

Charting a Path for a New Energy Future for Sebastopol

Maintaining City Municipal Services

*Report of the Sebastopol Ad Hoc
Citizens Advisory Group on
Energy Vulnerability*

*Presented to the
Sebastopol City Council*

April 3, 2007

About the Citizens Advisory Group on Energy Vulnerability

While there is a considerable range of opinions regarding the trajectory and possible outcomes of current energy trends, one thing is becoming clear: the era of abundant cheap fossil fuel-based energy is ending, and we are entering an era of energy uncertainty.

To help the City prepare proactively for these changes, the Sebastopol City Council formed the Citizens Advisory Group on Energy Vulnerability (CAGE) in January 2006. The City Council asked CAGE to provide it with analysis and recommendations regarding actions that the City can take in anticipation of significant future price increases and/or shortfalls of energy supplies, in order to enable the City to continue to fulfill its primary mission of providing for the public safety, maintaining public facilities and streets, supplying water and sewer services, and regulating land use.

The City of Sebastopol has long been a leader in thinking about the future and considering alternative strategies for improving the quality of life for Sebastopol's citizens as well as the inhabitants of our planet. For example, the City of Sebastopol is one of the first municipalities in the nation to make a commitment to reducing the greenhouse gas emissions (GHG) produced by municipal activities, and has been successfully implementing solutions to accomplish this.

It is in the spirit of this strategic thinking and action, and to help ensure that the City of Sebastopol retains the ability to effectively anticipate and respond to local, regional, and global changes, that CAGE now presents its findings to the City Council.

We hope that this report and its recommendations support the City of Sebastopol as it plans for an era of finite energy resources. Several of the recommendations here will also assist the City in achieving its GHG reduction goals.

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Executive Summary

Persuasive evidence has been gathering that worldwide oil and natural gas production has peaked, or will soon peak – at a time when supplies are tight and worldwide demand is significantly increasing. This could result in a widening energy supply shortfall, increasing vulnerability to sudden changes in supply, and notable price increases. Because of the extent to which we depend on these petroleum energy sources, this puts at risk the foundation of modern civilization and the functioning of the many systems that support our everyday lives. Also, because fossil fuels are a significant cause of global warming, it is vital that we don't meet our added energy needs using other fossil fuels such as coal.

To help the City prepare proactively for these changes, the Sebastopol City Council formed the Citizens Advisory Group on Energy Vulnerability (CAGE) in January 2006, to explore how this situation might impact Sebastopol's ability to maintain City municipal services, and how the City of Sebastopol might prepare for and respond to these upcoming challenges. As a result of our work, CAGE has prepared this report.

Chapter I. Background

The Upcoming Energy Challenges

Our industrialized society's standard of living has been made possible by an abundant source of inexpensive energy – derived primarily from fossil fuels, predominantly petroleum oil and natural gas. Unfortunately, global oil production (extraction) levels are estimated to be peaking now or soon, after which production levels will decline. This is known as peak oil. Natural gas production is also anticipated to begin peaking soon as well. At the same time, demand for inexpensive energy worldwide is strongly increasing, especially in rapidly industrializing countries such as China and India.

Even given the best case scenarios, experts question how world production can realistically ever increase to meet projected oil and natural gas needs. Therefore, a significant and increasing supply shortfall is expected. This could drastically impact the operation of our modern civilization, including our transportation systems, food production, chemical production, and electricity generation, both through significant shortfalls of supply and higher energy prices. These could in turn notably impact business viability, increase employment, undermine world currencies, generate food crises, and even risk civic disorder.¹

Overview of Primary Energy Alternatives

Currently, no alternative energy supplies are ready to replace the shortfall of supply. Robert Hirsch, author of *Peaking of World Oil Production* (also known as *The Hirsch Report*) for the U.S. Department of Energy, calculated that a relatively smooth transition to our new energy supplies would require one to two decades of aggressive, intensive, large-scale effort to both (1) significantly reduce energy usage, and (2) develop and implement new technologies and infrastructure. Unfortunately, we might currently be at the peak, or even past it, and therefore simply not have the time needed to make this transition smoothly.

Additionally, there is a risk that, in response to peak oil, we will increase our use of energy sources that are destructive to the planet, such as coal and tar sands, hastening global warming and the breakdown of the global ecosystems that support all life on earth. Similarly, nuclear power brings the enormously dangerous and unresolved problems of long-lasting and highly-toxic radioactive waste, as well as risks of nuclear proliferation and associated terrorist threats.

Therefore it is vital that we as a culture rapidly develop and implement as many as possible of the sustainable energy options that currently only provide a very small portion of our energy supply. We must use whatever time and relatively inexpensive fuel we have left to aggressively develop and implement a combination of sustainable energy sources such as: solar, wind, small hydroelectric, tidal and wave, geothermal, ethanol, biodiesel, (potentially) hydrogen, and (optimistically) nuclear fission. These can be combined with innovative technologies such as heat pumps, and hybrid and electric

vehicles. For each option, the advantages and disadvantages must be weighed to apply them in the most appropriate situations and avoid the pitfalls of inappropriate application or over-use.

Notable Community Responses

Around the world, individuals and communities have become increasingly concerned about the threats of both peak oil and global climate change. They've been exploring solutions (often with government support) such as setting transition targets, modifying regulations, providing subsidies, and encouraging public discussion and education. Inspiring examples include Sweden, Kinsale (Ireland), Totnes (UK), Woking (UK), Portland (Oregon), and California's Oakland, San Francisco, and Willits. Additionally, people and groups worldwide are taking action through the Internet such as the Post Carbon Institute and the Apollo Alliance. Examining these community responses can offer information and inspiration to support Sebastopol's exploration of what we can do here. We can also learn from studying history; Cuba's experience with its oil cutoff in 1989 provides a useful illustration of the drastic impacts on a society of these oil shortfalls – and the proactive steps needed to reduce this harm.

Chapter II. City of Sebastopol Analysis & Recommendations

Overview

As requested by the City Council, this report analyzes the City's operations and proposes ways that it can prepare to maintain municipal services in the event of increasing fossil fuel shortfalls or disruptions. Given the enormous negative impacts likely to occur without proactive responses, and with the current low level of national and state leadership, CAGE believes that it is prudent risk management for local municipalities, such as the City of Sebastopol, to prepare proactively for these changes.

Sebastopol has a number of projects in place to reduce energy usage, implement alternative energy sources, and prepare for energy disruptions. CAGE applauds this.

Nevertheless, the City (and our culture) still face significant risks from the dynamics described in this report. These are the five key types of vulnerabilities that the City faces:

- 1) **Increased Direct Energy Costs.** In FY 05-06, 3.4% of the City's expenditures went to direct energy costs, to pay for energy for: Water Wells (31% of costs), Ives Pool (17%), Buildings (16%), Street Lighting (16%), Vehicles (14%), and Sewage Lift Stations (7%). At the possible future energy price points that CAGE examined, these expenses could rise to 12% of City expenditures. The tripling of the City's natural gas costs in FY 05-06, because of Hurricane Katrina, demonstrates the City's vulnerability to sudden and drastic price increases in fossil fuel prices as a result of external events.
- 2) **Increased Indirect Energy Costs.** Fossil fuel energy price increases are expected to ripple through into product and labor prices, risking increased costs and decreased availability for a wide variety of materials needed for the City's functioning. Other government entities could also be impacted by these changes, and decrease their funding and services to the City, at a time when there is increased demand on City services.
- 3) **Insufficient Energy Supplies and Outages.** Energy supply shortages and outages of potentially unexpected and long duration could hinder City operations for extended periods of time, causing public health and safety issues. This could occur at a time of increased need for City services.
- 4) **Global Economic Crises and Disruption.** The City is also at risk from possible worldwide economic disruptions from these energy shortfalls and price increases. These secondary impacts could cause notable changes to businesses, employees, and governments, locally and beyond, which would significantly impact the City's costs, income, operations, and ability to maintain services.
- 5) **Insufficient/Late Transition Away From Fossil Fuels.** One of the most notable risks to the City would be if it were to transition too slowly away from a dependency on fossil fuel energy sources. This would leave the City vulnerable to a variety of potentially drastic and sudden impacts, and in a hasty last-minute scramble to try to install alternatives when high demand will likely make them much more expensive and less available.

Summary of Recommendations

Fortunately, the City has the opportunity to anticipate these challenges before the situation becomes more difficult. We therefore encourage the City to reduce its exposure to these risks by increasing activities to reduce energy needs, prepare for serious energy shortages and price increases, and transition away from fossil fuel energy sources.

To serve the City, we have identified key actions that the City can do in this regard. Below is a summary of our recommendations; the body of this report describes our underlying analysis and important specifics about implementation.

First Steps

- **Develop and pass an Energy Transition Resolution** (Recommendation A-1).
- **Appoint the City Council Energy and Sustainable Practices Subcommittee to implement this resolution and track the progress of these recommendations through the City Council process** (Recommendation A-2).
- **Establish a standing Citizens' Technical Advisory Committee (CTAC) to assist the City in implementing this resolution and these recommendations** (Recommendation A-3).
- **Direct City departments to determine departmental vulnerabilities and propose implementation plans** for this resolution, which the City Council Energy Subcommittee will then evaluate and prioritize, with CTAC's assistance (Recommendation A-4).
- **Explore potential partnerships and alliances with other organizations and government entities** to share information and collaborate on accomplishing, and sharing the costs, of these activities (Recommendations A-5 and A-12).

Implementation Steps

- **Develop procedures for easily tracking City energy use and costs**, and reporting these annually to the City Council, to observe trends and adjust actions and priorities (Recommendation A-6).
- **Seek permission to aggregate the City's electrical loads**, to apply credits from solar panels to other City locations (Recommendation A-7).
- **Continue reducing City usage of fossil fuels and electricity**, even in situations where costs can be passed through to users (Recommendation A-9). To do this, increase building energy efficiency, through implementing passive efficiency measures, using the City's Green Building guidelines on City buildings, determining why the Garzot building has such a high energy cost per square foot, and hiring a green buildings consultant (Recommendations B-1 through B-6). Assess the City's streetlighting plan and lighting types, and consider possible lighting system design changes (Recommendations B-13 through B-15). Consider energy costs when timing Ives Pool maintenance closures (Recommendation B-16). Explore replacing ornamental lawns with low-maintenance plants (Recommendation B-17) and buying more fuel-efficient vehicles (Recommendation C-1). Identify ways to continue reducing power usage by supporting water conservation — for example by assessing why water usage has increased, and adding requirements and incentives for conservation (Recommendations D-1 through D-6).
- **Proactively invest in additional energy technologies that transition away from fossil fuels**. To do this, explore creative funding mechanisms (Recommendation A-8) and the use of other alternative energy sources, such as wind and solar thermal (Recommendation B-7). Consider solar thermal pool heaters for Ives Pool (Recommendation B-8), additional alternative vehicles (Recommendation C-1), added use of motorized bicycles (Recommendation C-2), biofuels for vehicles (Recommendations C-3, C-4, and F-1), solar PV at wellheads (Recommendation D-7), and alternatives to petroleum-based asphalt (Recommendation B-9).
- **Prepare for longer-term outages and emergencies**. To do this, prepare plans for more drastic energy-limited situations (Recommendations B-10 through B-12, and F-2 through F-6), including determining the basic electrical consumption level needed for each department, how long current backup options would last, if this should be increased for longer outages, and other backup technology that might be useful. Assess how long water supplies will last, and determine if the City wants to extend that time (Recommendation D-8). Identify what it would take to make wells more self-reliant during outages (Recommendation D-9). Assess the EMS system, including the

dependency on the AMR contractor (Recommendations F-5 and F-6) and the high use of fire vehicles for EMS events (Recommendation F-2). Assess the Laguna Treatment Plant's emergency measures for longer-term outages, especially to avoid sewage pollution (Recommendation E-2). Encourage all citizens to have backup sources of drinking water (Recommendation D-10). Consider reducing the City's dependency on the Laguna Plant (Recommendation E-3). For more extreme circumstances, consider re-examining the water system design (Recommendation D-11).

- **Plan future City revenues in the face of these dynamics.** To do this, add energy vulnerability scenarios to the current revenue development planning process (Recommendation H-1) and to area "Buy Local" campaigns (Recommendation H-3). Encourage local businesses that serve key needs now met by Santa Rosa merchants, to encourage more local shopping (Recommendation H-4). Establish a policy and methods for supporting local green businesses, especially those which nurture and benefit from a transition away from fossil fuels (Recommendation H-5). Consider setting aside added financial reserves to cover increased risks (Recommendation H-2).
- **Reduce risks of impacts on employee availability** by assessing how sustained and serious fuel shortages or price increases might impact the availability of commuting employees (Recommendations C-5 and F-4) and establishing incentives to use alternatives to single occupancy vehicles (Recommendation C-6).
- **Reduce risks from trash collection cost increases and pickup failures,** by encouraging WMI's use of non-fossil fuel and reducing the City's total trash amount, with the goal of becoming a Zero Waste city (Recommendations G-1 and G-2).

Making Broader Connections

Because the City's activities are interdependent with those of the community and other levels of government, it is vital that the City also keep an eye on the larger community picture as it evolves – both to consider how this could impact the City's ability to maintain appropriate levels of service, and to explore how the City can constructively influence activities in other spheres. Larger potential impacts of these dynamics include harm to transportation systems, food supplies, other government entities, and the overall economy. The ripple effects of these unprecedented challenges and events will require both anticipation and flexibility in response.

To support constructive proactive action in the larger community, we advise the City to:

- **Establish a Community Outreach Committee** to make recommendations to the greater Sebastopol community about appropriate measures which could be taken to adapt to future uncertainties regarding energy supplies (Recommendation A-10).
- **Identify ways that the City can encourage actions at other levels of government** to reduce energy use and transition away from fossil fuel energy sources (Recommendations A-11 and E-1).
- **Consider joining with other cities to implement Community Choice Aggregation (CCA),** in order to buy and support local green power (Recommendation A-13). In the future, consider becoming a municipal utility, to better access local energy sources and control rates (Recommendation A-14).
- **Expand citizen conservation and adoption of alternatives** (Recommendations I-1 through I-5). Educate users on the energy component in the costs of City services, including water, sewer, Ives Pool, etc. (Recommendation A-9).

Conclusion

The future challenges to our energy supplies are significant, and so too are the opportunities for us all to make a positive difference now in how these events unfold in the future. We hope that this report is of service to the City of Sebastopol as it plans its part in our culture's transition to our new energy future.

The Upcoming Energy Challenges

Introduction

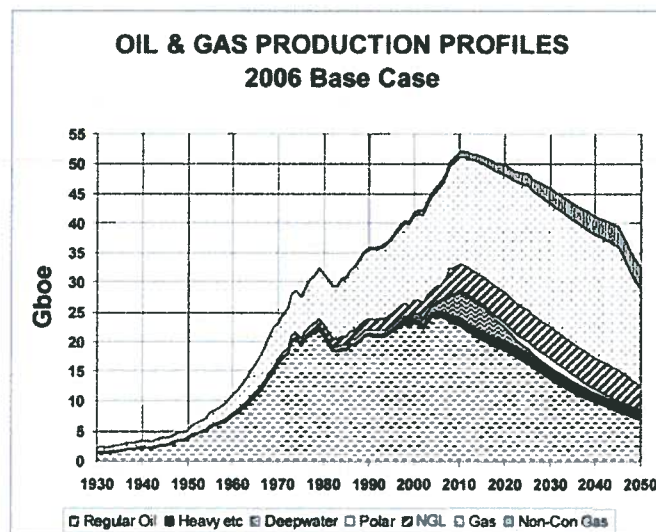
“The peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated more than a decade in advance of peaking.”

Peaking of World Oil Production: Impacts, Mitigation, & Risk Management, Robert L. Hirsch, et al., 2005

It is clear that the standard of living we as a society and as a community have enjoyed has been made possible by an abundant source of inexpensive energy – derived primarily from fossil fuels, predominantly petroleum oil and natural gas. Fossil fuels are also used to produce our foods and pharmaceuticals, manufacture our chemicals and plastics, and transport nearly all of our goods.

Unfortunately, we as an industrialized society are expected to soon reach a peak in the production (extraction) of oil from the total reserves on our planet. This means that we will start to extract less and less oil each year, and the production curve will begin declining at an accelerating rate. This is known as peak oil. Natural gas production is also anticipated to begin peaking, but the declining curve is steeper, because natural gas wells do not typically last as long as crude oil wells. Natural gas extraction rates are already in decline in North America, and, because the global trade in liquefied natural gas is relatively small, this almost guarantees higher prices and supply shortfalls for the U.S. in the years ahead.² “Consider that over half (54%) of American homes are heated by natural gas ... and 94% of power plants [currently being] built in North America are gas fired”³ and one can see the level of impact that these changes could have on the functioning of our society.

Chart 1. Oil and Gas Supplies and Projections ⁴



This peak in the production of oil is occurring at the same time as demand for inexpensive energy worldwide is strongly increasing, especially in rapidly industrializing countries such as China and India. According to a report released by the U.S. Department of Energy, these needs are expected to help drive global oil demand up 47% between 2003 and 2030. That report projects that world oil use will rise to

98 million barrels a day in 2015 and jump to 118 million barrels a day in 2030, up from 80 million barrels in 2003. To meet this growth in demand, oil production in 2030 would need to be 38 million barrels a day above 2003 levels.⁵ Global use is now about 86 million barrels a day.⁶

Unfortunately, even given the best case scenarios, experts question how world production can realistically ever get over even 90 million barrels a day, let alone meet those projected needs. Therefore, a significant and increasing shortfall is expected.⁷ Today we have reached a key point where user demand has increased to reach the level of supply, and threatens to exceed it. It is this pressure on supply that really concerns analysts. Already, we are seeing tight oil supply conditions in oil price increases and vulnerability to both weather and geopolitical events.

What makes this energy crisis different from past ones is the hard edge of reality that our usage level has reached our current supply levels, and is expected to continue to increase, without sufficient alternatives in place to replace liquid petroleum when supply no longer is sufficient to meet user demand.

This situation is the reason that CAGE has been charged with examining the future of energy and making recommendations to the City of Sebastopol as to how to best prepare for what is surely to be a challenging environment for maintaining the delivery of City services.

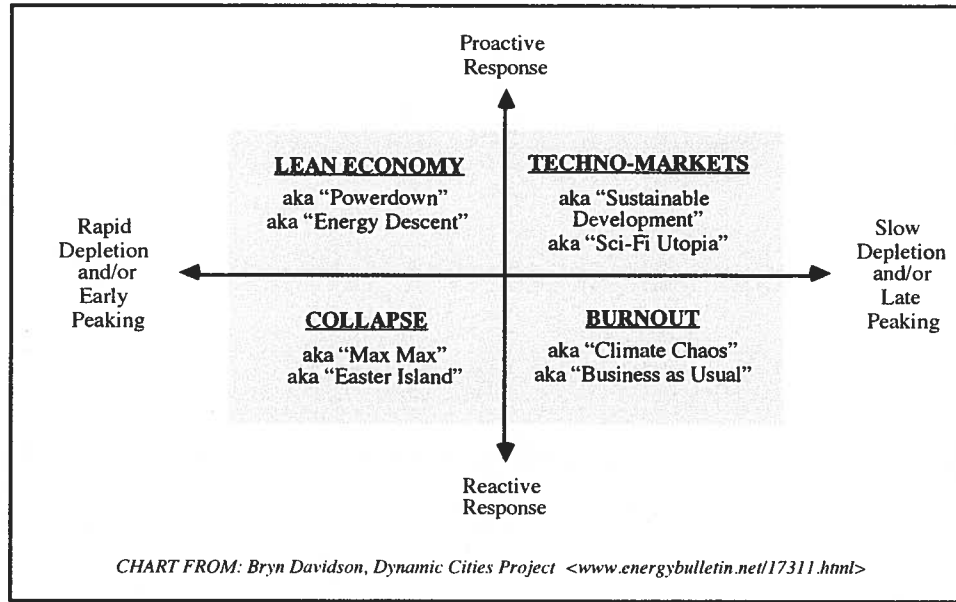
The following five points (primarily from The Hirsch Report) make it clear that the challenges of this emerging crisis demand immediate and serious attention.

