforce development program to train people in the skills required to install new, upgraded, repaired, reconstructed, or expanded energy efficiency and renewable energy infrastructure. The CPUC funds that go to PG&E for energy efficiency programs could be used for this purpose.

3.3.4 Supply Side Management: Increase production of energy from renewable sources.

Supply side refers to the ways and means of producing power. In order to adequately address the issue of supply, the City first needs to commission a follow up study that will determine, to the best of its ability, how much demand can be reduced from all end users, how much electricity can be generated in the city, and what outside sources of energy will be available to get an accurate picture of what the prospects are for powering the city. An analysis of this nature is outside the scope of this report, but is embodied in the CCA Program Plan. It is imperative that the City develop a means of exercising greater decision-making power about the primary sources of energy used to generate electricity for the San Francisco. This can come in the context of CCA, in the context of an improved constructive relationship with PG&E, or in some other context, but the bottom line is that decisions about primary power sources must be based on long term sustainability, not near-term profit. The following are several supply side strategies, followed by a summary of some of the emerging non-fossil technologies.

3.3.4.1 Community Choice Aggregation (CCA): Prioritize the implementation of CCA to establish control of our local energy system and accelerate deployment of renewable energy technologies.

(Corresponds to recommendation 3.4.1) – CCA is a program enabled under state law that allows the City to become an electricity purchaser for residents and businesses currently served by PG&E. The CCA implementation plan calls for 360MW of non-fossil energy generation and conservation. This is comprised of 31MW of photovoltaic (PV) power, 72MW of non-solar distributed generation, such as stationary fuel cells, 150MW of wind power, and 107MW of efficiency and conservation measures. Local control of pricing is another advantage of CCA. However, ratepayers are able to opt-out and remain full customers of PG&E if they prefer, and PG&E may continue to provide electricity transmission, distribution, meter reading, and billing services under the CCA program. The main advantage of CCA relative to Peak Oil & Gas is that the City has the ability to choose non-fossil primary energy sources, and does not depend on PG&E, which is a private corporation, for decision-making in this regard.[25]

3.3.4.2 Feed-in Tariffs: Encourage private investment in distributed generation of renewable electricity through feed-in tariffs.

(Corresponds to recommendation 3.4.7) – A feed-in tariff is a mechanism that allows small renewable generators to sell their power to utilities under predetermined terms and conditions. In essence, small energy suppliers are guaranteed a particular price for whatever they feed into the grid, thus removing uncertainty, resulting in the creation of an incentive to install distributed generation systems – such as solar photovoltaic systems – on non-owner-occupied buildings. This incentive structure has led to 20% of electricity in Germany coming from renewable sources. In early 2008, the CPUC made new feed-in tariffs available for the purchase of up to 480 MW of renewable generating capacity from small facilities.[26] Pursuant to this, effective February 2008, PG&E will purchase power from customers who install eligible renewable generation up to 1.5 MW in size.[27] Since PG&E is already doing this under AB1969 and CPUC supervision, the City should see if there is anything it might be able to do in this sphere.

3.3.4.3 Renewable Energy Plan: Create a citywide Renewable Energy Plan.

(Corresponds to recommendation 3.4.3) – The key to risk mitigation in this arena is diversification of the renewable energy sources at the City's disposal. There is no single energy source currently known that can replace petroleum or natural gas. It is also unlikely that any combination of known non-fossil, non-nuclear renewables will be able to meet current or projected demand. However, some combination of all non-fossil renewables combined with robust programs of conservation, energy efficiency, and localization, may be the best way to approach mitigation. An aggressive program, whether in the context of CCA or not, will be an inevitable key to transitioning out of the fossil fuel era. Currently, no comprehensive plan exists that would result in the City ceasing its dependence on fossil fuels for non-transportation energy use. The City – the SFE and the SFPUC – should produce a plan that would do so, combining robust energy demand reduction with aggressively increased cleaner renewable energy infrastructure investments. Such a plan should have near 100% clean renewable energy as its objective. This can be characterized as an updated Electricity Resource Plan or not. It can also be carried out in the context of CCA or not. It does not matter how it is done administratively, but it needs to be done.

3.3.4.4 Cogeneration: Accelerate development of cogeneration.

Cogeneration refers to the practice of capturing waste heat from existing industrial or commercial boilers or turbines that produce hot water and/or electricity on-site. The heat can be used for other industrial purposes or for space heating. The City carried out a limited study of the potential for cogeneration and found that there is a potential for more than106MW capacity from places like hotels, residential high rises, and hospitals.[28] Cogeneration should be pursued as an interim strategy to make the most of the fossil fuels currently being used to generate electricity.

3.3.4.5 Green Workforce: Develop a green workforce to install cleaner renewable energy technologies.

As with demand management, a trained workforce will be needed to do the work of installing new cleaner, renewable energy infrastructure on the supply side.

3.3.5 Continue to pursue sustainable alternatives to gasoline and petroleum diesel, with the understanding that the first and best option is to expand non-auto forms of transportation.

There are four key criteria that must be met when considering any prospective petroleum replacement fuel. They are, in the form of questions:

1. Is the fuel clean? (not just tailpipe emissions, but in the full fuel cycle from production to end use)
2. Is the fuel renewable, that is, sustainable?
3. Can the fuel power the vehicle fleet safely and economically?
4. Is the fuel production system scalable, i.e., is it possible to produce and use this fuel on a scale that can meet wide demand?

An additional factor that must be considered when assessing fuels is the degree to which the fuel option requires supporting infrastructure. Every alternative needs some degree of infrastructure investment. As systems are scaled up, these infrastructure investments become significant. Decisions about which infrastructure investments to make to serve which respective vehicles is highly subjective in nature and is proving to be highly controversial, as various possibilities compete for funding. This consideration is complex and does not lend itself well to a simple "yes/no" criteria assessment.

The following are several prominent non-fossil fuel options that are currently in use in San Francisco or under serious consideration. Each one is assessed in the context of the four criteria above. Many other technologies and options exist, but a thorough review of every experimental fuel is beyond the scope of this report. For further information, a good general source of information is the U.S. Department of Energy's Alternative Fuels and Advanced Vehicles Data Center.[29]

3.3.5.1 Biofuels

Biodiesel is a fuel that can be used in unmodified diesel engines; it is produced from plant or animal oils via a chemical process. The City currently operates all of its diesel engine vehicles on a mix of 20% biodiesel/80% petroleum diesel wherever feasible. In 2008, Darling International announced plans for a 10 million gallon per year biodiesel plant at the Port of San Francisco Pier 92.[30] When this facility becomes a reality, the City may be able to convert its entire fleet to 100% biodiesel.

The City also recently announced a program to capture waste "brown grease" for conversion to biodiesel.[31] Biodiesel is limited by the availability of biogenic oil that serves as its feedstock. Biodiesel produced by reprocessing captured grease has many advantages, but a limited source of supply. The City's current supply of biodiesel is manufactured from soybeans, and thus competes for land with food production. In a post-peak scenario, food production will have its own constraints, making crop-based biodiesel unavailable on a large scale.

San Francisco sponsors a Biodiesel Access Task Force that "studies and advises the City on all aspects of biodiesel, including city-wide strategies and incentives that would increase the use of biodiesel fuel by consumers, vendors, and the City's municipal fleets; and ways to streamline and put into action the necessary permit process for biodiesel filling station." For more information on the latest developments, please refer to the Biodiesel Access Task Force website.[32]

Straight Vegetable Oil (SVO) can be used in diesel engines that have undergone a simple and inexpensive (under $3,000) modification that worms the oil in the fuel line prior to combustion. The modified vehicles can still run on petroleum diesel. Currently, no automaker offers an SVO-powered vehicle, so the modification must be done as a retrofit. Because the volume of SVO is limited by the amount of waste fryer oil that can be obtained, it will not be available on a large scale.

Ethanol is an alcohol fuel derived via complex process from crops such as corn, sugar cane, and other vegetable matter. The economic viability of its manufacture is very much in question due to the large amount of energy used. Even if it were economically viable, a 2009 Minnesota study found that even if the entire U.S. corn crop were dedicated to ethanol production, this would displace only about 12% of total U.S. gasoline use.[33] Finally, there is an obvious conflict with food crops.

3.3.5.2 Hydrogen

Conventionally Produced: Most hydrogen today is produced via steam reformation of natural gas. Since natural gas will peak and decline just like petroleum, this method is not viable for the long term. Proposals exist to produce hydrogen through electrolysis powered by coal- or nuclear-generated electricity. These proposals arguably fail on all four of the above criteria.

Renewably Produced: Hydrogen is present in many substances and can be produced by electrolysis of water, where an electric current is passed through the water. This separates the hydrogen from the oxygen. The oxygen is vented, while the hydrogen is collected. This process, when powered by renewably generated electricity, is a clean, simple, and safe fuel production process. The hydrogen can be combusted in an internal combustion engine or converted to electricity chemically in a fuel cell, leaving a benign emission – water vapor. It is a relatively clean process.

To the extent that any of the renewable energy sources that drive the electrolytic process are sustainable, and to the extent that water is available in large quantities, hydrogen production and use are sustainable. Hydrogen can be produced locally wherever there is a supply of water and a primary source of renewable energy; therefore an enormous infrastructure is not required, nor trucking or pipelining of fuel. Water availability is, of course, a major drawback to this scenario.

Another obstacle is cost, both energy and financial cost. The process of moving from renewably produced electricity to hydrogen to motive force requires two energy conversions on top of the inefficiency and expense of producing renewable electricity in the first place. Vehicles run by overhead trolley wires are inherently more efficient; thus trolley buses will outperform hydrogen buses on all but the most lightly traveled routes. Furthermore, it will be very difficult to make hydrogen fuel cell automobiles affordable regardless of future improvements in the efficiency of renewable electricity production.

3.3.5.3 Natural Gas

There are over 120.000 natural gas vehicles on U.S. roads today.[34] The problem is that they run on natural gas. There is a renewable form of natural gas, known as biomethane or biogas, which could be part of an integrated long term approach that also advances waste minimization. Biomethane is produced from animal waste, crop waste, and sewage, so its availability will be constrained by the limits of this feedstock supply.[35] Therefore, biomethane is unlikely to be scalable to a magnitude large enough to replace any significant portion of gasoline.

3.3.5.4 Propane

There are about 190,000 propane-powered vehicles on U.S. roads today,[36] but propane is derived from petroleum. This, it offers no advantage over gasoline when assessed on the basis of long-term supply considerations.

3.3.6 Continue to monitor the possibilities of obtaining energy from emerging technologies.

The following are renewable energy sources and technologies relevant to San Francisco that are presented in this section as part of a Peak Oil & Gas response strategy. The purpose of presenting them here is that most of their benefit lies in the future, assuming that they are appropriately pursued. All of the following sources and technologies are in their early stages of development and offer great potential for growth, but remain expensive relative to conventional sources. The general strategy is for the City to do what it can to rapidly accelerate the deployment of the best of these non fossil-based prospects. One caveat is that all of these technologies produce electricity, not liquid fuels. To the extent that liquid fuels are needed, the challenge remains regarding how to translate electricity into liquid fuel. Direct use of the electricity for electrified transit and chemical battery EV charging is currently the highest efficiency scenario. A number of other technologies exist or are in development that are not mentioned here because they are not yet feasible in or near San Francisco.

3.3.6.1 Solar

Distributed Solar Photovoltaic (PV) – Solar PV refers to technologies that convert solar photons directly into electrical current. It is referred to here as "distributed" to distinguish it from concentrated solar power (CSP) addressed below. Distributed solar power systems are much smaller than conventional power plants and are *distributed* over a given geographical area. This offers several advantages over the conventional monolithic power generation paradigm in that it reduces risk of black outs, offers opportunities to increase efficiency, allows for more renewable energy systems, and minimizes risk of catastrophic accident and/or sabotage. This is a rapidly growing technology both in the economic sense and as it pertains to the technology itself. State and local incentives exist to assist homeowners and businesses to install PV systems, but cost remains a principal barrier to more widespread adoption. One concern raised in the Task Force proceedings is that the manufacture of solar panels themselves is a very energy intensive endeavor that currently requires fossil fuel inputs. This is true of virtually every "alternative" energy technology. Since the technology and economics of PV are evolving rapidly, it is difficult to estimate the maximum amount of power that might eventually be achieved through this technology. A 2001 study[37] estimated the total roof capacity of the City at 550 to 1300 GWh per year, at the high end, comparable to the total current residential electricity use in the City. The average annual solar radiation hitting San Francisco is very stable, with a standard deviation of less than 2.5%.[38] As of February 2009 there are over 1000 solar PV installations in the City, totaling about 6.5MW.[39] The mandate under CCA is 31MW, so there is a lot of potential for expansion.

Solar Water Heating – Solar water heating, also called solar thermal, takes direct advantage of the heat energy from the sun. It is a very common, proven technology. In 2007 state assembly bill 1437 was signed into law, which authorizes the CPUC to create a $250 million program with the goal of installing 200,000 solar water heating systems throughout the state. The program is expected to be in place by 2010.[40] There will be a lot of new activity in this arena in the City by 2010 and beyond and at the time of writing the SFE is looking forward to some new market analysis of solar hot water in San Francisco.[41] The City should promote solar thermal to offset natural gas used to heat water.

Concentrated Solar Power (CSP) – As the name implies, these facilities focus or concentrate solar energy to produce electricity by means of the extreme temperatures reached. Several types of CSP systems have been proven. CSP facilities are typically located in a remote area and the power is transmitted to the grid or load centers. A CSP facility has been operational in the Mojave Desert for many years, and several new projects have been proposed. The City should keep an eye on this as a possibility for the future. One drawback is that CSP is a newer version of the old centralized power generation paradigm.

3.3.6.2 Marine-Based Power Generation

Ocean Wave Energy Conversion – Ocean wave power generation is possible in places where strong, constant wind results in waves that have enough kinetic energy – a high vertical trough-to-peak differential – to allow specially designed buoys to take advantage of the differential and produce electricity. The nearest locations where this is the case, are off the coasts of Mendocino and Humboldt counties. Currently, PG&E is investigating the possibility of securing electricity from projects for which permits are pending. The City has also applied to the Federal Energy Regulatory Commission for permits to explore this resource. The current maximum generation estimate from the Mendocino project is 40MW. Another pending project in Humboldt County may produce up to 100MW. The total amount of electrical generation capacity possible via this type of system is estimated by the California Energy Commission to be about 8GW, so there is a lot of potential.

Tidal Power – Between 2001 and 2008 the City investigated the possibility of harnessing the power of the tidal current flowing through the Golden Gate into and out of the San Francisco Bay. Currently the investigation is on indefinite hold.[42] In 2006 the Electric Power Research Institute (EPRI), conducted a study that initially stated that about 35 MW of electricity could be generated from the Golden Gate tidal current. However, the SFPUC conducted its own feasibility study and determined that only about 10MW of extractable power exists.[43] Currently URS Corporation is carrying out another study. Under the most ideal scenario, only about one fifth of the City's current demand can be met via this potential power source.

Marine Current – Marine current power is generated via the offshore marine currents that are part of general ocean circulation, and that exist in most coastal areas. In San Francisco's case, it is the California Current that moves south along the coast. This is a very new prospect and not many examples exist worldwide. The City should keep an eye on developments in this field and investigate the possibility as a San Francisco energy resource.[44]

3.3.6.3 Wind Power

Urban Wind Power – A California Energy Commission study in 2004 that looked at wind energy resource in SF found not much large scale potential due to the lack of available undeveloped land. However, there may be some potential for smaller scale wind power installations on rooftops. The SF Urban Wind Power Task Force is investigating this prospect and a report is expected in March 2009. One of the things the City might be able to do is to provide information on wind generation to residents and businesses. SFE is currently investigating where some demonstration projects might be installed.

Remote Conventional Wind – SFPUC is looking into potential for wind along Hetch Hetchy corridor. Much of the state's best wind resource is already "locked up", that is other jurisdictions have secured the rights to it.[45]

Offshore Wind – The City (the SFE) is currently investigating the potential for offshore wind power but the process has just started. Offshore wind is about four times more expensive than land-based wind.[46]

An April 2008 Stanford University study found that somewhere between 63 to 86% of California's current electricity needs can be met with offshore wind energy alone.[47]

3.3.6.4 Geothermal

Geothermal energy is energy that is obtained from the heat within the Earth. It can be used "as is" as a heating source, or can be used to produce steam to run a geothermoelectric turbine to generate electricity. The geothermal we are talking about here is not to be confused with geothermal heat pumps that take advantage of the very near-surface (<10ft.) temperature stability that allows one to take advantage of a slight differential in temperature in order to heat or cool a space. Approximately 30% of PG&E's 2007 renewable energy portfolio is derived via geothermal.

Conventional – Conventional geothermal energy is limited to areas where the resource (heat) is near the surface and readily accessible. San Francisco is fortunate to be very far from a large conventional geothermal resource located only 75 miles away, the Geysers, mostly owned by Calpine Corporation. It is this source that PG&E is using to meet its state mandated 2010 Renewable Portfolio Standard (RPS) requirement. In 2007 PG&E contracted to purchase about 25MW of power from the Geysers that will come online in 2010.[48]

Enhanced – Enhanced geothermal, also known as hot dry rock geothermal, refers to a relatively new technology where very deep bore holes are drilled, water is injected, and hot water or steam emerges from a secondary production well. The U.S. Department of Energy recently invested over $40M in this technology and a test project at the Geysers is included in the funding.[49]

3.3.6.5 Biomass

Biomass is exactly what it sounds like, large quantities of biological matter. Biomass contains potential energy, typically in the form of methane gas, sometimes referred to as biogas or biomethane. The City operates a 2MW biogas-to-electricity generating system at the Southeast Treatment Plant.[50] Approximately 34% of PG&E's 2007 renewable energy portfolio is derived from biomass. These numbers can increase since the city produces copious quantities of green waste and other biomass "waste." Currently much of this material is used to create compost. It may be feasible to divert some of this stream toward biomass-to-electricity.

3.3.6.6 Other Sources

There are many other potential sources of energy in various stages of development. The City should monitor their progress, and pursue them as they become viable.

3.3.6.7 Non Primary-Source Technologies

The following two items are not energy sources per se, but have been proposed as means of generating electricity within the City.

Combustion Turbines – Combustion turbines (CTs) are stationary engines that run on natural gas or liquid fuels for the purpose of producing electricity. CTs have been proposed as a means of increasing in-City electrical generation. The advantages are that they can be scaled to a wide range of sizes to suit a variety of applications, and they can be located very close to load centers, and even on-site. But the City should avoid investments in energy facilities that will depend on depleting fossil energy sources. As currently proposed, CTs are an example of this. Money proposed for the CTs would be better spent on renewable technologies.

Stationary Hydrogen Fuel Cell Stacks

A hydrogen fuel cell is a device that uses fuel to produce electricity via chemical reaction. Fuel cells are a long-proven and gradually improving technology but they remain expensive. As the technology improves and manufacturing costs are reduced, stationary fuel cells may become a significant option for onsite generation of electricity. In the context of Peak Oil & Gas concerns, they only make sense when the hydrogen fuel that powers them is produced via clean renewable non-fossil energy sources. Significant improvements in hydrogen storage and transportation technologies will also be required to make general use of fuel cells feasible.

"Securing energy supplies and speeding up the transition to a low carbon energy system both call for radical action by governments - at the national and local levels…"

- International Energy Agency, World Energy Outlook 2008

3.4 RECOMMENDATIONS

3.4.1 Implement Community Choice Aggregation.

3.4.2 Contract an independent city-wide energy waste audit.

3.4.3 Produce an updated Electricity Resource Plan.

3.4.4 Develop smart grid technology.

3.4.5 Advance a Green Jobs workforce development program.

3.4.6 Continue the process of implementing feed-in tariffs.

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

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

Chapter 4
ECONOMY

4.1 ASSESSMENT OF CURRENT SITUATION

4.1.1 All industrial economies are utterly dependent upon energy.

Energy powers our manufacturing plants, runs the computers of our information technology sector, underpins our research, keeps the lights on for financial companies, and keeps the transportation system moving. This is not to say that energy is a huge cost; on the contrary, the United States Bureau of Economic Analysis calculates that every $100 of GDP required $3.70 of energy input.[1] Considering how ubiquitous energy is in the economy, this seems surprisingly minimal. What this tells us is not that energy is unimportant in the economy; indeed, it is vital. The point is that energy has been very, very cheap.

According to the Energy Information Agency of the US Department of Energy, in 2006, 62% of all energy used in the United States was generated from petroleum liquids or natural gas.[2]

4.1.2 San Francisco's economy has historically been extremely vibrant and independent.

Because of its strong trading ties, especially with Asia, San Francisco is less dependent upon the vagaries of the United States economy than many other places. However, as other economies are damaged by peak oil, San Francisco will feel the effect.

San Francisco's economy is powered by three key sectors. In addition, though San Francisco is no longer a powerful port, trade is nonetheless important to its economy. Below are summaries of each of those four:

4.1.2.1 Experience Sector

The "experience sector" refers to the business of hosting visitors to the city. Currently, the experience sector employs approximately 72,000 people in San Francisco,[3] or about 10% of the city's work force. Visitors to San Francisco fall into four main categories: meeting attendees, business travelers, vacationers, and local leisure visitors. Of these, convention/meeting travelers are the most important to the economy, because they spend approximately twice as much per person per day as the average visitor.

About one in every four passengers at SFO arrives on an international flight. Fourteen percent of visitors to San Francisco are foreign. In the short term, the foreign visitor trade may benefit from the expected decline of the dollar, particularly relative to the euro. (The euro is a very relevant currency, because out of the top five countries sending tourists to San Francisco – the United Kingdom, Japan, Germany, France, and Australia – Germany and France both use the euro.) China may contribute more visitors in the future, as bureaucratic obstacles to leisure travel from China are removed.

4.1.2.2 Financial Sector

In common with most cites, San Francisco is dependent on exports to pay for the food, energy, and goods it needs. San Francisco's premiere export is financial services of various kinds. Securities sales and banking services make up 40% of the city's export earnings.[4] As we know, this sector has been hit hard by recent US economic woes.

4.1.2.3 Knowledge Sector

San Francisco is home to a growing concentration of technology-driven businesses. One is the biotech cluster centered around the new California Institute for Quantitative Biomedical Research (known as QB3). Also, in common with many cities, San Francisco is working to develop a local green energy business sector.

4.1.2.4 Trade

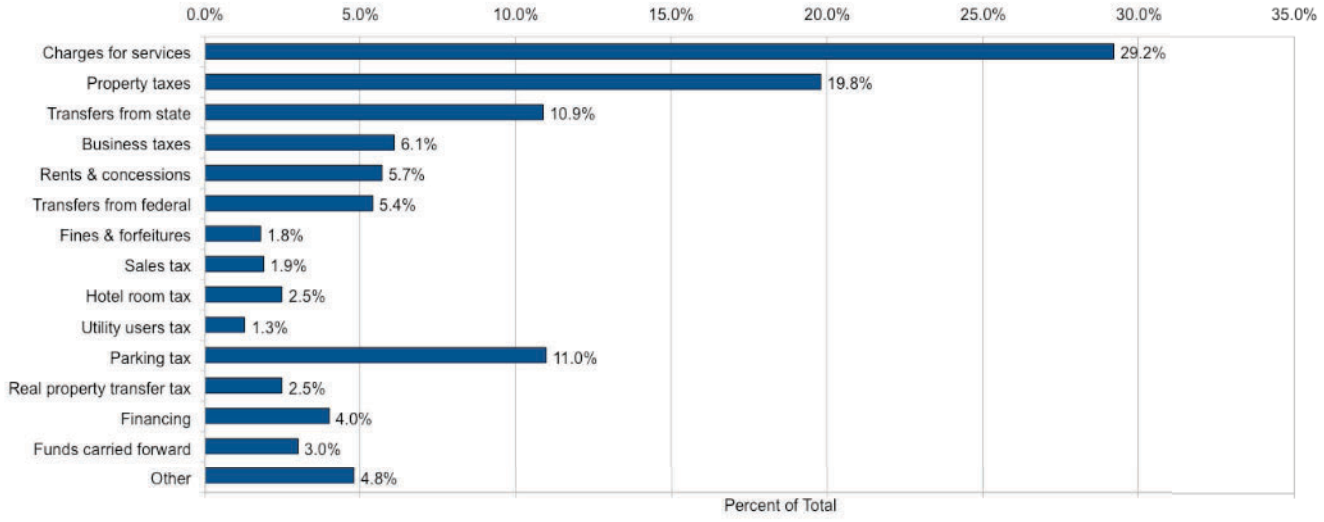
San Francisco's once-vibrant trade sector has declined since the end of World War II, as there has been a revolution in the shipment of cargo. Containerized and almost all bulk cargo is now handled by Oakland. The cost of air freight has fallen precipitously, while the cost of water shipping has risen somewhat. .[5] A globalized trade system has evolved that involves not only increasing shipments of finished goods, but also international sourcing of components. "Just in time" inventory systems have put a premium on speedy delivery of parts.

Though there is no theoretical reason why it should be so, 80% of all international shipments have transport costs of no more than 4% of the value of the cargo.[6] Thus as long as there are huge differences in labor costs between countries, most trade will be relatively insensitive to fuel price changes. This is a result of the extremely low cost of energy. A study done in 2006 estimated that shipping costs would need to rise by at least a factor of ten before transportation costs would be the limiting factor on trade.[7] Shipping costs have been so low that the economic literature is full of papers questioning why there is not *more* international trade.

Because San Francisco's manufacturing sector is extremely small and because its port has declined in importance for shipment and delivery of cargo, the City is reliant upon imported goods, many which first arrive in the United States in the Port of Oakland or by air freight. One of the key imports is oil itself. Worldwide, oil tankers are one of every four large trading vessels,[8] and the third biggest commodity import processed through the Port of Oakland.[9] (Beverages are number one.) For nearly all imports, the last leg of travel to San Francisco is by truck. See the Chapter 6, Transportation, for a more complete discussion of freight hauling.

4.1.3 San Francisco City Government

City Revenues (Year Ended June, 30, 2007)[10]



Other than fees for services, the biggest single source of income to the city is property tax revenues, close to one-fourth of the total, when transfer tax is included. Property taxes move with real estate prices and level of sales activity. Though San Francisco real estate prices have fallen less than 20% in the current downturn, fewer sales are taking place, resulting in lower transaction tax revenues.[11]

The next biggest source of revenues, transfers from the state and federal governments, are already falling, in response to declining revenue at higher levels of government. It remains to be seen what the federal government will do in the way of fiscal stimulus. For now, the decline in this revenue is pinching the City's budget.

The San Francisco Convention and Visitors' Bureau estimates that its industry generates $473 million in City tax revenues, 18% of the total city budget. This is comprised of sales, payroll, and hotel taxes, including transfer taxes on the sale of hotels.[12]

It is worth noting that the sales tax on gasoline makes up less than .5% of City revenues.

4.1.3.1 San Francisco International Airport (SFO)

The airport is a major gateway to San Francisco. For a discussion of freight and passenger travel, see the Transportation, Chapter 6. This section will consider the airport's financial stability.

SFO is required to achieve a balanced budget. Following the construction of the new international terminal, the airport has $3.8 billion in bond debt.[13] The main source of revenues is landing fees, which are based on tonnage landed for both cargo and passenger travel. Cargo traffic is a minor part of San Francisco's revenues, less than 6%. Air cargo is split pretty evenly with Oakland Airport. Through June 2008, SFO had not seen a decline in landing fees, as international flights have held up, and 2008 saw three new carriers begin service from San Francisco.

The airport was planning for significant growth in the future. However, the impact of the 2008 oil price spike has alerted airport planners to the sensitivity of the industry to fuel prices. The airport operates under a two-year plan which is being revised. Despite the uncertainty, the renovation of Terminal Two is in the early stages. Terminal One is also slated for major rebuilding.

4.1.3.2 Port of San Francisco

The Port of San Francisco is an enterprise department of the city. Like the airport, it is required to be financially self-supporting. Most of its annual revenue of $60 million is from leases. It has little ability to issue bonds. The Port has prepared a $1.5 billion capital plan, much of which involves strengthening the substructures of the piers. Two-thirds of this plan is unfunded. Several piers have already crumbled into the Bay.[14]

Funds will be difficult to find to develop the port's commercial and industrial potential. If the federal government makes capital available for infrastructure improvements, this would be an ideal use of such funding.

4.2 VULNERABILITIES

4.2.1 National economy

When it comes to rising oil prices, this much is clear: increases in oil prices have a strong negative effect on the economy in all oil-importing countries. Economists estimate that a spike in oil prices drives the economy lower, with a lag of approximately 12-18 months, but has no statistically significant effect on inflation. In other words, the demand reduction due to a damaged economy overrides the price effect. The negative effect of the 2008 price spike will continue to drag on the economy throughout 2009 and perhaps beyond. Of course, oil is only one factor influencing the economy, though it is an important one. Sadly, it is likely to reinforce the current recession.

Even more striking, the effect of oil price is "asymmetric": History shows that an increase in price generates a big negative effect, but falling prices don't have a positive effect. Price volatility is a drag on the economy. In an energy-constrained world, economic growth will increase demand for oil, driving up oil and gas prices. Rising energy costs will curb economic growth, reducing energy demand and bringing prices back down in a damaging cycle of volatility.

> *"The empirical evidence suggests that a 10 percent increase in the price of oil is associated with about a 1.4 percent drop in the level of U.S. real GDP. Interestingly, increases in oil prices have no significant effect on U.S. inflation."*
>
> - Keith Sill, Senior Economist,
> Federal Reserve Bank of Philadelphia[15]

Though the inflationary effect of rising oil prices may be modest, the contribution of increasing oil imports to the trade deficit is a major concern. Because demand for oil is not very price sensitive, demand does not decline as fast as prices go up. For instance, from 2005 to 2006, the average price of a barrel of crude went up 19.5%, but the number of barrels of oil imported to the US declined a mere 0.05%. The total cost of imported oil rose over 19%, though the volume was down.[16] Another example: in April, 2008, the US balance of trade deficit rose 7.8%, and the increase was entirely due to a jump in payments for oil imports, though the number of barrels was down. By increasing our trade deficit, rising oil prices put downward pressure on the dollar.

Despite the volatility of oil prices, the trend has been and will continue to be upward. Even at the recent low, the price of oil was 52% above its 2002 level, and triple its 1998 trough. As the price of energy rises, market forces will move us toward more efficiency; however, at some point, when the easy efficiency measures have been taken, the economy will begin a painful and protracted adjustment. When will that be? It's hard to predict, given the state of the economy.

The future could see the perfect economic storm. Expensive and scarce energy and the need for capital to mitigate the effects of climate change will put intense pressure on our financial system. As the economy begins to recover from its current slump, rising oil and gas prices will constrain it again.

Even if the economy as a whole is not pushed into an extended recession, there will be dislocations because some sectors will be more strongly impacted than others. Trucking and air travel will feel the pinch directly. Food production is also highly dependent upon oil to power equipment and as feedstock for pesticides, and upon natural gas for fertilizer. Food and personal transportation issues are discussed in separate sections of the report. Tourism will be affected by rising travel costs, and globalized trade may have seen its apex.

4.2.2 San Francisco's economic base

San Francisco's economy is strong. Nonetheless, at base it is dependent upon the broader global and national economies. As they are damaged by the cycle of price volatility described above, San Francisco's economy will suffer too. In addition, San Francisco's economic drivers have their own vulnerabilities.

4.2.2.1 Experience Sector

The spike in oil prices in 2008 makes clear that high fuel prices wreak havoc with the airline industry. There is no effective substitute for oil in making jet fuel. Driven by climate change considerations, the airline industry is searching for a substitute jet fuel that is not petroleum based, but still has high energy density per pound of fuel.

"Over the last 40 years, aviation has reduced fuel burn - and therefore carbon dioxide emissions - by 70 percent, but more needs to be done," according to Sebastien Remy, Head of Alternative Fuels Research Programs for Airbus. "Millions of barrels of kerosene are used each day for aircraft fuel, and worldwide demand is growing. In order to replace a significant portion of that jet fuel with bio-jet, we need to find something that has much greater yield than the current biomass sources available. Airbus believes that second-generation bio-jet could provide up to 30 percent of all commercial aviation jet fuel by 2030."[17]

Though it is possible to brew jet fuel from coal or from biological sources, and successful test flights have been done, the fundamental shortcomings of biofuels remain, as spelled out in the Energy Section (Chapter 3). Should the technical problems of bio-jet fuel be solved, it is clear that it will be far more expensive than the kerosene used now. In short, it appears that the age of cheap air travel is coming to an end.

To wit: though US passenger air travel tripled between 1981 and 2006,[18] but in 2008, following just a few months of high oil prices, United Airlines cut 17% of its flights. United carries almost half of all passenger traffic at SFO. American Airlines, which carries 10% of SFO passengers, cut 12% of flights.[19] The interaction between rising and unstable oil prices and stumbling GDP will put increasing pressure on airline profits and probably result in a continuing downward trend in air travel.

Travel by individual auto will also be increasingly costly. In short, leisure travel will be one of the first casualties of peak oil. The market for the remaining travelers will be extremely competitive.

One mitigation will be the probable increase in local visitors. Of the 16 million visitors to San Francisco in 2007, 4 million came from the surrounding area. As long distance travel becomes more expensive, one would expect to have more local visitors. However, local tourists spend less per visit, and are less likely to stay in a hotel, thus contributing less to San Francisco's economy.[20]

In sum, the days of affordable long-distance travel are coming to an end. Though various factors will mitigate the decline, the handwriting is on the wall. In the low-carbon future, visitors will be primarily local and/or wealthy. San Francisco is very well positioned to capture a large share of the market, but it will definitely be a shrinking pie.

4.2.2.2 Knowledge Sector

Technology, engineering, and consulting are not energy intensive, but they are sensitive to economic trends. As energy decline progresses, tax revenues to fund research may fall off. Capital expenditures could also be down.

4.2.2.3 Financial Sector

As we know, this sector has been hit hard by US economic woes. Even when the financial markets begin to recover, a continuing loss of confidence in the dollar is likely.

Both the financial sector and the knowledge sector are dependent upon regular interaction with the rest of the world. As physical travel becomes more expensive, high-speed, reliable internet connectivity will become even more vital than it is today. To keep our service sectors competitive, San Francisco needs to make this a priority.

4.2.2.4 Trade

Since both water and air freight are dependent on oil, it is likely that international trade will eventually decline - how soon is unclear. What is clear is that there will be a mode shift in shipping. Going forward, the historic decline in relative cost of air freight compared to rail and water shipping will reverse. Air freight will surely decline rapidly, because its fuel use per ton of cargo is approximately thirteen times as high as that of water freight. Because of its dependence on air travel, "just in time" inventory may very soon be unmanageable.

4.2.3 City Revenues

In general, San Francisco will have to do more with less. Demands on the city budget will rise at the same time as revenues fall. The City is seeing something like that now, with the difference that the squeeze on City finances due to Peak Oil & Gas will be indefinite, if not permanent. Probably a portion of the current economic distress stems from the 2008 oil price spike.

Though predictions vary, rising fuel prices will probably lead to an influx of new residents escaping the car dependence of the suburbs, so expect property taxes, the City's biggest source of revenue, to hold up relatively

well. In the past year, for example, San Francisco real estate values have gained as much as 30% in value relative to suburban real estate. (Suburban values have fallen more than values in San Francisco.)[21]

On the other hand, transfers from the state and federal governments will be ever more pinched. The same factors that will impact the City's municipal budget will have an even greater negative impact elsewhere. Long term, the City's fortunes are tied to the future of the region, state and nation, but the better San Francisco prepares itself for the era of expensive and possibly scarce energy, the more people will be attracted to it, and the better it will fare as a metropolis.

Another big vulnerability is that 18% of San Francisco's revenues come from the experience sector. Peak oil will reduce both the number of visitors and the amount they spend.

Meanwhile, as revenues fall, urgent needs for infrastructure projects to cope with the coming shift in transportation modes will require massive capital investment. The San Francisco Municipal Transportation Agency (SFMTA) will especially need funds to prepare for an influx of passengers.

4.2.3.1 San Francisco International Airport (SFO)

If air travel undergoes a protracted decline, the airport will be in the unenviable position of needing to raise landing fees to cover debt payments and other expenses, even as airlines struggle to survive. Currently, the airport pays $22 million into the city's general fund each year.[22] This payment is calculated as a percentage of the airport's revenue, which may decline.

As air travel becomes increasingly a luxury affordable only to the wealthiest elite, it could be difficult for SFO to manage its debt. Contracts with airlines are written with escalator clauses to enable the Airport to raise fees in the event that revenues fail to cover expenses.

4.2.3.2 Port of San Francisco

The Port of San Francisco is an enterprise department of the City, but also is subject to oversight by the state. If the City allows the port to continue to deteriorate, the cost of bringing its maritime facilities into working condition will be higher and harder to raise.

4.3 GOALS AND STRATEGIES

Constricting oil and gas supplies will cause three bad results simultaneously: a faltering economy (including a drop off in trade), declining City revenues, and a need for additional spending. San Francisco lawmakers need to treat this situation as the structural issue it is, and not a temporary problem. The Task Force's recommendations as to the basic conceptual framework for coping follow:

4.3.1 City planning should take rising oil and gas prices into account.

San Francisco uses a purchased econometric model of the city's economy. In this model, energy prices move with general inflation. In fact, the model cannot consider fast-rising energy prices. Until the recent downturn,

the increase in the price of crude oil averaged over 25% per year since 2002. The model needs to be upgraded to be more realistic. If the model cannot be revised, then a separate calculation needs to be made when evaluating the effect of potential legislation.

Quite aside from the use of the econometric model, evaluations of policies and plans generally do not adequately consider energy use. San Francisco has a plethora of commissions and agencies, nearly all making plans based on past energy prices. This was a reasonable way to proceed when energy was cheap. That assumption now needs to be changed. All City plans need to include a section explicitly assessing the effect of expensive and scarce energy.

4.3.2 Financing is key.

A continuing theme, not just of this chapter, but of the entire report, is the need for funding for vital improvements. It is imperative that the City do this painful work, because our future is at stake. Possibilities include:

- Levies on activities that should be discouraged. This would include:
  - Various assessments on autos, including a city vehicle tax; congestion pricing; bridge tolls; and a city gasoline tax.
  - Assessments on parking, including smart parking meters; raising the charges at city parking facilities and meters; impact fees on the building of new parking spaces, whether in new construction or existing buildings; and fees for new curb cuts.
  - Taxes on energy use, such as a city carbon tax.
  - Impact fees on the construction of large new residences
- Levies on activities that need not be discouraged, but which are not paying their full cost. This would include:
  - Increased developer impact fees
  - Establishment of assessment districts around transit
  - Other assessment districts
  - Progressive business tax
- Borrowing. Government agencies borrow regularly against future income, in the form of revenue bonds. Many of the recommendations of this report require an initial investment that will result in long-term savings. These could be financed by savings anticipation bonds, to be paid back through a sinking fund into which the savings are deposited. This would be applicable to:
  - Financing solar installations on City buildings
  - Financing installation of distributed generation (wind or solar) or solar thermal systems on privately-held buildings, through property tax bills to homeowners or utility savings surcharges to tenants
  - Energy performance improvements to buildings
  - Installation of new trolley lines for Muni buses

4.3.3 Prioritize high-speed internet throughout the city.

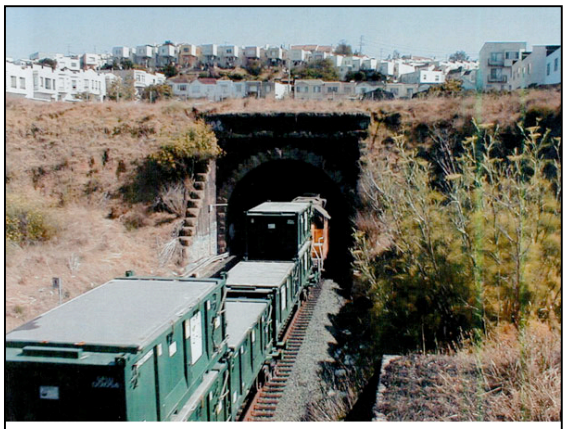
As physical transportation and overnight letter and package services become more expensive and thus less and less practical (due to rising air freight costs), electronic transmission of data will be necessary to maintaining our economic functionality. A well-functioning broadband network will facilitate telecommuting, virtual conferencing, and so on, to replace face-to-face communication. This will be extremely important to San Francisco, with our location on one coast and many overseas customers. The proposal to lay fiber-optic cable each time a street is dug up should be seriously considered.

4.3.4 Develop the southeast waterfront to take advantage of the coming rise in short haul water freight.

As discussed above and in Transportation, Chapter 6, the redevelopment of the port is both a challenge and an opportunity. It needs to be a priority.

4.3.5 Formulate a plan to revitalize rail in San Francisco.

A modern city needs modern freight and passenger rail service. One vital improvement is the tunnel through which trains approach the southeast waterfront. The inadequate size of the current railway tunnel is a choke point for our ability to replace trucks as virtually the only method of moving goods up the peninsula into San Francisco. Fixing it is the first step toward a functional freight system. Federal funds could become available for this sort of infrastructure improvement. Our plans need to make it a high priority.



Railway Tunnel Limiting Freight Traffic, San Francisco

San Francisco also needs to formulate a plan to improve rail access to the city, including movement across the Bay. When oil and gas become prohibitively expensive, electric rail will be the major transport mode. Convenient rail access will become increasingly important to maintaining the vitality of the experience sector. Cities and regions with well-developed rail will be at a competitive advantage, but such development takes time. Start now. (For more on freight, see Chapter 6, Transportation.)

4.3.6 San Francisco's infrastructure plans need to take the long-term view.

There will not be enough funding to handle all-important projects, so priorities will have to be carefully set. For example, while the airport is busy today, its future prospects are murky. Upgrades to the airport could fall into the category of orphan projects. The best plan is to wait and see, because improvement funds probably would be better spent elsewhere.

4.3.7 Expand and strengthen programs for local small businesses.

Strengthening the local core of our economy will become more important than ever as and Peak Oil & Gas hits, in order to protect our residents from the negative fallout happening in the broader economy. To a certain extent, market forces will push toward localization, but there may be dislocations. Also, cities and regions that act now to prepare will fare better in the transition time.

The City needs to create local sources of key resources. The Board of Supervisors should direct the Controller's Office to begin studying the city's balance of trade to identify pivotal imports. Then the Economic Strategy Report needs to be expanded to include a strategic plan to locally source vital inputs to our economy. Local control over two of the most important ones, food and energy, is top priority. These items are discussed in subsequent chapters of this report. However, these are far from the only inputs to look at. If we knew the composition of San Francisco's balance of trade, we could identify other vulnerabilities and begin to plan to mitigate them.

There is a great opportunity for small, local business to gain in importance as trade declines. This is not a bad thing, because small businesses generate new jobs. According to a 2006 study by Kent Sims, a former City economist, small businesses are more reliable employers in bad economic times than large companies.[23] They also keep profits local. San Francisco should take advantage of the changing economy to become more economically self-sufficient.

City government could push much harder to promote small businesses. San Francisco could use its financial might to pressure its own bankers to invest in and loan to local businesses. There is already legislation on the books, the Community Reinvestment Act, which requires that banks that do business here devote a portion of their lending to the local community. This legislation needs to be strengthened – and enforced.

San Francisco could also use its own purchases to give market support to local business. Such a policy is in place, but is not enforced.

The City could also make it easy to invest in local businesses. Banks who want to do business in the City could be required to support a local venture capital fund, including a local micro-finance fund. This fund could also accept direct investment from local small investors, allowing neighbors to invest in neighborhood businesses. (Here's one example of an opportunity San Francisco is missing: The California Clean Tech Open Competition is a contest held right here in San Francisco for putative clean tech startups. Most of the winners are local; many are students at the Presidio School of Management. The 2008 winners got seed money and free rent for a year - in San Jose.)

San Francisco needs to orient the business tax toward small businesses by making it progressive, based on gross receipts, not payroll, with an exemption for micro businesses. Such a tax change could raise needed revenue, too.

4.4 RECOMMENDATIONS

4.4.1 Require the Controller's Office and other departments to consider rising energy prices when evaluating potential policies and legislation.

4.4.2 Direct the Office of Economic and Workforce Development to revise the Economic Strategy Report in light of increasing fossil fuel prices.

4.4.3 Direct the Controller's Office to prepare a report on San Francisco's balance of trade, with attention to identifying key imports. Follow this with the creation of a strategic plan to find or develop local sources of these inputs.

4.4.4 Expand and enforce the City's own policy of sourcing locally for City purchases.

4.4.5 Resume development of a project to make high-speed internet available to all residents throughout the city.

4.4.6 Establish local venture capital and micro-lending funds.

4.4.7 Revise the City's business tax to be assessed on gross receipts as it used to be, and to be progressive, with an exemption for the smallest businesses.

4.4.8 Look for new revenue sources for City government to fund the transition despite declining revenues from current sources (See 4.3.2):

- **Carbon tax**
- **Progressive business tax**
- **Demand-sensitive parking fees**
- **City vehicle tax**
- **Gasoline tax based on price floor**
- **Borrowing against future savings**

4.4.9 Develop the southeast waterfront to take advantage of the coming rise in short haul water freight.

4.4.10 Evaluate plans for new or improved infrastructure to avoid "orphan" projects which will lose their rationale in light of Peak Oil & Gas.

4.4.11 Enlarge railway tunnel access to the port.

4.4.12 Formulate a plan to build a modern freight rail facility in San Francisco.

Chapter 5
FOOD SECURITY

5.1 ASSESSMENT OF CURRENT SITUATION

5.1.1 The nation's industrial food system is dangerously dependent on petroleum.

When fuel shortages eventually occur, this dependence will compromise our ability to grow the food we need for our basic survival. Although you don't find any oil on your dinner plate, petroleum and other fossil fuels are inside almost every bite we eat. At least one-tenth of all US energy is swallowed by our highly industrialized and centralized food system.[1] The synthetic nitrogen fertilizers that are essential for high crop yields are a byproduct of natural gas. Gasoline and diesel fuels power the combines that rumble through the grain fields. Millions of kilowatts of electricity are burned up in the factories that process the packaged goods that line the supermarket shelves. And then there's the fuel required simply to get food to market – we now have a globalized food system, one in which the typical American meal travels 1,500 miles from farm to fork. Organic products — though they may have a more sustainable veneer — are in many respects no different; 10 percent of organic products come from abroad.

According to Peak Oil researcher Richard Heinberg, for every calorie of food we produce, we need to expend about 10 calories of fossil fuels.[2] This is an unsustainable equation, and under our current food system, an interruption in petroleum supplies would put us all on a strict diet.

The dangerously tight connection between oil and food was on display in 2008 when high oil costs contributed to a spike in commodity prices. At that time, global prices for crucial commodities such as corn, wheat, and rice doubled or even tripled, sparking food riots around the world. In the US, food continues to be abundant, but consumers have also been hit with rising costs: the price of eggs rose about 40 percent in 2008, and has only slowly come back down.[3]

There are several reasons for skyrocketing food prices. Climate change is likely playing a role. The biofuels boom is also a culprit, as significant acreage is set aside to cultivate crops that — in the words of author Raj Patel — are being "set on fire." The volatility in fossil fuel prices has also forced food production costs upward. Artificial nitrogen fertilizers are a key example. According to the US Department of Agriculture, in 2007 farmers were paying more than twice as much for fertilizers as they were in 2000.[5] As *New York Times* columnist Paul Krugman has put it, "Cheap food, like cheap oil, may be a thing of the past."[6]

5.1.2 Fortunately, San Francisco is blessed to be located within a region of impressive agricultural assets.

California's mild Mediterranean climate is ideal for growing a diverse range of fruits, vegetables and grains, and the oak and grassland savannah of the state is perfect for grazing livestock. At the same time, the region enjoys important cultural advantages. San Francisco is among the "foodie" capitals of the country, and the appreciation for fine foods has helped re-establish regional food systems via farmers markets, Community Supported

Agricultural (CSA) programs, and restaurants and groceries that prioritize selling locally produced foods. According to a report published in September 2008 by the American Farmland Trust and Sustainable Agriculture Education (SAGE), in the San Francisco "foodshed," food production for sale directly to customers is increasing at about 9% a year.[7]

The San Francisco Foodshed Assessment by SAGE and American Farmland Trust concentrated its research on the food produced within a 100-mile radius of the Golden Gate Bridge. While this is an essentially arbitrary number (it excludes important food producing counties such as Fresno and Tulare), the 100-mile figure is useful shorthand for defining a "local" food system in a petroleum scarce future.

The Foodshed Assessment discovered that, in gross aggregate terms, the region is food self-sufficient. The City and County of San Francisco consumes about 935,000 tons of food a year; the Bay Area as a whole eats about 5.9 million tons of food annually. Within the 100-mile radius, roughly 20 million tons of food — including more than 80 separate commodities — are produced a year. Using current cultivation methods, the region is, in fact, capable of growing enough food to feed itself.