- 1) While the exact date for the peaking of the world's oil supply is not known, it is expected that we will reach the peak sometime within the next 20 years – and likely during the early years of that interval, if we have not already passed it.
- 2) The problems of declining fossil fuel production will not be temporary and our experience of dealing with past energy crises will not provide a good road map for navigating this energy crisis.
- 3) The decline of oil and natural gas supplies could create a severe problem for a number of industrial sectors, including:
 - a) Transportation
 - b) Food production
 - c) Chemical and plastics production
 - d) Electricity generation
- 4) The decline of oil production will likely result in dramatically higher energy prices, which will likely cause protracted economic hardship to the United States and the world's economy.
- 5) A smooth transition away from petroleum will require an intense national effort that needs to start a minimum of 10 to 20 years prior to the peak of production for us to have a relatively smooth transition to our new energy future.

Possible Scenarios for the Future

While we believe that the indicators for the peaking of the world's oil supply point to the need for serious consideration and planning, there are a range of viewpoints regarding how this energy crisis and our ability to respond to it might unfold. The following chart provides an effective overview of the primary scenarios being discussed by experts and observers of these dynamics.

Chart 2. Overview of Predicted Scenarios



This chart describes two key variables in determining how these trends will play out:

- **Horizontal axis: When the oil and natural gas extraction peaks occur.** On the one hand, the Association for the Study of Peak Oil (ASPO), made up primarily of retired petroleum geologists, has concluded that conventional oil production has already peaked and that all liquid fuels taken together (including natural gas liquids and synthetic fuels from tar sands, etc.) will peak in approximately 2010. On the other hand, the International Energy Agency (IEA) sees the peaking of oil production in 20 to 30 years, a more distant (and therefore manageable) point in the future.
- **Vertical axis: How governments, markets, and society prepare and respond to these projected peaks.** At the proactive end of the spectrum, the market – with government support – would significantly increase investment in alternative energy production and utilization technologies long before oil production peaking, so that by the time production begins to decline, mitigations will be in place and society can make a smooth transition to energy alternatives.

On the reactive end of the spectrum, society and its government would leave alternative energy investment strategies to the marketplace, which tends to structure investments around quarterly returns, making it less-focused on long-term investments. In this case, the market would wait to invest in alternative energy technologies at oil price points that make investments profitable in the short-term. Because of the scale of investment needed, and the time needed for rampup, this would likely bring too late of a response and fall far short of the time needed for a smooth transition. As a result, one would expect real and drastic shortfalls in the energy we need to fuel our modern society, and a wide range of serious repercussions impacting food supply, transportation, public health, civic order, financial systems, and the functioning of many levels of society that we all depend on but take for granted.

Therefore, Chart 2 reveals these four types of scenarios:

- 1) **TECHNO-MARKETS.** If government, the market, and society act proactively and invest in the necessary strategies to move our industrial and transportation systems away from oil, and the IEA is correct in their assumptions that the peaking of oil production is 20 to 30 years into the future, then we might be able to avoid economic and social turbulence and transition somewhat gracefully to a more sustainable future.
- 2) **LEAN ECONOMY/POWERDOWN.** If, on the other hand, the ASPO analysts are correct in their conclusion that the peak is earlier, the proactive stance will at least have prepared society to begin powering down its petroleum usage, helping to reduce the impacts of this transition.

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- 3) **BURNOUT/CLIMATE CHAOS.** However, if government, the market, and society do not respond in a timely fashion, and we find ourselves in the IEA future of a longer time to peak, we will probably experience a prolonged “business as usual” decline into a future, where we end up reaching the point of oil production peak without making the necessary investments in alternative energy technologies. Worse, the continued use of fossil fuels will continue to increase global warming and its harm to the healthy functioning of world ecological and economic systems.
 - 4) **COLLAPSE/MAD MAX.** If we find ourselves in the ASPO future (near peak), with official responses tending more toward the reactive end of the response spectrum, then we would expect the most severe scenario regarding energy price increases, potential for disruptions in supply channels, economic turbulence, and resource wars.

Economic Impacts

“Analysts warn ... that consumers and businesses could be just one major supply disruption away from more serious financial consequences..... a hypothetical supply disruption that jolts oil prices to \$80 or higher and keeps them there for an extended period – say, three months – could result in ‘a substantial falloff in discretionary spending’ that snowballs into a serious slowdown, ... with potentially grave consequences for economy.”

“Experts See Danger in Rising Oil Prices,” Brad Foss, Associated Press ⁸

How will these dynamics impact the global economy? It is predicted that petroleum prices will increase no matter which scenario occurs. However, in the best case scenario above (Techno-Markets), we will have acted proactively and had the time and new alternatives to smooth our transition. On the other hand, in the worst case scenario above (Mad Max), our culture would be short on time and not prepared proactively enough. These dynamics could then have significant impacts on our global economy, because our economic system depends so extensively on petroleum energy.

On June 23, 2005, in an exercise named “Oil Shockwave,” top former U.S. national security officials gathered to enact an oil crisis scenario that simulated the consequences of a major global oil supply crisis, and to “explore the economic and national security implications of America’s dependence on oil.”⁹ They found that “taking even a small amount of oil off the market could cause prices to rise dramatically” which could significantly damage the U.S. economy, and that at that point there were limited short-term options to protect the economy. In the exercise, high oil prices push the economy into recession and millions of jobs are lost.

Afterwards, the moderator commented, “Even among individuals who have spent years contending with security and energy issues, it was surprising to learn the extent to which seemingly small disruptions in world oil supplies could inflict serious economic damage and alter the global security environment.” He felt that two key conclusions from the process were:

- **“The economic and national security risks of our dependence on oil—and especially on foreign oil—have reached unprecedented levels.** The threat is real and urgent, requiring immediate and sustained attention at the highest levels of government.”
- **“If we wait until a crisis occurs to act, the nation will have access to few, if any, effective short-term remedies.** To protect ourselves, we must transcend the narrow interests that have historically stood in the way of a coherent oil security strategy and implement policies that will meaningfully address both the supply and demand aspects of our current oil dilemma.”¹⁰

This exercise shows that higher oil prices, especially oil price spikes, can cause significant economic impacts, including recessions. Determining the precise dynamics and impacts depends on a wide range of highly-complex variables that are extremely challenging to quantify and model. However we can imagine possible dynamics in general terms.

For instance, decreased energy availability and/or increased costs could notably reduce the current widescale transfers of commercial goods over long distances. This could significantly reduce the

products available at big box discount stores, which offer discounts by bringing in products from less-costly labor markets. Both consumers and businesses could suffer from a loss of key products and a drastic increase in pricing. A similar dynamic could occur with the many industries that have been moving plants and outsourcing to overseas facilities. These drastic changes in the economic structure could place stress on communities, causing notable unemployment and requiring them to very quickly start producing their own sources of food and other goods. People might also need to relocate their places of employment because of limitations on their ability to commute. Tourist trade could be significantly impacted. The effect on sales tax revenues could be dramatic. This could also create an opportunity for local businesses and producers to step in to fill the void.

These are just some ways an economic crisis could potentially be created by a combination of geopolitical and energy-related dynamics.

Five Key Vulnerabilities

The question then becomes what we can do now to prepare ourselves for these events, to minimize their impacts on our lives. We as a society have little control over the geological peak of oil supplies. However, we can be proactive in preparing for these dynamics, by understanding and preparing for the risks that they bring. This will greatly impact our lives in the future, regardless of when the actual oil production peak occurs.

Therefore, CAGE has identified that the peaking of oil and natural gas production brings with it five major types of impacts or vulnerabilities:

1) Increased Direct Energy Costs

As described above, shortfalls in the supply of oil and natural gas are expected to drastically increase their prices. It is likely that this will also increase competition for other energy sources, which could also increase those costs.

2) Increased Indirect Energy Costs

Energy price increases will also increase a wide variety of other prices, because energy costs are embedded in nearly all other products and services, in two key ways:

- Energy is used for production and transportation, and
- Oil and oil by-products are used as inputs to make products such as plastics, chemicals, and asphalt.

These increased costs could add up significantly, with notable cumulative and ripple effects, including increased costs for labor, materials, and supplies; increased inflation (which decreases the purchasing power of savings); decreased reliability in bill payments by businesses and individuals (because of funding shortfalls); budget cuts at all levels of government (to pay for these costs); increased demands on government services (by those unable to meet their financial obligations); and thus tax increases (which will further exacerbate these problems).

3) Insufficient Energy Supplies and Outages

The increasing shortfalls of energy relative to user demand are expected to lead to insufficient fuel supplies, electricity outages, and more. This could cause untold ripple effects, by making other supplies and services less available, and impacting the basic functioning of our society and communities.

4) Global Economic Crises and Disruption

Drastic price increases and energy shortfalls could have serious impacts on our global economic system overall, by significantly impacting the economic viability of individuals and businesses worldwide, and engaging the world in geopolitical events related to oil and energy supply issues. This could have impacts on the stability of the dollar, government budgets worldwide, and potentially help cause a recession and significant job loss.

5) Insufficient/Late Transition Away From Fossil Fuels

Increased prices and supply shortfalls are just symptoms of the larger problem of supply decline and the need to transition away from fossil fuels. As the gap between supply and user demand increases, oil and natural gas will likely become so expensive and/or scarce that we will require replacement sources of energy to meet a wide range of our current needs. However, according to Robert Hirsch, it will take 10 to 20 years before the oil production peak to develop and implement these alternatives – and we might be at that peak now. If our culture doesn't intensively and proactively reduce our energy needs, and shift from petroleum to alternative energy sources, we are vulnerable to increasing problems with energy costs and shortfalls, as well as reduced access to sustainable alternatives, both because of price and limited availability.

Conclusion

In examining the enormous negative impacts likely to occur without proactive responses, and with the current low level of national and state leadership, CAGE believes that it is prudent risk management for local municipalities, such as the City of Sebastopol, to begin preparing proactively for the possible impacts associated with the decline and depletion of worldwide fossil fuel supplies, including drastic price increases and unpredictable disruptions in energy supply channels, and to proactively transition away from dependence on these supplies and towards ecological and sustainable energy sources. We can also reduce the rate of consumption of the oil supplies we have, to reduce the overall energy needs of our society and give us more time for this transition to a new energy future.

Overview of Primary Energy Alternatives

Where Will We Get Our New Power?

How then will we make up the anticipated shortfall of oil and natural gas? Currently, no known energy replacement offers the technological “silver bullet” of low cost, reduced vulnerability, high reliability, and low environmental harm. However, analysts have concluded that we can smoothly transition to our new energy future if we both:

- 1) **Develop a combination of alternatives aggressively;** and
- 2) **Reduce energy demand significantly (to meet reduced energy supply),** through individual conservation, increased energy efficiency (such as better gas mileage), and improved community infrastructure (such as better public transportation).

Because of the scale of change needed for a smooth transition, and thus the time needed for technical rampup and behavioral change, it is vital that we act proactively on both aspects, starting at least 10 to 20 years before the peak. We might have already passed that 10-year trigger point or be near it. If we wait too long for clear signs of crises or for price signals to catch up, there could be insufficient time and energy available to change direction without experiencing severe and expensive consequences, not only economically but also socially, culturally, and environmentally. “On the other hand, with timely mitigation, economic damage can be minimized,” according to Hirsch.¹¹

“It is important to note that initiation of all of the options simultaneously does not even satisfy half of the U.S. liquid fuels requirements prior to 2025. If the peaking of world conventional oil production occurs before 2025, the U.S. may not have a choice in terms of a massive national physical mitigation program. Even with the most optimistic assumptions and assuming crash program implementation, physical mitigation will require decades and trillions of dollars of investment to make substantial contributions.”

Economic Impacts of Liquid Fuel Mitigation Options, Roger H. Bezdek, Robert M. Wendling, and Robert L. Hirsch¹²

Choosing Wisely

As supplies of petroleum and natural gas fall short of demand, and costs rise, consumers and energy producers will look for alternatives. Already, they’re turning to coal, tar sands, and oil shale (including coal liquefaction for vehicle fuel) because prices are reasonable and supplies abundant. Unfortunately, burning these fossil fuels generates greenhouse gases (GHG), such as CO₂, thus extending the enormous destruction of global warming. These energy sources also cause extensive health and environmental harm throughout their lifecycle, through production pollution, spills, workplace exposure, and emissions that cause diseases such as lung cancer and asthma. Similarly, there is a call to increase use of nuclear power; however this brings the enormously dangerous and unresolved problems of long-lasting and highly-toxic radioactive waste as well as risks of nuclear proliferation and associated terrorist threats.

Therefore it is vital that we encourage the development and implementation of replacement energy forms, which (1) are based either on sustainable sources that will continue for the indefinite future (such as sun, wind, and water), or on sources that can easily be regrown (such as renewable biological sources); (2) do not directly produce net GHG and other pollutants; and (3) do not burden future generations with unacceptable waste and nuclear proliferation.

However, implementation of more sustainable energy sources is still in its infancy, currently meeting only a very small portion of our energy generation needs. Additionally, it is not expected that any one source can and will meet all of our needs. Current demand is already challenging the production capacity of sustainable alternatives, and both costs and delivery times have notably increased. Production is also limited by supplies of raw materials, such as the silicon needed for most solar PV panels. These problems are likely to worsen as energy problems become more obvious to the general public and

demand for alternatives increases. Thus, to smoothly shift to new energy sources without destroying our planet and ourselves, it is vital that we implement multiple sustainable sources as quickly as possible.

Primary Energy Alternatives

The following is an overview snapshot of what are today viewed as the primary replacements for fossil fuels, to assist the City in understanding the options available. Please note:

- This is a rapidly-evolving arena and we expect ongoing innovations in technology and implementation to continue shifting the picture from a decision-maker's perspective.
- In our analysis of an energy source's production of GHG, we're only discussing *direct* production. Keep in mind that many of these technologies require significant energy to create the infrastructure and/or the fuel itself, and this embedded energy can also have GHG impacts. Actual net impacts depend on how a particular energy source is produced, e.g. whether biodiesel feedstock is grown and processed using petroleum or a sustainable power source.
- In addition to the fuel replacements discussed here, our culture will need to address other current uses of petroleum products, for instance as lubricants, and as feedstocks for a variety of products, including plastics, chemicals, and more.

Non-Sustainable Energy Sources

- **Coal. Use:** Generating electricity; potential for vehicle fuel and heating.
Advantages: There are still large reserves of coal globally, especially in the U.S., which makes it tempting to use.
Disadvantages: Extraction is harmful to the environment and workers. Burning coal and coal byproducts produces significant GHG and other pollutants.
- **Tar Sands and Oil Shale. Use:** Same as conventional petroleum.
Advantages: Requires no changes to current distribution system. Can run in existing engines.
Disadvantages: Extraction is difficult and requires high amounts of water and energy (adding to GHG impacts). Techniques such as clearcutting, strip mining, and steam extraction cause devastating environmental problems. Produces substantial waste and pollution. Requires intensive processing.¹³
- **Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG). Use:** Same as propane and natural gas.
Advantages: Can be used in some vehicles, including converted gas engines. Produces lower smog-creating emissions. By being compressed into liquid form, can be more easily stored and shipped from other countries.
Disadvantages: Costs of conversion or new vehicle. Limited number of filling stations. They still are fossil fuels and thus are limited resources that will also peak in supply, produce GHG, and are otherwise harmful to the environment.
- **Nuclear Fission. Use:** Generating electricity.
Advantages: Existing technology. Produces no GHG.
Disadvantages: Produces radioactive waste that remains highly toxic for thousands of years, causing problems in both transportation and storage. Production and transport are unforgiving of error, and its materials can be used in nuclear weapons, thus making us vulnerable to both accidents and terrorism that can harm people and ecosystems around the globe. Safety requirements and negative impacts greatly add to net actual costs.

Sustainable Energy Sources

- **Solar Photovoltaic (PV). Use:** Generating electricity.
Advantages: PV panels convert sunlight directly into electricity producing no pollution or GHG. Energy can be fed into the grid, which financially benefits the owner and reduces the system's peak power needs.

Disadvantages: Only works when the sun is shining. Systems not tied to the grid require battery storage components that can be costly and bulky; they are best used in low-energy situations and for short durations, especially where continuous energy is desired.

- **Solar Thermal.** Use: Directly heating air and water from the sun. Less often, generating electricity.
Advantages: Common and useful applications are south-facing windows (to let sun in during the winter), swimming pool heating, hot water heating (works best in hot climates), and creating steam to power turbines. Can be designed to retain energy.
Disadvantages: Requires the sun to generate energy.
- **Wind Power.** Use: Generating electricity.
Advantages: Produces no pollution or GHG. Can be fed into the grid.
Disadvantages: Work best in places with high and constant wind speeds.¹⁴ Because wind varies, continuous power is not assured. Thus, wind power supplements other energy sources. For systems not tied to the grid, current battery storage options can be costly and bulky. There have been concerns about bird deaths, taking land from other uses, and noise and aesthetic issues.
- **Hydroelectric Power.** Use: Generating electricity.
Advantages: Operates 24/7. New dams provide added stored water, and can mitigate flood control problems.
Disadvantages: Building dams is very harmful to the environment, flooding land, drastically changing ecosystems, and endangering wildlife. Dams produce significant amounts of CO₂ and methane on an ongoing basis (from rotting vegetation).¹⁵ Weather patterns can effect available water resources.
- **Tidal and Wave Power.** Use: Generating electricity. (Note: See footnote for article about local exploration of the ocean's energy-generating potential.¹⁶)
Advantages: Operates 24/7. Produces no GHG.
Disadvantages: Subject to damage during storms. Potentially disruptive to the environment. Relatively new technology.
- **Geothermal Power.** Use: Generating electricity and heat.
Advantages: Operates 24/7. Produces little or no GHG. Almost no environmental impact. Resistant to external disruptions.
Disadvantages. Geothermal hot water is only available at sites with specific geological conditions. Although these sites can produce energy for many decades, they can eventually cool down.
Note: **Ground source heat pumps** can also tap into earth energy; for more information, see Heat Pumps in the Innovative Technologies section below.
- **Ethanol.** Use: Similar to gasoline. Could be used for generating electricity and heating. Produced primarily from corn, sugar cane, and other crops.
Advantages: Comes from a biological, renewable source. Its pure form (E100) can produce considerably less pollution than petroleum. Can run in some existing gasoline engines.
Disadvantages: There is not enough farmland to provide for current energy consumption levels, risking development globally of large amounts of wild land. Competes with food uses; demand is already driving up corn and meat prices. Requires expansion of current production capacity.
Note: **Cellulosic ethanol** (made from plant fibers, like agricultural waste and switchgrass) is now under development and can avoid the farmland limitations while offering an improved energy ratio and cost profile.¹⁷
- **Biodiesel.**¹⁸ Use: Replacement for diesel. Produced primarily from vegetable oil.
Advantages: Is a renewable resource and produces less pollution than petroleum fuels. Can run in existing diesel engines (sometimes modification is needed in older vehicles).
Disadvantages: Requires new production facilities. Competes with food sources. There is not enough farmland in the U.S. to meet our current consumption levels. A maximum of B50 (50% biodiesel) or lower is recommended for temperatures below 40°.

Note: Producing biodiesel from waste vegetable oil can reduce waste and avoid concerns about competition with food supplies. However, waste oil quantities are limited. Also, producing biodiesel from algae ponds (e.g. within waste treatment processing facilities) could mitigate sourcing concerns.