But the picture becomes more complicated when considering exactly what types of foods are produced, and where they are eventually eaten. Northern California agriculture — a $10 billion industry, or one-quarter of the state's total food economy — is highly concentrated on the most lucrative fruits, vegetables, nuts, and dairy products. Grains account for only 4% of the foodshed's agricultural production. This is less an issue of environmental capacity — many grains can thrive in the area's soils and climates — than it is a matter of economics. It is not financially wise to grow bulk commodities on expensive land.

Chicken in Community Garden, San Francisco

5.1.3 The Foodshed Assessment concluded that certain key foods are not currently produced or grown sufficiently to meet the region's needs: eggs, citrus fruit, wheat, corn, pork, and potatoes.

Our globalized food system is to blame for the contradiction of simultaneous abundance and scarcity. Much of the food grown in the region is destined for export to other parts of the country — or even, in the case of wine grapes, other parts of the world. The rich soils of the Salinas Valley in Monterey County are a good example of the dynamics at play. The area accounts for one-third of the vegetable production in the foodshed study area. Yet the vast majority of the area's harvest is consumed in other parts of the US; the Salinas Valley, often referred to as "The Nation's Salad Bowl," grows more than half of the lettuce eaten in the US.

While salad mix, almonds, and wine might make for a nice appetizer, it's hardly a recipe for a well-balanced diet. Farmers and policy makers need to reconsider whether growing food for export is the wisest course, and whether the region's fertile soils couldn't be better used to grow a variety of crops for regional consumption. Yolo County organic grower Paul Muller of Full Belly Farm summarizes the challenge: "We have spent 100 years dismantling America's local food systems. It's time to grow them back."[8]

5.2 VULNERABILITIES

The global food system's susceptibility to fossil fuel price increases poses a major challenge to maintaining food security in San Francisco. As fuel prices rise, they will push food costs upward. At first, this will mean additional stress on families' budgets as City residents are pressed to maintain their food consumption habits. While rising food costs will affect all San Franciscans, pressures will be especially acute for City households that are already on the brink of hunger. According to the San Francisco Food Bank, nearly 150,000 residents — or almost one-fifth of the population — are currently at risk of hunger.[9]

The greater risk is that price shocks will eventually translate into physical shortages, and that food will become scarce for all residents, regardless of income levels. Such a scenario is nothing short of a public health emergency.

If that were to occur, the food crisis would not be limited to San Francisco, of course, but would likely affect the nation as a whole. This is the key weakness of a globalized food system: All local communities are vulnerable to disruptions in the long and complicated industrial food chain. The best strategy to reduce this vulnerability, then, is to re-regionalize our food system.

5.3 GOALS AND STRATEGIES

To meet the Peak Oil & Gas challenge and create a largely fossil fuel-free food system, San Francisco must pursue two key policy tracks. The first is to work with regional policy makers (such as ABAG, the Association of Bay Area Governments) to encourage diversified regional food production while at the same time strengthening regional freight networks by investing in rail and water transport. The second is to vastly increase San Francisco food production by encouraging vacant or underutilized land to be used for gardening and to equip residents with the skills and materials they need to be successful gardeners.

It should be noted that these parallel efforts are closely related. As San Francisco begins to distinguish itself as a leader in urban food cultivation, City leaders will be better poised to encourage other Bay Area officials to reconsider their current land use policies.

5.3.1 Diversify Regional Agriculture and Rebuild Efficient Transportation Networks.

A century ago, in an era before utter reliance on petroleum, San Francisco was a thriving cosmopolitan city of roughly 350,000 people that was able to feed itself mostly from the bounty of the surrounding countryside. While certain key factors have changed — most obviously the loss of farmland due to suburban sprawl — it seems reasonable that, with determined political energy, a similar system could be reestablished in the 21st century.

Successfully recreating a local food system will require diversifying agricultural land use to include more grain and humane meat production; encouraging farmers to adopt organic and sustainable methods; and improving transportation links from the farm fields to the urban center.

One way of encouraging a diversification in agricultural production is by protecting the region's endangered farmlands. There are roughly 10 million acres of land in the 25 counties that lie at least partially within a 100-mile radius of the Golden Gate Bridge. According to the Foodshed Assessment, only about half of that land is used for agriculture.[10] One reason for this is the high real estate prices in the region. Every year, valuable

croplands are lost to sprawling development; one out of seven acres of urban land in the foodshed study has been developed just since 1990. While Peak Oil will likely halt suburban sprawl and force a cutback in long-distance food shipping, it is still important that county and municipal governments take steps to protect agricultural lands. This could take the form of local governments encouraging farmers to put their lands into agricultural conservation easements and providing additional property tax rebates to growers. San Francisco's elected officials should use their influence with policymakers in nearby counties to promote such land use policies.

At the same time, San Francisco could help diversify regional food production by making a commitment to buying locally. The City should commit to buying as much locally grown food as possible for public institutions such as schools, hospitals, prisons, and government agencies. The City should also encourage private companies to purchase locally grown foods for their cafeterias, and to offer employees incentives for joining CSA programs.

But even a well-diversified regional food system will be dependent on fossil fuels. It's safe to assume that, even in the case of acute fuel shortages, agricultural production will be prioritized as an essential service — the tractors will keep running long after the casual trips to the shopping mall have been wrung out of the system. Nevertheless, it's important for growers to pursue measures to reduce their reliance on fossil fuels. One way of doing this is to adopt organic practices and break their dependence on chemical fertilizers. Another is to pursue low-till and no-till cultivation methods that will require fewer tractor hours. Improving irrigation efficiency is also important, as water pumping is the number one use of electricity in California.[11]

Local policy makers can promote a shift to sustainable agriculture by offering industrial growers a property tax rebate if they transition to organic methods, as Woodbury County, Iowa has done.[12] San Francisco's elected officials should use their influence with their peers in other governments to encourage such innovative policies.

Perhaps the most important way to reduce the food system's reliance on petroleum and encourage diversified regional production is by strengthening farm-to-market distribution systems. Re-investing in medium distance food freight systems should be a top priority for San Francisco and Bay Area policy makers.

Much of the food that comes into the City arrives here via the San Francisco Wholesale Market and the South San Francisco Produce Terminal. An immediate priority should be rebuilding the rail networks that once linked these depots to the Peninsula and, by extension, to the rest of the state. The City should also pursue rebuilding the freight-handling capacity of the Embarcadero. Reconstructed barge and rail terminals along the waterfront would allow for the shipment of foodstuffs from the Sacramento Valley as well as from Napa and Sonoma counties via the Petaluma River. (For additional recommendations on freight handling, see the Transportation section of this report.)

By encouraging a rethinking of current agricultural practices in Northern California and reestablishing more efficient food distribution, San Francisco leaders can help ensure a steady food supply into the City.

5.3.2 Create a Garden Within the City.

With its high population density, small land area, and cool, foggy climate, San Francisco is unlikely to ever be food self-sufficient. Nevertheless, there are huge opportunities for dramatically increasing food production within the City's 49 square miles.

By providing residents with the skills and the resources to start growing some of their own food, San Francisco could become a model of urban food production. This would, most obviously, bolster the City's own food

security. Equally important, by demonstrating leadership on the issue, San Francisco's elected officials would be better placed to encourage policy makers in surrounding counties to rethink their current land use.

Historical precedents and contemporary examples from other countries show that there is great potential for San Francisco to boost its agricultural production.

Perhaps the best-known example of urban food cultivation is the World War II (WWII) Victory Garden program. In an effort to free up food for the soldiers (as well as to reduce the amount of fuel needed to transport food for civilians), the government encouraged citizens to grow some of their own fruits and vegetables. Some 20 million Americans answered the call, and by the end of the war nearly 40 percent of fruits and vegetables were coming from backyard or community gardens.[13] In San Francisco, part of the lawn in front of City Hall was converted into a vegetable garden, and there were more than 250 garden plots set up in Golden Gate Park.[14]

More recently, Havana, Cuba has shown that widespread, medium-scale urban farming can fulfill nearly all of a City's fruit and vegetable needs. In a kind of dress rehearsal for global Peak Oil, the island nation of Cuba has struggled with a collapse in petroleum availability when the Soviet Union dissolved, and Cuba's access to oil dried up. Wracked with hunger, Cubans responded by creating urban gardens throughout the country. Today, Havana organically produces more than 80 percent of its fruits and vegetables.[15]

Unfortunately, the City and County of San Francisco is not doing as much as it can to follow these historical and international models and encourage residential food production. Currently, the City spends less than half a million dollars a year on food production programs and horticulture education.[16] (This does not include programs paid for by the San Francisco Unified School District or the Community College District.) With a budget of more than $6 billion, this accounts for a fraction of one percent.

The lack of public resources dedicated to local food production is disappointing when contrasted with the surprisingly large amount of land available in the City. The San Francisco Department of Public Works (SFDPW) estimates that there are some 400 acres of public right of way suitable for conversion into public gardens.[17] This does not include properties owned by the SFPUC, the SFUSD, or the Port Authority, which could include dozens of additional acres.

There are also hundreds of privately owned but vacant lots within the City that could be converted into productive food gardens. A survey done by Kevin Bayuk of the San Francisco Permaculture Guild and the Urban Alliance for Sustainability discovered 950 vacant lots covering 108 acres. This is likely a conservative estimate.[18]

Additionally, private backyards are likely being underutilized. Amy Franchesini of Future Farmers and the San Francisco Victory Garden project, using block and lot numbers from the San Francisco Planning Department, estimates that there are 1,887 acres of backyard space in City. While there is little way of knowing how these spaces are being used, it's safe to assume that only a small fraction are employed for home food cultivation.[19]

Finally, there is the significant amount of space in the City's parks and public golf courses. In a densely built environment, these green areas provide a valuable recreational purpose. Nevertheless, some portion of these parklands and golf courses could be converted into food gardens, just as they were during the height of WWII.

If put into production, these vacant or underutilized lands would dwarf the acreage currently used by the City's 50 Community Gardens. Since there is, in fact, significant land that can be used for urban food cultivation, the question is: How can the City best take advantage of this surprising resource?

There are two main challenges to address: Making vacant and underutilized land available to residents; and funding programs that will give residents the technical skills and physical resources to grow some of their own food.

In an effort to address those challenges, a select group of City staffers and local community leaders involved in the San Francisco food system gathered at the Main Library on May 6, 2008 for a design charette to imagine how to dramatically boost food production with the City's limits.[20]

Currently, demand for gardening space is outstripping supply — most of the City's community gardens have long waiting lists, and when the Garden for the Environment announced its plans to install backyard vegetable gardens, its staff received nearly 200 applications for 15 available Victory Gardens.[21]

Participants at the design charrette suggested many possible ways of guaranteeing universal access to vegetable gardening spaces. Among other actions, the City should encourage residents to plant fruit trees along their sidewalks and facilitate the removal of curbside concrete to plant sidewalk gardens. To ensure that private backyards are fully utilized, the City could offer special property tax rebates and water discounts for residents who can demonstrate they are growing food. Similarly, the City should offer property owners special incentives to encourage them to allow gardeners to grow food on any vacant parcels. For property owners who have no plans to develop their parcels, the City should pursue creating special agricultural conservation easements. Additionally, the City could offer homeowners incentives for tearing down backyard fences and encouraging whole-block vegetable cultivation and composting, which would likely lead to greater harvests. Similar incentive plans for home water catchment, gray water systems, rooftop gardening, and beekeeping should also be considered. The City should also investigate the feasibility of "vertical farming"—using the sides of buildings to grow crops — and of organic hydroponics. The consensus at the gathering was that no open space should be allowed to go to waste: The highest and best use of unoccupied or underutilized land is to grow food on it.

But even if the City were to guarantee universal access to vegetable gardening spaces, many residents might not take advantage of the opportunity because they would not feel capable of growing their food. Having only experienced an industrial, centralized food system, three generations of people are ignorant of the basic principles of home food cultivation.

It is crucial, then, that the City also provide resources to train people in basic horticultural skills. The City should dramatically expand funding for food production education programs (like those that currently take place at Garden for the Environment). At the same time, City departments should work closely with staff at the SFUSD and CCSF to ensure that horticulture training is available to people of all ages and income levels. The City should consider creating a Bureau of Agriculture – housed within either SFE, the San Francisco Recreation and Park Department (SFRPD), or the San Francisco Department of Public Health (SFDPH) – that would employ neighborhood horticulture extension agents to help train community gardeners. Part of the Bureau of Agriculture's responsibilities could include organizing public education campaigns on food preservation and the ecological benefits of a less meat-heavy diet.

Aside from providing technical training, the City can also bolster local food production by providing essential gardening materials to residents (at reduced costs, depending on income). For example, the City should establish a citywide materials depot where residents would be able to get quality organic compost, mulches, seeds, vegetable starts, and irrigation equipment. The City should also consider establishing a seed bank where community gardeners could buy, sell and trade seeds specially bred for San Francisco's climate.

Participants at the design charrette had other innovative suggestions for City officials. For example, the City should rewrite the rules regarding small scale animal husbandry to allow residents to keep more chickens and rabbits than currently permitted, while also allowing residents to keep a small number of goats and hogs. The City should also reduce the number of miles that the municipal compost has to travel and create a plan for more neighborhood composting as well as vermicomposting (worm) systems. Another important opportunity for local food production is aquaculture, and it was suggested that the City should investigate what types of aquaculture may work along the Bay and Pacific shorelines. Remodeling the City's composting system and establishing an aquaculture fishery could become the responsibility of a newly created Bureau of Agriculture.

Finally, participants suggested that the City could help pay for these investments by placing a new tax/fee on sales of fast food items within San Francisco.

Even if the City were to aggressively pursue a local food production strategy, San Francisco will always be dependent on the surrounding counties for much of our caloric needs. But by producing some of our own fruits, vegetables, and eggs, the City can reduce its reliance on surrounding farmers and, crucially, free up acreage that can then be dedicated to grain production and livestock raising unsuitable for San Francisco.

5.4 RECOMMENDATIONS

5.4.1 Implement a "Buy Local First" food purchasing policy as a way of bolstering regional food production. Public institutions should seek to purchase regionally grown food whenever possible.

5.4.2 Create a Bureau of Agriculture that will empower residents to be their own food producers.

5.4.3 Undertake a comprehensive evaluation of public parklands, San Francisco Department of Public Works (SFDPW) rights-of-way, and SFPUC, Port Authority, and San Francisco Housing Authority (SFHA) properties to determine what vacant parcels can be used for food cultivation. The Recreation and Park Department should study what portions of parklands and golf courses could be transitioned from recreational to food production uses.

5.4.4 Investigate offering private property owners property tax rebates or water bill rebates for transitioning vacant or underutilized land to food production.

5.4.5 Dramatically expand funding for food production education programs and work closely with the SFUSD and city government to coordinate citywide horticultural trainings.

5.4.6 Investigate instituting a tax on fast food sales to pay for local food production and education programs.

5.4.7 Create a materials depot (or multiple depots) where residents can access (at reduced cost, depending upon income) essential materials such as organic compost, and possibly seeds, vegetable starts, hand tools, and irrigation equipment.

(continues on next page)

5.4.8 The SFDPW should clarify its regulations regarding street tree planting and actively encourage residents to plant productive fruit and nut trees. SFDPW should also actively encourage residents to remove sidewalk concrete (while maintaining Americans with Disabilities Act corridors) and plant street-side gardens.

5.4.9 The Department of Public Health should rewrite the rules surrounding small-scale animal husbandry to allow for an increase in the number of chickens and rabbits that can be kept, while also allowing residents to keep a small number of goats and hogs.

5.4.10 SFE should develop a plan for reducing the number of miles the municipal compost travels and begin a program of block or neighborhood compost centers.

5.4.11 SFE should investigate the potential of innovative technologies such as water catchments systems, gray water systems, vertical farming, and local aquaculture to boost local food production.

5.4.12 City officials should use their influence with elected officials in nearby counties to encourage new incentives — such as agricultural conservation easements — to protect farmland. City officials should also encourage their peers to promote a transition to more diverse and sustainable farming methods by offering property tax rebates to farmers switching to more ecologically sound practices.

5.4.13 Begin studying how to re-establish rail and barge freight lines into San Francisco.

Chapter 6
TRANSPORTATION

6.1 ASSESSMENT OF CURRENT SITUATION

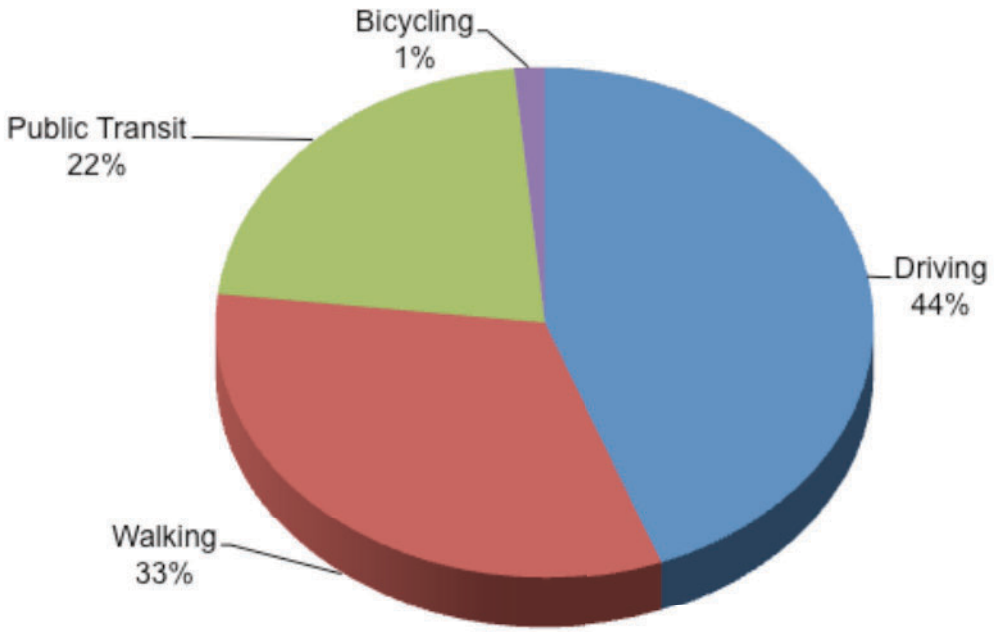
6.1.1 Passenger Transportation

6.1.1.1 Automobiles

Compared to most other U.S. cities, San Francisco has an exceptionally diverse transportation system.

An Metropolitan Transportation Commission (MTC) study indicates that within city limits, driving trips are fewer than half of total trips.[1] (See chart below based on MTC data.) Inter-county auto use is substantially higher, with around 80% of round trips into the city, and 90% of round trips into the surrounding counties, taken in an automobile.[2]

Prevalence of Transportation Modes Within San Francisco



As is typical of dense urban environments, San Francisco has relatively low automobile use: while the average American household has 2.28 cars,[3] San Francisco averages 1.1 cars per household.[4] The vast majority of private automobiles operated in San Francisco are conventional, gasoline-only, non-hybrid vehicles. San Francisco residents purchase substantially more hybrid vehicles than the national average, but fewer than 0.48% of cars in the San Francisco metro area are hybrids (a figure higher than every other metro area in the country except for Portland, Oregon).[5]

San Francisco has officially adopted a city policy of "transit-first" and voters have repeatedly supported this policy. However, there continues to be tension between the interests of driving and those of walking, bicycling, and transit. Most recently, in 2007, voters soundly defeated Measure H, which would have dramatically increased the amount of parking developers would be able to construct throughout the City. Parking is the key factor in determining automobile use; thus, bitter battles are being repeatedly fought over parking policies.

6.1.1.2 Walking

Walking is the second-most prevalent way to get around San Francisco. Though only 9.4% of San Francisco residents walk to work, nearly a third of all trips taken in the City are on foot, meaning a substantial number of San Francisco residents walk for recreational or other non-work purposes. San Francisco's high density and Mediterranean climate make walking a good way of getting around for short trips for most of the year, the famous hills notwithstanding.

6.1.1.3 Transit

Despite the official transit-first policy, only 21.7% of trips taken in the City are on public transit. The main provider of public transit in San Francisco is the San Francisco Municipal Railway (Muni). In the past decade, Muni has provided between 208 million and 235 million rides per year on its light rail vehicles (20% of public transit ridership), buses (electric, 33%, and diesel, 43%), and cable cars (4%).[6]

In a bid to reach clean-air goals, Muni has begun incrementally converting its fleet to hybrid engines. The plan is to convert eventually to purely electric engines powered by hydrogen fuel cells. Currently, every diesel-powered vehicle in the fleet uses 20% biodiesel.[7]

While Muni is the main provider of public transit within San Francisco, a number of other regional transit providers connect to the City from throughout the region as well. San Francisco is working on a Transbay Transit Terminal that will effectively connect most of these different transit services in a single facility. The five-story, 900,000-square-foot facility is expected to serve around 45 million passengers per year, eventually (if all goes as planned) housing AC Transit, Amtrak bus service, BART, Caltrain, Golden Gate Transit, Greyhound, high-speed rail, Muni bus lines, and SamTrans.

6.1.1.4 Bicycles

The MTC study found that bicycling represents 1.5% of trips that start and end within San Francisco. A more recent survey by SFMTA found that 6% of all vehicle trips in the city (not counting pedestrian trips) were made by bicycle. More importantly, the number of bicycle trips is climbing rapidly, up 25% between 2007 and 2008.[8]

Requiring no fuel and able to make use of roads yet also be brought onto some public transit, bicycles are versatile and efficient. With simple modifications such as headlights, reflectors, and panniers, bicycles can be made suitable for a number of trip purposes, including commuting, shopping, and travel to and from social and cultural events.

San Francisco is a bicycle-friendly city in a number of ways. While its hilly topography does present some challenges, the relatively small size and year-round mild climate of the City allow residents to use bicycles at any time and to ride point-to-point inside the city within an hour. Cycling is also a very visible part of San Francisco's culture: For instance, the San Francisco Bicycle Coalition now claims over 10,000 members, and on the most recent Bike to Work Day, Market Street had more bicycle traffic than car traffic during peak commute hours.[9]

6.1.2 Freight transportation

6.1.2.1 Trucking

San Francisco is perched at the end of a peninsula, with virtually all cargo arriving by truck. Even air freight is trucked up from the airport. The one exception is the import of bulk aggregate (gravel) by barge to pier 80. Nearly all material exports also leave by truck.

For domestic shipping, the U.S. economy is also centered on trucking. According to the 2002 Commodity Flow Survey, 67% of all ton-miles in the U.S. were shipped by truck.[10]

6.1.2.2 Water freight

Waterborne transport is about 20% more energy efficient than railroad transport, which in turn is about eleven *times* more energy efficient per ton than truck transport[11]. There is some dispute as to the exact efficiency difference between water and truck transport, but it is certainly an order of magnitude. Energy has been so cheap that trucking's flexibility has been more valuable despite its far higher energy cost. Truck transport trips are shorter on average than rail or water trips, and its cargo less dense.

The Port of San Francisco consists of "finger piers" and other industrial piers, which are not well suited for intermodal (container) shipping. Today, there are 39 piers remaining. Between the gradual de-industrialization of the city and the rise of containerized cargo, the industrial potential of the port of San Francisco has long been neglected, and many, though not all, of these piers are in disrepair. Oakland has better infrastructure and geography to handle multi-modal freight, but there is a strong possibility that short-haul coastal and river shipping will increase significantly in volume, reviving the fortunes of the Port of San Francisco.

Certain piers especially deserve a closer look. Pier 80, the breakbulk (pallet) cargo terminal, has tremendous potential. It is a deep water pier with on-dock rail access, as well as home to a complex of historic Victorian-era brick industrial structures. The Pier 90 complex houses the city's recycling facility and some freight handing, but could be used for much more.

6.1.2.3 Rail freight

In common with many other cities and towns, San Francisco has drastically curtailed its freight rail capacity. The only remaining freight rail line into the city comes up the peninsula, sharing track with Caltrain, before turning east toward piers 80 and 90-96. It runs through a tunnel that is too low for modern freight rail operations. When Caltrain electrifies its trains, the electric lines will be overhead, making the problem even worse.

6.1.2.4 Air freight

Air freight arrives at both San Francisco International Airport (SFO) and Oakland Airport, in approximately equal volume.[12] However, SFO handles 93.2% of the international cargo. Cargo processed through SFO is more valuable, totaling $63.8 billion in value, and ranking San Francisco fourth in value in the U.S. At SFO, 57 airlines handle cargo in 989,000 square feet of office and warehouse space. Seventeen of these are cargo-only airlines.

Package shippers such as United Parcel Service (UPS) and Federal Express (FedEx) are a vital part of San Francisco's economy. Currently, they ship by air and truck. In the financial district, bicycle carriers dominate courier services due to traffic congestion and a dearth of parking.