- **Straight vegetable oils** (or SVO). Use: Replacement for diesel, in modified diesel engines.
Advantages: Directly uses existing waste (such as from restaurants), not new material. Removes waste from the disposal system.
Disadvantages: Limited quantities keep the impact small. Requires fuel filtering and vehicle modification.
- **Biogas**. Use: Generating electricity and heat.
Advantages: Operates 24/7. Primarily utilizes waste methane, a GHG gas that would otherwise be released into the atmosphere. This results in a greater than 100% reduction in GHG (because it offsets 100% of the power source we didn't use, plus reduces the methane being released).
Disadvantages: Small incremental contribution to reduce the total load.
- **Hydrogen**. Use: Vehicle fuel; generating electricity and heat. Hydrogen is produced, normally using electricity, or as a waste by-product of chemical production. It can either be burned directly or turned into electricity through fuel cells.
Advantages: Produces no pollution itself. If manufactured from a renewable source, produces no GHG.
Disadvantages: Hydrogen is very volatile and prone to leakage. Use in vehicles is at early stages of development and would require significant improvement in fuel cell technology (costs and size) as well as significant investments in completely new production systems, distribution systems, and end-user technology.
- **Nuclear Fusion**. Use: Generating electricity.
Advantages: If achieved, could offer high energy output for low energy input, without toxic byproducts and safety issues.
Disadvantages: Highly speculative. No one knows when and if it will be a viable energy source.

Innovative Technologies

- **Heat Pumps**. Use: Transfer energy differential from the earth or outdoor air to heat or cool indoor air or water.
Advantages: Clean and immediate heating and cooling. Significantly more efficient than gas-burning furnaces.
Disadvantages: Air source heat pumps works best in moderate climates such as Sebastopol or warmer. Water source heat pumps need a large source of water, like a lake. Ground source heat pumps require drilling wells or trenching, which is expensive and potentially harmful to the aquifer.
- **Hybrid Vehicles**. Use: Vehicles have both gas and electric motors. Recaptures previously-lost energy.
Advantages: Improves energy efficiency and thus can improve mileage. Allows flexibility of continued gas use.
Disadvantages: Still uses fossil fuels, just potentially lower amounts, if efficiency is used to improve mileage.
- **Electric Vehicles**. Use: Allows vehicles access to a broader range of energy sources.
Advantages: Emits no emissions during use.
Disadvantages: Only as green as the electricity that powers them. Few cars available in the U.S. Can be expensive and have limited range, so best for short trips. A new generation of cars is in pipeline.
- **Plug-In Hybrid Vehicles**. Use: Hybrid vehicles that are rechargeable.
Advantages: Further reduces gas use and can reduce GHG. On commonly-made short trips, could avoid gas use altogether. Uses excess electric capacity at night, reducing need to build added plants.
Disadvantages: Only as green as the electricity used to power them. A new technology.

Notable Community Responses

Around the world, individuals and communities have become increasingly concerned about the threats of both peak oil and global climate change. The solutions they've been exploring (often with government support) include setting transition targets, modifying regulations, providing subsidies, and encouraging public discussion and education. Below is a sampling of some of the key community responses, as information and inspiration to support Sebastopol's exploration of what we can do here. (Note: For more information about these projects, see the citations in this section's footnotes as well as the resources in Appendix D.)

- **Sweden – Sweden plans to be the first country in the world to be oil independent by 2020.** “Minister for Sustainable Development Mona Sahlin has declared that Sweden is going to become the first country in the world to break the dependence on fossil energy. Sweden will stop using oil by 2020 and eventually the energy supply of the country will be based on renewable energy only. The goal is to gradually rid the country of gasoline-run cars and oil-heated homes.” Their plan includes: large-scale investments in renewable energy, tax and funding incentives, increased efficiency rates, specific interim objectives, and an Environmental Objectives Council to monitor progress towards the goals.¹⁹
- **Kinsale, Ireland – Permaculture students at Kinsale Further Education College prepared *Kinsale 2021 – An Energy Descent Action Plan*, which considers how Kinsale could “make the transition from a high energy consumption town to a low energy one.”** The report says, “The impending peaking of world oil production will lead to huge changes around the world, and Ireland will not be immune from this.” One of their goals is that the majority of Kinsale's energy come from sources within a ten-mile radius. Methods for accomplishing this include reducing energy use and expanding renewable energy sources, including wind power.²⁰
- **Totnes, UK – “Totnes is the UK's first town exploring how to prepare for peak oil.”** Transition Town Totnes is a community-led initiative working towards the creation of a Totnes *Energy Descent Action Plan*, modeled on the *Kinsale Energy Descent Action Plan*, “as a tool for designing a positive timetabled way down from the oil peak.... The thinking behind TTT is simply that a town using much less energy than we presently consume could, if properly planned for and designed, be more resilient, more abundant, and more pleasurable than the present.”²¹
- **Woking, UK – Woking is committed to “actively promoting Climate Neutral Development, tackling the causes of Climate Change,” and helping develop sustainable energy sources. The Woking Borough Council has cut carbon-dioxide emissions by 77% since 1990, and increased its energy independence,** using a hybrid-energy system involving small private electricity grids, combined heat and power (CHP), solar photovoltaics (PV), and energy efficiency. According to Alex Steffen, “Woking has turned its town centre, its housing estates, and its old people's homes into inspirational islands of energy self-sufficiency. The UK grid could go down forever, and these folks would have their own heating and electricity year-round.... The CHP units generate heating when needed in winter, and lots of electricity along with it when the PV is not working at its best.” The PV generates substantial amounts of electricity in summer, when the heating isn't needed. (A heating demand is required for efficient CHP operation.) “Because the use of private wires is so much cheaper than using the national grid, the whole package costs fractionally less than the equivalent heating and electricity supply would cost from the big energy suppliers.”²² Note: More about CHP heat recovery is at <www.aceee.org/pubs/ie983.htm>.
- **Oakland, California – Oakland aims to be oil independent by 2020.** On Oct. 17, 2006, inspired by Sweden, the Oakland City Council unanimously passed legislation making Oakland the first city in the U.S. to aim for oil independence by 2020. The City Council and Mayor will form a task force, composed of local, regional, and national experts, which will develop a plan to reduce oil consumption citywide, reduce emissions of greenhouse gases, seek to secure Oakland's energy needs, and establish Oakland as a national leader in green jobs creation.²³
- **Portland, Oregon – On April 18, 2006, the Metro regional government, serving the Portland Oregon area, produced a *White Paper: Future Oil Supply Uncertainty and Metro*, describing the issue and ways it could be addressed.**²⁴ On May 10, 2006, the Portland City Council passed a **resolution to create**

a task force to investigate implications of peak oil, largely in response to activism from Portland Peak Oil, a local grassroots group. The task force received staffing and assistance from the Office of Sustainable Development and other government agencies.²⁵ “The resolution charged the Task Force with examining the potential economic and social consequences of peak oil in Portland and developing recommendations to mitigate the impacts of rising energy costs and declining supplies.” The Task Force held meetings and involved stakeholders and citizens in gathering information, which they used to create their Jan. 16, 2007, public comment discussion draft report.²⁶

- **San Francisco, California** – On April 13, 2006, the **San Francisco Board of Supervisors passed a *Peak Oil Plan of Response and Preparation*** – the first city in the country to pass a peak oil resolution.²⁷ On July 28, the San Francisco Local Agency Formation Commission (LAFCo) began holding a series of hearings, inviting the public to help develop a plan of response.²⁸

- **Willits, California** – In response to concerns about future oil supply declines, the community group Willits Economic Localization (WELL) was formed. **They currently seek to identify Willits’ current resource use (energy, food, transportation, etc.), and determine ways to reduce the use of imported resources and replace them with local ones.** Their local energy audit found that half of all energy consumed is from “non-sustainable transportation.” The balance is mostly industrial uses and home heating, cooling, and cooking. Various WELL subgroups are developing alternative solutions. The City has joined with WELL and other groups, including the Willits Chamber of Commerce, in signing a declaration supporting sustainable localization. The City of Willits has committed to find ways to power city operations with renewable energy and conservation, and to promote both in private homes and businesses. WELL members and other volunteers have submitted recommended changes to the County’s General Plan that would promote sustainable localization of goods and services.²⁹

- **Worldwide** – Around the world, people are connecting with others concerned about this issue – to learn more, explore ways we can prepare, and join together in taking action. For instance, the Post Carbon Institute <www.postcarbon.org> has formed the Relocalization Network <www.relocalize.net> to support connections and local groups. Also, the Apollo Alliance <www.apolloalliance.org> has created an inspiring vision that brings together the goals of business, labor, and environmentalists to act together for shared goals of energy independence, good jobs, a healthy environment, and national security. They are working on collaborative projects and supporting state and local Alliance groups and activities.

- **Cuba** – There is one more country to consider in this discussion, Cuba, which offers an example from the past of what happens when a country has a drastic drop in its oil supply.³⁰ In 1989, when the Soviet Union collapsed, it abruptly stopped shipping oil, supplies, and subsidies to Cuba. Along with the ongoing U.S. embargo, the result was frequent blackouts (up to 16 hours a day) and a drop by a third of the average daily caloric intake, for a nation of 11 million people. Buses, generators, and factories stopped running; fossil-fuel based large-scale farming production dropped drastically; and seeking food became a primary activity.

Solutions weren’t easy, but the changes led to creativity. Soon Cubans started growing organic food (including rooftop gardens in cities), changed their diets drastically to feature fruits and vegetables, replaced machines with hand tools and human labor, used oxen on farms, reduced energy consumption, prioritized locally-based preventive medicine, encouraged bikes and ridesharing, and developed an inventive energy-saving mass transit system. Agriculture shifted from export to feeding their own people, the government aggressively promoted organic techniques, people got to know each other, and they talk about the ways their lives are better now.

According to Peter Rosset, Executive Director of the Institute for Food and Development Policy, “The Cuban experience tells us that we can feed a nation’s population with a small-farm model based on alternative technology and without chemical pesticides, and in so doing we can become more self-reliant in food production.”

We can learn from this story and get ideas for what we can do proactively so that our transition doesn’t need to be this abrupt, and can even result in a community that offers us more of what we really want in our lives.

Chapter II. City of Sebastopol: Analysis and Recommendations

About CAGE's Approach

As requested by the City Council, this report focuses on ways that the City can maintain municipal services in the event of increasing fossil fuel shortfalls or disruptions. It is important that the City also keep an eye on the larger community picture as it evolves, because it is likely that the City's ability to maintain appropriate levels of service in an energy-constrained future will be significantly impacted by what happens in the surrounding community and beyond. Larger potential impacts of these dynamics include harm to transportation systems, food supplies, other government entities, and the overall economy. The ripple effects of these unprecedented challenges and events will require both anticipation and flexibility in response.

Also note that we primarily focus here on medium-scale scenarios, as the most drastic scenarios are extremely complex and challenging to model and plan for, except by the general principle of transitioning away from dependence on fossil fuels. We suggest that the City, in its planning process, consider what these more drastic scenarios might look like and how it might prepare for them.

CAGE's charter asked that we review vulnerabilities and potential remedies for each of the functional areas of Sebastopol's City government. Therefore, this chapter is divided into nine sections:

- A. Overview
- B. Buildings & Facilities
- C. Vehicles
- D. Water
- E. Wastewater
- F. Police, Fire, & Emergency Services
- G. Trash Collection & Disposal
- H. City Revenues
- I. City Programs to Encourage Citizen Action

Within each of these sections, information is presented in four groupings:

1. **Description.** The key elements of Sebastopol's current operations which are relevant to this topic, including energy usage.
2. **Vulnerabilities.** Ways that Sebastopol's current operations are vulnerable to the issues described in Chapter I of this report.
3. **Current City Programs.** Current City programs and activities that address energy vulnerability issues – for instance, reducing energy usage, purchasing alternative technology, etc.
4. **Recommendations.** Our recommendations for additional ways the City can proactively prepare for the likely upcoming changes and help ensure a more smooth transition to our new energy future.

A. Overview

1. Description

About Sebastopol. The City of Sebastopol is located in northern California, approximately seven miles west of Santa Rosa (the Sonoma County administration center) and 13 miles east of the Pacific Coast. The town sits in the hills above the second largest freshwater wetland area in Northern California, the Laguna de Santa Rosa. Founded in the 1850s as a small trade center for area farmers, Sebastopol was incorporated in 1902. With a variety of stores, it has a population of approximately 8,000 and serves a West County market area of 50,000. The mild Mediterranean climate and ocean influences make the area appropriate for agriculture and tourism.³¹

Governance. Sebastopol has a Council-Manager form of government, with five City Council members elected at-large. The Council directs the City Manager, who in turn supervises the management of the Building Department, the Finance Department, the Police Department, the Fire Department, Engineering, Planning, and Public Works. The City has 46 full-time employees, 16 part-time employees (including temporary and reserve police officers), and approximately 35 volunteer firemen.³²

City Energy Usage & Costs: Overview.³³ As shown in Table 1 below, the City reduced its direct energy costs for electricity, natural gas, and vehicle fuel by 10% between FY 03-04 and FY 04-05, from \$279.4k to \$250.7k, because of lowered electricity usage and costs. Some of this was offset by an increase in natural gas and vehicle fuel usage and costs.

However, in FY 05-06 total energy costs increased back to prior levels, with the City spending \$279.2k, an increase of 11% from FY 04-05. Most of this increase (+\$32.9k) was from added natural gas costs, largely the result of the enormous price spike in the winter of 05-06 from Hurricane Katrina. This situation is an example of the City's vulnerability to sudden and drastic price increases from external events. Vehicle fuel costs also went up notably this year (+\$4.8k), because of related price increases, even though usage decreased. Overall electricity usage and thus costs continued their decline. In FY 05-06, direct energy costs were approximately 3.4% of the City's total ongoing expenses of \$8.3M.

*Table 1. Overview of City Energy Usage and Costs*³⁴

	<u>Total Energy Costs</u>	<u>Total Ongoing City Expenses</u>	<u>% Energy Costs</u>	<u>Energy Sources</u>		
				Electricity (cost; kWh)	Natural Gas (cost; therms)	Vehicle Fuel (cost; gallons)
FY 05-06	\$279.2k	\$ 8.3M	3.4%	\$197.5k 1.60M kWh \$.124/kWh	\$47.3k 34.0k therms \$1.39/therm	\$34.4k 14.4k gallons \$2.39/gallon
FY 04-05	\$250.7k	\$ 8.9M	2.8%	\$206.8k 1.72M kWh \$.120/kWh	\$14.4k 31.3k therms \$.46/therm	\$29.6k 15.7k gallons \$1.88/gallon
FY 03-04	\$279.4k	\$ 9.3M	3.0%	\$245.0k 1.85M kWh \$.133/kWh	\$ 9.6k 22.3k therms \$.44/therm	\$24.8k 15.5k gallons \$1.60/gallon

City Energy Usage & Costs: By Energy Source.

- **Electricity:** In FY 04-05, the City used 1.72M kWh of electricity, a decrease of 7% from FY 03-04. This electricity cost \$206.8k, a decrease of 16%. In FY 05-06, City electricity usage decreased again, by 7%, to 1.60M kWh. Costs decreased 4.5%, to \$197.5k. The highest electricity costs were for Water Wells (44% of costs), Street Lighting (22%), and Buildings (17%). In buildings, electricity powers lighting, HVAC systems, and plug loads (mostly computers and office equipment).³⁵
- **Natural Gas:** In FY 04-05, the City used 31.3k therms of natural gas, an increase of 40% from FY 03-04. This natural gas cost \$14.4k, an increase of 50% over FY 03-04. In FY 05-06, City natural gas use increased 9%, but costs tripled to \$47.3k, because of increased prices. The highest cost was for Ives Pool (71%), followed by Buildings (21%) and Vehicle Fleet (8%).
- **Vehicle Fuel:** In FY 04-05, the City used about 15.7k gallons of vehicle fuel, a slight increase of 1% from FY 03-04. This fuel cost \$29.6k, an increased cost of 19%. In FY 05-06, City fuel usage dropped 8% to 14.4 gallons but costs increased 16% to \$34.4k, because of notable price increases.

NOTE: Vehicle fuel figures do not include the cost for City staff's use of their own cars for transportation on City business, which the City reimburses.³⁶

Table 2. Details of City Energy Usage & Costs (FY 04-05)

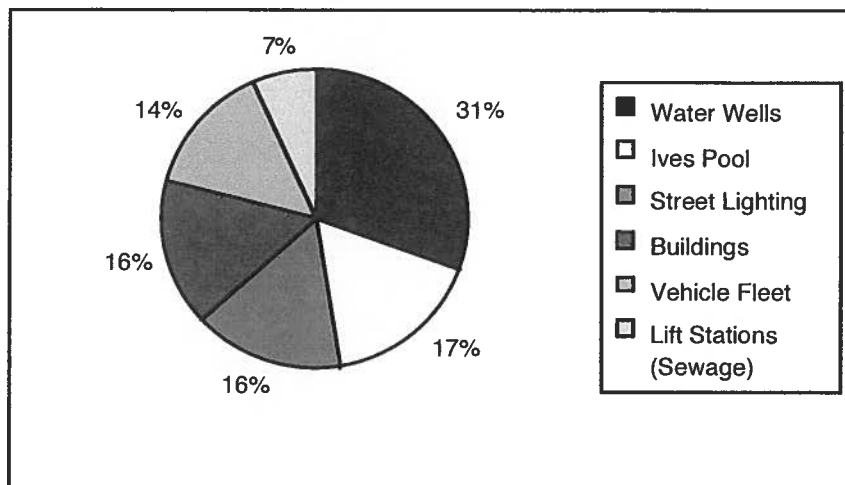
	Costs FY 04-05		Energy usage Electricity (cost; kWh)	Natural Gas (cost; therms)	Vehicle Fuel (cost; gallons)
Water Wells	\$98.9k	39%	\$98.9k 902.3k kWh	---	---
Street Lighting	\$42.7k	17%	\$42.7k 354.1k kWh	---	---
Buildings	\$37.5k	15%	\$33.5k 236.6k kWh	\$4.0k 6.5k therms	---
Vehicle Fleet	\$32.3k	13%	---	\$2.7k 2.0k therms	\$29.6k 15.7k gallons
Ives Pool	\$22.4k	9%	\$14.7k 101.5k kWh	\$7.7k 22.8k therms	---
Lift stations (sewage)	\$16.6k	7%	\$16.6k 129.2k kWh	---	---
TOTAL	\$250.7k		\$206.7k 1.72M kWh	\$14.4k 31.3k therms	\$29.6k 15.7k gallons
<i>Average rate</i>			<i>\$.12/kWh</i>	<i>\$.46/therm</i>	<i>\$1.88/gallon</i>

Table 3. Details of City Energy Usage & Costs (FY 05-06)

	Costs FY 05-06		Energy usage Electricity (cost; kWh)	Natural Gas (cost; therms)	Vehicle Fuel (cost; gallons)
Water Wells	\$86.3k	31%	\$86.3k 761.5k kWh	---	---
Street Lighting	\$44.3k	16%	\$44.3k 357.0k kWh	---	---
Buildings	\$44.5k	16%	\$34.4k 242.5k kWh	\$10.1k 6.7k therms	---
Vehicle Fleet	\$38.2k	14%	---	\$3.8k 2.3k therms	\$34.4k 14.4k gallons
Ives Pool	\$46.5k	17%	\$13.1k 89.3k kWh	\$33.4k 24.9k therms	---
Lift stations (sewage)	\$19.0k	7%	\$19.0k 148.1k kWh	---	---
TOTAL	\$279.2k		\$197.5k 1.60M kWh	\$47.3k 34.0k therms	\$34.4k 14.4k gallons
<i>Average rate</i>			<i>\$.12/kWh</i>	<i>\$1.40/therm</i>	<i>\$2.39/gallon</i>

City Energy Usage & Costs: By City Function. In FY 05-06, the City's energy costs by City function were: Water Wells \$86.3k (31% of total energy costs), Ives Pool \$46.5k (17%), Buildings \$44.5k (16%), Street Lighting \$44.3k (16%), Vehicles \$38.2k (14%), and Sewage Lift Stations \$19.0k (7%).

Chart 3. City Energy Costs by City Function (FY 05-06)



2. Vulnerabilities

We will now use the model described in Chapter I to explore the five ways that the City of Sebastopol is vulnerable to these anticipated energy supply problems:

- 1) Increased Direct Energy Costs
- 2) Increased Indirect Energy Costs
- 3) Insufficient Energy Supplies and Outages
- 4) Global Economic Crises and Disruption
- 5) Insufficient/Late Transition Away From Fossil Fuels

1) Vulnerability: Increased Direct Energy Costs

In FY 04-05, the City spent \$250.7k on direct energy costs, for electricity, natural gas, and vehicle fuel. This was approximately 2.8% of the total City expenditures of \$8.9 million. In FY 05-06, the City spent \$279.2k on direct energy costs, an increase of 11% and now 3.4% of total City expenditures.

While this is still a relatively small part of Sebastopol's budget, City revenues are limited and twice in the past few years the City has had to increase its sales tax to meet its needs. Also, if energy costs increase drastically as predicted, they will become a significantly larger portion of the City's budget. In order to get some understanding of these potential impacts, the City Council asked CAGE to estimate the increased direct costs to the City for each of the City's three energy sources, at two possible future price points. These price points, and the resulting projected increased costs, are shown in Table 4 below. At price points B, direct energy costs could jump to 12.1% of the City's budget.

Table 4. Estimated Cost Impacts of Possible Future Price Points A and B

ELECTRICITY				Net Cost Increase	
	kWh Used	Average Cost/kWh	Total Cost		
<i>FY 04-05</i>	1.72M	\$0.12	\$206.7k		
Price Point A	1.72M	\$0.250	\$430.0k	+\$223.3k	+108%
Price Point B	1.72M	\$0.500	\$860.0k	+\$653.3k	+316%

NATURAL GAS				Net Cost Increase	
	Therms Used	Average Cost/Therm	Total Cost		
<i>FY 04-05</i>	31.3k	\$0.460	\$14.4k		
Price Point A	31.3k	\$1.000	\$31.3k	+\$16.9k	+117%
Price Point B	31.3k	\$2.000	\$62.6k	+\$48.2k	+335%

VEHICLE FUEL				Net Cost Increase	
	Gallons Used	Average Cost/Gallon	Total Cost		
<i>FY 04-05</i>	15.7k	\$1.88	\$29.6k		
Price Point A	15.7k	\$5.00	\$78.5k	+\$48.9k	+165%
Price Point B	15.7k	\$10.00	\$157.0k	+\$127.4k	+430%

TOTAL ALL 3			Total Cost	Net Cost Increase	% of Total City Expenses
<i>FY 04-05</i>			\$250.7k		2.8%
TOTAL A			\$539.8k	+\$288k +115%	6.0%
TOTAL B			\$1,079.6k	+\$829k +331%	12.1%

Note: These calculations assume that usage levels stay the same and that the City's Total Ongoing Expenses are \$8.9M, the FY 04-05 amount for General, Water, and Sewer Fund expenditures. We use FY 04-05 as the baseline in general in this table, to avoid the distortion of the Katrina natural gas price spike in FY 05-06, which has since somewhat subsided.

The City's operations are highly dependent on electricity from PG&E, in terms of cost and supply (outages). PG&E, while primarily a distributor of energy, both generates electric power and purchases it from as many as 400 independent generation sources both inside and outside of the state.³⁷

Natural gas provides 42% of PG&E's 2006 projected energy sources. Therefore, Sebastopol's electricity bill will likely be impacted by increased natural gas prices. PG&E's other projected energy sources for 2006 were: Nuclear 23% (up from 2% in 2004); Large hydroelectric 19%; Eligible renewable 13% (up from 4%); and Coal 3% (down from 29%). Eligible renewable includes Biomass 5%, Small Hydroelectric 4%, Geothermal 2%, Wind 2%, Solar (less than 1%).³⁸

Note that Sonoma and Lake Counties have the largest share of PG&E's geothermal plants. Also, hydroelectric power and water supplies can be negatively impacted by global warming.

2) Vulnerability: Increased Indirect Costs

Energy price increases will also increase other costs to the City, because energy prices are embedded in nearly all other products and services that the City acquires, in two key ways:

- **Energy is used for production and transportation, and**
- **Oil and oil by-products are used as inputs to make products such as plastics, chemicals, and asphalt.**

These increased costs could add up significantly, with notable cumulative and ripple effects, including increased costs for labor, materials, and supplies. The City is already experiencing this in its building projects with long-term bids, as costs for materials and transportation can go up as much as 25% from bid to build, quickly exceeding estimates and budget. City staff has attributed some of this to an increase in energy-related costs.

Indirect costs to the City from increased energy prices might include a wide range of items, including less obvious ones such as:

- **Increased costs for employee compensation.** City personnel might require salary increases to cover commuting costs, or find these costs untenable and seek work closer to their home. This might result in added costs to find new employees and pay them enough to either cover commuting or afford local real estate prices.
- **Decreased property tax because of decreased real estate value.** If high energy prices result in an economic slowdown, this could amplify the current housing slowdown, and potentially decrease real estate prices – and property tax income to the City.
- **Reduced funding of state and federal government programs** that currently benefit the City or provide emergency support. This might result from a national economic slowdown (partly caused, or intensified, by high oil prices), increased demand for government services (because many people and government entities have increased need for assistance), and/or increased costs to government for energy and energy-related products (necessitating budget cuts in other areas). Any of these could in turn reduce the services and funds available to the City, including those that provide support during emergencies.
- **Decreased reliability of payments to the City by local citizens.** As energy-related costs rise, this puts added financial stress on community members, and could compromise their ability to pay the City for water, sewer, property tax, etc., including pass-through increases in energy costs. This could reduce City income. Citizens might also adjust by decreasing their consumer spending, which would reduce Sebastopol's sales tax revenues.
- **Increased demand for City services, such as police and fire.** At a time of reduced funding, the City could find itself with increased demands on its services. More people could need assistance with survival issues of food and energy, while those support systems become overwhelmed. Financial distress – and related issues, such as hunger – could cause increased crime and conflicts, and even civic unrest.

3) Vulnerability: Insufficient Energy Supplies and Outages

Oil Supply. Almost 50% of California's imported oil over the past five years comes from just two countries, Saudi Arabia and Iraq, a dependence that leaves the state more vulnerable than the rest of the country to disruptions in the world oil markets, according to reports from the Associated Press. Although still the fourth largest domestic producer of crude in the U.S., California fields have been declining at a rate of between 2-4% per year, with production now averaging about 700,000 barrels per day. Imports account for roughly 751,000 barrels per day, or 40% of total use.³⁹ Alaskan crude rounds out the remaining 20% of the state's needs, according to California Energy Commission (CEC) figures.⁴⁰ The risk of disruptions in California's, and therefore Sebastopol's, access to gasoline and diesel fuel is relatively high and will become higher in the near future unless significant changes occur. Although these changes are out of the realm of direct control by California cities, there might be ways for Sebastopol to encourage forward planning by other entities.

Electricity Supply. The CEC predicted some danger of rolling blackouts in 2006, with increasing danger in subsequent years. In fact, a Stage II emergency was narrowly averted during the 2006 summer heat wave, because of pre-arranged voluntary conservation. The danger of potential blackouts still remains, due to both insufficient generation capacity and insufficient transmission capability, in the case of higher-than-average summer temperatures.⁴¹ In the worst case shown, the shortfall of available energy could reach 7.2% in the year 2010.

Natural Gas Supply. While the City is prepared to manage short-term energy supply problems, the potential for shortages in the delivery of natural gas compounds the risk already present with electricity. Nearly 42% of California's electrical generation is supplied by natural gas, but the natural gas supply risk is not included in the CEC's appraisal of electrical supply risk. The Energy Information Administration (EIA) has predicted natural gas prices to exceed \$10/M BTU by the end of 2007, based largely on the falloff in production in the Gulf of Mexico. In Canada, source of 24% of California's natural gas, there are two complicating factors. First is the overall decline in gas production throughout Canada. The second issue is the competition for natural gas to produce oil from the Alberta tar sands.

Longer-term disruptions in the availability of energy could have a significant impact on the operation of the City. The City water system has the highest electricity use and therefore is most vulnerable to interruptions in delivery of electricity. Other impacts to the City could include:

Interruptions of Electricity and Natural Gas Supplies

- **Public health issues** from interruptions of: water pumped for domestic use; pumps for sewage; home heating and cooking; etc.
- **Public safety issues** from interruptions of: water pumped for fire protection; radios, computers, and telephones at police and fire stations; street lights; etc.

Interruptions of Gasoline and Diesel Supplies

- **Public health issues** from interruptions of: ambulance service; backup power for water pumping; backup power for sewage pumping; trash collection; etc.
- **Public safety issues** from interruptions of: Police Department patrols and response; Fire Department response; etc.

4) Vulnerability: Global Economic Crises And Disruption

As discussed in Chapter I, determining the financial impacts from the scenarios discussed here depends on a wide range of highly-complex and inter-related variables that are extremely challenging to fully quantify and model. However, as the Oil Shockwave process demonstrated, even a small shortfall of oil supply could cause enormous impacts on the global economy, risking recession and millions of lost jobs. This would likely reduce the City's income, including from tourist travel and sales tax, both

vital to the City's budget, as well as generate a wide range of problems and dislocations that could significantly impact the City's expenses, operations, and ability to maintain City services.

5) Vulnerability: Insufficient/Late Transition Away From Fossil Fuels

Increasing world demand and decreasing supply are early warnings of the larger problem of supply decline and the need to transition away from fossil fuels. As the gap between supply and demand increases, fossil fuels will be so expensive and/or scarce that we will require replacement sources of energy to meet a wide range of our current needs.

However, as discussed in the Energy Alternatives section, there is no one easy replacement for fossil fuels, and all the current alternatives added together still fall far short of current (and anticipated) world usage. To have a smooth transition to our new energy future, it is vital that our culture both intensively reduce its total energy needs and develop alternatives, starting at least 10 to 20 years before the oil production peak. Unfortunately, we might now or soon be at the peak, increasing the urgency. Availability of ecological energy systems is already being challenged by current demand and supply constraints, increasing costs and delivery times. As peak oil issues become more obvious to the general public, it's likely there will be increased competition for limited supplies.

Therefore, if the City delays too long in transitioning from a dependency on fossil fuels to alternative sources, it is vulnerable to both significantly increased energy costs and outages and reduced access to sustainable alternatives, both because of price and availability.

3. Current City Programs

Sebastopol has a number of projects in place to reduce energy usage, implement alternative energy sources, and prepare for energy disruptions. CAGE applauds this. These will be discussed in the appropriate sections of this report.

4. Recommendations: Overall

The City can significantly reduce the price, supply, and public safety crises that it experiences as a result of world energy supply issues, no matter how the details play out, in one key way: by proactively reducing its dependence on fossil fuels and choosing to transition to a future without cheap fossil fuels and with less net energy available.

By doing this, the City will reduce its exposure to the five key vulnerabilities we have described. In addition, the City will contribute to achieving its current targets for GHG reduction and help stem the enormous damage fossil fuels cause to the environment and the planet. Also, we can avoid scrambling if the situation becomes more drastic.

To support the City in implementing this transition, CAGE offers below our overall city-wide recommendations. Additional recommendations are included in each focus area of this report.

First Steps

Recommendation A-1: We recommend that the City develop and pass an Energy Transition Resolution, which would establish an official City policy of proactively transitioning the City away from a dependence on fossil fuel energy sources and towards ecological and sustainable sources.

This policy should state that the purpose is to prepare for the likelihood of fossil fuel supply decreases – and the resulting price increases and supply shortfalls – by implementing very strong measures to reduce our energy usage and dependence on fossil fuel energy sources as quickly and ecologically as possible. It should strongly encourage the identification and adoption of new ecologically-friendly technologies, as they become available and reasonably economical. Emphasis should be placed on the seriousness of the anticipated energy challenges, and thus the importance of making this energy transition proactively, rather than reactively, and integrating this transition into the City's planning and daily actions.⁴²

Recommendation A-2: In order to support the City in implementing Recommendation A-1, we recommend that the City Council Energy and Sustainable Practices Subcommittee take responsibility for tracking the progress of this report's recommendations through the City Council process, as well as any new and ongoing tasks that arise. We also suggest that the City Council Energy Subcommittee be made into a standing committee, to keep this an ongoing project.

Recommendation A-3: In order to assist the City in implementing Recommendation A-1, we recommend the establishment of a standing Citizens' Technical Advisory Committee (CTAC) on Energy Independence and Sustainability. The Committee should include community members with appropriate skills and knowledge, and have a staff person liaison, with staff time and funding allocated to support these activities. The City Council Energy Subcommittee would help direct CTAC's activities and coordinate them with the City Council.

The CTAC would support the City's activities by independently tracking this topic, and advising the City on specific ways to refine the City's approach as events unfold. As part of this work, it could:

- 1) Collect key information from a variety of sources on these topics, especially:
 - a) Ongoing trends in energy supply and demand, and their impact on pricing and availability;
 - b) Alternative technologies and approaches, including new and long-term methods that are coming up, and their status and appropriateness for City needs; and
 - c) Successful actions being taken by other governments and communities to address these challenges, to identify ones which might be useful options for the City to consider.
- 2) Explore additional and creative funding mechanisms to encourage proactive and timely implementation of solutions.
- 3) Report annually to the City Council on the status of these energy supply issues and the recommendations in this report. With City staff assistance, this would include information about current impacts on City finances and functioning.
- 4) Explore creating an action plan for the City Council to adopt, focused on specific added measures the City could take to reduce dependency on petroleum-based fuels and increase use of alternative energy, and distinguishing how it goes further than the City's current GHG reduction planning. This plan would be created in coordination with City staff and tied to their specific activities.

Recommendation A-4: We recommend that City departments be directed to identify ways they can help implement Recommendation A-1, by assessing how their department would be impacted by the energy challenges discussed in this report, and exploring and proposing possible remedies, such as ways to further reduce energy needs and shift to non-petroleum energy sources. Each department would report on this to the City Council by a specified deadline.

In this process, City departments would:

- Identify department vulnerabilities to serious energy cost increases and extended supply shortfalls.
- Consider both medium-level scenarios (disruptive but stable) and more drastic ones (serious and extended upheaval, with risks of civic disorder and breakdown of basic supplies of food, transportation, etc.).
- Look at past emergencies and outages, here and in other areas, to get input about likely increased community demands, increased fuel needs, changes in human and social dynamics, etc. Examples to examine could include past natural disasters such as the Loma Prieta earthquake and Hurricane Katrina.
- Assess how sustained and serious fuel shortages or price increases might impact the availability of commuting employees.
- Consider how to add energy vulnerability scenarios to the department's ongoing procedures and planning processes.
- Propose ways to proactively transition away from fossil fuels to sustainable fuel sources.
- Propose targets for systematic change and progress.

We advise the City to identify key information resources for staff to utilize in making these plans, including this report, as well as The Hirsch Report and The Oil Shockwave Report, which outline the potential challenges we face. More information about these and other resources are in Appendix D of this report.

The City Council Energy Subcommittee would then review the departmental assessments, evaluating and prioritizing the proposals, with assistance from CTAC and the City Manager.

Recommendation A-5: We suggest that the City Council Energy Subcommittee explore potential partnerships with other organizations, to collaborate on accomplishing, and sharing the costs of, these activities. Partner options might include the California League of Cities, the California Energy Commission, and the Mayors' and Councilmembers' Association of Sonoma County. The City could also encourage the Mayors' and Councilmembers' Association and other organizations to commit to similar goals within their organizations.

Implementation Steps

Recommendation A-6: We recommend that the City develop procedures for easily tracking City energy use and costs, and report these annually to the City Council. This would help provide an ongoing picture of the City's status as this process unfolds, so that the City can observe changes and trends, determine impacts of world dynamics, identify positive results from City actions, and make ongoing adjustments to actions and priorities. The City especially needs an improved system for tracking vehicle fuel usage and costs.

Recommendation A-7: We recommend that the City seek permission to aggregate the City's electrical loads. This is an accounting adjustment that permits the credit on one meter to be applied to charges on another. This would allow a City PV solar panel in one location to generate credits that could be applied toward electric meter costs elsewhere in the City. The City of Davis had special legislation passed at the state level to allow aggregation of the City's electrical loads. The City of Sebastopol could request the same. (For more about the Davis program, see the footnote.⁴³)

Recommendation A-8: We recommend that the City, as proactively as possible, invest in energy technologies that transition away from, and decrease reliance on, fossil fuels. This is a key way to prepare for future energy uncertainties, and will very likely result in net cost savings to the City. This is because it is predicted that increased demand for alternative approaches will result in increased costs and decreased availability.

To support these investments, we encourage the City to consider creative funding mechanisms, perhaps in alliance with CTAC or local community members and groups, such as a local "community mutual fund" that leverages the equity existing in the assets of this community.

Recommendation A-9: To serve City residents, we encourage the City to continue their efforts whenever possible to reduce or eliminate energy costs for energy uses which can be passed on to those who use those services (such as water, sewer, and Ives pool). It would also be valuable to educate local residents about how increased energy costs contribute to increased utility prices, as part of encouraging their proactive conservation of water and sewer services, and to minimize negative reactions to price increases.

Recommendation A-10: We recommend that the City Council establish a Community Outreach Committee to proceed with Phase II of this project as described in CAGE's charter, "to make recommendations to the greater Sebastopol community about appropriate measures which can be taken to adapt to future uncertainties regarding energy supplies." This group's work to help the community prepare on a wider scale would include, but not be limited to, analyzing and preparing recommendations regarding "the following community-based services and operations: 1. Food supply; 2. Basic consumer necessities; 3. Medicine and health care; 4. Transportation; 5. Local business (including opportunities); and 6. Residential and commercial heating and power." Part of this group's work would be collecting key information about other communities' actions relative to this issue, and connecting with individuals

and groups taking action on these issues, both locally and globally. They would then “develop a community education program regarding their findings.”

Recommendation A-11: We recommend that the City identify ways that it can encourage actions at other levels of government which reduce energy usage and support a transition to renewable non-fossil fuel energy sources. For instance, the City could:

- Encourage Sonoma County government to pass an Energy Transition Resolution, consider forming a citizen’s advisory group, and otherwise explore ways that it can help prepare this county for these energy challenges. The County might find helpful input in the City of Sebastopol’s innovative policies (for example, its Green Building Program) and in this report’s recommendations. Constructive actions taken at the County level can improve the preparedness of the greater Sebastopol area.
- Encourage and support other local cities in passing Energy Transition Resolutions and exploring other ways that they can help prepare this region for these energy challenges. Because energy supply impacts will be community-wide, shared preparation benefits us all. This activity might occur via the Mayors’ and Councilmembers’ Association of Sonoma County.
- Talk with experts and community groups about possible changes in government policies and regulations at all levels that could support our area’s energy transition. Consider supporting these changes. For instance, it could be useful to adjust fuel station regulations to reflect the differences in biodiesel fuel.
- Encourage the Federal government to aggressively increase vehicle mileage standards. It is estimated that by doubling the average fuel economy of our cars and trucks to 40 miles per gallon (considered possible with hybrid technology, for instance), we could save five million barrels of oil every day by 2015; this is more than twice our current imports from the Middle East.⁴⁴
- Consider endorsing the Oil Depletion Protocol. In this plan, countries voluntarily sign up to reduce their oil production and oil imports over time. In Richard Heinberg’s book *The Oil Depletion Protocol*, he argues for it as a key solution to avert oil wars, terrorism, and economic collapse from the upcoming reduction in supply.⁴⁵

Recommendation A-12: We suggest that the City explore forming alliances with others who are taking action on this issue, to learn from each other and cross-pollinate ideas. For instance, the City could:

- Learn about, connect with, and explore alliance possibilities with other cities and governments addressing these issues, including those listed in the Communities section in Chapter I.
- Explore allying with other groups working on this issue. For instance, it might join the national and California branches of the Apollo Alliance⁴⁶ or ally with the Post Carbon Institute.