6.2 VULNERABILITIES

The transportation challenges in a city as compact and dense as San Francisco are surmountable, but even so, moving people and goods around quickly and efficiently may prove difficult should there be energy scarcity. Even more difficult will be transportation between the city and the surrounding area, and between the city and the rest of the world.

6.2.1 Today, 45% of energy used in San Francisco is consumed in the form of vehicle fuel.

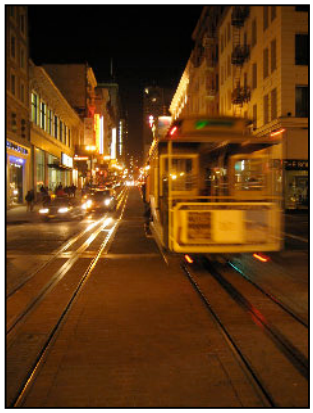
(See Chapter 3 on energy for details of energy use.) This is both a challenge and an opportunity. Approximately half of this is used for travel within the city limits. The portion used for package delivery and other freight operations is not known; however the vast majority of cargo hauling within the Bay Area is accomplished by diesel truck.

The median age of automobiles in America today is nine years[13]; assuming this holds, even if starting tomorrow every new vehicle sold in America were a hybrid or electric car, by 2018, half of the autos on the road would still run on conventional, non-hybrid, gasoline engines.

But the rate of replacement of conventional autos by hybrids is nowhere near 100%. During the first ten months of 2008, 2.4% of new autos sold in the U.S. were hybrid vehicles; of those, 15% were SUV or luxury vehicles that achieve fewer than 30 miles per gallon in city driving. As previously mentioned, fewer than one-half of one percent of cars in the San Francisco Bay Area are hybrids. And hybrids still need fossil fuels or fossil-fuel substitutes, albeit less. Hybrids are not being developed fast enough and are still not fuel-efficient enough to make a substantial difference on their own in reducing domestic oil consumption.

6.2.2 The municipal transit system does not have the capacity to handle a substantial increase in ridership.

Automobiles will be affected more by Peak Oil than any other transportation option, but no mode of transportation will go unaffected: A shift away from automobile use, the most common mode of transportation, will dramatically increase the number of people using other means to get around. Those likely to be first and hardest impacted by forced mode shift are populations already on the margins who will find themselves unable to keep up with spiking fuel prices. However, very quickly, members of all economic strata in San Francisco will feel the impacts of the low-energy environment that will be imposed upon the City. While there is substantial capacity in the existing networks for increases in bicycle and pedestrian use, public transportation networks will likely struggle to cope with increased passenger loads. Even without the impact of Peak Oil, San Francisco forecasts an increase in ridership based on projections by the Association of Bay Area Governments that project San Francisco's population to grow by 19.5% in the next 35 years.[14] The system already suffers from overcrowding on a number of lines, and gas-price-induced ridership spikes in 2008 demonstrated that San Francisco can expect to see tremendous increases in passenger volume when fuel prices rise again.



Muni has a backlog of capital needs just to maintain the current level of service. In 2007, Muni projected twenty-year capital-cost expenses of $20.1 billion; however, only $11.1 billion in revenue is currently projected over that time period, leaving a $9 billion shortfall.[15] A study commissioned by the Mayor's office in 2007 calculated that it would take a capital investment of $125 million to equip Muni to handle a 17.5% increase in ridership, $519 million for a 47.5% increase, and $886 million for a 77.5% increase.[16] When San Franciscans attempt to shift from driving to transit, as they surely will, the municipal transit system could be overwhelmed unless Muni begins adding capacity now.

6.2.3 Too much of Muni's funding is auto-based.

Funding for the operation of the municipal transportation system comes from a variety of sources. Unfortunately, many of the largest sources are auto-based, including bridge tolls, parking tickets, parking fees, and the like. In fact, in the fiscal year ending June 2008, $134 million of Muni's $703 million in operating costs – 19% - is generated by the Department of Parking and Traffic.[17] These sources are appropriate and should be continued, even expanded, but unless costs to drivers are increased, the amount provided to Muni will decline as San Franciscans drive less, and own fewer cars.

6.2.4 Electric cars cannot replace the current vehicle fleet.

There are alternatives to the conventional auto that do not use petroleum at all. One such automobile type is the plug-in electric car. However, there are significant infrastructure challenges in bringing electric vehicle use up to any meaningful scale. Electric vehicles require hours to fully charge, which eliminates the possibility of establishing charging stations that, like gas stations, could quickly recharge the vehicles.

Even if the City were willing to spend the necessary funds to build and maintain citywide electric-car-charging infrastructure, San Francisco does not have access to the significant electrical power that would be necessary

to charge more than a fraction of the vehicles on the road: A recent study estimates that, given current capacity, California's electric grid would be unable to handle the conversion of more than 15% of the current automobile stock to electric vehicles.[18]

6.2.5 Bicycle transportation faces many hurdles.

Only some challenges will be mitigated by the implementation of the Bicycle Plan. Cycling seems dangerous, adequately securing a bicycle and its accessories is difficult or impossible, and use of a bicycle requires ownership, as there exists no bicycle-sharing program in San Francisco (though such systems are currently being pursued by the City).[19]

6.2.6 Air travel is exceptionally vulnerable to fuel price increases.

Such an effect was already demonstrated during 2007 and 2008, when the increase in the price of oil caused sharp increases in plane fare and drove several airlines into bankruptcy.[20] (Because of the direct connection to the broader economy at large, air travel is covered in greater depth in Chapter 4, Economy.)

6.2.7 The U.S. economy will be damaged by rising trucking costs.

This will affect San Francisco both directly, in higher costs of American goods, and indirectly through the broader economy. The Task Force expects that there will be a worldwide mode shift in the transportation of cargo, because of the differences in relative efficiency of air, truck, rail, and water transportation. Air freight will decline in predominance, while rail will gain market share. Short sea shipping will likely make a comeback. Already the U.S. Maritime Administration is sponsoring a public-private cooperative venture to promote a coastal marine highway connecting Oregon and California. As a major manufacturing center, Los Angeles is another likely node in a network of coastal shipping routes. In the future, food is another probable product for shipping to the Bay Area by water.

Within the U.S., it will be very difficult to move away from trucks because our entire infrastructure is focused on roads for moving most goods. Though energy efficiency will become much more important, it will be difficult, if not impossible, to move a significant portion of freight from truck to rail. One rail analyst asserts that the nation's 140,000 miles of rails are so congested they cannot handle even an increase of 25%.[21] Major investment will be needed to keep America's rail system functional, not to mention efficient.

In contrast to our counterparts in Europe and Japan, the United States has failed to update its rail system. Europe and Japan have not only invested in rail, but in *electric* trains, even for cargo, giving them fuel flexibility. Europe also has an extensive system of river and canal cargo routes. In contrast, the U.S. transportation system is based on diesel trucks, diesel trains, and kerosene airplane fuel. The American economy will be at an ever greater competitive disadvantage as fuel prices increase. (For more on the economy, see Chapter 4.)

6.2.8 San Francisco has limited cargo alternatives.

San Francisco's economic drivers are primarily services, but even producing these requires substantial cargo hauling. Package delivery is particularly vital. In addition, San Francisco residents require food and other products. Rail access is limited by the inadequate size of the current tunnel, which forms a choke point against expanded freight rail. The City urgently needs to develop freight access other than by truck, or it will find itself at an economic disadvantage compared to other cities that have alternative cargo infrastructure.

6.3 GOALS AND STRATEGIES

Many of the goals and strategies of Peak Oil & Gas preparation are very similar to those used in climate change mitigation. Specifically, both focus heavily on the importance of transitioning away from fossil fuel use. The major difference is that while the effects of climate change are obviously of tremendous concern, none of those consequences make fossil fuel use more expensive or difficult. Carbon reduction strategies operate on the assumption that we should reduce fossil fuel consumption because we *ought* to in order to ward off myriad negative consequences.

Peak Oil & Gas preparation, on the other hand, is not about reducing consumption because of the consequences of failing to do so. Due to declining supply, we will have no choice: Our consumption of fossil fuels *will fall*. The challenge of Peak Oil & Gas are not to induce people away from fossil fuel consumption, but in preparing for changes in transportation modes and lifestyles that will occur regardless of how the world prepares. When the impact of Peak Oil & Gas makes driving more expensive, for instance, people will want to use alternative transportation. The challenge is to ensure that alternatives are available in sufficient quantity when San Franciscans are ready to shift travel modes.

6.3.1 Identify funding for and move ahead with Muni capacity expansion plans.

Any realistic, post-Peak transportation scenario must have a robust public transit network as its backbone. While private auto use will continue for at least some time to be a dominant mode of travel, and walking and bicycling will serve residents traveling inside their own neighborhoods or those nearby, it is public transportation that will make it possible to travel from one end of San Francisco to another, or out of the city entirely, without being dependent on fossil fuels. As oil prices rose through 2008, transit ridership spiked. This will occur again, probably even more acutely, when oil prices go up again.

The necessity for increased transit capacity means considering all possible ways to raise money, including additional sales taxes, assessment districts, public-private partnerships, and other funding sources. Many funding sources are based on auto use (parking fees and the like). These sources should be continued and expanded for the time being, but with the clear understanding that they are problematic in the long term.

6.3.2 Electrify Muni as much as possible.

As part of its Clean Air Plan, Muni proposes to gradually replace older diesel buses with hybrid-electric buses, moving by 2020 to a zero-emissions fleet composed of fuel-cell, electric-drive vehicles. This is not good long range planning from a Peak Oil & Gas perspective. Assuming that hydrogen fuel cell buses are commercially viable in time for this transition (which is not at all clear), they are dependent upon natural gas to produce the hydrogen, as a source either of hydrogen, or, using electrolysis of water, of fuel for electricity generation. Overall, fuel cell buses are intrinsically much more expensive and less fuel-efficient than trolley buses. Moreover, the electricity for the trolley system comes from the city-owned Hetch-Hetchy hydroelectric plant. It is cheap, stable, and has no link to fossil fuels. MUNI already has

in place a Trolley Expansion Plan to extend trolley lines to the underserved southeast areas of the city. It is past time to implement this plan.

6.3.3 Relieve pressure on the system through smart land-use planning.

One of the best methods of easing the burden on San Francisco's transportation system is to minimize the necessity of its use. Clearly, San Francisco should continue to provide comprehensive, robust transportation options to its residents and visitors, but if individuals are able to find their needs in their neighborhoods – jobs, groceries, places of social and cultural value – then they will not need to rely on public transit or take a spot in traffic. Thus, neighborhood-friendly zoning that focuses on mixed use and encourages transit-oriented development not only increases the social cohesion of San Francisco's neighborhoods, but makes them more transportation-efficient as well. San Francisco should also encourage telecommuting to allow residents who are able to eliminate their commute entirely.

6.3.4 Proactively reduce auto use in the city.

When gasoline prices sharply rise and supplies become unreliable, mode shift will occur regardless of whether San Francisco plans for it or not. San Francisco should not be merely reactive to an increased demand for non-auto transportation. On the contrary, the City should actively *induce* shifts away from automobile use toward more efficient and sustainable alternatives as vigorously and as soon as possible. Encouraging a shift away from autos now, before conditions worsen, will help ease the challenges San Francisco residents may face later. This is in part because, if populations that would shift suddenly away from car use can be induced instead to gradually make that shift, the transportation system will have time to grow and adapt where necessary instead of being victim to explosive ridership growth. The City, too, will have lighter infrastructural burdens if the number of automobiles on the road is decreased, lowering maintenance costs and liberating funds.

6.3.5 Reduce *all* automobile use, not just conventional autos.

There are alternatives to the conventional automobile that use less petroleum (hybrids), or none at all (plug-in electric, fuel cell, and alternative fuel autos), and it is tempting to believe that, because these alternatives would be similar to current transportation patterns, the City should focus on encouraging residents to switch from one sort of auto to another more sustainable type.

This would be a mistake and would send a mixed message. Hybrid vehicles lessen, but do not eliminate the need, for fossil fuels. Even hybrids that manage to get 50 to 60 miles per gallon will be costly to fuel if the price of gasoline rises to $8, $10, or $15 per gallon (or beyond). Meanwhile, stunted by a low theoretical ceiling as to the number of vehicles the current electrical system could handle, the electric car should not be seen as a viable replacement for a significant number of internal-combustion engine vehicles in San Francisco. Remember that the theoretical maximum of electric vehicles that the grid in California can charge at night is only 15% of the current fleet. The realistic maximum is even lower; furthermore, the grid will be under additional pressure due to falling natural gas supplies and rising demand as end uses other than transportation switch from fossil fuels to electricity.

6.3.6 Charge actual market rates for public parking.

City-run parking spaces, whether metered or neighborhood spaces, charge rates substantially below what the market will bear. This is effectively a parking subsidy, paid for by the City in lost revenue. San Francisco should raise the price of its parking so that rates are comparable to rates for private garage spaces. Such rate changes can be facilitated by upgrading the technology used to manage parking. For instance, smart meters that make it easy to pay and can automatically deduct funds from users' bank accounts or credit cards are one good option. The San Francisco County Transportation Authority, which administers revenue from the Proposition K sales tax, is testing a smart parking meter program called SF Park.[22] The City should also suspend the construction of City-run parking, as expansion of car use should be discouraged, and conversely, a reduction in future car use will reduce the value of parking lots. In addition, to encourage the use of energy-efficient vehicles, San Francisco should strategically convert some portion of its parking to scooter/motorcycle spaces. This would not only increase City revenues by increasing the density of paid parking, but would provide support to congestion-reducing, energy-efficient transportation.

6.3.7 Discourage the construction of new parking spaces anywhere in the city.

Remember there will be fewer cars in the future. An increase in the price of City-run parking will increase market pressure to construct new, private parking spaces. The City should therefore enact complementary policies that will minimize any expansion of parking, including the removal of any requirement for the provision of parking spaces in new residential developments, and the assessment of impact fees on new parking spaces. The City should also prohibit the conversion of green space to parking, as, once laid, asphalt poisons the land beneath it and leaves it unsuitable for other non-auto-related uses, such as growing food.

6.3.8 Promote car-sharing.

Counter-intuitively, one effective method of reducing car dependency is by increasing auto availability through car-share programs. Car-sharing programs can allow those who would prefer not to own a car, but require one for occasional trips, to make that transition. In addition, the current costs of owning and operating cars are relatively low, but as they inevitably rise, residents may be tempted to give up ownership by the relatively low-cost appeal of car-share programs that are incurred on a trip-by-trip basis. Convenient access to a car-share program will probably be a key element of low-carbon San Francisco. Car-share stations could eventually become the nodes in an electric car-charging network. The City should mandate car-sharing parking stations in every neighborhood and in new developments.

6.3.9 Make bicycling seem – and be – safer, easier, and more secure.

Bicycles have a tremendous amount of promise as a sustainable mode of transportation. It is likely that non-recreational cycling will increase as gasoline costs push people into exploring other options, but greater bicycle use will only take hold if barriers to cycling are actively addressed and eliminated. Thus, it makes sense to increase road safety, bicycle security, and bicycle access.

6.3.9.1 Make the roads safe for cyclists.

San Francisco must strive to make its residents feel safe using bicycles on city streets to get to points of interest both within and beyond their respective neighborhoods. This means establishing well-marked

bicycle lane networks that feature prominent lane striping, or physical barriers to keep cyclists safely separated from auto traffic. The cars are not the only peril cyclists have to worry about: repairing pot holes and other damaged road surfaces where they appear in bicycle lanes has to be a critical priority. And cyclists have road safety responsibilities as well. The City, potentially in partnership with the San Francisco and Bay Area Bicycle Coalitions, should make it a priority to educate cyclists on how City laws and ordinances apply to them.

6.3.9.2 Increase bicycle security.

Cyclists must also feel confident that their bicycles are safe when they have locked them up. The threat of thieves stealing bicycles or bicycle parts is very high in San Francisco; in 2008, San Francisco ranked #4 on Kryptonite Locks' top-ten list of the worst cities in the country for bicycle theft.[23] And, of course, the more expensive a bicycle is, the more worried its owner will be about its theft, and the more it is a prize target for thieves. This means that, ironically, the more one has invested in one's bicycle, the more worried that individual may be about actually using it on City streets. While there are currently bicycle *racks* in various parts of the City, San Francisco should consider widespread bicycle *locker* installations, so that City cyclists can feel safe leaving their bicycles for hours at a time without concern that pieces will be stolen, or that the bicycles will be left completely exposed to the elements. To make cycling competitive with auto use, San Francisco should consider partnering with auto garages to install bicycle lockers on their premises, potentially paid for with a city-wide, fee-based cyclist membership system.

6.3.9.3 Implement a bicycle-sharing program.

Through City Car Share and other similar programs, drivers can rent any of a range of vehicles suited for different activities, use them for a few hours or for days, and return them to convenient, reserved on-street parking spaces. Currently, no such program exists in San Francisco for bicycles. A bike-share program in San Francisco, similar to the successful ones in Paris, Berlin, and Washington, D.C., will be a key element of a functioning post-peak transportation system.

6.3.9.4 Explore package delivery by bicycle or other alternative vehicles.

San Francisco's compact geography and mild climate could work to its advantage with respect to delivery of smaller items. Package shippers such as United Parcel Service (UPS) could deliver by bicycle or electric shuttle from neighborhood distribution centers. Already, UPS is experimenting with bicycle delivery in Portland. San Francisco is even better suited to delivery bicycles, and has bicycle couriers already. San Francisco should study how to facilitate such delivery, and should cooperate with companies in this field to determine how parking and loading facilities should be upgraded in order to facilitate such deliveries.

6.3.10. Install temporary and permanent pedestrian, bicycle, and transit rights of way.

The City should support and encourage car-free living by generously designating rights of way to pedestrians, cyclists, and public transit. This includes installing and maintaining wide pleasant sidewalks; creating a thorough network of bicycle lanes kept in good repair; designating transit-only traffic lanes; and closing targeted streets, on temporary or permanent bases, to auto traffic. The City has been engaging in this last tactic on weekends in Golden Gate Park and also on the Embarcadero; the City should ambitiously expand this program to other streets that could benefit from such traffic holidays.

6.3.11 Develop alternatives to hauling freight by truck.

6.3.11.1 Port of San Francisco

There is a great opportunity for San Francisco in the coming rise in shorter distance water shipping. It is vital that the City preserve and renovate its available piers, particularly Piers 70-96, in order to exploit this potential competitive advantage. The Pier 90 complex presents the Port with an exceptional opportunity, for it has considerable open space and, like Pier 80, is accessible by rail. Should Federal infrastructure funding become available, the port upgrade is ideal for submission. It needs to be a priority.

6.3.11.2 Freight rail

A modern city needs modern freight rail access. San Francisco must build up its rail capacity, starting with the Caltrain tunnel. Fixing it is the first step toward a functional freight rail system, as well as a big step toward revitalizing our maritime industry. This is another project ideally suited for using Federal infrastructure funds.

Beyond the enlargement of the tunnel, San Francisco needs to formulate a plan to revitalize rail access to the city. When oil and gas become prohibitively expensive, electric rail will be the major cargo transport mode. Cities and regions with well-developed rail will be at a competitive advantage, but such development takes time and must be commenced immediately.

6.3.12 Accurately plan for the future.

In order to get ready for looming transportation mode shifts, San Francisco has to accurately predict what that shift is going to be. Current regional planning forecasts do not take the effects of expensive gasoline into account and predict a slight growth in car use in the next 25 years. Yet through 2007 and 2008, across the country, gas prices over $4 per gallon caused millions to opt to use public transit instead of automobiles. Gas prices are likely not only to increase, but to become increasingly volatile as rising oil prices cause a reduction in oil demand, which in turn causes a sudden drop in oil prices. San Francisco must integrate the mode shift effects of potentially unprecedentedly high fuel prices and price volatility into forecasts – and must calculate the expected reduction in revenue that a drop in bridge fares, parking meters, and other car-generated revenue streams would cause.

6.3.13 Act locally, regionally, statewide, and nationally.

Obviously, San Francisco must do everything it can to prepare its own local transportation networks. But San Francisco does not exist in isolation. Indeed, San Francisco thrives because it lies at the heart of a productive metropolitan area in a powerful and affluent state. The Bay Area, the State of California, and the country as a whole will likely succeed or fail together. To that end, the City must do what it can to advocate for smart transportation policies both within and beyond its borders.

6.3.13.1 Support Regional Transit.

Most directly, this means supporting regional transportation systems already in place, such as BART, CalTrain, and Golden Gate Transit. And, indeed, San Francisco has taken clear steps to support the growth of these systems. The most significant investment is the new TransBay Terminal, currently in the early stages of development, which will tie together all of San Francisco's local and regional transportation services

in one facility, including California's high-speed rail service, when that is built. Regional transportation strategies should include not only expanding capacity and reach of regional facilities, but also interoperability and ease of use. For example, San Francisco should do all it can to make it a regional priority to bring the TransLink fare card system completely online. San Francisco should also continue to advocate for the expansion of the railway tunnel(s), and for the electrification of CalTrain.

6.3.13.2 Fight for State, Federal Policies and Funding.

San Francisco should use those avenues it has available to advocate on state and federal levels to fund projects that will reduce dependency on oil. Ideally, this would result not merely in particular Bay Area projects being funded, but in the development of statewide and national programs that will increase walking, bicycling, and public transit use, and decrease private auto use. Individuals are more likely to support funding for programs that have been successfully implemented in their area. Thus, programs implemented anywhere in the country that encourage alternatives to the single-occupant automobile are a victory for San Francisco, because such successes make it easier for elected representatives to support further expansion of such programs.

6.3.13.3 Work With Allies.

San Francisco need not act alone in advocating changes, and indeed, the primary mission of the City is self-governance, not outward-facing advocacy. For this reason, San Francisco should provide whatever support it can to those organizations already fighting for these causes. Organizations advocating throughout the Bay Area include TransForm, the Bay Area Bicycle Coalition, and Greenbelt Alliance, among numerous others. Nationally, San Francisco should support the efforts of the American Public Transportation Association, Transportation for America, the U.S. Public Interest Research Group, the Congress for the New Urbanism.

6.4 RECOMMENDATIONS

6.4.1 Fund the expansion of Muni's capacity and routes ahead of an expected demand surge.

6.4.2 Electrify the Muni system to the greatest extent possible, prioritizing proven technologies such as catenaries (overhead wires) and electrified rails over experimental technologies.

6.4.3 Use smart land-use planning to minimize pressure on the city's transportation system.

6.4.4 Wherever possible, the City should adopt policy initiatives intended for the private sector (telecommuting, use of EVs, etc.), serving as a model to prove the effectiveness and viability of such initiatives.

6.4.5 Continue to explore ways to promote telecommuting.

6.4.6 Where feasible, convert some prime auto parking spaces into motorcycle/scooter parking.

6.4.7 Charge actual market rates for City-operated parking spaces, both for garages and on-street parking, utilizing smart meters to facilitate ease of payment.

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6.4.8 Discourage the construction of new parking spaces, both public and private, anywhere in the city, by levying significant fees for such construction and setting strict guidelines for the expansion of parking.

6.4.9 Prohibit the use of green space for parking.

6.4.10 Expand and promote car-sharing and specifically explore messaging and education strategies that encourage San Franciscans to give up car ownership, relying instead on occasional use of a shared vehicle.

6.4.11 Implement the bicycle plan without delay.

6.4.12 Prioritize the repair of potholes that are in bicycle lanes.

6.4.13 Explore installation of bicycle lockers throughout the city, potentially as part of a bicycle locker membership program.

6.4.14 Investigate the feasibility of expanding freight operations on the waterfront, particularly on Piers 70 through 96.

6.4.15 Formulate a plan to accommodate increasing freight rail volume into San Francisco, considering improvements to the current infrastructure and possible rail expansions and extensions.

6.4.16 Mandate that all transportation modeling use Peak Oil & Gas assumptions in fuel price forecasts, rather than only projections based on historical price trends.

6.4.17 Take the lead in establishing a working group of city, regional and state-level decision-makers to collectively strategize on how to achieve Peak Oil & Gas preparedness beyond the boundaries of San Francisco.

6.4.18 Approach package delivery companies to develop pilot programs for bicycle delivery of smaller packages.

6.4.19 Evaluate plans for use of land along the port, rail lines and airport in light of the predicted mode shift in freight hauling, to prepare for increased rail and water shipping and decreased air freight.

Chapter 7
WATER SUPPLY

7.0 INTRODUCTION

This chapter and the following three focus on agencies and departments of the City and County of San Francisco (City). As directed by the enabling ordinance for this Task Force, this report assesses the impact of rising fossil fuel prices on those governmental units dealing with water supply, waste collection and disposal, and emergency services.