Recommendation A-13: To ensure local power on a more long-term basis, and to directly support local and “green” energy sources, the City could investigate the feasibility of joining with other cities and/or Sonoma County in implementing Community Choice Aggregation (CCA). CCA allows California municipalities (cities and counties) to “aggregate” or combine customers in their area to buy power directly. PG&E still runs the system and does billing and maintenance. CCA was enabled by state legislation in 2004 and the California Public Utilities Commission (CPUC) implementing regulations are nearly complete. San Francisco is preparing to go to a CCA structure, when this becomes available. Marin is well along the path of CCA formation, and a number of other California cities and counties are also exploring this possibility.

Under a CCA structure, we could have more choice in our energy sources. For instance, we could choose to independently support current and new “green” power sources, thus helping to reduce our generation of GHG. (For example, we might support biogas generation from local dairies (such as Straus Dairy has implemented), installation of wind and/or solar farms, local purchase of the Geysers if they become available, etc.) We could also support our local economy, better control prices through long-

term contracts, and buffer ourselves from costly rate hikes. The law also allows municipalities to administer their share of state energy conservation funds.

As this could entail a notable initial cost, it is likely that Sebastopol would do this in conjunction with other entities, and it is important to embark on such an action with a clear set of goals relative to those costs. For more information on CCA, including local implementation efforts, see the Institute for Local Economic Democracy's webpage <www.iled.org/ccpower.html> and the Local Government Commission's Energy Clearing House <www.lgc.org/energyclearinghouse>. For more about activities in other communities, including Marin and San Francisco, see <www.local.org>.

Recommendation A-14: The City might also in the future investigate creating a municipal utility, probably in conjunction with other local government entities. Here, the municipality owns and runs the electrical generation and distribution system. Because municipalities pay no income tax and don't need to generate profits for stockholders, this would potentially reduce rates and/or help fund City operations. This could also allow us to buy and cultivate local energy sources to feed into our local grid, as described in the CCA option above. Healdsburg has a municipal power system which allows them to buy most of the City's electricity from the Geysers geothermal plant. Note: Creating a municipal utility would be a more challenging project than CCA.

B. Buildings & Facilities

1. Description

Buildings. The newest of the City's buildings is 15 years old. Some, if not historic, would qualify at least as historical. All of the buildings were built when energy costs were not an issue.

In FY 05-06, the City spent \$44.5k on energy costs for buildings – \$34.4k on electricity and \$10.1k for natural gas. This was 16% of the City's total energy costs and an increase of 19% from \$37.5k in FY 04-05. The City buildings with the highest energy costs (in order) were the Police Station, Garzot Building (a children's educational center at Libby Park), Fire Department, City Hall, and Teen Center. The Police Station's energy costs were \$19k, 43% of the total. The Garzot Building had the highest energy cost per square foot (\$3.55 per square foot), three times the City average of \$1.19 per square foot.

Ives Pool. In FY 05-06, the City spent \$46.5k on Ives Pool energy costs – \$13k for electricity and \$33.4k for natural gas. This was over double the total cost of \$22.4k in FY 04-05. Although electricity usage dropped 12% in this period and natural gas usage only went up 10%, the price of natural gas nearly tripled that year because of Hurricane Katrina. Ives used 73% of the City's natural gas total.

Street Lighting. In FY 05-06, the City spent approximately \$44k on direct street lighting energy costs (by our estimate⁴⁷) for 357 kWh of electricity, about 16% of the City's total energy costs.

2. Vulnerabilities

- **Increased direct energy costs** for buildings operation could throw the City budget into deficit and force the City either to search for more funds or cut back its overall services.
- **Increased indirect costs** could pressure the budget, delay or compromise ongoing activities and projects, hinder maintenance, and block obtaining necessary supplies.
- **Increased energy outages** could impact the City's ability to function – closing offices, shutting off access to computer information, etc. If they are frequent and/or of long duration, the City might be forced to have shorter hours, shut down certain buildings or rooms, reduce services, etc.

3. Current City Programs

Sebastopol Campaign for Climate Protection (Sebastopol CCP). On January 15, 2002, the City of Sebastopol passed a resolution committing the City to participate in the International Council of Local Environmental Initiative's Climate Protection Campaign (ICLEI). On August 20, 2002, Sonoma County became the first U.S. county where all local governments (the County and all nine cities) pledged to measure and reduce their greenhouse gas (GHG) emissions. In 2003, Sebastopol completed their inventory of the City's GHG emissions. The City Council has since adopted plans to reduce GHG by 34% (334 tons) by 2008, and 42% (417 tons) by 2010, from a baseline of 977 tons. Because the major cause of GHG is energy production, the City has been pursuing a program to reduce its energy usage.

Improving Energy Efficiency. In their June 2005 *City of Sebastopol Energy Efficiency Study*, consultants assessed four City facilities – the Library, Police Station, Garzot Building (in Libby Park), and Municipal Water System – and recommended a variety of measures, all of which have been implemented.⁴⁸

Installing Solar on City Buildings. The City has installed 37.5 kW of PV solar on City property, at the Fire Station, Ives Pool, and the Public Works corporation yard (across from the Community Center). The City plans to install an added 65 to 90 kW of PV solar at City Hall, the Police Station, and the sewage lift station on Morris St. In addition, the City has acquired bond funding to install approximately 150 kW at six additional sites on City land, to be installed in FY 07-08.

Solar energy has reduced electric energy costs by 30-75%, depending on the site. Payback periods have been shorter than anticipated and are expected to improve even more, because of the installation of larger systems and increased costs of energy from PG&E. Through efficiency and solar PV systems, the City has reduced GHG from buildings by 49 tons, or 35%, from FY 00-01 to FY 04-05.⁴⁹

Street Lights & Traffic Signals. The City contracts with PG&E to maintain street lights. In 2001, the City upgraded all traffic signals to energy-saving LEDs, which was funded by a California Energy Commission (CEC) loan. The last report to the CEC, covering 2003-2004, showed an annual energy savings of 12,818 kWh, and an annual cost savings of \$583.

4. Recommendations: Buildings & Facilities

Improve Buildings' Energy Efficiency

Recommendation B-1: We recommend that the City develop a policy that systematically retrofits all City buildings with *passive* energy efficiency measures (those that require no ongoing energy use). These include insulation, efficient windows, weather stripping, natural ventilation, and the planting of deciduous foliage on south and west facing sides of buildings. CAGE believes that more attention needs to be paid to these types of measures, and that they should be considered before investing in new technologies. These were not mentioned in the consultants' *Energy Efficiency Study*.

There are two reasons to implement passive measures, either first or in conjunction with mechanical measures. First, passive measures work even when power is unavailable, such as a power outage or rolling blackouts. Second, these measures will most likely decrease the size of HVAC equipment, increasing efficiency and lowering costs.

Recommendation B-2: We recommend that the City assess why the Garzot building has such a high energy cost per square foot, and identify ways to reduce this cost.

Recommendation B-3: With both its existing and new buildings, we recommend that the City itself use the City's Green Building guidelines and attempt to exceed the minimum requirements by as much as possible. These types of measures typically reduce energy usage by 25-40%.

Recommendation B-4: With both its existing and new buildings, we recommend that the City evaluate less-common but effective energy control measures such as awnings or trellises on south and west facing portions of buildings and enclosing entryways.

Recommendation B-5: With any new City buildings, we recommend that the City design the buildings with roofs oriented for maximum solar access and install PV solar whenever viable (sized to meet the building's anticipated electrical loads).

Recommendation B-6: The City might want to hire a consultant who specializes in green buildings to help develop additional specifications and recommendations.

Implement Alternative Technologies

Recommendation B-7: We recommend that the City explore other alternative energy sources and new technologies, including wind and solar thermal, for current and new City buildings.

Of available electrical generating resources, solar PV is currently the most viable, so it is appropriate that the City has been investing in this technology. It is not believed that Sebastopol has sufficient wind resources for electrical generation, although it might be reasonable to evaluate this. Other alternative energy sources and new technologies, such as those described in the Energy Alternatives section in Chapter I, might also reduce the City's dependence on fossil fuels.

Recommendation B-8: We recommend that the City assess the efficacy of installing solar thermal pool heaters (where the sun heats the water directly). Systems could be designed to either replace or augment the existing gas heaters. This is especially valuable because heating is the City's major use of natural

gas. (The solar panels there are used only for electrical functions.) Increases in natural gas prices will eventually translate to higher user fees or a colder pool.

Recommendation B-9: For maintaining public facilities and streets, we suggest that the City explore alternatives to asphalt, a petroleum-based material which is expected to get increasingly expensive. Options for road surfaces include concrete, which lasts substantially longer (50-75 years vs. asphalt's 15-30 years) and could also bring in City income by supporting an in-town business. Also consider other alternative materials, such as bricks and cobblestones, in targeted low-volume areas where one wishes to slow traffic and add charm.

Prepare for Longer-Term Emergencies

Recommendation B-10: We recommend that the City assess the “emergency-basic-only” electrical consumption for each department, how much stand-alone backup electrical generation capacity is currently in place, and where this backup power is. Determine what amount of downtime that backup power covers, and decide if the City wants to extend the coverage, in case of longer-term outages of the grid and/or shortages in the supply of other energy sources.

Recommendation B-11: Determine if backup generators could use alternative fuels (for instance, biodiesel for diesel engines, and ethanol for gasoline engines). Assess costs and benefits.

Recommendation B-12: Continue tracking backup storage technology and assess applicability to City's backup needs, especially at mission-critical sites.

Reduce Energy Usage and Costs: Street Lights

Recommendation B-13: We suggest that the City assess their streetlighting plan with PG&E. What does it cost? Is this the best plan for the City if energy costs escalate?

Recommendation B-14: We suggest that the City investigate with PG&E the most economical lighting types.

Recommendation B-15: We suggest that the City assess lighting requirements and determine if lighting can be reduced while still protecting safety. Remove or disable duplicating street lights. Investigate motion sensors for street lights in appropriate areas.

Reduce Energy Usage and Costs: Other

Recommendation B-16: We suggest that the City consider energy costs when timing Ives Pool maintenance closures — for instance doing this during the winter, the highest heating months.

Recommendation B-17: We recommend that the City explore replanting non-recreational (ornamental) lawns on City property with low-water, low-maintenance plants, including native plants, to reduce water and mowing needs. (See resources in footnote.⁵⁰)

C. Vehicles

1. Description

Vehicles. The City-owned and -operated vehicle fleet includes seven Fire Department vehicles, eleven police cars, two police motorcycles, and a variety of dump trucks and motorized equipment operated by the Public Works Department. The City has two electric bicycles, which officers can patrol in, at their discretion.

Costs. In FY 05-06, the City spent approximately \$38.2k on vehicle energy costs (\$34.4k for vehicle fuel and \$3.8k for natural gas). This is an increase of 18% from the \$32.3k spent in FY 04-05. Although vehicle fuel usage dropped 8% during that period, from 15.7 gallons to 14.4 gallons, total costs increased because the average rate per gallon increased from \$1.88 to \$2.39.

Fuel Supplies. The Police Department and Public Works purchase their fuel from private service stations. The Police Department does not have a dedicated fuel supply. Fuel tanks at the Public Works yard are no longer used, but could be reactivated. The Fire Department has one 500-gallon diesel tank and one 500-gallon gasoline tank. They annually use about 1,500 gallons of diesel and 1,000 gallons of gasoline. The diesel tank also provides fuel to the station emergency generator. They try to keep tanks at half or above, but tanks could easily be at 250 gallons each at worst case. During normal usage, this supply could last 3 to 4 weeks. During a major disaster, this shrinks to only 7 to 10 days. During a disaster, the Department would be high priority for fuel from their vendor, if supplies were available.

Reimbursed Employee Transportation. City employees routinely use their own cars for transportation on City business and are reimbursed by the City.⁵¹

2. Vulnerabilities

- **Increased direct energy costs** for vehicle operations could throw the City budget into deficit and force the City either to search for more funds or cut back its services, decreasing public safety, fire response time, etc.
- **Increased indirect costs** would pressure the budget, delay or compromise ongoing activities and projects, hinder proper maintenance of vehicles (increasing failures), and block obtaining necessary supplies.
- **Increased energy shortages** could impact the City's ability to function by reducing availability of vehicles to provide key City functions, including public safety.

3. Current City Programs

Vehicles. Included in the City's vehicle fleet are two light-duty electric vehicles, two hybrid administrative police vehicles, one hybrid for the building department, and two more-fuel-efficient police cruisers. Two added hybrid vehicles will arrive soon for the police and fire departments.

Commute Schedules. The City currently operates under work schedules that reduce employee commutes, with most staff either on a 9-80 schedule (9 days and 80 hours every two weeks) or a 4-10 schedule (four 10-hour days weekly).

Note. Biodiesel is under consideration by the City, as an element of the GHG emissions reduction plan. However, in a Feb. 28, 2005 memo, City staff assessed both B20 and B100, noting the benefit of GHG reductions, and stating concerns about increased fuel costs at that time and a possible unknown drop in vehicle horsepower. They indicated that equipment can operate on B20 without modifications, while B100 would require retrofitting most vehicles (at an unknown cost), isn't recommended for temperatures below 40°F, and is not advisable for standby equipment, due to fuel spoilage. Separately, City Manager Dave Brennan has stated a concern about storage limits – that each fuel source would need separate tanks and regular use so it doesn't go bad.

4. Recommendations: Vehicles

Implement Alternative Technologies

Recommendation C-1: We recommend that the City continue upgrading its vehicle fleet to include more alternative and fuel-efficient vehicles. Could Public Works use a small hybrid in place of a truck for some tasks? Could a hybrid be converted to more truck-like functionality with a roof rack or a trip to the body shop? Could the Police Department use a hybrid for traffic enforcement?

Recommendation C-2: We suggest that the City encourage more use of motorized bicycles for downtown area patrol.

Recommendation C-3: We recommend that the City continue to explore biofuels as an emergency fuel supply in City vehicles (i.e., biodiesel in diesel engines, ethanol in gas engines), in case of lack of supply and/or extended emergencies. Also explore appropriateness for ongoing use. Explore which engines could be converted for use with biodiesel, if it became necessary. Consider starting with B20, as it appears to have fewer issues. Identify what conditions would need to be met in order to use biodiesel on a more regular basis. Explore ways to address staff concerns. For instance, to address storage concerns, consider making a supply agreement with a local retail biofuel vendor, with provisions for emergencies. If fossil fuel supplies do indeed fall increasingly short of demand, the City would need to be prepared to transition to a non-fossil fuel energy source. More information about cities who successfully use biodiesel is in Appendix A. The City might talk with them to find what has worked for them.

Recommendation C-4: We suggest that the City investigate the viability of installing a biofuels pump for City use, for biodiesel and/or ethanol, or consider working with a local gas station to offer this for both the City and the public. In the future, consider co-creating a cooperative biofuels plant, for biodiesel and/or ethanol.

Assess Employee Commutes

Recommendation C-5: We suggest that the City assess how sustained and serious fuel shortages or price increases might impact the availability of commuting employees. This information would also help the City in meeting its GHG targets, as the GHG Tracking Report recommends quantifying employee GHG emissions for commutes.

Recommendation C-6: We suggest that the City establish incentives to encourage staff to use alternatives to single occupancy vehicles, such as public transit, bicycles, and carpooling. The Sonoma County government has recently said that it will establish such incentives, in order to meet its GHG reduction targets. Their program is expected to include: free or discounted bus passes, telecommuting, flexible work schedules, and special parking spots for carpoolers.⁵²

D. Water

1. Description

System Design. Sebastopol pumps high-quality groundwater from deep wells. Since 1934, eight wells have been drilled. Three are currently online: #4 (Petaluma Ave and South Main St.), #6 (Fircrest Mobile Homes), and #7 (Cooper Rd.). In 2007, the City will replace Well #2 (Jewell Ave) with Well #8, at the same site. Water is pumped from the wells to three storage reservoirs serving two zones. Zone 1 has a reservoir at the top of First Street, which can store 1.5 million gallons (MG), at an elevation of 225-250 feet. Zone 2 has two reservoirs on Pleasant Hill Road near Blackney, each with a 3 MG capacity, at an elevation of 305-340 feet. As reference, the City Plaza is at elevation 79 feet above sea level.

Water Usage. In 2004, total annual City water consumption was 479MG – an increase of 4% from 460MG in 1995-1996. Commercial facilities use about one third of the water, including hotels, hospitals, and laundromats. Over the past 15 years, per capita usage for all users has been between 155 and 175 gallons per day GPD (gallons per day). Water usage roughly doubles in the summer, largely due to landscape irrigation and other needs caused by warmer weather.

Financial. The overall City water budget in FY 05-06 was \$1.09M, with revenues of \$1.08M. Funds are spent on operations, maintenance, administration, and debt. In FY 05-06, the City spent approximately \$86.3k on energy costs for water wells, the City's top energy cost (31% of the total). This is a decrease of 13% from the \$98.9k spent in FY 04-05. Energy usage in FY 05-06 was 761.5 kWh, down 16% from 902.3 kWh in FY 04-05. These reductions were the result of shifting usage to more energy-efficient wells, and possibly also from lower water consumption, as the Barlow canning plant was not operating in FY 05-06.

2. Vulnerabilities

- **Increased electrical costs.** Sebastopol relies on deep wells for its water supply, and pumping costs are the largest part of Sebastopol's overall energy budget. Because the water system is the highest electricity user, it would be significantly impacted by increased energy costs, and both the City and other local users could find themselves with much more expensive water and/or lack of supply.
- **Outages and water supply.** The water system is dependent on the electric grid and therefore would be notably impacted by both electrical outages and shortfalls of diesel supply for backup generators. The City has about three days of backup diesel for water (see calculations in footnote).⁵³ The City also has about five days of water reservoir storage, at current average annual usage rates. Therefore, it appears that water at the tap could be maintained for about 8 days total without electricity or resupplied diesel (at normal usage rates).⁵⁴ Would the City be able to supply the same quantity of water if we have longer times of energy scarcity? If not, what would the City do?

Note that these calculations are based on averages. The number of functioning days could increase or decrease notably depending on the time of year, fire calls, availability of diesel resupply, water conservation efforts, and rationing. For instance, because water usage rates double in summer, the number of functioning days might notably decrease in the summer and increase in winter.

- **Increased water usage.** Expansion of the city's population and/or activities could increase the rate of water consumption, increasing costs to citizens, and making the City more vulnerable to energy price increases and outages.
- **Increased indirect costs** could delay or compromise ongoing activities and projects, hinder proper maintenance (increasing failures), and block obtaining necessary supplies.

3. Current City Programs

Modified Water Pumping Schedules. The City has modified water pumping schedules, so that pumping is done at night as much as possible, when it is cheaper, using time-of-use meters at the wells.

Water Conservation Program. The City offers rebates for installing low-flow toilets and high-efficiency commercial clothes washers in existing facilities. It also encourages water-saving measures for new buildings and remodels over 500 square feet, both in its Green Building Program (see Appendix B) and in Municipal Code Chapter 15.74 “Water and Energy Conservation Requirements.” This includes requirements that exceed those of most other California jurisdictions, such as mandatory ultra-low-flow toilets, mandatory hot water recirculation systems for some situations, and mandatory “Energy Star” appliances. In addition, the City’s Water Efficient Landscape Program (Sebastopol Municipal Code 15.36) requires new commercial and residential projects that need a conditional use permit to design for water conservation by using methods such as drip irrigation and appropriate plants in appropriate places.

Upgrades to Wells. The City has upgraded the pumps for the existing Wells 4, 6, and 7. It is estimated that these upgrades will result in electrical savings of at least 25%. The City is also installing a cross-connection to improve system reliability.