Since the City's electricity is largely provided by the Hetch Hetchy hydro-electric system, its electricity supply is relatively immune to the effects of Peak Oil & Gas. The cost of driving City-owned vehicles using gasoline or diesel will go up. Heating of buildings with natural gas will become more expensive as well. Gasoline, diesel, and natural gas may at some point suffer from interruptions in supply.

It should be noted that San Francisco's Hetch Hetchy electricity is derived from water flow. Therefore, any long-term conditions that could diminish water flow to the point of negatively impacting electrical production must be considered in long term planning.

7.1 ASSESSMENT OF CURRENT SITUATION

The San Francisco Public Utilities Commission Water Department provides high quality fresh drinking water to San Francisco and several surrounding communities, 85 percent of which is sourced and delivered from the Tuolumne River watershed (225 million gallons per day). The delivery system is primarily gravity driven. In the fiscal year 7/1/08-6/30/09, it is projected that 62.7 MWh of power will be supplied to the system, representing 7.44% of the total power supplied to San Francisco by the San Francisco Public Utilities Commission (SFPUC) for the same period.[1] The Water Department also operates a number of repair and administrative vehicles that run on either gasoline or diesel.

7.2 VULNERABILITIES

The Water Department's need for power is met easily from the Hetch Hetchy system and thus is not seriously impacted by future diminution of fossil fuel availability. Nevertheless, even now, there are times during the year when generation falls below even the City's municipal demand, and power must be purchased from the regional grid to make up for the shortfall. There is a certain amount of excess power that the SFPUC can "use" as a bank for these shortfalls, but not necessarily on a one-to-one basis.

A further vulnerability is that the Hetch Hetchy system operates on a "water first" basis, giving top priority to fulfilling water needs downstream. Thus, it is not always possible to store adequate water supply for power generation as needed.

As global warming progresses, it may lead to a possibility of more severe drought conditions. In a worst case scenario, this could exceed the SFPUC's drought design, both in level of severity and length of time.[3]

7.3 GOALS AND STRATEGIES

7.3.1 Explore the increased use of water storage to maintain an adequate level of power generation at all times during the year.

This may require stepping up progress in water conservation by San Francisco residential and commercial water users.

7.3.2 Create by conversion and/or replacement purchase a vehicle fleet not dependent upon fossil fuels.

The Water Department has sufficient power to pump water. Its Peak Oil & Gas vulnerability is in the maintenance area. The SFPUC should move in concert with all City departments to reduce energy use and fossil fuel use in particular.

7.4 RECOMMENDATIONS

7.4.1 Review both the possibility of Raker Act and/or PG&E contract amendments to secure a more sustainable year-round generation of Hetch Hetchy power for San Francisco municipal government agencies and departments.

7.4.2 In keeping with City policy, pursue a more aggressive program of conversion of all Water Department vehicles and equipment to non-fossil fuel power.

Chapter 8
WASTEWATER

8.1 ASSESSMENT OF CURRENT SITUATION

The wastewater system operated by the SFPUC includes a city-wide sewer and storm drain system and a number of water treatment facilities. The total system is expected to draw 68.6 MWh from the City's power in the 08-09 fiscal year, representing 8.14% of the total municipal electricity use.[1]

The Wastewater Division at the SFPUC has been actively pursuing various alternative energy and energy-saving processes for co-generation of power and heating at the Southeast and Oceanside plants, including use of digester gases to generate 2MW of power and the installation of a 255 kW photovoltaic project in the Southeast Plant, the latter providing 11% of the facility's power need.[2]

8.2 VULNERABILITY

The Wastewater Division has minimal vulnerability in the delivery of adequate power from the SFPUC. In fact, the group is expecting to make a significant contribution to mitigation for other departments through its "greasecycle" program detailed below.

8.3 GOALS AND STRATEGIES

The Wastewater Division is pursuing a local fats, oil, grease (FOG) program to produce biodiesel. Although production of biofuel for other department uses is not a regular activity of the wastewater group, keeping the FOG materials out of the wastewater treatment processes will improve efficiency and reduce maintenance costs. It is anticipated that the FOG project will go a long way to localizing the supply of biofuel for the City's current 80-20 program for city-owned diesel fueled vehicles, thereby avoiding the present necessity of bringing in biodiesel from the midwest. This move is in keeping with the City's goal of achieving local sustainability.

At the same time, the SFPUC is negotiating with operators of specific City vehicle sub-fleets (eg,, Muni) to determine the feasibility of increasing the percentage of bio-diesel from the current 20%. There is a high probability that the FOG program, in conjunction with a proposed Darling biodiesel production facility, can make the City's fleet close to 100% biofuel driven if technically feasible.

8.4 RECOMMENDATIONS

8.4.1 Accelerate the timeline for on-site generation of sustainable power.

8.4.2 Continue to pursue the FOG program.

Chapter 9
WASTE DISPOSAL AND RECYCLING

9.1 ASSESSMENT OF CURRENT SITUATION

Waste disposal and recycling carried out by the company permitted by the City of San Francisco (Norcal) involve three streams of waste:

1. Recycling is the collection, processing, and shipping to market of paper, glass, metal, and plastic materials. In 2006, a total of 1.4 million tons of waste were diverted to recycling, representing 68% of total waste generated.
2. Green waste is the collection, transfer and delivery of food and other organic waste to a compost landfill facility.
3. Waste disposal is the collection, transfer, and landfilling of the remainder of San Francisco's garbage. In 2006, a total of 663,404 tons were landfilled.[1]

Most of the activities noted above are essentially trucking functions. The vehicles used are traditional front, side, and rear loaders; roll-off, roll-on drop box vehicles, and transfer trailers. All of these are commonly diesel and are currently operating with the 20-80 biodiesel fuel now achieved by the City's diesel fleets as well. Darling Delaware Corporation has recently announced plans to construct a major biofuel manufacturing facility in the area.[2] This local supply could increase the percentage of biodiesel in the fuel mix that can be reasonably accomplished in the near term.

Collected waste is delivered to a facility at Pier 96 for transfer and recycling processing. The facility is managed by Norcal, under permit from the City. From there, material for landfill is sent to Altamont in Alameda County and the compostable material is sent to a landfill near Dixon, in Solano County, where it is composted. At the present time, the finished compost is fed into the agricultural market.

In 2007, the Pier 96 facility, in cooperation with SFPUC, installed a 245 kW capacity photovoltaic project.[3]

The final significant activity is the marketing of the processed recyclables. Of course, whenever possible, material should be sold at a profit as a mitigation of cost of service to the public. As a last resort, however, it will be preferable to have the material used in a positive application as an alternative to landfilling even if no revenue is forthcoming. Also, from a Peak Oil & Gas perspective, local end-use markets will be preferable.

In this regard, the container glass market is very good in California. Glass, being both heavy and relatively low-valued per ton, requires local marketing. Fortunately, there are glass container manufacturing facilities in both northern and southern California and corollary preparatory processing companies as well. These facilities will be especially useful if there is an increase in demand for local food preservation containers.

Half of the rigid plastic recyclables are currently marketed to a local manufacturing facility producing bender board, a landscape edging material. This material is expected to diminish over time as petrochemical plastics become more expensive and are increasingly replaced by carbohydrate-based polymers. In the meantime, there are also domestic and Asian markets for the remaining plastics, though less reliable.

Metals and paper are primarily marketed into Asia, although limited amounts of each can still find domestic users. Although India is experiencing an industrial boom, the relatively large Chinese demand remains the overwhelming reality.

In the marketing of recyclables, the current global economic slowdown has resulted in a dramatic lessening of demand for these commodities accompanied by severe price drops. However, the need for strong North American fiber and metal scrap, combined with a weaker dollar, will help to recover this export market for the foreseeable future. We are also fortunate in having two major world-wide metal scrap companies located in Oakland (Schnitzer and Sims) as outlets into the global metal marketplace.

9.2 VULNERABILITIES

9.2.1 Rising fuel costs will lead to rising costs to residents and businesses.

Without reasonably priced local biodiesel, the rising cost of fuel will be an important factor contributing to rising service costs to the consumer, but it is not anticipated that the quality of service will be negatively impacted, although a greater financial strain would be placed on the using public, especially the vulnerable populations. Fuel costs for transferring the waste to the Altamont landfill, 50 miles distant, will continue to rise. Although the City has adopted a zero-waste goal, much of the material remaining to be diverted will be organic and suitable for composting. Since the present location for composting is located 60 miles away in Solano County, a significant reduction of transfer load-miles is not anticipated as the zero-waste goal progresses.

9.2.2 There could be a loss of revenues from recycling, also leading to rising service costs.

A special note should be made here concerning the collection of recyclables. There has long been a problem of the illegal scavenging of material intended for collection by Norcal. This is particularly true for material left out at the curb for pickup, mostly from residential sources. It is also probable that the degree of scavenging will escalate as the value of the commodities and the number of those experiencing economic hardship increase in the community. Thus, we can expect a more sustained and growing problem of resource scavenging. Recognizing that the scavenged material will also find its way into the marketplace, the significant negative impact will be increased cost of services by Norcal due to loss of revenue and increased problems of litter. Since these increased costs will invariably be passed on to San Francisco residents, it can be seen as yet another economic hit added to an increasing burden.

9.3 GOALS AND STRATEGIES

9.3.1 All service vehicles in Norcal's fleet should be transitioned away from fossil fuels.

At least two garbage truck manufacturing companies, International and Volvo, are currently producing hybrid collection vehicles, which could be an interim step. Since much of the collection truck activity involves short movements and idling, hybrids would greatly reduce fuel need. A schedule of conversion should be required as a condition of the next rate negotiation. Clearly it is in the interests of the residents of San Francisco to hold future service fees down.

9.3.2 The Pier 96 facility, or any alternate facility, should move steadily toward being powered on-site and off the grid.

The recent solar photovoltaic installation is just the first step.

9.3.3 Compost generated from San Francisco's waste stream should be processed locally and used to benefit local food programs.

As detailed in Chapter 5 on Food Security, the decline of fossil fuel availability will result in increasing food prices and declining food security, especially among economically vulnerable San Franciscans. Programs for growing food within city limits will need to be expanded. San Francisco's sandy soil would benefit from the addition of composted organic waste. The city should begin identifying possible locations for neighborhood composting centers. To encourage backyard composting and gardening, a portion of current green waste disposal fees could fund a program to subsidize the giveaway of compost bins, as many suburban communities do.

9.3.4 The City should consider ways in which it could make use of the recycled materials which are locally generated to boost the city's manufacturing economy.

The FOG program is an example of such a project, and is well on its way to becoming a successful public-private partnership. In addition to greases, San Francisco has many other potentially reusable materials which could form the supply base for local businesses.

9.4 RECOMMENDATIONS

9.4.1 The City should require Norcal to replace its present fleet with currently manufactured hybrids, and eventually with electric alternative vehicles.

9.4.2 In its rate process with Norcal, the City should develop expanded lifeline rates for lower and moderate income citizens.

9.4.3 In keeping with its policy of moving toward local sustainability, San Francisco should identify alternative composting sites, either within city limits with a neighborhood focus, or significantly closer than the current Solano site.

9.4.4 Studies should be undertaken to evaluate the potential for local product manufacturing, utilizing the supplies of recycled materials locally generated.

Chapter 10
EMERGENCY SERVICES

10.0 INTRODUCTION

Emergency service programs in San Francisco are headed up by an exclusive department, but also include the first responders, i.e., the departments of police, fire, and public health. Transit agencies and other units and/or personnel may be brought into the planning and execution of required services.

Traditionally, the focus of emergency services planning has been that of localized natural and/or physical disasters, such as earthquakes, floods, extensive fires and, more recently, potential terrorist attacks. All traditional disaster planning has been underpinned by the following basic assumptions:

1. The disaster will happen at some time in the future.
2. The specific time of the event is not known.
3. If there is no advance planning and preparation, it will be too late when the event occurs.
4. The event will be essentially localized, so that planning could reasonably rely on outside assistance within a relatively short time. In San Francisco this belief has been manifested in a program emphasizing preparedness for 72 hours after a disaster.
5. Finally, the focus of such planning is to minimize damage and to *maximize recoverability to pre-disaster conditions* as quickly and efficiently as possible.

10.1 ASSESSMENT OF CURRENT SITUATION

10.1.1 The San Francisco Department of Emergency Services

As noted above, this department has been engaged in traditional disaster planning and, insofar as can be determined within the scope of this report, said planning seems to be on a par with similar planning efforts in other jurisdictions.

10.1.2 The San Francisco Police Department (SFPD)

The SFPD vehicle fleet is comprised of 338 marked patrol cars, 400 plus unmarked and specialty vehicles, and 110 motorcycles. Nearly all of these vehicles have received exemption from the Board of Supervisors Resolution #107-06 calling for use of alternative hybrid and electric vehicles wherever feasible. The Department also maintains 250 bicycles, 45 dirt bikes, and 19 horses.[1]

Total electric power delivered to the SFPD is projected to be 6.1 MWh for fiscal year 08-09, or seven tenths of one percent of total power delivered to City units.[2] This power is paid for from the general fund budget allocated to the SFPD.

In 2004 the SF Board of Supervisors passed Resolution 431-04 calling for a transition of all General Fund units from SFPUC subsidized rates to full service rates. The General Fund subsidized rate of 0.0375 per kWh was to be transitioned to the full service rate of 0.08822 per kWh. In the final transition step, the SFPD will pay a 19.2 % increase to the SFPUC. However, even at full rate, the charges are a minuscule percentage of the annual budget.

10.1.3 The San Francisco Fire Department (SFFD)

The SFFD was one of the first city agencies to initiate a project to determine the feasibility of using biodiesel in their vehicles. By now, almost all of their vehicles use B20 regularly the rest use B20 occasionally.

Total electric power delivered to the SFFD projected for fiscal year 08-09 is 4.4 MWh, or three tenths of one percent of total power delivered to City units.[2] Like the police department, the SFFD is transitioning to paying market rate for electricity. At full cost of service the total power billed by the SFPUC would be approximately three tenths of one percent of their annual general fund budget.

10.1.4 Emergency ambulances rely on petroleum fuel.

In addition to the ambulance fleet operated by SFFD, there are hundreds of private ambulances that the City emergency response relies upon. So far as the Task Force is aware, all of these ambulances operate on gasoline or diesel fuel.

Currently, all City-operated diesel backup generators, including those in hospitals, use standard fossil-fuel diesel. Transition to biodiesel is not considered an option because it tends to degrade more quickly and therefore is deemed less reliable.

10.1.5 Emergency communications depend on diesel generators.

An element of special note that cuts across all participating elements is that of communications. San Francisco is currently participating in the development of the SF Bay Area Regional Interoperable Communications System (BayRICS) and is in the implementation phase (having purchased and installed equipment) along with Marin, San Mateo, Santa Clara, Alameda, and Contra Costa. Power backup for the system in the event of grid shutdown commonly involves battery packs for immediate change until backup diesel generators can kick in.

10.1.6 Emergency back-up fuel supplies.

Muni policy is to maintain from 75 to 100% biodiesel fuel storage in tanks at its four yards (Marin, Woods, Flynn, Kirkland) which provides an emergency supply of about 150,000 gallons. Other back-up supplies of fuel are not known at this time.

10.2 VULNERABILITIES

In the arena of emergency response, there are new types of vulnerability arising from Peak Oil & Gas, including lack of fossil fuels available to respond to other types of emergency, increased potential for civil unrest due to fuel shortages, and economic disruptions resulting from energy price spikes.

These are the new possibilities that emergency responders need to take into account in preparing their portfolios of response plans.

10.2.1 Emergency services responders rely upon fossil fuels.

For vital communications and other essential backup generators, continuing reliance on fossil-fuel diesel will be a long-term vulnerability. There should be plans for shortages and supply interruptions. In the long term, the ongoing process of Peak Oil & Gas will make fossil fuel-based disaster response infeasible.

10.2.2 There is the potential for civil unrest from the impact of Peak Oil & Gas.

Already in 2008, climbing gasoline prices and their equally devastating impact on food prices affected the daily lives of our citizens, before oil prices fell again in the face of the recession. Peak Oil & Gas does not exist in a vacuum. The impact is being exacerbated by the mortgage debacle, the weakened U.S. dollar, the war drain on our economy, the rising cost of many raw materials, and the like. We are entering a period of severe economic distress that many analysts believe will not be short-lived.

Traditionally, at times of worsening economic conditions, e.g., the Great Depression of 1929-32, there is an increase of illegal activities and violence growing out of desperation, rage, frustration, and hopelessness. Of special interest to security forces is that we can expect to see people engaged in illegal or otherwise socially unacceptable behavior who have, heretofore, been average law-abiding citizens. This will be especially so as more families find it difficult to provide for basic needs such as food and shelter.

There is already an increase in illegal gas siphoning and scrap material scavenging, not only from curbside recycling programs, but from empty buildings, construction sites, etc.[3] As conditions worsen, rage and frustration may result in actions against perceived "responsible" parties such as oil company offices, gasoline stations and delivery trucks. Alternatively, the latter two may become targets for more serious theft. For more on the impact of Peak Oil & Gas on crime, see Chapter 13.

10.2.3 The Police Department is dependent on fossil fuels, totally exposed to coming cost increases.

The police have the largest single fleet of vehicles in the city, the majority of which remain committed to the exclusive use of gasoline. Most patrol cars operated by agencies on the local, county, state, and national levels use similar specifications and the most commonly used model is the Ford Crown Victoria. To date, no particular action has been taken by the using agencies to determine if Ford, or any equivalent car manufacturer, can develop a hybrid or alternative fuel vehicle to meet the specifications for patrol cars that now exist.

10.2.4 The Fire Department's continued dependence on fossil-fuel diesel could be a mid to long-term vulnerability.

As far as can be determined, there has been little movement to develop fire vehicles using alternative power other than biodiesel. There may be enough biodiesel from locally recovered lipids to supply all SFFD vehicles, but this is not yet clear, nor is it established that all SFFD vehicles can operate on B100.

10.3 GOALS AND STRATEGIES

10.3.1 San Francisco should develop a long-term plan to wean its emergency service vehicles off fossil fuels.

It is tempting to exempt the police department, but there is clearly plenty of room for improvement without loss of effectiveness. There is already a company, Carbon Motors, that is offering a fully-spec black & white that can run on biodiesel.[4] In addition, many police activities now using standard black-and-white cruisers could be performed equally well or better with alternative vehicles. Other cities are moving strongly toward neighborhood electric vehicles, bicycles, horses, or Segways for duties in which high speed chases are not anticipated.

10.3.2 Insure the operability of backup generators and other vital systems in case of loss of regular fuel supplies.

The City should develop long-term, ongoing planning for power and fuel requirements necessary to maintain plant, equipment, and vehicles at all times, even if conditions may arise that preclude significant outside assistance. In the short term, the City should evaluate the adequacy of its access to fuel in case of interruption of the usual supply network. In the long term, vital San Francisco facilities should replace diesel generators with alternative fuel systems as soon as possible.

10.3.3 The City should develop planning for "long emergencies."

The goal of the long emergency plan is to insure that power and fuel required for maintaining plant, equipment, and vehicles is available, without the expectation of significant outside assistance.[5]

10.3.4 The SFPD should undertake a review of its coverage of the city in terms of increasing civil unrest.

For example, a more sustained neighborhood, personalized presence of foot-patrol officers may be desirable to help build cohesion and solidarity in our community. This idea has already been suggested in a recent consultant study.[6] In addition, if it is anticipated that such conditions may also generate an environment of increased civil unrest, it is incumbent upon planners to develop strategies to cope effectively with such unrest.

10.4 RECOMMENDATIONS

10.4.1 The Department of Emergency Services should investigate the feasibility of replacing all backup diesel generators with hydrogen fuel cell or other non-fossil fuel systems.

10.4.2 The SFFD should encourage manufacturers to develop alternative fuel vehicles meeting all fire department specifications.

10.4.3 The SFPD should develop a plan to transition to alternative fuel vehicles. The Department should join with sister agencies in challenging Ford and other manufacturers to build alternative fuel vehicles meeting patrol car specifications.

10.4.4 The SFPD, in conjunction with the SFFD, should prepare to beef up security of gasoline depots, service stations, and other facilities that could be potential targets of vandalism or crime in a potential energy crisis.

10.4.5 The SFPD should evaluate ways to increase the use of alternative patrol and control equipment, including horses, electric scooters and neighborhood electric vehicles, bicycles, etc.

Chapter 11
BUILT ENVIRONMENT

11.0 INTRODUCTION

The recommendations in this section are designed to allow the people of San Francisco to salvage as much of their current comfortable lifestyles as possible in the coming low-energy era by re-creating some of the built environment -- the homes, apartment buildings, offices, commercial buildings, parking garages, and other edifices -- to serve people well in the future. The chief strategy for achieving this goal is to prioritize buildings' energy performance, so that San Francisco's structures remain as useful as possible when hydrocarbon energy becomes rare and expensive.

11.1 ASSESSMENT OF CURRENT SITUATION

11.1.1 Current inventory

There are 115,315 owner-occupied houses and condos, 214,385 renter-occupied apartments, 461 high-rises, 250 historical buildings, 150 theaters, and 62 museums in San Francisco, and they account for approximately half of the city's total energy use.1 Nine hundred and twenty-four of the City's 195,000 rooftops are currently fitted with solar photovoltaic panels,[2] and five are fitted with wind turbines.3 No data have been collected regarding how many local buildings are in need of retrofits for energy conservation and efficiency, but anecdotal observations lead this Task Force to assume that most are.

11.1.2 Natural Gas

Approximately 80% of the energy used by San Francisco's buildings comes from natural gas, directly or indirectly. More than half of natural gas use is for space heating, water heating, and cooking. The remainder is used to generate electricity. (See Chapter 3, Energy for more details about energy use.)

11.1.3 The City has several energy programs in place.

11.1.3.1 Energy Watch

San Francisco's "Energy Watch" Energy Efficiency Program[4] is designed to help small businesses and owners of commercial or multi-family properties obtain energy-saving lighting; heating, ventilating, and air conditioning (HVAC) equipment; refrigerators; and other devices. This program does not provide assistance for owners of single-family homes.

11.1.3.2 Solar Energy Incentives

In 2008, San Francisco established the "Solar Energy Incentive Program" to increase the number of solar photovoltaic (PV) systems in the City by offering direct cash payments to property owners who install PV equipment.[5] The San Francisco "Solar Task Force" is currently evaluating additional methods for increasing the number of solar generating facilities in the City.[6]

11.1.4 Land use patterns are established.

The basic land use patterns embodied in the city are not amenable to large-scale reinvention.

11.2 VULNERABILITIES

Because San Francisco's buildings rely heavily on natural gas (both directly and as the fuel for electricity), they will not serve inhabitants well when the fossil fuels on which they rely become increasingly scarce and costly in the post-peak era.

11.2.1 The Green Building Ordinance is not strong enough to address Peak Oil & Gas considerations.

The City recently adopted a Green Building Ordinance (GBO)[7] for new construction that focuses on climate change and other environmental considerations, as do all of the similar ordinances that have been passed in other jurisdictions, including the California Green Building Standards Code.[8] This is a forward-thinking step, but the Leadership in Energy and Environmental Design (LEED)[9] standards and other criteria on which the GBO are predicated do not address Peak Oil & Gas concerns, which require giving foremost consideration to a building's energy use. One recent study found that, "in terms of energy use, up to 30% of LEED platinum rated buildings perform no better than conventional buildings."[10] Another study concluded:

> *"The energy impacts of better fan systems in climates where economizers are used can result in 20 to 50 percent lower HVAC [heating, ventilation, and air conditioning] 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."*[11]

The current GBO does not contain rigorous quality control measures. Buildings are complex entities composed of numerous systems, any of which may fail to function properly for a variety of reasons. To maintain optimum levels of energy performance, periodic testing and adjustment (retro-commissioning) of these systems is necessary.

In addition, this ordinance is expected to apply to less than 38% of new construction activity.[12]

11.2.2 Standard economic analyses undervalue energy performance improvements.

11.2.2.1 Non-monetary value should be included.

Better buildings can have higher initial costs. The Task Force believes that this cost should be viewed 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 San Franciscans' quality of life, increasing the City's ability to maintain a municipal transportation system and other city functions, and improving the local economy's resilience when energy is scarce. The dollar cost of energy performance enhancements may seem high today, but the results will be invaluable tomorrow.

> *"… when PV is judged in terms of its value as a hedge against future energy and fuel costs, its environmental benefits, its long-term reliability and stability, and its distributed nature, a compelling case can be made for it as a significant option for energy portfolios even today--a case that will only grow stronger in the future."* [13]

11.2.2.2 Energy-saving measures are widely assumed to cost more and deliver fewer benefits than they actually do.

Standard cost-benefit analyses of green buildings fail to adequately reflect the real present value of energy savings.[14] The "business as usual" economic model favored by most investors is not a useful guide for planning to cope with low-energy scenarios. Because this model assumes that future patterns of energy flow will be a reflection of past patterns, it regards the costs of lessening the built environment's need for energy as too expensive to be worthwhile. However, as energy prices escalate, every dollar invested in improved energy performance today will have an ever-shorter payback period and an ever-higher rate of return. The "business as usual" model also fails to acknowledge the likelihood of intermittent interruptions in the delivery of imported power, in which case San Franciscans' 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, perform when only locally generated electricity is available. Therefore, renewable local electric generating facilities and energy efficiency have value beyond their dollar savings.

Standard economic analyses also underestimate future increases in energy prices and undervalue energy improvements by assessing their benefits too narrowly. A 2008 study declared:

> *"… the direct energy savings associated with choosing a better window technology may not justify the cost – and the linear design process rejects the upgrade. But the integrated design process goes on to determine that the window upgrade allows a smaller, more efficient HVAC system—with total cost savings that justify the window technology upgrade."* [15]

Another study found that:

> *"The market has struggled to calculate the value of Green buildings, because Green building benefits such as longer lifespan, reduced replacement and lower operating costs are not easily expressed when accounting methods use depreciation only."* [16]

11.2.2.3 Inaction burdens future generations.

The issue of costs also raises the question: Cost to whom? A failure to improve the built environment now would unfairly burden future San Franciscans. Buildings have been the longest-lived of humankind's creations to date and are likely to be the longest-lived part of the legacy left to succeeding generations. The buildings constructed today will be used by San Franciscans for generations, barring an earthquake or other catastrophic event. Insufficient investment today could mean that future residents will find themselves living and working in indoor environments that do not provide the comforts and necessities to which they are accustomed, and they will be further disadvantaged by having fewer means with which to change these circumstances.

Since the affects of Peak Oil are not reversible, future opportunities to improve or rebuild the existing stock will be fewer and more problematic. Therefore, it behooves us to leave behind structures that are as highly functional as the current technology allows.

11.2.3 "Split incentives" deter retrofitting rental properties.

Approximately two-thirds of San Francisco's residents rent rather than own their homes. Few landlords are interested in spending money that will lower their tenants' energy bills, and few tenants are interested in spending money to improve properties they do not own. The term used to describe this situation is "split incentives." Split incentives are a form of market failure, and problems that are not solved by market forces – or not solved quickly enough – can be resolved by government action.

11.2.4 The resources needed to construct, repair, replace, improve, or demolish the built environment will decline in the post-peak era.

The difficulty of obtaining financing in the current credit market and questions surrounding the strength of real estate prices have already started to discourage investment in buildings here and elsewhere. 17 When declining amounts of energy lead to a decline in economic strength (see Chapter 4 on the Economy), capital for improvements or new construction will become less available. Peak Oil & Gas will also affect the availability of the materials needed to alter the built environment. Since the processes of mining, manufacturing, and shipping of construction materials are energy intensive, the supplies needed to upgrade the building stock will become increasingly scarce and expensive as the world continues to transition into the low-carbon age. The energy required to rebuild or rehabilitate structures will also become a constraint. At times, some or all of these three resources – capital, materials, and energy – could be entirely unavailable. If no action is taken now, a key opportunity to increase the built environment's energy performance may be lost.

Prudent use of the remaining fossil fuels is particularly imperative, not only for reconstructing the built environment, but for all purposes.

11.2.5 High-rise buildings will be vulnerable to power interruptions.

High-rise buildings require electricity to operate elevators and pump water. During the transition away from fossil fuels, San Francisco may experience extended power outages, and high-rise buildings will not be useful then unless they have been fitted with their own power sources.

11.2.6 Shadowing will impose limitations.

Shadows thrown by tall buildings, which can extend for hundreds of feet, will limit San Franciscans' ability to use sunlight to generate electricity, heat water, and provide warmth to indoor spaces. Shadowing will also limit the types and amounts of food that can be grown.

11.2.7 The City does not require newly constructed buildings to be tested for leakage.

San Francisco's current building inspection procedure does not reveal whether windows, doors, pipes, vents, and skylights have been properly installed.[18]

11.3 GOALS & STRATEGIES

The goal of equipping buildings to better withstand Peak Oil & Gas exigencies is to allow San Franciscans to live as well as possible in an energy-constrained environment. The two paths to achieving this goal are first, to reduce buildings' need for energy and second, to equip local structures with the capacity to generate as much energy as possible from renewable sources.

> *"Currently available, cost-effective technologies could significantly reduce the energy consumption of residential and commercial buildings, and the United States is making inadequate use of these measures."*
>
> - American Physical Society[19]

The prevailing attitude toward real estate development and management, in which short-term financial considerations have dominated the decision-making process, worked acceptably as long as energy was abundant and cheap. However, this will prove to be a liability in the post-peak era. Many mitigation strategies do not have short pay-back periods, but are nonetheless advisable because they afford the advantage of allowing residents to continue having warmth, light, and other necessities and amenities that would otherwise be lost when fossil fuels become rare and expensive. The City should aggressively promote the maximum amount of mitigation against Peak Oil & Gas possible, and it should do so as quickly as possible.

> *"Architects know that buildings can be designed to operate with far less energy than today's average U.S. building at little or no additional cost. This is accomplished through proper siting, building form, glass properties and location, material selection and by incorporating natural heating, cooling and ventilation and day-lighting strategies."*
>
> - American Institute of Architects[20]

11.3.1 Update and extend the Green Building Ordinance (GBO).

Financing for construction and renovation has almost vanished due to the current economic downturn. As a result, few new projects are expected to move forward soon. However, if a catastrophic event such as an earthquake were to necessitate the rebuilding of large swaths of the city, the GBO could become an important tool for mitigating against the impacts of Peak Oil & Gas.

11.3.1.1 Enact performance-based standards for new buildings.

The GBO should prioritize a project's energy performance as its chief criterion. The State of California already has a performance-based standard for the design of commercial buildings (Title 24)[21]. A similar standard for residential buildings is needed. San Francisco would be well-served by developing and enacting a performance-based building code that is dynamic and adaptive rather than prescriptive; incorporates new energy efficiency inventions and techniques as they become available and are shown to be effective; is continually monitored; and is revised on an ongoing basis, as a result of lessons learned, to yield ever-increasing energy savings.

11.3.1.2 Require renewable electricity generation.

Locally produced electricity that is obtained from renewable sources will become increasingly valuable in the post-peak age, when power from other sources becomes problematic. Electricity is a universal energy medium. It can be generated from a wide variety of primary energy sources, transmitted easily, and used in a wide variety of applications. The ability to generate electricity without the use of fossil fuels will become a major determinant of residents' quality of life in the post-peak age, and in a built-out city such as San Francisco, most of the best places to site new electric generating equipment are on buildings. Therefore, the City should require that all new buildings include facilities to generate enough electricity from renewable sources to power all of their systems and plug loads. It may not be possible to provide sufficient on-site generating facilities in all instances, particularly in cases of high-rise buildings.

Therefore, it may be necessary to allow some developers to site compensating electrical generating equipment at another location within the city limits.

11.3.1.3 Require commissioning of new buildings and retro-commissioning of existing buildings.

Commissioning is defined as "…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 …"[22] It is a quality assurance procedure that is commonly analogized to tuning up cars or pianos, since the goal is to recalibrate or repair them so that they function optimally. One expert says:

> *"We often find that while existing building systems may be operating in a fashion that maintains comfort and air quality, they are rarely performing to their designed effectiveness and efficiency without a commissioning process. This gap in efficiency between operation and performance contributes to wasted energy …"*[23]

Requiring commissioning of new buildings and periodic retro-commissioning of existing buildings will help to keep the built environment's energy usage as low as possible.

11.3.1.4 Require tests for leakage.

Expanding the inspection procedure to check for leaks should improve the energy performance of local buildings.

11.3.1.5 Require net-zero buildings now and move toward requiring energy-positive buildings.

According to the U.S. Department of Energy, "A net-zero energy building is a residential or commercial building with greatly reduced needs for energy through efficiency gains (60% to 70% less than conventional practice), with the balance of energy needs supplied by renewable technologies." [25] Among the means for reducing a structure's energy requirements are efficient appliances, low-E windows, high thermal mass, passive heating and cooling, deep daylighting, tankless water heaters, and airtight buildings envelopes.

The California Global Warming Solutions Act (AB 32) [26] mandates a net-zero requirement for new homes by 2020 and new commercial buildings by 2030. While this Act's goals are laudable, its timelines are not sufficient to mitigate against the consequences of Peak Oil & Gas. Therefore, the City should take steps to accelerate these requirements for all new construction and major renovations. Since financing for new construction and large-scale renewals is almost totally unavailable today, few if any such projects will go forward in the near future. The City could take advantage of this lull in activity to write and adopt new codes that move the dates of the net-zero requirements as far forward as possible, perhaps to 2010 for residences and 2012 for other buildings.

> *"With integrated design you'll get 70 percent to the carbon-neutral goal. You'll get the rest by on-site energy generation."*
>
> - Kent Peterson, president of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) [24]

Energy-positive buildings generate more energy than they and their appurtenances consume. This concept is not new, but it has only recently been looked at in earnest, as public concern over environmental threats has grown. To create an energy-positive building, two steps are necessary. First, conservation and efficiency are maximized so that the need for energy use is reduced as sharply as possible. Then a building is outfitted with enough clean renewable generating capacity to account for the amount of power it requires for its operation plus generate excess electricity to feed into the grid. Since diesel motors and other generators that rely on fossil fuel inputs will become idle for lack of fuel in the post-carbon era, reliance on them is inadvisable. There are at least seven energy-positive buildings in the U.S. at this time, [27] and they demonstrate that it is possible to construct such buildings using available technologies, though doing so requires more planning than is necessary for conventional buildings.

Energy-positive buildings will be optimally useful in the post-Peak era, so the City should strive to have as many of them as possible.

> *"Residential solar water heating systems cost about 10 times as much as established but less efficient electric and natural gas water heaters, pay for themselves in 4 to 8 years through fuel savings, and last 15 to 40 years."* [28]

Since the building industry requires time to adapt to new standards, the City should take a two-stage approach, requiring net-zero buildings now and moving aggressively to mandate energy-positive buildings within as short a time span as possible.

11.3.1.6 The GBO should be extended.

The GBO should be extended to cover all new construction and major renovations, regardless of a project's size, zoning, or other attribute.

11.3.1.7 The GBO should ensure that compliance with its provisions will be less costly than noncompliance.

11.3.2 Encourage monetary compensation for provided energy.

Currently, San Franciscans who generate electricity and provide it to PG&E are subject to a "net metering" arrangement, under which the amount of power they feed into the grid is subtracted from the amount they draw from the grid. Those who provide more electricity than they use are not compensated for their surplus contribution. John Geesman, a former Commissioner on the California Energy Commission, said it well: "Excess generation is confiscated by the utility company."[29]

"Feed-in tariff" systems encourage property owners to install renewable generation equipment by requiring that they be paid for any excess electricity they contribute to the grid. To assure owners that their investments will be profitable, feed-in tariff schemes guarantee that a minimum price will be paid over a minimum time span, typically twice the amount per kilowatt-hour that local utility customers pay over twenty years. Utilities that purchase this power receive several benefits, including enjoying the avoided costs that would be associated with building additional generating capacity. Thirty-four countries incentivize distributed generation by offering feed-in tariff payments.[30] Gainesville, Florida, recently became the first city in the United States to approve a feed-in tariff plan, which will go into effect on March 1, 2009.[31]

U.S. Representative Jay Inslee (D-Washington) points out that, "the feed-in tariff enacted in Germany in 2003 has helped the European nation achieve 55 percent of the world's installed solar capacity, provide 14 percent of its electricity supply from renewable sources and create at least 140,000 jobs."[32]

By working with local and state agencies, such as the San Francisco Public Utilities Commission, the California Public Utilities Commission, and the California Energy Commission, to require feed-in tariff payments for San Francisco property owners, the City could create incentives for the installation of PV, wind turbines, and other renewable generation equipment.

11.3.3 Retrofit existing buildings for high energy performance.

In San Francisco, there are far more existing buildings than potential new ones. To achieve the energy independence that will allow residents to live more rewarding lives in the post-carbon era, existing buildings should be retrofitted for high energy performance by reducing the amount of energy they consume, adding generating equipment, or both. In Berlin, Germany, a program that retrofitted 600,000 apartments reduced citywide energy use by 50%.[33]

11.3.3.1 Institute trigger points for retrofits.

San Francisco currently requires reassessment of real estate under four circumstances: 1) change in ownership; 2) change in use; 3) completion of major improvements; and 4) completion of new construction. All of these could become trigger points that require retrofits for energy efficiency, and the City is currently evaluating a time-of-sale requirement for energy conservation and efficiency improvements. The City could add another trigger point to cover smaller renovations, specifically any change to an existing structure whose value exceeds 10% of the property's pre-improvement value.

11.3.3.2 Develop financial programs to overcome the split incentive problem and induce building owners and tenants to pursue energy conservation and generation.

Overcoming the problem of split incentives is a vital step toward retrofitting the city's housing stock for the low-energy future. Therefore, the City should develop and offer incentives to property owners and tenants. One option is to follow the lead of Chicago, which allows tenants to deduct half of one month's rent annually to spend on improvements of their choice.[34] Additional enticements will also be required.

11.3.4 Require energy performance evaluations and disclosure.

To allow potential renters or buyers of properties to make informed evaluations of the degree of energy performance that they can reasonably expect to receive, actual measurements of every building's gas and electric

usage should be conducted and published. Collecting this data will also help the City to detect patterns of energy usage and monitor the effectiveness of its green building standards.

Other jurisdictions have adopted this strategy. The European Union requires an energy evaluation at the time of sale and recently developed a label to inform users of a building's energy performance[36]. Several of its member countries have already taken steps in this direction: Since July, 2007, France has required energy performance audits whenever a property is rented or sold[37], and since January 1, 2001, England and Wales have required that developers provide "Energy Labels" for all new homes that publicly inform buyers and renters of a structure's energy fitness[38].

Owners of underperforming properties should be given a time-limited opportunity to correct problems before being required to disclose information. According to the Alliance to Save Energy, "Continuous Commissioning® typically saves 15-20% of total annual energy use with an average 2-year payback making it one of most cost-effective, whole-building energy efficiency techniques today…"[39]

Since the California Historical Building Code[40] exempts certain buildings from energy efficiency requirements, it may be necessary for the City to offer special enticements to owners of such properties.

11.3.5 Engage in and promote programs that help to finance the cost of electric generation equipment, energy conservation, or energy efficiency.

11.3.5.1 Cash incentives.

San Francisco property owners who retrofit their buildings with solar equipment can receive a $6,000 cash incentive from the City plus receive a $1.90 per watt rebate from the State of California plus receive a 30% federal tax credit. A two-kilowatt solar electric generating system, which can be reasonably expected to produce approximately 300 kilowatt-hours per month in the local climate, would cost its owner less than $6,000. This expenditure would be recouped over time and after the payback period ended, savings would accrue every month.

> *"Among Bay Area counties, San Francisco ranks last in terms of solar energy installed per capita."*
>
> - San Francisco Assessor Phil Ting and David Hochschild [41]

11.3.5.2 Solar facilities leases.

Several solar leasing companies offer programs that allow owners to enjoy the benefits of solar photovoltaic panels without bearing the cost of purchasing them.

11.3.5.3 Solar assessment district.

The City is investigating following the lead of Berkeley, California, which pioneered the creation of a solar assessment district that allows property owners to finance the cost of solar panels through their property taxes over a 20-year period.[42]

11.3.5.4 Green mortgages.

Purchasers can obtain a "green mortgage," a type of loan that accounts for the fact that people who pay lower utility bills keep more money for themselves and therefore are more creditworthy; such loans can cover the cost of energy improvements as well as the building's purchase price.[43]

11.3.5.5 Green insurance.

Since August 1, 2008, owners of green homes in California can receive a 5% discount on their insurance coverage premiums. [44]

11.3.5.6 Clinton Climate Initiative.

Former President Clinton created a $5 billion fund to retrofit existing buildings for energy efficiency, the Clinton Climate Initiative Energy Efficiency Building Retrofit Program[45], which San Francisco might be able to join.

11.3.5.7 New federal programs.

San Francisco may also be able to benefit from new programs created by the current federal administration, which has proposed spending $150 billion over the next decade to improve energy efficiency and create five million jobs. Among the proposals is a project to make one million units per year more energy efficient. Should San Francisco be the beneficiary of some of the stimulus funds, the City could direct its share of federal monies, in part, to improving the homes of renters, especially those occupied by economically vulnerable households.

11.4 RECOMMENDATIONS

11.4.1 Require all new development to meet net-zero energy standards as an interim step toward requiring energy-positive buildings.

11.4.2 Strengthen San Francisco's Green Building Ordinance.

11.4.3 Expand and facilitate programs that help to retrofit the existing building stock for better energy performance and for the installation of energy generating equipment.

11.4.4 Expand the building inspection procedure to include a test to detect leakage and develop a protocol of appropriate mitigations.

11.4.5 Require energy audits of buildings upon sale, remodel, and other occasions, and require that the results be published.

11.4.6 Create a solar assessment district to allow the City to finance the cost of solar panels for building owners.

11.4.7 Work with local and state agencies to enact a feed-in tariff system to encourage the installation of distributed renewable generation facilities.

Chapter 12
PROTECTING VULNERABLE POPULATIONS

12.0 INTRODUCTION

One of the greatest dangers of Peak Oil & Gas is that the energy situation will be left to market forces. Unless the government intervenes, a scenario could unfold in which the economically vulnerable are deprived, while the wealthy outbid them for food, housing, and warmth. Of course, this is a nationwide problem. This section will address the unique situation of energy justice in San Francisco.

12.1 ASSESSMENT OF CURRENT SITUATION

12.1.1 Though San Francisco is a wealthy city overall, that wealth is unevenly distributed.

In 2006, approximately 11% of San Francisco residents were below the Federal poverty line. People of color were more likely than the average to live in poverty.

San Francisco's average household income has been rising, but income inequality is also on the rise. (This increasing income gap is being seen in cities throughout the United States.) Census Bureau statistics confirm what most San Francisco residents believe: The city is becoming ever more gentrified, with fewer low-income households and more high-income households. This appears to be due more to an inflow of wealthy households than to increasing incomes of people already living in San Francisco. In short, there is an ongoing exodus of low-income residents from San Francisco, and they are being replaced by high-income residents.[1] Even though the number of low income residents is falling, this does not relieve the City of responsibility of making provision for the ones who remain.

The number of jobs available in the city has held steady, but its composition has changed. Primarily, the number of professional and managerial jobs has risen, while middle income jobs have been lost. There has also been a modest increase in service jobs, mostly low paying and serving the experience sector. In the aggregate, average wages have climbed in San Francisco, but the distribution of those wages is uneven.

12.1.2 Far fewer San Franciscans are homeowners than the national average.

Approximately 62% of San Francisco homes are rental units, whereas nationwide about two-thirds of Americans are homeowners. Working class San Franciscans have fewer assets than workers elsewhere. Households are said to be asset poor if they do not have sufficient assets, including savings, home equity, and retirement accounts to support themselves for three months. By this definition, 37.4% of San Francisco households are asset poor, including 59% and 56% of African-American and Hispanic households, respectively.[2]

Despite the ongoing exodus of low-income households, there is a continuing need for affordable housing. San Francisco currently has in place land use policies, particularly with respect to parking, that add unnecessary cost to new housing. Each off-street parking space provided adds $50-100,000 to the cost of a new residential unit, yet parking is required for most new development.

Bayview/Hunters Point was designated an environmental justice neighborhood by the state in 1998. The San Francisco Department of Environment (SFE) has instituted a number of grant programs for low-income residents in that neighborhood, aimed at subsidizing both energy efficiency and conservation measures and the installation of solar panels for qualifying homeowners. Reaching vulnerable renters is a continuing and difficult problem.

12.1.3 The transit system is vital to vulnerable populations.

Though San Franciscans of all income levels use public transportation, the bus system is used more heavily by the economically disadvantaged.[3] Discounted Fast Passes are available for low income individuals, but the discount is quite modest, only $10. In addition, the availability of discounted Fast Passes is extremely limited because they are sold at only two locations in the city during a four-day time window each month.[4]

12.1.4 Currently, both public and private social services in San Francisco are nearly all automobile-based.

Meals on Wheels alone serves nearly 1,500 homebound seniors, using volunteer drivers.[5]

12.2 VULNERABILITIES

12.2.1 Declining economic activity.

Initially, peak oil will manifest itself in two ways: rising transportation costs and damage to the overall economy. As the economy contracts, more people will become economically vulnerable. The city will need to allocate more resources to aiding the vulnerable out of a shrinking resource base. The probable future will feature lower city revenues, as detailed in Chapter 4 on the Economy, and greater demands on public resources. The temptation will be to address this as a short-term issue of the economic cycle, which will push the issue into the future, where it will be even harder to solve. In fact, it is a long-term structural issue.

12.2.2 Rising transportation cost.

Because of San Francisco's robust transit system, bikeable size, and mild climate, transportation within the city will be less of a problem than in other cities. However, rising fuel costs will push more low-income residents onto buses and bicycles. MUNI needs to be prepared for increased ridership. City government needs to recognize that facilitating bicycle transportation is a social justice issue. Housing and land use planning should take the move to bicycles, as well as to public transit, scooters, and other lower cost transportation into account.

12.2.3 Rising food prices.

Food is an energy issue. Food insecurity will become more prevalent as peak oil's impact manifests in the form of higher food prices. (See Chapter 5 on food security for more detail.)

12.2.4 Need for affordable housing.

The Task Force expects the disparity in income to intensify as wealthier people are attracted by San Francisco's big three: transit, climate and culture. Because of this in-migration, providing affordable housing will be more imperative than ever, in order to prevent the lower income San Franciscans from being pushed out of the city.

12.2.5 Rising cost of heating and cooking.

Though utility costs in the city are modest due to our mild climate, the cost of heating and cooking can still be a strain on the economically vulnerable. The majority of water heating, cooking, and space heating in San Francisco is fueled by natural gas. (See Chapter 3 on Energy.) Because renters are on average lower income than homeowners, energy justice programs should focus on tenants.

Current environmental justice grant programs are targeted on Bayview/Hunters Point. This is not the only low income neighborhood. Other neighborhoods have vulnerable residents in need of attention and should also be eligible for grants.

12.2.6 Transportation for service providers.

Rising fuel cost will create budget problems for both public and private providers of social services, since many of these are provided in the home, entailing transportation now provided by fossil-fueled automobiles. For private charities, the recruitment of volunteer drivers will be more difficult. For public agencies, the cost of services will climb.

Finally, there is the distinct possibility of food and energy supply interruptions. Other areas of the country have already had gasoline shortages. It is far from impossible for shortages of food, gasoline, even electricity, to come to the Bay Area.

12.3 GOALS AND STRATEGIES

12.3.1 Strengthen the social safety net.

Because the damage to the broader economy will be felt very soon (in fact, is probably already being felt as part of the current recession), many of our recommendations can be summarized as: Do more of the same things we do to provide food security, an economic safety net, and affordable housing for low income residents.

12.3.2 Expand grow-your-own food programs for low income residents.

Green space needs to be protected, especially in low income neighborhoods. The search for land for community gardens needs to be intensified, and could include land owned by the City or SFPUC, as well as land use negotiated with private owners of unused land. The Planning Commission should reject conversions of green space to parking or other uses (but especially parking!) unless absolutely imperative. (See Chapter 5. Food Security, for much more on food and Peak Oil & Gas.)

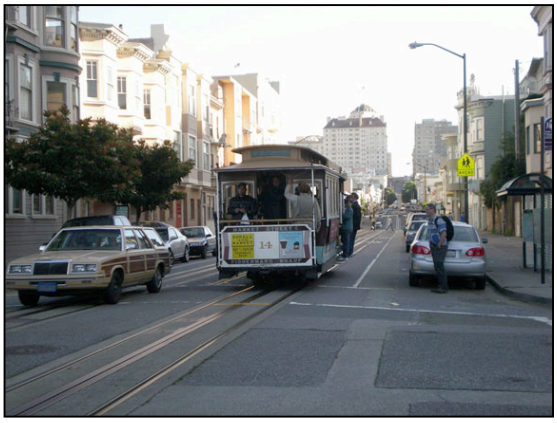
12.3.3 Change zoning regulations and the permitting process to facilitate less car-centered construction.