Graywater Systems. Graywater systems conserve water and reduce wastewater. Through the initiative of a local developer, a Sebastopol development at Florence/Healdsburg will be the first multi-unit, commercial project in Sonoma County with a legal graywater system. The City is open to other graywater installations, though the City Planning Director notes that “there are critical public health and water quality issues with these systems. It is very unlikely they would be approved if the systems emitted wastewater at or below the 100-year flood elevation.”

4. Recommendations: Water

Reduce Energy Usage By Supporting Water Conservation

To reduce the City’s vulnerability to potential electrical brownouts and blackouts, conserving water and energy will be vital.

The City’s overall water usage in FY 02-03 (including for businesses) was about 162 gallons per day per capita. Residences used from 88 to 133 gallons per person per day between 1996 and 2003. As a baseline comparison, the World Health Organization recommends a minimum water supply of 12 gallon per day per person. Although this implies a different standard of living than we currently enjoy, these figures do suggest that we could take care of our needs with less water.

There is currently no method for physically rationing water. The City’s water bill to the customers is probably the best leverage the City has to encourage conservation.

Recommendation D-1: On new construction, we suggest that the City require on-demand hot water recirculation systems. These systems save water because, when one turns on the hot water, nothing comes out of the faucet until the water is hot. This can save up to several gallons of water each time. These systems are relatively simple to install when a building is built, and much more difficult to do as a retrofit. (Note: These systems are currently an option for green building points and required on some additions.)

Recommendation D-2: On change of ownership, we suggest that the City require retrofit of water conservation measures (i.e., low-flow toilets, faucets, and showerheads) equivalent to new construction.

Recommendation D-3: We suggest that the City look more closely at why water usage has increased. This information could be used to target certain uses for reduction.

Recommendation D-4: We encourage the City to continue to support, and to expand, existing consumer water conservation programs as much as possible. These current programs include: conversion to low-flush toilets; water-saving plumbing fixtures in new and remodeled construction; and water conservation

practices. The City could explore additional ways to offer water conservation advice and incentives, either linked with the Green Building Program or separately.

Recommendation D-5: We encourage the City to implement an aggressive landscape conservation incentive plan for existing commercial and residential buildings, using as input the Water Efficient Landscape Program (Municipal Code 15.36), which is for new projects. Include incentives for drip irrigation and xeriscaping (water-wise landscaping that uses plants matched to the local climate and avoids losing water through evaporation and runoff).

Recommendation D-6: We suggest that the City encourage more graywater systems, as appropriate. A potentially meaningful portion of domestic water is available for use in gardens (e.g. bath water and laundry) and buildings could be plumbed for graywater reuse. Sebastopol's Building Dept. should be commended for its support of the first permitted graywater system in Sonoma County. Hopefully more will follow.

Implement Alternative Technologies

Recommendation D-7: We suggest that the City consider putting solar PV at the wellheads, to offset the cost of electricity and reduce City GHG. (Wells are the City's highest energy users.) We roughly estimate that it would take approximately 25,000 square feet of solar panels to power the existing water pumps. The panel materials alone would cost around \$1 million. Installation would double the costs. (Note: Obtaining permission to aggregate electrical loads, per Recommendation A-7, would increase the benefit of this installation to the City.)

Prepare for Longer-Term Emergencies

Recommendation D-8: We suggest that the City do a more formal analysis of how long water supplies would last, assessing fuel needs throughout the system, including any booster pumps. Use this information to determine if the City wants to increase the size or number of water or diesel storage tanks, in order to extend the amount of time that water would be available in an extended outage. Otherwise, in these cases, some form of rationing system would likely need to be initiated.

Recommendation D-8: We recommend that the City explore setting up the wells to be self-reliant during outages, for instance through using generators. Identify what would be required.

Recommendation D-10: We suggest that the City encourage everyone to have some source of backup drinking water. For example, rooftop rainwater catchment systems offer an off-the-grid solution for irrigation and even emergency household use. Rooftop rainwater catchment systems could be permitted on a demonstration basis in several new and existing residences and on a public building. This technology should be given an opportunity to prove itself. If it works well after a trial period, the City could allow more to be installed.

Recommendation D-11: For longer periods of energy scarcity and high cost, the City could re-examine the current water system design to see if a more distributed system has any advantages in an era of expensive energy.

E. Wastewater

1. Description

System Design. Before 1980, the City operated its own sewer and wastewater treatment ponds (“the sewer farm”). These ponds near the Community Center still exist, although are no longer in use.

In the 1970s, the Clean Water Act required cities to build secondary treatment plants, and Federal grants became available for construction. Sebastopol joined with Santa Rosa, Cotati, and Rohnert Park to share the upgraded Laguna Plant. The City transitioned to this system between 1976 and 1980, and now contracts with the Santa Rosa Subregional Water Reclamation System (Laguna Plant) for its wastewater disposal. Santa Rosa operates the Laguna Plant at Llano Road for these four cities and the South Park Sanitation District.⁵⁵

Sebastopol operates its own lift stations (wastewater pumping stations) and conveyance infrastructure. A lift station operated by the City of Sebastopol then pumps raw wastewater from Morris Street, via a 14” sewer force main, approximately two miles uphill to the City of Santa Rosa’s Llano Interceptor Sewer at Llano Road. This then carries wastewater by gravity flow to the Laguna Plant.

Current Volume. Sebastopol’s average dry weather wastewater flow to the Laguna Plant is 0.6 million gallons per day (MGD). In the winter, this increases by 25% because of water leaking into sewer pipes. The total dry weather capacity from all cities to the Laguna Plant is 21 MGD. Sebastopol has contracted for 0.84 MGD of (dry weather) capacity, leaving it room for about 40% growth above current usage rates.

Financial. The Laguna Wastewater Treatment Plant has an annual \$24M budget, of which 10% is paid to PG&E (\$2M for electricity and \$0.5M for natural gas). About \$600k per year is spent to pump water to the Geysers.

For Laguna Plant services, the City pays \$1.4M annually. This includes \$800k for operations and \$600k for debt service. In addition, the City budgets \$570k for the City’s internal wastewater services, including lift station operation and administration. The City’s total annual wastewater cost is therefore nearly \$2M or about \$600 per customer per year. In FY 05-06 the City spent \$19.0k on energy for lift stations, an increase of 14.5% from the \$16.6k spent in FY 04-05.

Energy Usage. The Laguna Plant is a state-of-the-art tertiary filter/activated sludge facility which uses energy-intensive 1.3 MW air blowers. It also has a 2.2 MW UV disinfection system. These operate 24 hours per day. The plant has a designated 60,000 volt substation. The effluent from the Laguna Plant is very high quality, but the energy cost is also very high, as demonstrated by its \$2.5 million per year PG&E bill.

The Plant gets about 10% of its power from self-generated methane gas from the waste (saving about \$250k annually), and has a solar array for the pump station.

In FY 05-06, the City of Sebastopol lift stations used 148.1 kWh of electricity, a 15% increase from the 129.2 kWh used in FY 04-05.

Backup Emergency Systems. The Laguna Plant has two days of diesel backup. There is no storage for untreated wastewater, but large ponds off-site can store treated water. The Morris Street lift station has 300 gallons of diesel which would serve for 40 days. The three-day outage and spill at this lift station during the 2006 flood, due to a mechanical problem, shows the potential problems a wastewater system failure can create.

2. Vulnerabilities

- **Increased direct energy costs and outages.** The Laguna Plant uses state-of-the-art industrial technology which produces almost drinkable effluent. It is also very energy-intensive. The plant’s

high-quality output has allowed the surrounding cities to grow without undue environmental or public health repercussions.

However, the plant is largely dependent on PG&E's electric grid to meet its energy demands. Increased electrical costs will increase everyone's sewer bills. In an energy shortfall, the plant would not be able to operate fully for extended periods and it might have to discharge partially-treated or raw wastewater into the Laguna.

- **Increased indirect costs** could delay or compromise ongoing activities and projects, hinder proper maintenance (increasing failures), and block obtaining necessary supplies.

3. Current City Programs

Ensure System Integrity. The City recently completed a video inspection of 100% of its sewer lines to assist in determining the most deteriorated lines for repair and replacement.

Reduce Wastewater. Sebastopol has adopted a zero-net-flow wastewater mitigation ordinance for new residential development. It requires that, for each new single family dwelling built, 4.8 toilets and 4.8 showers elsewhere in the City be retrofitted to be low flow. The developer can either make the actual retrofits or pay an in-lieu fee that the City will use to reduce wastewater flows. The goal is to neutralize the wastewater impact of new development, and also reduce water demand.

Alternative Power. Among the City's upcoming solar installations, a solar power system will be installed at the Morris St. lift station in 2007.

Graywater Systems. The City has approved the first graywater reuse system for a multi-unit (and commercial) project in Sonoma County. Graywater systems conserve water and reduce wastewater. (See discussion in the Water section of this report.)

4. Recommendations: Wastewater

Note: Wastewater flows would likely be reduced by the water conservation measures recommended in the Water section of this report.

Encourage Actions at Other Levels of Government

Recommendation E-1: The City could encourage the Laguna Treatment Plant to consider adding more solar energy, in order to save money from increased energy costs, help during extended outages, and support the transition from fossil fuel dependency. The City could also encourage the Plant to create an Energy Transition Plan.

As a local example, the Sonoma Valley County Sanitation District (SVCSD) has installed PV projects on a number of sites to offset energy consumption and operation costs. The Sonoma County Water Agency, which runs the sanitation district, hopes to slash the Sonoma Valley Sanitation District's PG&E bill from \$699,923 to zero by spending \$7 million to install thousands of solar panels on approximately four acres at the valley's wastewater treatment plant.⁵⁶

Prepare for Longer-Term Emergencies

Recommendation E-2: Because of its dependency on the Laguna Treatment Plant, we recommend that the City determine what emergency measures the Plant has in place, including procedures to ensure that untreated sewage is not dumped into the Laguna during an extended power outage.

Recommendation E-3: The City might choose to reduce Sebastopol's dependency on the Laguna Plant, in these ways:

- Consider the implications of future growth. Sebastopol and the surrounding cities have staked their future growth projections on the ability of the Laguna Plant to service their wastewater needs. Healthy future growth is less certain under conditions of electricity blackouts at the Laguna Plant. Note that Sebastopol is not alone in its dependency on large-scale wastewater treatment technology. Nearly every city in the U. S. would face the same wastewater-energy problem.
- The City could evaluate allowing composting toilets for domestic use, as an alternative to flush toilets. This would save water and wastewater use and costs. These systems use no or little water and can be operated safely with proper maintenance. Current health codes restrict their use, but the City could re-examine and perhaps adjust these codes.

Composting toilet systems could be permitted on a demonstration basis in several new and existing houses and on a public building as a joint venture with component manufacturers. They should be given an opportunity to prove themselves on both health and cost basis. If they work well in a trial period, the City could allow more to be installed. An important part of promoting alternative technologies such as these would be to create regulations and safety guidelines which would assure safety but not price them out of the market.

F. Police, Fire, & Emergency Services

1. Description

Police Department. Police Department personnel include sworn and civilian personnel, with seven volunteer reserve police officers and two community service volunteers. There are fifteen sworn Officers, including the Chief of Police, one Administrative Support Manager, five Communication Officers, one full-time police Control Aide, and three part-time School Crossing Guards.

Fire Department. The Sebastopol Volunteer Fire Department is staffed by one paid Fire Chief and a volunteer staff consisting of two Assistant Fire Chiefs, six Fire Captains, 26 Firefighters, and three Reserve Firefighters.

Emergency Medical Services (EMS). The City of Sebastopol's EMS system is comprised of a coordinated response by private ambulance and the Sebastopol Fire Department. The Sonoma County EMS Agency contracts with a private company, American Medical Response (AMR), which is the exclusive ground transport ambulance provider for Sebastopol and the greater Santa Rosa area. While one ambulance is generally located in Sebastopol, ambulances are relocated as service demands dictate. This requires fewer ambulances, but requires greater vehicle movement, thus creating an unquantified higher amount of fuel used in "commuting" to Sebastopol to ensure quick response times when the primary unit is on a call. Depending on time of day, the Fire Department provides initial EMS response with either a 190hp diesel rescue squad or a 350 hp fire engine. In 2006, they responded to 505 EMS emergency calls (57% of total calls). The larger fire engine is used during daylight hours (273 calls), to be flexible to respond to any emergency, due to lower staff availability. This extra coverage can result in an inefficient use of resources. During evening hours (232 calls), the more economical rescue squad is used. The Fire Department has a 5-minute response standard; the ground ambulance has an 8-minute response standard.

Emergency Preparedness. The City's key current emergency plans are in these documents:

- Energy Conservation Policy: Extended Electrical Power Outage Contingency Plan, 1/26/06. This document describes basic City procedures, including steps to ensure water reservoir levels, monitor sewer-pumping facilities, open public buildings for the public's temporary relief, and assist residents with home oxygen systems. (More information about this is in Appendix C.)
- City of Sebastopol Emergency Operations Plan (1996)
- Citizen preparation tips. On the City website's Fire Department page, the City indicates that residents and business should be prepared to handle natural disaster emergencies for the first 72 hours of the disaster. More information is at <www.ci.sebastopol.ca.us/fire.shtml>.
- Sebastopol Community Emergency Response Training (through the Fire Department)
- Reference: Earthquake Recovery, A Survival Manual for Local Government (Sept. 1993). Governor's Office of Emergency Services, State of California

2. Vulnerabilities

- **Medium- to long-term energy shortages and outages** would become increasingly likely in the conditions this report describes, as tightening global fossil fuel supplies make industrial societies increasingly vulnerable to sudden supply shortfalls from weather or terrorist events. These outages could significantly hinder the City's ability to offer emergency services, by impacting both the functioning of its command centers and limiting vehicle trips. Unfortunately this could potentially occur at the same time as a large and unprecedented increase in demand for City emergency services, because of problems such as increased crime and civic unrest, shortfalls of food supplies, regional economic instability, increased unemployment, etc. At the same time, it is likely that other government agencies would also be stressed and limited in their ability to offer assistance.

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- **Significantly increasing energy costs** could notably increase the costs of Sebastopol's emergency services, causing pressure to either find more funds or reduce services. If a medium-to-long term energy shortage had a major impact on the region's economic health, the City would likely face drastically increased demands for services of all types while experiencing a reduction in revenues.
 - **Increased indirect costs** could delay or compromise ongoing activities and projects, hinder proper maintenance (increasing failures), and block obtaining necessary supplies.

3. Current City Programs

Police Department

- The Department has purchased two motorcycles, two hybrid vehicles (a Ford Escape and Prius), and two higher-mileage patrol cars. They plan to purchase a third hybrid (a Ford Escape).
- The City will be installing solar power at the police station in 2007, after implementing energy-saving improvements.

Fire Department

- The Department will soon have a hybrid command car (Ford Escape).
- At the firehouse, the City installed a solar power system and upgraded the heating system.
- Natural gas consumption is about 40% less than ten years ago, largely because of the installation of an updated natural gas heater as well as a diesel exhaust system that allows them to keep the bay doors closed during the day.
- The newer engines are more efficient than older apparatus.

4. Recommendations: Police, Fire, & Emergency Services

All three components of the City's emergency response system seem well-focused on general energy conservation and efficiency, as well as the related goal of reducing the City's greenhouse gas emissions. Compared with similar City operations across the nation, they are well ahead of most similar-sized operations.

In addition, there seem to be sufficient plans in place for "traditional" emergencies of relatively short duration, such as earthquakes, short-to-medium term power outages (hours to days), and many types of weather-related emergencies. Direct costs for police, fire, and EMS response systems also seem manageable for most foreseeable temporary emergencies

However, we feel that the City could benefit from considering and planning for sustained price increases and longer-duration energy outages and shortages. We do not see that emergency response services are considering how they would operate in a sustained low-energy environment. We encourage City staff to think outside of their current "emergencies are brief, and then things go back to normal" framework and explore the possibility of a major shift in fossil fuel availability and costs.

Implement Alternative Technologies

Recommendation F-1: We recommend that the City continue exploring non-petroleum fuel options, as discussed in the Vehicles section of this report, to ensure reliable supplies for extended outages as well as transition away from petroleum fuels, which are expected to be increasingly expensive and of insufficient supply.

Prepare for Longer-Term Emergencies

Recommendation F-2: Given that so many fire calls are for medical events, we suggest that the City consider if it might be helpful to provide additional paramedic units (and transport units) in town without adding to outside contract costs. Would it be helpful to bring on additional paramedic-trained firefighters within the Sebastopol department? Would it be appropriate to get smaller dual-use fire/EMS apparatus, for instance an efficient command vehicle which is also a paramedic response vehicle? This might offer better mileage while maintaining response time and reducing wear and tear on the larger trucks. Assess costs and benefits and how this relates to the setup/contracts with the ambulance company.

Recommendation F-3: We encourage the City to explore disaster planning for more extreme scenarios, including extended outages, extremely limited energy supplies, drastic price increases, and community duress. What planning now could be useful should those events occur? For instance:

- Assess current City fuel supply levels and procedures. Determine if the City wants to increase minimum levels maintained in storage tanks or establish additional backup sites.
- If energy supplies were constrained, would it be helpful to prioritize which vehicles were sent out, based on energy supplies and vehicle mileage rate? This could provide savings compared to sending out more vehicles than necessary.
- Is there cross-training between fire and police staff that could be useful? Sebastopol is a small enough city that an adoption of cross-training principles could allow police units to call in appropriate resources for a particular emergency.
- Should there be a system for allocating emergency fuel supplies between competing needs, such as water/wastewater, backup generators, police and fire use vehicles, city administration, and police/fire/EMS command and control? If inter-departmental cooperation is not enough, who would decide which of the critical services would be allowed to lapse first? Are there any policies that would get triggered, locally or beyond?

Recommendation F-4: We suggest that the City determine how department staff would be impacted by sustained fuel shortages (i.e., officers and staff who live out of the immediate locale).

Recommendation F-5: We recommend that the City ensure that the EMS subcontractor has a reliable source of fuel in case of sustained fuel shortages. (They currently get fuel only at consumer stations.) Perhaps the EMS fuel needs should be factored into Sebastopol City diesel reserves, and/or the City and AMR could discuss how this could be reflected in the service contract.

Recommendation F-6: Review the AMR contract to identify vulnerabilities to the City in the scenarios described in this report. For example, if fuel prices greatly increase, will the company raise prices or pull out of the contract? What are the conditions under which the company could pull out of its contract, leaving the City without coverage?

G. TRASH COLLECTION & DISPOSAL

1. Description

Trash collection is sub-contracted to a private vendor, currently Waste Management Inc. (WMI). Overall disposal management is the responsibility of the Sonoma County Waste Management Agency. WMI's garbage trucks use an unknown quantity of fuel.

2. Vulnerabilities

- **Increased energy costs could increase trash collection fees**, adding to cost pressures for both the City and city residents. This might result in some residents not paying for garbage services and instead discarding items by the side of the road and other inappropriate places.
- **Fuel shortages** could result in company failure to pickup trash, resulting in garbage accumulating at and in homes, at the risk of public health.
- **Increased indirect costs** could also increase rates and delay or compromise company activities and projects, including proper equipment maintenance.

3. Current City Programs

The City has considered requiring the trash hauler to use biodiesel or CNG, but they do not currently have the leverage. In addition, they indicate that this would result in a cost to ratepayers.⁵⁷

4. Recommendations: Trash Collection & Disposal

Recommendation G-1: As the City depends on WMI for this City service, we recommend that the City (perhaps in alliance with other city customers of WMI) continue to encourage WMI to explore non-petroleum fuel sources as they develop.

Recommendation G-2: We suggest that the City reduce its vulnerability on this issue by reducing Sebastopol's waste, with the goal of becoming a Zero Waste city. Actions could include:

- Encouraging composting and recycling on residential and commercial sites in Sebastopol.
- Requiring all new residential construction to include a compost facility.
- Working with local individuals and groups to develop other possible actions.

H. City Revenues

Note: This section covers City revenues. Other aspects of City finance are covered in the appropriate sections of this report.