The Task Force is aware that housing for the economically disadvantaged is a large and intractable issue, and that city government is pursuing many paths toward ameliorating it. One opportunity that Peak Oil & Gas will open up is to reduce the cost of newly built housing by providing less parking. As driving becomes more expensive, fewer people will own their own cars, so the future will see a decreased demand for parking. Though the timing is uncertain, this decline in driving - and parking - will certainly occur during the lifetime of buildings built or renovated today.

Building owners may increasingly choose to convert former garage space to living space or other uses. The Building Department should begin now to establish an expedited permit process for these conversions.

12.3.4 Make public transportation reliable, convenient, electric, and inexpensive in all parts of the city.

The discount Fast Pass program should be expanded, its discount deepened, and its distribution made more convenient. MUNI should emphasize reliability on bus lines serving low income neighborhoods, where residents have fewer other options. To reduce the vulnerability of MUNI as a whole and also serve low income neighborhoods better, MUNI should expand the trolley bus service into the southern and eastern sections of the city by moving ahead with the trolley expansion plan, thereby reducing the dependence of the residents of this side of town on diesel fuel.



12.3.5 Promote accessory housing units (i.e. in-law units) citywide.

Accessory units provide new and affordable housing without changing the neighborhood's built character. These units can make it possible for extended families to live in a single house, let seniors to "age in place" by allowing caregivers or family members to live on the premises, and can provide extra income for fixed-income homeowners. The City should legalize existing units, and the Building Department should begin now to establish an expedited permit process for the conversion of garage spaces to housing or work space. Neither the existing units nor the conversions should have parking requirements, because such requirements are unfeasible for this type of unit.

12.3.6 Search for new revenue sources to fund needed programs.

It is imperative that San Francisco address this as a long-term structural problem, rather than a short-term issue of the economic cycle. For more on financing, see Chapter 4 on the economy.

12.3.7 Plan for a wide variety of personal transportation options.

Bicycle transportation will be an especially critical element of transportation for the economically disadvantaged. It is vital to make bicycling safer and more convenient. Scooters, electric bicycles and scooters, neighborhood electric vehicles: All these will be a part of the transportation future, particularly for economically vulnerable residents. The City needs to plan to accommodate them. Implement the Bicycle Plan now - but don't stop there. Provision for bicycles and alternative transportation modes needs to be ongoing and vigorous.

12.3.8 Focus renewable energy on low income neighborhoods.

Subsidies should be focused on non-homeowner households because they are both the poorest and the hardest to reach. Public funds for solar and other "greening" programs should be spent on public housing first and low-income residents next.

12.3.9 Focus conservation programs on renters and low income residents.

Subsidies to landlords can be aimed at those with low-income tenants. Other jurisdictions have programs to subsidize landlords who weatherize units occupied by low income tenants, or have ordinances allowing tenants to allocate a portion of their rent toward conservation measures. The City could cooperate with a nonprofit agency to purchase in bulk simple efficiency equipment aimed at tenants, such as insulated blinds, making them available to residents at low cost.

12.3.10 Convert social service workers who make home visits from automobile use to neighborhood electric vehicles, transit, scooters, or bicycles.

The cost of auto travel will increase, and the City and other service providers will have to be creative in finding ways to continue to provide home-based services. The City could offer incentives to switching away from fossil-fueled cars and disincentives to continued auto use.

12.3.11 Prepare for potential food and energy supply interruptions.

The allocation of living essentials should not be left up to the market, because low-income people will be shortchanged. A rationing plan is called for. This is not only a social justice issue, but also will avoid long lines and decrease the potential for civil disturbances. It should be based on per capita allocation, not on a percentage reduction from current usage, to be fair to those who already use less than average. Preparing a plan now will reduce disruption when it is needed.

12.4 RECOMMENDATIONS

12.4.1 Expand programs assisting low-income families to grow their own food.

12.4.2 Protect current green space to maximize San Franciscans' ability to grow their own food.

12.4.3 Eliminate all minimum parking requirements for new affordable housing construction to lower the cost.

12.4.4 Legalize accessory (in-law) housing units.

12.4.5 Design an expedited permitting process for conversion of garages to living space, without any parking requirement.

12.4.6 Review the pricing structure of discounted MUNI Fast Passes for low income San Franciscans. The most disadvantaged residents should get passes deeply discounted, even free. Also, make discounted – or free - passes easier to obtain.

12.4.7 Implement the Bicycle Plan. Then do more.

12.4.8 Find new revenue sources, both for poverty programs and to allow MUNI to expand and improve its service.

12.4.9 Expand programs to reduce energy use in low income residences, targeting especially renters.

12.4.10 Prepare a rationing plan to allocate scarce resources on a per capita basis in the event of supply interruptions.

Chapter 13
SOCIETAL FUNCTIONING:
PUBLIC RESPONSES AND EDUCATION

13.0 INTRODUCTION

In 1973, people throughout America found themselves unexpectedly waiting in long gas lines. Many Americans experienced tension, some even panic. Though the timing of Peak Oil & Gas is uncertain, there is no doubt that it is coming. While there may be little we can do to stop its coming, what we can do is to change our relationship to what happens and learn to meet our unknown future differently by helping people prepare psychologically for it.

Beyond the various energy efficiency and conversation efforts that the San Francisco Department of the Environment (SFE) and other agencies are already engaged in, critical societal issues will need to be addressed. Policies that help the public participate in preparing for Peak Oil & Gas and encourage the public to help each other through the energy transition are crucial to successfully mitigating the impacts of Peak Oil & Gas. Citizens can make a significant contribution to mitigating the effect of Peak Oil & Gas on the city, provided they can be motivated to act. Conversely, a frightened and confused citizenry can retard official efforts to cope. Since the functioning of the city can be greatly affected by the attitudes of its citizens, it is important to anticipate their behavior, so that actions can be taken to channel these responses in more positive directions.

13.1 ASSESSMENT OF CURRENT SITUATION

As of early 2009, the general public knows little about Peak Oil & Gas. The memories of those gas lines from 25 years ago have mostly faded. The price of oil is low, and the financial crisis is people's top concern. If they are aware of Peak Oil & Gas at all, the vast majority of people rest complacently, in the belief that some combination of some conservation and alternative fuels will handle the problem with little necessity for significant change in lifestyle.

However, a few months earlier, when oil was at an all-time high, and gasoline rose to nearly $5 per gallon in the Bay Area, the shape of early public responses to peak oil was evident. People drove less and carpooled more. They eliminated some non-essential trips, and traveled slightly less on vacations. Business travel decreased.

As the price per gallon of the fuel many people depend on daily rose, seemingly inexplicably, something less measurable, yet no less real, rose along with it: stress and anxiety. Part of the difficulty with Peak Oil & Gas is that there is no existing response model, no easy way out, particularly given how long the U.S. has already delayed its efforts to prepare. The challenge before the City is to anticipate the societal difficulties that may emerge as we enter the downslope of the fossil fuel era, and to develop contingency plans based on this assessment.

13.2 VULNERABILITIES

13.2.1 Economic uncertainty and price volatility may cause anxiety, depression, and crime.

Clearly the first effect that Peak Oil & Gas will have is to move people out of their cars. When prices reached their all-time high in the summer of 2008, there was a significant increase in public transit use in the Bay area. As the price of oil climbs back to those levels and beyond, we will likely see more of the same. To the extent that transit alternatives are available, these changes will occur in a straightforward manner. However, should there be a rapid shift to public transit without adequate increased capacity, the overcrowding and lack of availability that are likely to result will undoubtedly lead to further social problems.

Falling oil production will have a lingering negative effect on the economy. Negative public responses to Peak Oil & Gas will tend to intensify in proportion to the magnitude of economic stress, shortages, and lifestyle changes forced on them by rising oil and natural gas prices. As oil and gas prices climb higher, the correspondingly higher price of food could result in food hoarding.[1] In the face of expensive food, possibly coupled with unemployment, the most common psychological responses would be depression, anger, and fear. There will likely be increased criminal activity.[2]

Anxiety will come not only from higher prices, but also from price instability. If San Franciscans don't understand what is going on and what they can do, the combination of unstable and climbing oil prices could lead to fear, desperation, and increasingly disruptive behavior. There may be an attitude of "every man/woman for himself/herself", destructive to the functioning of the community as a whole.[3] Amid competition for scarce resources, criminal behavior, such as stealing and fighting, is a distinct possibility, and there may be protests against these deteriorating conditions.[4]

In response to anxiety, there are both rational and irrational response strategies that arise in people; sometimes both arise in the exact same person. People have a tendency to become more irrational as their stress and anxiety levels increase. There are numerous examples, both historical and current, of this effect.[5]

13.2.2 The fabric of society could be at risk.

At some point the price of oil could climb even higher, to $300 and more per barrel. Without advance planning, such prices could lead to significant societal disruption. With food becoming increasingly expensive, travel and the distribution of goods significantly affected, and unemployment climbing, economically vulnerable populations – including a high percentage of people of color – could experience increasing malnutrition, and some may not be able to maintain health without government intervention.

From failure of multiple global systems – financial, currency or trade, for example – a scenario could arise that would force governments to dedicate an overwhelming share of their resources to basic human needs. These extreme conditions could lead to a level of societal degradation that is difficult for most people to contemplate.[6]

How fast can things deteriorate? In 2000, truckers on strike in the U.K. resulted in the British economy coming to within 48 hours of collapse, with empty shelves at stores throughout the country.[7] The U.K. truckers' strike is but one example; there are numerous historical examples.[8] During 2008 alone, trucker strikes took place in country after country, some resulting in mass unrest, all because of the higher prices of fuel.[9]

It is important to examine and prepare for this kind of scenario because, as we have seen in the financial crisis of 2008, unanticipated change can happen quickly. If San Francisco is to lessen the probability of these more extreme possibilities, a bold and concerted preparation effort must be undertaken early.

13.3 GOALS AND STRATEGIES

The overall strategy to address people's responses to Peak Oil should include informing the public and encouraging more community involvement in problem-solving.

13.3.1 Create a permanent body to advance and monitor the City's responses to Peak Oil & Gas.

The first step necessary to respond meaningfully to this issue is for the City to establish a permanent programmatic mechanism that will work beyond this Task Force to:

1. Monitor and report on the implementation of measures in this report adopted by the Board of Supervisors.
2. Produce reports and other materials, beginning to educate City staff and the public about the issue.
3. Coordinate peak oil, climate change, and other environmental city efforts among the various departments involved.

In lieu of a new division or department or commission, some means of promulgating peak oil preparedness measures throughout the City government and the populace at large must be defined. This programmatic mechanism will task City staff with carrying out, for example, infrastructure investment analysis that takes into account a constricting fossil fuel universe. It would also be in the City's interest in this regard, to operate an "Energy Transition Resource Center" that would provide information and services to residents and businesses to assist them in reducing their energy consumption.

13.3.2 Begin a public education program on Peak Oil & Gas, to inform, inspire, and guide San Franciscans, as well as mitigating anxiety.

A principal mitigation strategy is public education. If the public is made adequately aware of the gravity of the situation, many of the steps that need to be taken – choosing public transit instead of a gasoline-powered car for example – will happen as a result of individual choice that is in turn the result of an effective public education campaign.

This education campaign should frame Peak Oil & Gas as a time of energy transition. It should pledge San Francisco residents to embark on this transition together, creating a common goal and common identity for the people of the city. The public education campaign must also inspire individuals, businesses, and other organizations to make specific changes in order to begin to prepare for the transition. The campaign should recommend what changes to make, and it should provide guidance and options as to how to make those changes.

In this campaign, the City should provide three key functions:

1. Inform the public about what will be happening,
2. Inspire people to make a shift, and
3. Guide them on how to prepare.

First, inform the public about Peak Oil & Gas and the challenges and opportunities ahead. Some key message points:

- The age of cheap oil is ending.
- There will not be enough affordable oil.
- Biofuels will not be a large-scale substitute.
- There are no easy energy substitutes.
- Electric vehicles cannot replace our current vehicle stock one-for-one.
- Gas rationing may be necessary.
- The goal is adaptation not prevention: We will need to change our lifestyles…and yet we're not going back to a pre-carbon time.
- Community and cooperation are essential in this time of change.

Second, inspire San Franciscans to make shifts:

Information alone does not motivate people to shift behavior. They need to be inspired to make changes. The government as an entity and individuals in government can take the lead in shifting the zeitgeist towards a low energy lifestyle. The Mayor can address the city, launching a campaign to promote a new identity for San Francisco as a low-carbon city and announcing that energy descent/transition is now a City purpose, and the City is officially tackling the task of transitioning to a low-carbon future, beginning with the adoption of the Oil Depletion Protocol. This campaign would include a website, slogan, commercials, and other advertisements.

Third, guide people in preparing:

- Lay out some clear pathways to action that, if adopted en masse, will dramatically reduce the dependence on oil and gas. Possibilities include;
- Reducing dependence on cars
- Eliminating or reducing purchases of non-necessities
- Buying locally
- Living locally – community events, meals, resource sharing
- Changing dietary habits – including relying less on imported foods and moving to a simpler diet
- Relying on less heating fuel – living with the thermostat lower and taking less lengthy or frequent showers
- Refocusing attention towards neighborhoods and communities. The City can provide guidelines for community governance.
- Living and working collaboratively. Provide education in collaborative methods for decision-making and leadership.

There are effective tools available to assist people in learning how to meet abrupt changes and to manage fear responses, without feeling caught off guard. Supporting and enhancing existing programs, and creating new programs that assist people with emotional responses (despair, fear, anger) will help people psychologically prepare for unexpected changes. For these tools and programs to be successful, the time to start is before the effects of Peak Oil start to be felt.

13.3.3 Foster the emerging transition movement.

Communities in the U.K. have taken a lead role by developing a model for peak oil mitigation and adaptation, to create, reframe, or organize communities. The "Transition Towns" model is a guide for towns to create "transition initiatives" to shift from heavy dependence on petroleum to independence from fossil fuels. Such initiatives provide the foundations for the development of the town's Energy Descent Plan, a flexible and modifiable plan to meet a rapidly-changing and unknown future. Over 80 small-to-medium-sized towns in the U.K. have created, adopted, and begun to craft and implement transition initiatives. It has yet to be implemented in any city with an extended metropolitan area, and is currently being evaluated for use by a few London districts. This has begun to spread to places in other countries, recently to the U.S.[10]

This model is primarily designed to be driven by the public who declare that they want to be a "transition place" and who take on the primary thrust of bringing out transition. The City should investigate which aspects of this model are appropriate for San Francisco.

13.3.4 Create an identity for San Francisco as a "City of Transition."

Preparing for Peak Oil and transitioning to being a low-carbon city needs to become a City purpose, part of the City's culture and identity. San Francisco has been known around the world as a forward-looking innovator. Indeed, it's one of the reasons people live here. Thus, San Francisco is a natural leader among large cities in this.

For a large city, perhaps the most useful aspect of the Transition Towns model is the framing of the peak oil crisis as a ***transition***. In that model, the people of a town decide to create an identity for the town, one that is actively and quickly moving towards a goal of having an economy and lifestyle that does not depend on oil. Such a town can be said to have *ownership* of being a transition town. When people embrace an idea, a concept, or an identity – such as being a transition city – it permeates and influences how they think and what they do, and can bring unity to people in distress, mental or otherwise.

Imagine a people, aware that the world is heading toward an unknown post-peak future, choosing not to be afraid or in denial about Peak Oil & Gas. Residents could see their beloved San Francisco as a city embracing and tackling the most difficult transition our society has yet to face. Accordingly, energy transition becomes an issue that people talk about, a value that they incorporate into their decision-making process, and a framework within which to understand the changes happening in their lives.

One way to achieve this is through creating an identity shift for the city itself as a place of transition. The City of San Francisco can create an identity campaign, similar to the "I Love New York" campaign in the 1970s, to create awareness of this city identity and purpose. In addition to creating this awareness both inside and outside of San Francisco, such a campaign could easily lead to the involvement of neighborhoods and communities.

13.3.5 Promote community organization, in order to encourage joint problem solving.

Community building is an integral part of maintaining stability, especially during the later phases of energy transition. Strategizing and problem-solving at the neighborhood level will be key to weaning San Franciscans from the current unsustainable system.

The government has three key coordinating roles to play here:

- Help coordinate the efforts of individual districts or neighborhoods in creating transition initiatives. The San Francisco government can provide support and infrastructure for such an effort. The City can establish a liaison with Transition U.S., a source for transition materials.
- Help establish local governance. For example, Washington, D.C. has two types of neighborhood governance bodies: Neighborhood Planning Councils, used for decision-making within the neighborhood, and Advisory Neighborhood Commissions, that advise the city government on issues affecting their local areas.[11]
- Provide training programs in collaborative techniques for use in neighborhoods and in government (as described in the next section).

13.3.6 Support and encourage collaboration for decision making and problem solving.

In periods of difficulty, better ways of working together to manage the impact of Peak Oil & Gas are going to be needed. The complex, interdependent challenges facing leaders, organizations, and communities require new approaches. Collaboration needs to be an effective part of our mitigation strategy.

> *"Because of its ability to connect and engage people, collaboration is far and away the most strategic approach to work that we know. Collaboration's…approach means that sustainability starts from day one of its implementation."*[12]

In addition to collaboration's benefit in neighborhoods and communities, the City government can be instrumental in improving intergovernmental collaboration and co-operation among regional governments.[13]

In the past five years, new collaboration tools have emerged that effectively address both the needs of the collective and the needs of individuals. For these to have an impact, people and organizations must be trained and become practiced at using these tools and techniques well in advance of when they will be needed.

13.4 RECOMMENDATIONS

ADMINISTRATION:

13.4.1 Create a permanent City body to advance and monitor the City's responses to Peak Oil & Gas.

INFORMATION/EDUCATION:

13.4.2 Create and promote an identity for San Francisco as a leading-edge transition city.

13.4.3 Develop and implement a peak oil public education program on Peak Oil & Gas that informs, inspires, and guides the citizenry.

13.4.4 Support and enhance existing programs, and create new programs that assist people with emotional responses and help people psychologically prepare for unexpected changes.

13.4.5 Support and expand sustainable energy awareness programs in the San Francisco Unified School District (SFUSD) curriculum.

COMMUNITY AND SOCIETY:

13.4.6 Examine models for community, such as Transition Towns, to determine which aspects can be adapted to this city and the metro area. Support the efforts of districts and neighborhoods that create Transition initiatives.

13.4.7 Support the creation of neighborhood governance (Advisory Neighborhood Commissions, Neighborhood Planning Councils).

13.4.8 Help build neighborhood cohesion and collaboration and develop neighborhood activities that help prepare for the coming oil decline.

13.4.9 Promote the use of neighborhood centers, schools and libraries, to meet, organize, and share resources.

Chapter 14
VISION OF LOW-CARBON SAN FRANCISCO: THE CITY IN 2050

The Task Force does not have a crystal ball to predict exactly how that world will look in forty years. There could be technical or other developments that are beyond our current imagination. Still, having spent the past 15 months studying this issue, the Task Force has made some educated guesses, based on what we know now. This is our vision of what might be, not a prediction. We hope it helps to bring our recommendations to life.

Imagine yourself transported to the San Francisco of 2050. Natural gas and petroleum are still available, but in much reduced quantities. They are devoted to vital functions, such as emergency services, air travel, and heavy equipment. Through our municipal energy buying cooperative, a massive effort has expanded electricity from renewable sources, and nearly all the energy that powers daily life is in the form of electricity. Reliable tidal power comes from a turbine installed near the Golden Gate Bridge, and additional power comes from offshore wind, marine current, and ocean wave power systems that are barely visible on the horizon from Ocean Beach. San Francisco has found a way to thrive on less than half the energy it used at the dawn of the 21st century. This has been accomplished by reducing consumption, strengthening local communities, and localizing the economy.

The world and U.S. economies have changed. Internationally traded commodities are much more expensive, and thus, *stuff* is more expensive. International trade has receded and a thriving local economy has emerged in its place. The century-long trend of substituting fossil energy for human work has reversed. The economy is less consumption-focused, and the pace of life is slower, but surveys consistently show that San Franciscans are far "happier" than they were in the early 21st century.

The streets are full of pedestrians, bicycles, buses, electric scooters and neighborhood electric vehicles. Residents rarely need cars, but when they do, they check one out from a car-sharing stand, and the few gasoline-powered ones all get well over 50 miles per gallon. Mass transit is in full bloom. The Muni system is the circulatory lifeblood of the city. Trains are full. Most bus lines are powered by overhead electric lines. Less frequented routes are served by buses powered by batteries, hydrogen fuel cells, or biodiesel. Biofuels are not being used to fuel private automobiles much, but biodiesel is used in trucks, buses, airplanes and heavy equipment. BART has its own source of renewable power. CalTrain has been electrified. Commuters check out bicycles from bike sharing stations scattered about the city.

Nearly half of the produce city residents consume is grown within city limits, and most of the rest is delivered from the surrounding region. The city is dotted with productive food gardens. Many buildings have graywater systems, so that used household water is routed to backyards or community gardens. Numerous backyards house chicken coops. Each neighborhood has a garden assistance center, featuring facilities for composting organic waste and advisors knowledgeable about farming in San Francisco's unique mix of climate zones. Meat consumption is very low, and the overall health of San Franciscans is improved over that of the early 21st century.

Most buildings in San Francisco are topped by solar hot water systems and solar photovoltaics (PV). PV is incorporated in roofs and south-facing walls of structures, painted on as PV paint, and mounted on free-standing structures in open spaces throughout the city. New buildings are required to be energy positive, producing more energy than they use. Existing buildings have been retrofitted with weatherization; energy audits and tune-ups are required every three years. San Francisco's mild climate has made it relatively easy to meet heating and cooling loads through conservation and efficiency. Many former garages have been converted to residential space, or are being used for cottage industries, or for hydroponic gardens, which are competitive for fresh produce now that shipping costs are high.

National and world economies have stabilized at a lower activity level than today, and San Francisco has seen a renaissance as the business center of the Bay Area. Jobs that moved to the suburbs during the auto age have moved back into San Francisco, so that employees can take advantage of its position at the center of a web of electric-powered public transit.

The piers at the southeast port are humming with barges and coastal freighters. They take advantage of the revitalized rail facility nearby to offload food and other non-containerized cargo for transshipping to the south or distribution inside San Francisco. Container shipping still uses the Port of Oakland.

There is much less activity at San Francisco airport than formerly, because flying is expensive, and because the California High Speed Rail system has been operational for many years, eliminating the 30% of the Bay Area air travel that used to be devoted to intrastate city-hopping. Construction of a national high speed rail system is underway and will interconnect with the California system in a few years. Fewer private individuals can afford to fly, and businesses make use of electronic communications more than ever to limit the need for costly travel.

Street life is lively, with frequent fairs, meetings and events. Neighborhood councils participate in decisions affecting them, and this has brought a greater sense of community than ever, while continuing to foster the individual expression that is one of San Francisco's most prized values. Representatives of these groups meet in city-wide gatherings to exchange ideas and explore goals, both common and diverse.

Do we know that this is the look of San Francisco's future? Of course not. There is a much darker future that could unfold if we fail to act. This is an optimistic vision assembled by the Task Force, assuming that the City moves ahead soon on the basic recommendations of this report, and assuming that the world at large also begins to take needed action. This outlook could be wrong in many aspects, but in some ways, we are confident that it is a close approximation of what the future holds: We are certain that energy will be more expensive and less available in the future, and that the future will not look like a continuation of the past. We are certain that the City needs to make fundamental changes to its ways of using energy. Finally, we are confident of the ability of the people of San Francisco to persevere in the face of whatever the future holds for them.

Summary of Recommendations

Recommendations - Energy

3.4.1 Implement Community Choice Aggregation.

3.4.2 Contract an independent city-wide energy waste audit.

3.4.3 Produce an updated Electricity Resource Plan.

3.4.4 Develop smart grid technology.

3.4.5 Advance a Green Jobs workforce development program.

3.4.6 Continue the process of implementing feed-in tariffs.

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

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

Recommendations - Economy

4.4.1 Require the Controller's Office and other departments to consider rising energy prices when evaluating potential policies and legislation.

4.4.2 Direct the Office of Economic and Workforce Development to revise the *Economic Strategy Report* in light of increasing fossil fuel prices.

4.4.3 Direct the Controller's Office to prepare a report on San Francisco's balance of trade, with attention to identifying key imports. Follow this with the creation of a strategic plan to find or develop local sources of these inputs.

4.4.4 Expand and enforce the City's own policy of sourcing locally for City purchases.

4.4.5 Resume development of a project to make high-speed internet available to all residents throughout the city.

4.4.6 Establish local venture capital and micro-lending funds.

4.4.7 Revise the City's business tax to be assessed on gross receipts as it used to be, and to be progressive, with an exemption for the smallest businesses.