1. Description

Sales Taxes are the chief source of General Fund revenue for the City. The City currently receives 1.2% of the 8% sales tax. In FY 05-06 (Estimated), the City received \$1.7M in sales tax, or about 28% of the City's income. In FY 04-05, the top source of sales tax income was automotive sales and services. In FY 05-06, it became grocery retail sales.

Property Tax runs a close second revenue source for the City, at nearly \$1.1M in FY 05-06, or about 22% of total income.

Other Top Income Sources for the City are: Property Tax In-Lieu of VLF (Vehicle License Fee, \$420K in FY 05-06, 9.3% of revenues), Property Tax In-Lieu of Sales Tax (\$350K, 7.7%), Transient Occupancy Tax (\$280K, 6%), and Real Estate Transfer Tax (\$205K, 4.4%). The City also receives income within funds, including sewer, water, gas tax, and redevelopment.

2. Vulnerabilities

As discussed in Chapter I., the problems of energy availability and costs could notably effect both local and global economies, and thus impact City revenues. For example, increased energy costs could significantly increase the costs of goods and reduce their availability – impacting those who depend on those goods, and decreasing the net income of both businesses and consumers. This could in turn increase unemployment and cause other notable changes in the economic structure. Tourist trade could be significantly impacted, and people might need to relocate their places of employment because of limitations on their ability to commute. These changes could also create an opportunity for local businesses and producers to step in to fill the void. These considerations are at the heart of current efforts toward local and regional self-sufficiency (also called “localization” and “relocalization”).

Sonoma County Economy. According to an economic survey prepared for the county's Economic Development Board and reported in the Press Democrat, the long-term effects of higher energy costs on tourism and wine as mainstays of the Sonoma County economy cause concerns about predictions of an economic rebound. Two of the three foundations of Sonoma County's economy – wine and tourism – rely upon robust consumer spending, and if energy prices continue to take a larger bite out of people's budgets, it says, trouble could lie ahead for those sectors.

“Travel and tourism could easily falter if airlines are able to raise fares and gasoline prices remain elevated, generating a loss of both long-distance and local travelers,” the EDB report's author, Steven Cochrane, managing director of Economy.com, wrote in his report.

Purchasers of Sonoma County's higher end wines have more disposable income, and are less likely to scale back on the good things in life because of higher energy costs, he said. Nevertheless, short-term risks remain – especially to producers of lower cost wines – if consumers rein in their spending, he said.

The third core sector of the Sonoma County economy – telecommunications equipment manufacturing – continues to struggle, as shown by continued production job cutbacks at Agilent Technologies. However, other local tech companies, such as Alcatel and Medtronic, are hiring people to fill research and development positions, which Cochrane says is encouraging. “It gives me some hope that those jobs are going to last,” he said.

If there were a downturn in the economy sharp enough to trigger job losses, this could put the previously hot housing market at risk. People could be forced to sell their homes, resulting in a significant number of homes coming on the market in a short period, he said. This could trigger a drop in prices, and a drop in property tax revenues to the City.⁵⁸

Additionally, a significant number of Sebastopol people commute to employment, some over great distances, including to the Bay Area. How will increasing fuel prices and shortages impact their ability to earn a living, and thus pay their bills, including to the City?

Sebastopol Sales Tax. Effect unknown. Sales tax revenues could go either up or down in these scenarios. On the one hand, product prices would increase for fuel as well as many other goods, because of their embedded fuel costs for transport. On the other hand, this might cause people to reduce spending, travel, etc. People might shift their purchases to or from other towns, such as Santa Rosa.

Property Tax. Effect unknown. With economic difficulties, people might have difficulty in paying their bills. According to City Manager Dave Brennan, “I don’t believe effects on property taxes can be effectively determined.” Further analysis of trend data might offer more information for prediction.

Transient Occupancy Tax. Effect unknown. There will likely be a shift to people taking shorter trips. This might decrease tourists from longer distances and increase local travelers. Further analysis of trend data might offer more information for prediction.

3. Current City Programs

Planning Future City Income. The City currently has programs which explore possible ways to nurture this City’s economic future, including the Retail Market Analysis recently done for the City by Economic Planning Systems, the branding program, and the economic summits.

City Emergency Reserves. The City currently has programs in place for emergency reserves.

4. Recommendations: City Revenues

Recommendation H-1: We recommend that the City add energy vulnerability scenarios to its current revenue development planning process. This could include the Retail Market Analysis, the branding program, and the economic summits.

Recommendation H-2: We recommend that the City consider setting aside added reserves to cover energy costs, emergency response, and investments in proactive programs.

Recommendation H-3: We suggest that the City add energy vulnerability to campaigns that encourage people to buy from local Sebastopol merchants. For instance, the campaign might note that increased gas costs are just a warning about the larger issues of global demand soon exceeding supply, causing further price increases as well as supply shortfalls. They could also emphasize that buying local supports local business and industry, which creates stability of supply for the items upon which we depend in our daily lives.

Recommendation H-4: We encourage the City to develop specific ways to encourage local businesses that serve needs now met by Santa Rosa businesses, such as clothing stores, shoe stores, computer services, etc. It is likely that, as gas prices increase, people will wish to reduce their trips to Santa Rosa and other distant locations, and increase their local shopping instead. The City can support that trend by examining current shopping patterns, identifying the top business categories that bring west county people to Santa Rosa, and prioritizing attracting these business types to Sebastopol – especially those that bring in sales tax revenues.

Recommendation H-5: We suggest that the City develop ways to encourage its future financial well-being (and tax base) by supporting businesses that offer products and services that support a constructive transition to our new energy future, especially those which save their customers energy and provide alternatives to fossil fuel power. For instance:

- State as a City policy that the City supports these businesses, as a key basis of our future economy.
- Explore specific ways to nurture the viability of these businesses, including incubating the formation of new ones.

I. City Programs to Encourage Citizen Action

1. Description

By their rules and regulations, cities can encourage citizen behavior to prepare the community for energy price increases and shortages, and for a transition to non-fossil fuel energy sources. This can also reduce the City's net use of energy, reducing costs and vulnerability to shortages.

2. Vulnerabilities

To the extent that citizens are not prepared for energy price increases and shortages, or for a transition to non-fossil fuel energy sources, they might find themselves in various crises and expect help from the City and other government agencies. They might be less able to pay their bills to the City (for water, sewer, and property tax) as well as other energy-related bills, such as power bills that keep their homes livable. In addition, energy outages would also cut off the electricity needed for home heating, cooling, cooking, and other basic maintenance functions, risking citizens' health and reducing citizens' ability to work, shop, and do other daily activities. These dynamics could then increase problems with crime, individual and group disruption of ordinary system functioning, and civic unrest.

3. Current City Programs

Solar Sebastopol. Solar Sebastopol is a group of solar business and community members, formed to promote adoption of solar technology in Sebastopol and encourage solar businesses. The project was initiated by the City and is believed to be the first of its kind. Its goal is the installation of one megawatt of new solar power in Sebastopol, which is equivalent to about 500 average-sized homes. The City has supported this program through reduced building permit costs and a streamlined approval process. As of Aug. 29, 2006, Sebastopol had added 325 kW of solar power within city limits, or just over 32% of the one megawatt (1,000 kW) goal. This includes both private and City installations. This program might be one of the reasons that Sebastopol's zip code has the highest per capita of solar in the state. In an Oct. 3, 2003 editorial, the San Jose Mercury News commended Sebastopol for showing "the rest of the state and nation how local communities can take their energy future into their own hands." More about this program is at <www.solarsebastopol.com>.

Encourage Solar Installations. On Nov. 16, 2004, the City passed City Council Resolution No. 5458, which established permit fees in cases "when a solar power system is not already installed on the building or proposed to be installed as part of the building permit." There were different fees for new construction, remodeling, and re-roofing. Fees were designated to support Solar Sebastopol and "provide incentives for installing solar power in residential and commercial buildings." This fee raised \$10,000 to support this program and has since been rescinded.

Green Building. The City of Sebastopol has adopted a mandatory Green Building Program – one of the few in California or the U.S.⁵⁹ According to the City, this program encourages builders to: conserve resources, minimize waste, create healthier and more durable homes, reduce operational costs, reduce toxic pollutants, reduce GHG emissions, and support local manufacturers and suppliers of resource-efficient building materials. More about this program is in Appendix B.

4. Recommendations: City Programs to Encourage Citizen Action

Recommendation I-1: We recommend that the City require all new construction to install PV solar, sized to meet the buildings estimated electrical loads. For locations that do not have appropriate solar resources, an in-lieu fee could be assessed that the City would use to add PV solar for the public benefit. (Note: A related proposal is currently pending before the City Council.)

Recommendation I-2: We recommend that the City require all new buildings to orient roofs to allow for maximum solar access.

Recommendation I-3: We recommend that the City review the Codes, Covenants, & Restrictions (CCRs) of new developments to ensure that none inhibit sustainable energy practices. For instance, some deeds prohibit clotheslines and solar power.

Recommendation I-4: We recommend that the City use Solar Sebastopol as a model for encouraging other types of energy providers to collaborate in the interest of the community.

Recommendation I-5: We encourage the City to educate the public about these issues, to encourage their proactive action and support of City action on this issue. In addition to, or in conjunction with, the proposed Community Outreach Committee (Recommendation A-10), the City could:

- Create a webpage on the City document with key information on this topic, including this report. This probably would be a link on the City's new "Sustainable Sebastopol" webpage (under Programs). Make plans to continue updating and expanding this page, for instance with links to resources locally and beyond. (This might be done in partnership with a local community member or group.)
- Explore with local groups and individuals ways to support the larger community response to these scenarios.
- Create public education program/events, by planning, sponsoring, and/or collaborating in their creation. For instance, the City might sponsor a public film festival on peak oil, global warming, and related issues, in collaboration with an interested community group.
- Explore with the Sebastopol Historical Society the idea of doing an exhibit of the 1970s gas crunch, the reality of what it was like, the lines – and why this time it might not just come and go, why it might get worse, and why preparation is vital to our experience of this transition.

Appendix A: Other Cities Using Biodiesel

Biodiesel is a renewable alternative fuel made from vegetable oils (often soybean), rendered animal fats, or waste oils such as from restaurants. It is offered as B100 (100% biodiesel) as well as blends with petroleum diesel. (For instance, B20 is 20% biodiesel.)

Biodiesel provides an alternative to petroleum, offering an option in the face of the projected shortage of supply, and reducing our dependence on oil products that are harmful environmentally and often located in hostile countries. Biodiesel exhaust also has lower levels of most GHG emissions (thus helping combat climate change) as well as air pollutants (such as particulates, sulfur oxides, and carbon monoxide). It is far safer to transport, store, and use than petroleum products, as it is non-toxic, less flammable, and (if spilled) biodegrades relatively quickly.⁶⁰

Biodiesel in blends up to B20 can be used in modern diesel vehicles (such as cars, trucks, and generators) with little or no engine modification.⁶¹ In fact, the Diesel engine was originally designed to run on vegetable oil, not fossil fuel. Some older vehicle models require changing the synthetic rubber seals in the fuel system. According to Hawaii-based Pacific Biodiesel Inc., a commercial producer of the fuel, biodiesel is the only alternative fuel that can extend engine life because of its “superior lubricating properties,” thus reducing wear and tear.⁶² Efficiency, and thus fuel mileage, is similar to gasoline.

Biodiesel is sometimes more expensive than petroleum diesel. Even so, economies of scale in production, combined with the rising cost of petroleum, “may reduce, eliminate, or even reverse this cost differential in the future.”⁶³ Today, more than 600 major fleets use biodiesel commercially, and over 1,000 retail filling stations make it available to the public. More than 1,500 biodiesel distributors are operating nationwide.⁶⁴

Here are a few of the municipalities that are using biodiesel in their vehicles.

San Francisco, CA — Since 1999, San Francisco’s Healthy Air and Smog Prevention ordinance has established requirements for City fleets to purchase vehicles that either use alternative fuels or are energy-efficient with low emissions. San Francisco now has more than 800 alternative fuel vehicles in its fleets. Several City departments and agencies have successfully used B20, including the SF Airport, Department of Public Works, MUNI buses, and the SF Zoo. Ferries operating out of San Francisco have also used B20 with excellent results. The City uses about 8 million gallons of diesel a year.

On May 18, 2006, the San Francisco mayor issued an Executive Directive designed to increase the pace of municipal use of biodiesel. The directive encourages fleet managers to identify equipment that can most quickly be transitioned to biodiesel and make preparations. It directs all diesel-using departments to begin using a B20 blend as soon as practicable in all diesel vehicles and other diesel equipment, with incremental goals resulting in 100% by December 31, 2007.

The San Francisco Fire Department also announced that it has initiated a six-month pilot program to test and monitor the use of B20 in two fire trucks, six engines, and one ambulance. The program will take place in the southeastern section of San Francisco, an area that consistently experiences the city’s poorest air quality. Upon successful completion of the pilot program, the Fire Department expects to expand the use of biodiesel throughout the City.

Berkeley, CA — In 2004, Berkeley transitioned to B100 for nearly all its vehicle fleet. Berkeley had already used other cleaner fuels including B20 as well as all-electric, electric-gas hybrids, and compressed natural gas (CNG). However, the city experienced issues with B100 (maintenance problems that were mostly quality control problems, e.g. contamination in fuel from vendor). They switched to B20, which is currently used in 138 of its diesel vehicles,⁶⁵ and were contemplating changing to B50.⁶⁶ In 2005, the City reported that they had cut vehicle emissions of GHG by 47% since 2002, “primarily

the result of the City's pioneering use of biodiesel fuel in its fleet and the expanded use of electric and natural gas powered vehicles." ⁶⁷

Calgary, Canada — The City of Calgary created one of the first large biodiesel pilots in Western Canada. "The City's initial trial has evolved from a six-month pilot project supporting one Calgary Fire Department vehicle to a sustainable, year-round program supporting 77 vehicles – mainly from Water Services, Waste and Recycling and the Fire Department. As of April 30, 2006, nearly one million liters of biodiesel had been used in City vehicles." Approximately 75% of the total was a B5 blend, and the remaining 25% was B20. "The B5 blend is used during the colder months as a precaution to prevent gelling during cold weather. It is anticipated that the percentage of B20 will increase as the project progresses. The use of biodiesel has helped reduce greenhouse gas emissions (GHG) by approximately 16% per liter when compared to the exclusive use of petroleum diesel." ⁶⁸

Carlsbad, NM — On Jan. 13, 2006, the Carlsbad Fire Department started using B50 in its Fire Department command vehicle. "The fuel is manufactured entirely from Carlsbad's waste stream of restaurant frying oil.... The Petroleum Science Laboratory at New Mexico State University-Las Cruces gave our fuel an extremely high rating for purity, cetane value, flash point, viscosity, lubricity, and other analytical parameters." They plan to transition the vehicle to B100.⁶⁹

Santa Barbara — Beginning July 1, 2006, Santa Barbara planned to move from diesel fuel to a B20 blend (with 20% virgin soybean oil) to help power its fleet of 150 vehicles. Santa Barbara fire trucks will be among the vehicles that will soon run on the alternative fuel.⁷⁰

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For more information about these projects, see the citations in this section's footnotes. For general information about biodiesel, see the National Biodiesel Board website at <www.biodiesel.org> and the information and links on this Wikipedia page <<http://en.wikipedia.org/wiki/Biodiesel>>.

Appendix B: City of Sebastopol Green Building Program

The City of Sebastopol has adopted a mandatory Green Building Program – one of the few in California or the U.S.⁷¹ “Green Building is a comprehensive approach in construction and design practices that consume fewer materials and energy over the lifetime of the building, while comfortably and safely protecting the occupants.” The City’s goals with this program are to conserve resources, minimize waste, create healthier and more durable homes, reduce operational costs, reduce toxic pollutants, reduce GHG emissions, and support local manufacturers and suppliers of resource-efficient building materials. The City of Sebastopol’s mandatory sustainable building criteria are based on the County of Sonoma Waste Management Agency Green Building Guidelines.

The program is for new residential, commercial, and commercial remodels of 500 square feet and larger. To receive a certificate of occupancy, a minimum 60 overall points in the rating system is required, with 15 points minimum in each category (Indoor Air Quality, Energy Efficiency, and Resource Efficiency). Required elements include dual-flush toilets and flow-reduced faucets and showerheads. The City is also developing a comprehensive Land Use/Energy Conservation program that might specify other sustainable building techniques as mandatory requirements.⁷²

Some of the ways that builders can get points which relate to CAGE’s mandate include:

- A. Site:** Design Resource-Efficient Landscapes; Install High-Efficiency Irrigation Systems; Provide for On-Site Water Catchment / Retention
- E. Plumbing:** Insulate all Hot Water Pipes; Install Flow Reducers on Faucets and Showerheads; Install Ultra-Low Flush Toilet; Install Tankless Water Heater; Pre-plumb for Graywater Conversion (check with local code); Install On-Demand Hot Water Circulation Pump
- F. Electrical:** Install Compact Fluorescent Light Bulbs – CFLs; Install Air-Tight Insulation-Compatible Recessed Fixtures for CFLs; Install Lighting Controls; Install High Efficiency Ceiling Fans with CFLs
- G. Appliances:** Offer Energy Star Dishwasher; Offer Horizontal Axis Washing Machine; Offer Energy-Efficient Refrigerator
- I. Windows:** Install Energy-Efficient Windows
- J. Heating Ventilation and Air Conditioning:** Install Attic Ventilation Systems; Install Whole House Fan; Install 13 SEER/11EER or higher AC with a TXV; Install 90% Annual Fuel Utilization Efficiency (AFUE) Furnace; Install Zoned Hydronic Radiant Heating; Install Heat Recovery Ventilation Unit (HRV)
- K. Renewable Energy and Roofing:** Pre-Plumb for Solar Water Heating; Install Solar Water Heating System; Pre-Wire for Future Photovoltaic (PV) Installation; Install Photovoltaic (PV) Panels; Install Solar (PV) Walkway Lights; Install Radiant Barrier Roof Sheathing
- L. Natural Heating and Cooling:** Incorporate Passive Solar Heating; Install Overhangs or Awnings on South Facing Windows; Plant Deciduous Trees on the West and South Sides
- Other:** Develop Homeowner Manual of Green Features/Benefits; Innovation Points (for innovative approaches not already on this list)

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More information about the Sebastopol program is at <www.ci.sebastopol.ca.us/greenbuildingprogram.shtml>. This includes a link to more information about the points system elements. For added information on City requirements, download the City Municipal Code and review Chapter 15.74 (“Water and Energy Conservation Requirements”).

Appendix C: City of Sebastopol Energy Conservation Policy: Extended Electrical Power Outage Contingency Plan (Excerpts)

Jan. 26, 2006

This City Contingency Plan describes basic response procedures. Some items of interest for this report are:

- Public Works staff shall monitor **water reservoir levels** and make plans to obtain additional emergency generators as needed to insure adequate water levels.
- Public Works staff shall monitor **sewer-pumping facilities** to insure proper generator operation and have contingency plans in place for generator failure.
- Fire Department staff shall maintain a supply of portable oxygen cylinders to **assist those with home oxygen systems** that can fail during power outages.
- Also, if needed, **public buildings to be opened** to the public for temporary relief are: (listed in order).
- During a major electrical system failure, City staff will coordinate with the American Red Cross for operation of **emergency shelters**.
- Prior to an event, the Fire Department staff will **contact local hospitals and care homes to determine patient status** as a result of an extended power outage. Staff will assist these care facilities with their internal disaster plan implementation.
- Public Works shall maintain a list of **emergency generator vendors** and provide that information to local business upon request.

The plan's full text is at <www.ci.sebastopol.ca.us/extendedelectricaloutage.shtml>

APPENDIX D: Resources For More Information About Energy Issues

Books

Collapse: How Societies Choose to Fail or Succeed, Jared Diamond, Penguin Group, 2005.

Diamond, who teaches geography at UCLA, identifies five factors that contribute to a society's collapse: climate change, hostile neighbors, trade partners (that is, alternative sources of essential goods), environmental problems, and, uniformly, a society's response to its environmental problems.