4.4.8 Look for new revenue sources for City government to fund the transition despite declining revenues from current sources (See 4.3.2):

Carbon tax

Progressive business tax

Demand-sensitive parking fees

City vehicle tax

Gasoline tax based on price floor

Borrowing against future savings

4.4.9 Develop the southeast waterfront to take advantage of the coming rise in short haul water freight.

4.4.10 Evaluate plans for new or improved infrastructure to avoid "orphan" projects which will lose their rationale in light of Peak Oil & Gas.

4.4.11 Enlarge railway tunnel access to the port.

4.4.12 Formulate a plan to build a modern freight rail facility in San Francisco.

Recommendations – Food Security

5.4.1 Implement a "Buy Local First" food purchasing policy as a way of bolstering regional food production. Public institutions should seek to purchase regionally grown food whenever possible.

5.4.2 Create a Bureau of Agriculture that will empower residents to be their own food producers.

5.4.3 Undertake a comprehensive evaluation of public parklands, San Francisco Department of Public Works (SFDPW) rights-of-way, and SFPUC, Port Authority, and San Francisco Housing Authority (SFHA) properties to determine what vacant parcels can be used for food cultivation. The Recreation and Park Department should study what portions of parklands and golf courses could be transitioned from recreational to food production uses.

5.4.4 Investigate offering private property owners property tax rebates or water bill rebates for transitioning vacant or underutilized land to food production.

5.4.5 Dramatically expand funding for food production education programs and work closely with the SFUSD and city government to coordinate citywide horticultural trainings.

5.4.6 Investigate instituting a tax on fast food sales to pay for local food production and education programs.

5.4.7 Create a materials depot (or multiple depots) where residents can access (at reduced cost, depending upon income) essential materials such as organic compost, and possibly seeds, vegetable starts, hand tools, and irrigation equipment.

5.4.8 The SFDPW should clarify its regulations regarding street tree planting and actively encourage residents to plant productive fruit and nut trees. SFDPW should also actively encourage residents to remove sidewalk concrete (while maintaining Americans with Disabilities Act corridors) and plant street-side gardens.

5.4.9 The Department of Public Health should rewrite the rules surrounding small-scale animal husbandry to allow for an increase in the number of chickens and rabbits that can be kept, while also allowing residents to keep a small number of goats and hogs.

5.4.10 SFE should develop a plan for reducing the number of miles the municipal compost travels and begin a program of block or neighborhood compost centers.

5.4.11 SFE should investigate the potential of innovative technologies such as water catchments systems, gray water systems, vertical farming, and local aquaculture to boost local food production.

5.4.12 City officials should use their influence with elected officials in nearby counties to encourage new incentives — such as agricultural conservation easements — to protect farmland. City officials should also encourage their peers to promote a transition to more diverse and sustainable farming methods by offering property tax rebates to farmers switching to more ecologically sound practices.

5.4.13 Begin studying how to re-establish rail and barge freight lines into San Francisco.

Recommendations - Transportation

6.4.1 Fund the expansion of Muni's capacity and routes ahead of an expected demand surge.

6.4.2 Electrify the Muni system to the greatest extent possible, prioritizing proven technologies such as catenaries (overhead wires) and electrified rails over experimental technologies.

6.4.3 Use smart land-use planning to minimize pressure on the city's transportation system.

6.4.4 Wherever possible, the City should adopt policy initiatives intended for the private sector (telecommuting, use of EVs, etc.), serving as a model to prove the effectiveness and viability of such initiatives.

6.4.5 Continue to explore ways to promote telecommuting.

6.4.6 Where feasible, convert some prime auto parking spaces into motorcycle/scooter parking.

6.4.7 Charge actual market rates for City-operated parking spaces, both for garages and on-street parking, utilizing smart meters to facilitate ease of payment.

6.4.8 Discourage the construction of new parking spaces, both public and private, anywhere in the city, by levying significant fees for such construction and setting strict guidelines for the expansion of parking.

6.4.9 Prohibit the use of green space for parking.

6.4.10 Expand and promote car-sharing and specifically explore messaging and education strategies that encourage San Franciscans to give up car ownership, relying instead on occasional use of a shared vehicle.

6.4.11 Implement the bicycle plan without delay.

6.4.12 Prioritize the repair of potholes that are in bicycle lanes.

6.4.13 Explore installation of bicycle lockers throughout the city, potentially as part of a bicycle locker membership program.

6.4.14 Investigate the feasibility of expanding freight operations on the waterfront, particularly on Piers 70 through 96.

6.4.15 Formulate a plan to accommodate increasing freight rail volume into San Francisco, considering improvements to the current infrastructure and possible rail expansions and extensions.

6.4.16 Mandate that all transportation modeling use Peak Oil & Gas assumptions in fuel price forecasts, rather than only projections based on historical price trends.

6.4.17 Take the lead in establishing a working group of city, regional and state-level decision-makers to collectively strategize on how to achieve Peak Oil & Gas preparedness beyond the boundaries of San Francisco.

6.4.18 Approach package delivery companies to develop pilot programs for bicycle delivery of smaller packages.

6.4.19 Evaluate plans for use of land along the port, rail lines and airport in light of the predicted mode shift in freight hauling, to prepare for increased rail and water shipping and decreased air freight.

Recommendations – Water Supply

7.4.1 Review both the possibility of Raker Act and/or PG&E contract amendments to secure a more sustainable year-round generation of Hetch Hetchy power for San Francisco municipal government agencies and departments.

7.4.2 In keeping with City policy, pursue a more aggressive program of conversion of all Water Department vehicles and equipment to non-fossil fuel power.

Recommendations - Wastewater

8.4.1 Accelerate the timeline for on-site generation of sustainable power.

8.4.2 Continue to pursue the FOG program.

Recommendations – Waste Collection

9.4.1 The City should require Norcal to replace its present fleet with currently manufactured hybrids, and eventually with electric alternative vehicles.

9.4.2 In its rate process with Norcal, the City should develop expanded lifeline rates for lower and moderate income citizens.

9.4.3 In keeping with its policy of moving toward local sustainability, San Francisco should identify alternative composting sites, either within city limits with a neighborhood focus, or significantly closer than the current Solano site.

9.4.4 Studies should be undertaken to evaluate the potential for local product manufacturing, utilizing the supplies of recycled materials locally generated.

Recommendations – Emergency Services

10.4.1 The Department of Emergency Services should investigate the feasibility of replacing all backup diesel generators with hydrogen fuel cell or other non-fossil fuel systems.

10.4.2 The SFFD should encourage manufacturers to develop alternative fuel vehicles meeting all fire department specifications.

10.4.3 The SFPD should develop a plan to transition to alternative fuel vehicles. The Department should join with sister agencies in challenging Ford and other manufacturers to build alternative fuel vehicles meeting patrol car specifications.

10.4.4 The SFPD, in conjunction with the SFFD, should prepare to beef up security of gasoline depots, service stations, and other facilities that could be potential targets of vandalism or crime in a potential energy crisis.

10.4.5 The SFPD should evaluate ways to increase the use of alternative patrol and control equipment, including horses, electric scooters and neighborhood electric vehicles, bicycles, etc.

Recommendations – Built Environment

11.4.1 Require all new development to meet net-zero energy standards as an interim step toward requiring energy-positive buildings.

11.4.2 Strengthen San Francisco's Green Building Ordinance.

11.4.3 Expand and facilitate programs that help to retrofit the existing building stock for better energy performance and for the installation of energy generating equipment.

11.4.4 Expand the building inspection procedure to include a test to detect leakage and develop a protocol of appropriate mitigations.

11.4.5 Require energy audits of buildings upon sale, remodel, and other occasions, and require that the results be published.

11.4.6 Create a solar assessment district to allow the City to finance the cost of solar panels for building owners.

11.4.7 Work with local and state agencies to enact a feed-in tariff system to encourage the installation of distributed renewable generation facilities.

Recommendations – Protecting Vulnerable Populations

12.4.1 Expand programs assisting low-income families to grow their own food.

12.4.2 Protect current green space to maximize San Franciscans' ability to grow their own food.

12.4.3 Eliminate all minimum parking requirements for new affordable housing construction to lower the cost.

12.4.4 Legalize accessory (in-law) housing units.

12.4.5 Design an expedited permitting process for conversion of garages to living space, without any parking requirement.

12.4.6 Review the pricing structure of discounted MUNI Fast Passes for low income San Franciscans. The most disadvantaged residents should get passes deeply discounted, even free. Also, make discounted – or free - passes easier to obtain.

12.4.7 Implement the Bicycle Plan. Then do more.

12.4.8 Find new revenue sources, both for poverty programs and to allow MUNI to expand and improve its service.

12.4.9 Expand programs to reduce energy use in low income residences, targeting especially renters.

12.4.10 Prepare a rationing plan to allocate scarce resources on a per capita basis in the event of supply interruptions.

Recommendations – Societal Functioning

ADMINISTRATION:

13.4.1 Create a permanent City body to advance and monitor the City's responses to Peak Oil & Gas.

INFORMATION/EDUCATION:

13.4.2 Create and promote an identity for San Francisco as a leading-edge transition city.

13.4.3 Develop and implement a peak oil public education program on Peak Oil & Gas that informs, inspires, and guides the citizenry.

13.4.4 Support and enhance existing programs, and create new programs that assist people with emotional responses (despair, fear, anger) and help people psychologically prepare for unexpected changes.

13.4.5 Support and expand sustainable energy awareness programs in the San Francisco Unified School District (SFUSD) curriculum.

COMMUNITY AND SOCIETY:

13.4.6 Examine models for community, such as Transition Towns, to determine which aspects can be adapted to this city and the metro area. Support the efforts of districts and neighborhoods that create Transition initiatives.

13.4.7 Support the creation of neighborhood governance (Advisory Neighborhood Commissions, Neighborhood Planning Councils).

13.4.8 Help build neighborhood cohesion and collaboration and develop neighborhood activities that help prepare for the coming oil decline.

13.4.9 Promote the use of neighborhood centers, schools and libraries, to meet, organize, and share resources.

ENDNOTES

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Jason Mark, Task Force Member, co-manager, Alemany Farm

Jessie Woletz, Earth Share of CA

Mei Ling Hui, San Francisco Department of the Environment

Antonio Roman-Alcala, co-manager, Alemany Farm

Blair Randall, director, Garden for the Environment

Richard Katz, Task Force Member

Jeanne Rosenmeier, Chair, Peak Oil Task Force

David Pascal, SFE and Mayor Gavin Newsom's Office

Paula Jones, San Francisco Food Systems, Dept of Public Health

Chris Cook, author and journalist, Diet for a Dead Planet

Erica Etelson, member, Berkeley Peak Oil Task Force

Andrea Jadwin, co-director, SF Garden Resource Organization (SFGRO)

John Bela, San Francisco Victory Gardens

Kevin Bayuk, Urban Alliance for Sustainability and SF Permaculture Guild

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Energy

June Brashares, Green Energy Programs Director, Global Exchange http://www.globalexchange.org

Eric Brooks, Sustainability Committee Chair, San Francisco Green Party http://www.sfgreenparty.org

Rory Cox, Pacific Environment, http://www.pacificenvironment.org

Carl Duisberg

Don Eichelberger, Sustainability Working Group, San Francisco Green Party

Paul Fenn, Local Power, http://www.localpower.com/index.php

Alice Friedemann, freelance journalist who specializes in energy and member of the Northern California Science Writers Association, http://www.ncswa.org/

John Geesman, Former Commissioner, California Energy Commission http://www.energy.ca.gov

Aaron Israel, Chair, Sierra Club Bay Chapter Energy Committee, http://www.sanfranciscobay.sierraclub.org/chapter/chapter_home.htm

David Room, Director, Energy Preparedness, http://www.energypreparedness.net

Marlene Vogelsang, Resource Specialist, Pacific Energy Center http://www.pge.com/pec/

Kari Ving, Biofuel Coordinator, San Francisco Public Utilities Commission

David Fridley, Staff Scientist, Lawrence Berkeley National Laboratory, http://www.sfbayoil.org/sfoa/myths/david.html

Economy

Ted Egan, Chief Economist, City of San Francisco

Jennifer Entine Matz, Managing Deputy Director, Office of Economic and Workforce Development

Tim Redmond, San Francisco Bay Guardian

John Kaufman, Portland Peak Oil Task Force

Dan Goldes, Executive Vice President, San Francisco Convention and Visitors Bureau

Denise Martinez, San Francisco Airport

The members of San Francisco Post-Carbon

Andre Angelantoni, Inspiring Green Leadership

David Pilpel

Marya Stark

Food

Jessie Woletz, Earth Share of CA

Mei Ling Hui, San Francisco Department of the Environment

Antonio Roman-Alcala, co-manager, Alemany Farm

Blair Randall, director, Garden for the Environment

David Pascal, SFE and Mayor Gavin Newsom's Office

Paula Jones, San Francisco Food Systems, Dept of Public Health

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Andrea Jadwin, co-director, SF Garden Resource Organization (SFGRO)

John Bela, San Francisco Victory Gardens

Kevin Bayuk, Urban Alliance for Sustainability and SF Permaculture Guild

Julia Brashares, San Francisco Parks Trust

Transportation

Andy Thornley, Program Director, San Francisco Bicycle Coalition

Tom Radulovich, BART Board member, and Executive Director, Livable City

Jason Henderson, Ph.D., Assistant Professor, San Francisco State University

Denise Martinez, San Francisco Airport

Peter Straus, Manager of Muni Service Planning, San Francisco Municipal Railway

Paul Bignardi, Transportation Planner IV, San Francisco Municipal Railway

Peter Dailey, Deputy Director, Maritime, Port of San Francisco

Richard Katz

Dave Snyder, Transportation Policy Director, San Francisco Planning and Urban Research Association

Lucien Burgert, Mechanical Engineer, San Francisco Municipal Railway

Built Environment

Paolo Soleri, Arcosanti

Debra Walker, Building Inspection Commissioner

Christina Olague, Planning Commissioner

Kathrin Moore, Planning Commissioner

Nate Bellino, PG&E

Milton Marks III, Public Architecture

John Geesman, former Commissioner, California Energy Commission

Roger Tomalty, Arcosanti

Michael Poremba, San Francisco Post-Carbon

Protecting Vulnerable Populations

Razzu Engen, Transit Justice Project

Sraddha Mehta, Grant Program Manager, San Francisco Department of the Environment

Societal Functioning

Nick Parsons, LMFT, San Francisco.

Richard Heinberg, author, *Powerdown* and *The Party's Over*.

Rob Hopkins, founder, Transition Towns, U.K.

David Johnson, Transition Towns, Portland, Oregon

Mike Adams, urban farmer, Berkeley, CA

Photographs

Port of San Francisco: Ben Lowe

Railway tunnel: Bernie Meyerson

Community garden: Ben Lowe

Cable car at night: Ben Lowe

Trolley bus: Jeanne Rosenmeier

Tractor in traffic: Ben Lowe

City water plant: www.waterandwastewater.com

Cable car street scene: Joy Rios

Union Square: Ben Lowe

APPENDIX I
MEMBERS OF THE TASK FORCE

Jeanne-Marie Rosenmeier, Chair

Jeanne-Marie Rosenmeier is a self-employed CPA, who has lived and worked in the Bay Area since 1982. She is active in San Francisco Oil Awareness and San Francisco Post Carbon, and was a founding member of Diablo Post Carbon. In 2002, Ms. Rosenmeier was the Green Party candidate for California State Treasurer. Her interests focus on the economic and social consequences of the inability of oil supply to expand to meet demand, as well as the interaction between the limits to oil production and climate change. Her undergraduate degree is in mathematics, and she received an MBA from the University of Chicago in 1975.

Bernard Meyerson, Vice Chair

Bernie Meyerson is Vice President and co-owner of East Bay Resources, Inc., a 20-year old recyclable paper brokerage. Since 1971 he has been a waste and recyclables management consultant to local, state, national, and international clients. Mr. Meyerson has lectured and given classes at UC Berkeley Extension and San Francisco State. Prior to 1971 he had a 14-year career in International Higher Education in New York City and the University of Illinois. He holds a BA and MA in Political Science and International Relations.

Patricia Gerber

Pat Gerber is a San Francisco author and cartoonist. A life-long environmentalist, she has been active in the anti-war movement since 2002 and remains a member of numerous local and national peace groups. She studied architecture with Paolo Soleri and received a Master of Liberal Arts from Johns Hopkins University in 1979.

Woody Hastings

Woody Hastings is an environmental professional with over twenty years of experience in community organizing, strategic planning, policy analysis, government relations, media outreach, and project management. Energy-related projects he has worked on include solar photovoltaic installations, a landfill gas-to-energy project, alternative fuel vehicle policy, a solar/hydrogen technology demonstration project, and leading a campaign to defeat an oil pipeline. Mr. Hastings first became concerned about global oil supply limitations on his arrival to California in 1979 to find cars lined up waiting for gas. He holds a degree in Environmental Sustainability and Social Justice from San Francisco State University.

Benjamin Lowe

Benjamin Lowe is a researcher and advocate focusing on issues of regional transportation. He has worked on a range of transit projects, working with the Transportation and Land Use Coalition (now TransForm) on a report about the benefits of encouraging school children to walk and bicycle to school, and also served as Treasurer and Marin County Grassroots Organizer for the North Bay Transportation Alliance, a campaign to secure funding for the Sonoma-Marin Area Rail Transit (SMART) commuter rail program. Mr. Lowe has also worked on a number of Federal, state, and local emergency management and homeland security projects. For instance, he helped to draft the Los Angeles Neighborhood Council Emergency Preparedness Plan, and served on the support staff for the Department of Homeland Security team tasked with the National Infrastructure Protection Plan, which outlines Federal policies for protecting U.S. infrastructure from natural disasters, catastrophic failure, and terrorist attack.

Jason Mark

Jason Mark is an author, activist, and urban farmer committed to creating a more ecologically sustainable San Francisco. He co-manages Alemany Farm, the City's largest food production site. Alemany Farm uses organic food production to grow green job for low-income communities and promote neighborhood food security. Mr. Mark is also the co-author, (with Kevin Danaher and Shannon Biggs) of the book Building the Green Economy: Success Stories from the Grassroots (PoliPointPress). He edits the environmental quarterly magazine *Earth Island Journal*. His writings on the environment have appeared in *The Nation, Orion, E, Yes! The San Francisco Chronicle, Alternet.org, Grist.org,* and *TomPaine.org*.

Cal Simone

Cal Simone is a writer, speaker, coach, and teacher influenced by Carl Jung. He began his involvement with Bay area peak oil groups in 2005 as the East Bay post carbon group's first speaker, talking on "Consumerism at the End of the Oil Age" and the societal and psychological implications of a post-peak collapse, and has been writing and speaking about it ever since. His writings on peak oil and a variety of other topics have appeared in *Culture Change Letter,* the *ManKind Project Journal,* and *Open Exchange* magazine. Mr. Simone is also active in the Tribe of Men, a men's leadership group that develops and practices cutting-edge methods of governance and collaborative decision-making in groups. Earlier in his life, he was a music producer and founded an award-winning Macintosh software company.

APPENDIX II
DATES OF PEAK BY COUNTRY

Oil Producing Countries Past Peak, with Date of Peak:

Mexico	2004	Gabon	1997
Denmark	2004	Syria	1995
USA(natural gas liquids)	2002	India	1995
Yemen	2001	Egypt	1993
Norway	2001	Alaska	1989
Oman	2001	Indonesia	1977
Australia	2000	Romania	1976
United Kingdom	1999	Canada (conventional)	1974
Ecuador	1999	USA, lower 48	1971
Colombia	1999	Texas	1971
Venezuela	1998	Germany	1967
Argentina	1998	Austria	1955
Malaysia	1997		

Non-OPEC Countries Not Yet at Peak:

Vietnam	Chad
Thailand	Brazil
Equatorial Guinea	Angola
Sudan	China

OPEC countries in the Middle East produce approximately 30% of the world's petroleum. Most observers believe that only Iraq and possibly Saudi Arabia have the capacity to increase production by any significant amount.

Source: Energy Watch Group: http://www.energywatchgroup.org/fileadmin/global/pdf/2008-02_EWG_Oil_Report_updated.pdf

APPENDIX III
FURTHER RESOURCES

Other Peak Oil Reports

- Oakland, California http://www.oaklandnet.com/Oil/pdfs/OIO-ActionPlan-020608.pdf
- Portland, Oregon http://www.portlandonline.com/osd/index.cfm?c=42894&a=145732
- State of Connecticut http://www.terrybacker.com/Peak%20oil%20and%20Natural%20Gas%20Report%20final%20111607-1.pdf
- Brattleboro, Vermont http://vtpeakoil.net/community/document.php?id=231
- Burnaby, British Columbia, Canada http://postcarboncities.net/files/report_burnaby_global%20peak%20in%20oil%20production_11Jan06.pdf
- Haines Borough, Alaska: http://postcarboncities.net/files/HEFT%20DRAFT%20Report.pdf
- Sebastopol, California http://postcarboncities.net/files/SebastopolCAGEReport2007.pdf
- South Australia http://www.parliament.sa.gov.au/NR/rdonlyres/D40BA2BB-ED42-44D9-83B4-88F01F225D57/.../TheImpactofPeakOilonSouthAustralia.pdf

Books

- *The Coming Oil Crisis*, by Colin J. Campbell
- *Hubbert's Peak: The Impending World Oil Shortage*, by Kenneth S. Deffeyes
- *The Party's Over*, by Richard Heinberg
- The Oil Depletion Protocol: A Plan for a Sensible Energy Future, by Richard Heinberg
- *Powerdown: Options and Actions for a Post-Carbon World*, by Richard Heinberg
- *Peak Everything*: Waking Up to the Century of Declines, by Richard Heinberg
- High Noon for Natural Gas, by Julian Darley
- *The Long Emergency*, by James Howard Kunstler
- *Twilight in the Desert*, by Matthew R, Simmons
- Overshoot: The Ecological Basis of Revolutionary Change, By William Catton
- Plan B 3.0: Mobilizing to Save Civilization, by Lester R. Brown

Reports

- Peaking of World Oil Production: Impacts, Mitigation and Risk Management (The "Hirsch Report"); http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf
- The Real New Deal: Energy Scarcity and the Path to Energy, Economic, and Environmental Recovery; http://www.postcarbon.org/files/real-new-deal.pdf
- Crude Oil: The Supply Outlook, by the Energy Watch Group; http://www.energywatchgroup.org/fileadmin/global/pdf/2008-02_EWG_Oil_Report_updated.pdf
- Preparing for Peak Oil: Local Authorities and the Energy Crisis; http://www.odac-info.org/sites/odac.postcarbon.org/files/Preparing_for_Peak_Oil.pdf
- Post Carbon Cities; http://www.postcarbon.org/post_carbon_cities_6
- World Energy Outlook 2008; http://www.worldenergyoutlook.org/2008.asp

Documentaries

- Crude Awakening, http://www.oilcrashmovie.com/
- End of Suburbia, http://www.endofsuburbia.com/
- The Power of Community: How Cuba Survived Peak Oil, http://www.powerofcommunity.org/cm/index.php

Governmental Agencies

- Energy Information Administration, http://www.eia.doe.gov/
- International Energy Agency, http://www.iea.org/
- National Renewable Energy Laboratory, http://www.nrel.gov/
- Energy Efficiency and Renewable Energy, (USDoE) http://www.eere.energy.gov/
- California Energy Commission, http://www.energy.ca.gov/

Peak Oil & Gas Organizations & Websites

- Association for the Study of Peak Oil International, http://www.peakoil.net/
- Association for the Study of Peak Oil U.S., http://aspo-usa.com/
- The Energy Bulletin, http://www.energybulletin.net/
- The Oil Drum, http://www.theoildrum.com/
- Oil Depletion Protocol, http://www.oildepletionprotocol.org/
- Post Carbon Institute, http://www.postcarbon.org/
- Global Public Media , http://globalpublicmedia.com/
- The Oil Age Poster, http://www.oilposter.org/

Local Resources

- Bay Localize, http://www.baylocalize.org/
- Urban Alliance for Sustainability, http://www.uas.coop/
- Alemany Farm, http://www.alemanyfarm.org/
- SF Oil Awareness and SF Post Carbon, http://www.sfbayoil.org/
- SF Biofuels Cooperative, http://www.sfbiofuels.org/

Online Lectures

- David Rutledge, Cal Tech, "Hubbert's Peak, the Coal Question, sfbiofuels and Climate Change" http://today.caltech.edu/theater/item?story_id=24502