Energy at the Crossroads: Global Perspectives and Uncertainties, Vaclav Smil, MIT Press, 2003.

An authoritative, sober, thorough, and thoughtful integrated text on energy. Smil is a Professor at the University of Manitoba.

Hubbert's Peak: The Impending World Oil Shortage (Revised Edition), Kenneth S. Deffeyes, Princeton University Press, 2001.

Deffeyes, Professor of Geology Emeritus at Princeton University, concludes that worldwide oil production has peaked, and that soon chronic shortages will become a way of life.

One World, Ready or Not, William Greider, Simon & Schuster, 1997.

Greider, a journalist and independent researcher, surveys the dynamics and contradictions of the corporate-driven global economy, which, he says, is heading toward "an economic or political cataclysm." He proposes a number of steps governments of the world can take to avert disaster: moderate the flow of goods by imposing tariffs to rectify trade deficits, change labor practices in developing countries, and allow labor to share in the ownership of capital

Overshoot, William R. Catton, Jr., University of Chicago Press, 1980.

Catton, who was a sociologist at Washington State University, argued in this classic that the Industrial Revolution has led to an "Age of Exuberance" — a vast increase in both world population and use of industrial products that exceeds the "carrying capacity" of the earth in terms of production of minerals and energy. The result is a "drawdown," stealing resources from the future under the delusion of "cargoism," the idea that technology will always save us from overshoot and crash or die-off.

The Party's Over: Oil, War, and the Fate of Industrial Societies, Richard Heinberg, New Society Publishers, 2003.

Heinberg, an award-winning author and member of the Core Faculty at Santa Rosa's New College, shows how our modern industrial society is completely dependent on fossil fuels and hence vulnerable to reductions in energy availability. He argues that peak oil is imminent, and that oil plays a major role in geopolitics, terrorism, and war.

Powerdown: Options and Actions for a Post-Carbon World, Richard Heinberg, New Society Publishers, 2004.

In this sequel to The Party is Over, Heinberg provides an update, reviewing further the four primary ways that our culture can approach these energy supply issues. He determines that we can either do a process of Powerdown (through intelligent, informed, cooperative means), while Building Lifeboats (to build community solidarity and preserve knowledge, artifacts, and tools). Or we can do a Last One Standing strategy of war (with destructive competition for diminishing resources), while Waiting for a Magic Elixir (with wishful thinking, false hopes, and denial).

The Prize, Daniel Yergin, Simon & Schuster, 1991.

A history of the global oil industry from the 1850s through 1990. Yergin is an independent researcher and the co-founder and chairman of Cambridge Energy Research Associates. With this book, he won the Pulitzer Prize for General Non-Fiction in 1992. The Prize was the basis for a six hour documentary television series titled "The Prize — The Epic Quest for Oil, Money, & Power," narrated by Donald Sutherland.

Resource Wars: The New Landscape of Global Conflict, Michael T. Klare, Henry Holt & Company, 2002.

An analysis based on concrete facts and projections of the likely shape of future wars resulting from: finite energy, mineral, and water resources; escalating demand; and the location of resources in regions torn by ethnic and political unrest.

Twilight in the Desert, Matthew Simmons, J. Wiley & Sons, 2005.

Simmons, an investment banker, details the long-standing dependence of the U.S. on Saudi oil. With a field-by-field assessment of its key oilfields, he highlights many discrepancies between Saudi Arabia's actual production potential and its seemingly extravagant resource claims, and predicts oil prices approaching \$190/bbl soon.

Getting to Zero Waste, Paul Palmer, Purple Sky Press, 2005.

Palmer presents a theory of universal reuse of all goods and design for repeated reuse, not just of a post-discard total recycling of materials, which is energy-intensive and destroys the time and energy that went into creating the complex objects that are recycled. Paul Palmer was the founder of Zero Waste Systems Inc. in the mid-1970s in Oakland, California, which was a pioneer in the reuse of chemicals.

Reports, Articles, & Testimony

“Peaking of World Oil Production, Impacts, Mitigation and Risk Management,” Robert L. Hirsch, et al, Science Applications International Corporation, 2005.

This full report (commissioned by the U.S. Department of Energy and often called “The Hirsch Report”) is online at <www.projectcensored.org/newsflash/the_hirsch_report.pdf>. A summary is at <http://en.wikipedia.org/wiki/Hirsch_report>. More about the report is at <www.counterpunch.org/heinberg07302005.html>

“The Inevitable Peaking of World Oil Production,” Robert L. Hirsch, *Bulletin of The Atlantic Council of the United States*, Oct. 2005.

This shorter summary by Hirsch of the problem of peak oil is at <www.d-n-i.net/fcs/pdf/hirsch_world_oil_production.pdf>

“The End of Cheap Oil,” Tim Appenzeller, *National Geographic*, June 2004

<magma.nationalgeographic.com/ngm/0406/feature5/?fs=www7.nationalgeographic.com>

“After Oil: Powering the Future,” Michael Parfit, *National Geographic*, August 2005 (cover story)

<www7.nationalgeographic.com/ngm/0508/index.html>

“Global Warming Heats Up,” *Time*, Mar. 26, 2006

<www.time.com/time/magazine/article/0,9171,1176980,00.html>

“Oil Shockwave – An Oil Crisis Executive Simulation,” Energy Commission

<www.energycommission.org/site/page.php?report=8>

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<www.federalreserve.gov/boarddocs/speeches/2006/200606152/default.htm>.

“Gulf Oil Decline in Sight,” *Science*, 26 November 2004.

<www.sciencemag.org/cgi/content/summary/306/5701/1469c>

“The Truth About Oil Security,” *Fortune*, Sept. 16, 2002, *Money Magazine*

<http://money.cnn.com/magazines/fortune/fortune_archive/2002/09/16/328566/index.htm>

“Will Gas Lines in the Coming Decade Make Those of 1973 Look Short?”, Paul Raeburn, *Scientific American*, October 2001. <www.sciam.com/article.cfm?chanID=sa006&colID=12&articleID=00081C95-DB64-1C6E-84A9809EC588EF21>

“What Does Zero Waste Really Mean?”, Paul Palmer, *Rachel’s Democracy & Health News*, March 3, 2006 <www.ega.org/news/index.php?op=read&articleid=369>

Webpages

The Apollo Alliance <www.apolloalliance.org>

The Apollo Alliance is “working within the progressive community to unite uncommon allies behind an agenda for energy independence, good jobs, and national security” saying that “working Americans do not have to choose between the economic well-being of their families, the environmental health of their communities, and the security of their country.”

Association for the Study of Peak Oil and Gas (ASPO) <www.peakoil.net>

ASPO is “a network of scientists, affiliated with European institutions and universities, having an interest in determining the date and impact of the peak and decline of the world’s production of oil and gas, due to resource constraints.” It was founded in 2000 by Colin Campbell and Jean Laherrère, a French petroleum geologist.

Business Alliance for Local Living Economies (BALLE) <www.localeconomies.org>

BALLE is an alliance of businesspeople around the U.S. and Canada who share the goal of building local living economies. In California, there are local BALLE networks in Berkeley, Napa Valley, Oakland, San Benito County, San Francisco, Santa Cruz County, Sierra Nevada, Sonoma County, and Willits.

California Energy Commission (CEC) <www.energy.ca.gov>

The CEC forecasts the state’s future energy needs, promotes energy efficiency through appliance and building standards, educates the public on energy conservation and efficiency, and supports renewable energy technologies.

Dry Dipstick <www.drydipstick.com>

A Peak Oil metadirectory managed by Mick Winter.

International Council for Local Environmental Initiatives (ICLEI) <www.iclei.org>

ICLEI is an international association of local governments, and national and regional local government organizations, that have committed to sustainable development. Through Local Renewables (LR), ICLEI aims “to support and strengthen local governments which promote the generation and supply of renewable energy sources and energy efficiency in the urban environment.” Through the Cities for Climate Protection (CCP), cities are enlisted “to adopt policies and implement measures to achieve quantifiable reductions in local greenhouse gas emissions, improve air quality, and enhance urban livability and sustainability.”

International Energy Agency (IEA) <www.iea.org>

The IEA is an intergovernmental organization, founded by the Organisation for Economic Co-operation and Development (OECD), which “acts as energy policy advisor to 26 member countries in their effort to ensure reliable, affordable and clean energy for their citizens. It is “dedicated to preventing disruptions in the supply of oil, as well as acting as an information source on statistics about the international oil market and other energy sectors and promoting and developing alternate energy sources, rational energy policies, and multinational energy technology co-operation.”

Oil Depletion Analysis Centre <www.odac-info.org>

The Oil Depletion Analysis Centre (ODAC) is a British educational charity working to raise international public awareness and promote better understanding of the world's oil-depletion problem. ODAC believes that lead time is running short for a smooth transition to new energy systems and a less oil-dependent way of life.

Oil Futures News Headlines <news.tradingcharts.com/futures/headlines/Oil.html>

This free website offers commodity futures and financial market information; this particular page on the site specializes in oil headlines.

Open Directory Project: <<http://dmoz.org/Society/Issues/Environment/Energy>>

An open directory of energy-related websites.

Peak Oil News <www.peak-oil-news.info>

"The latest peak oil news, information resources, and articles."

Post Carbon Institute <www.postcarbon.org>

Post Carbon Institute is "a think, action and education tank offering research, project tools, education and information to implement proactive strategies to adapt to an energy constrained world."

The Powerdown Project <www.powerdownproject.org>

The mission of the Powerdown Project at Santa Rosa's New College "is to bring the urgent issues of energy vulnerabilities to communities and their policy makers, through education, outreach and research, and to offer alternative and viable responses to address energy consumption, production and distribution." They are working on a municipalities template for assessing and addressing these issues.

Relocalization Network <www.relocalize.net>

The Relocalization Network supports "Local Post Carbon Groups as they work to develop and implement the strategy of Relocalization in their communities, so that each locality operates well within its regional ecological boundaries."

Sustainable Toronto <www.utoronto.ca/envstudy/sustainabletoronto/index.htm>

This consortium between the University of Toronto Environmental Studies Program and the York Centre for Applied Sustainability at York University promotes community sustainability and facilitates the transition to a sustainable society by challenging and working with all sectors, including governments, researchers, educators, businesses, non-profits and other community members.

The Energy Bulletin <www.energybulletin.net>

A "clearinghouse for current information regarding the peak in global energy supply."

The Oil Drum <www.theoil Drum.com>

The Oil Drum features discussions of ideas related to peak oil, sustainable development and growth, and the implications of these ideas on politics, economics, and everything else.

Energy Information Administration, United States Department of Energy <www.eia.doe.gov>

A statistical agency of the U.S. Department of Energy which provides "policy-independent data, forecasts, and analyses to promote sound policy making, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment."

Wikipedia, Renewable Energy <http://en.wikipedia.org/wiki/Renewable_energy>

Summary information about renewable energy, with links for more information.

WTRG Economics <www.wtrg.com/index.html>

A U.S. based consulting company that assists producers and consumers of energy in the identification and analysis of energy price risk and its impact on their business.

Report Endnotes

- 1 **NOTE:** For more about the dynamics that could potentially arise from peak oil, see *The Party's Over* and *Powerdown*, both by Richard Heinberg.
- 2 **SOURCE:** Richard Heinberg, personal communication.
- 3 **SOURCE:** "There Is No Substitute For Crude," Curtis Hesler, *Professional Timing Service*, Aug. 10, 2006
- 4 **SOURCE:** February 2007 ASPO Newsletter <www.aspo-ireland.org/newsletter/en/pdf/newsletter74_200702.pdf>
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- 6 **SOURCE:** The International Energy Agency 2007 oil demand forecast, as report in "Developments In The Energy Sector," Joseph Dancy, Adjunct Professor, SMU School of Law, March 16, 2007 <www.financialsense.com/fsu/editorials/dancy/2007/0316.html>. This article also has other current information related to peak oil
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- 10 **SOURCE:** "Oil Shockwave – An Oil Crisis Executive Simulation," Energy Commission <www.energycommission.org/site/page.php?report=8>
- 11 **SOURCE:** "The Inevitable Peaking of World Oil Production," Robert L. Hirsch, *Bulletin of The Atlantic Council of the United States*, Oct. 2005
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- 14 **SOURCE:** "Bumper crop of US wind farms boosts turbine makers," Scott Malone, Aug. 25, 2006 <http://yahoo.reuters.com/news/articlehybrid.aspx?storyID=urn:newsml:reuters.com:20060825:MTFH88254_2006-08-25_12-00-55_N24260370&type=comktNews&rpc=44>
- 15 **SOURCE:** "Hydroelectric power's dirty secret revealed," *New Scientist*, Feb. 24, 2005 <www.newscientist.com/article.ns?id=dn7046>
- 16 **NOTE:** For information on exploration of local ocean power, see "PG&E sees power in North Coast waves," Glenda Anderson, *Press Democrat*, Mar 1, 2007 <www1.pressdemocrat.com/apps/pbcs.dll/article?AID=/20070301/NEWS/703010302/1033/NEWS01>
- 17 **NOTE:** For example, see <<http://biz.yahoo.com/bw/060130/20060130006100.html?.v=1>>
- 18 **NOTE:** More about biodiesel is in Appendix A.
- 19 **SOURCES:** "Sweden Raises The Renewable Energy Bar," John Laumer, Jan. 24, 2006 <www.treehugger.com/files/2006/01/sweden_raises_t.php>
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- 24 **SOURCE:** Portland's White Paper is at <www.metro-region.org/library_docs/council/whitepaper_oil_supply_uncertainty.pdf>
- 25 **SOURCE:** Portland Peak Oil <www.portlandpeakoil.org>
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- 27 **SOURCE:** Resolution text and press release is at <<http://energybulletin.net/15086.html>>

- 28 **SOURCE:** “San Francisco Peak Oil Hearing,” Dennis Brumm, July 28, 2006 <www.indybay.org/newsitems/2006/07/26/18291649.php>
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- 30 **SOURCES:** “The Power of Community: How Cuba Survived Peak Oil,” Megan Quinn, *Permaculture Activist*, February 26, 2006, <www.permacultureactivist.net>. Megan Quinn is outreach director for The Community Solution, <www.communitysolution.org>, a nonprofit organization which offers the documentary, “The Power of Community: How Cuba Survived Peak Oil.”
“Cuba attaining sustainable agriculture,” Lem Harris, *People’s Weekly World*, Jan. 17, 1998
“Cuba Turns to Mother Earth,” Robert Collier, Chronicle Staff Writer, *San Francisco Chronicle*, Feb. 21, 1998 <www.sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/1998/02/21/MN102237.DTL>
OTHER RESOURCES: The video “The Greening of Cuba” profiles the Cuban farmers and scientists working to reinvent a sustainable agriculture, using both traditional and new methodology. See <www.foodfirst.org/node/1135>.
Another video, “The Power of Community - How Cuba Survived Peak Oil,” also describes the crisis Cuba faced and how they overcame it, providing a valuable example of how to successfully address the challenge of reducing our energy use. See <www.communitysolution.org/cuba>.
- 31 **SOURCE:** City of Sebastopol <www.ci.sebastopol.ca.us> and Sebastopol Chamber of Commerce <www.sebastopol.org>
- 32 **SOURCE:** *GHG Inventory Report*, Sept. 2003
- 33 **SOURCE:** All City of Sebastopol information in this chapter is based on information supplied by the City of Sebastopol, unless noted otherwise.
- 34 **NOTES FOR TABLE 1:** (1) Total Ongoing City Expenses figures were provided by the City of Sebastopol and are a total of General Fund, Sewer Fund, and Water Fund expenses. (2) Vehicle fuel figures are approximations, because of incomplete underlying data. (3) The City pays for street lighting on a bundled plan with PG&E which includes energy costs and maintenance. Therefore, we have adjusted the streetlighting figures for all three fiscal years to approximate the energy portion of this cost, which we estimate to be about half, in order to more accurately reflect its costs relative to other City energy costs. (4) Per unit energy prices shown are calculated from the City’s net usage and payments.
- 35 **SOURCE:** *City of Sebastopol Energy Efficiency Study*, June 2005
- 36 **SOURCE:** *GHG Inventory Report*, Sept. 2003
- 37 **SOURCE:** PG&E <www.pge.com/education_training/about_energy/how_electric_system_works/index.html>
- 38 **SOURCE:** PG&E’s Power Content Label (inserted in bills).
- 39 **SOURCE:** San Jose Mercury News <www.mercurynews.com/mld/mercurynews/news/breaking_news/14878393.htm>
- 40 **SOURCE:** California Energy Commission, <www.energy.ca.gov/html/energysources.html>
- 41 **SOURCE:** California Energy Commission <www.energy.ca.gov/2005_energypolicy/index.html>
- 42 **NOTE:** The City can get input on language from San Francisco’s Peak Oil Resolution, which is at <<http://energypreparedness.net/resolutions/sanfrancisco>>
- 43 **NOTE:** For more information about Davis’ program and related regulations, see <www.dsireusa.org/library/includes/summtabsrch.cfm?Incentive_Code=CA26R&Back=regtab&state=CA&type=Purchase&CurrentPageID=7&EE=1&RE=1>.
- 44 **SOURCE:** Real Goods, Fall 2006 <www.realgoods.com>
- 45 **NOTE:** The text of the Protocol is at <www.oildepletionprotocol.org/theprotocol>. More about Heinberg’s book is at <www.oildepletionprotocol.org/thebook>
- 46 **NOTE:** Information about the California Apollo Alliance is at <www.apolloalliance.org/state_and_local/California/index.cfm>. Information about their work with states and towns is at <www.apolloalliance.org/state_and_local>. Information about their strategic approach is at <www.apolloalliance.org/strategy_center>
- 47 **NOTE:** For more information about our calculations, see Footnote 34.
- 48 **SOURCE:** *City of Sebastopol Energy Efficiency Study*, June 2005
- 49 **SOURCE:** *Sebastopol Greenhouse Gas Tracking Report*, Dec. 2005
- 50 **NOTE:** Resources that can assist with implementing this include the local California Native Plant Society and Harmony Farm Supply (a nationally-recognized resource on organic gardening and related topics). Also see <www.cnps.org>. For instance, under Publications, they have a variety of resource books. Additionally, <www.HighCountryGardens.com> specializes in water wise perennials “for the western garden and beyond.”
- 51 **SOURCE:** *GHG Inventory Report*, Sept. 2003
- 52 **SOURCE:** “Sonoma County Going Greener,” Bleys W. Rose, *Press Democrat*, Sept. 15, 2006

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- 53 **NOTE:** The City has three days of backup diesel for water based on the following calculation:
Pumping energy used = 900 MWh/year x year/ 365 days = 2.5 MWh/ day
Energy in 600 gals of diesel = 600 gals x 120,000 BTU/ gal x 2.9 E-4 KWh/BTU = 21,000 KWh
Days of storage = 21,000 KWh / 2.5 MWh/day x 1000 KW/MW = 8 days
Assuming 40% efficiency for diesel to electricity gives three days total.
- 54 **NOTE:** This conclusion is based on our rough calculation. For instance, we wonder if the system still needs diesel for water pressure. This calculation assumes not. We recommend that the City do a more precise assessment of this.
- 55 **NOTE:** More about the Laguna Treatment Plant is at <<http://ci.santa-rosa.ca.us/default.aspx?PageId=2135>>
- 56 **SOURCE:** *Bohemian*, Dec. 21, 2005, p7
- 57 **SOURCE:** Dave Brennan, City Manager
- 58 **SOURCE:** "Fuel costs threaten county's economy. Analyst says wine, tourism may face consumer spending cuts," Kevin McCallum, *Press Democrat*, Oct. 18, 2005 <http://pressdemocrat.com/evergreen/stories/101805_mccallum.html>
- 59 **SOURCE:** Kenyon Webster, Planning Director
- 60 **SOURCE:** Calgary's EcoFuel Biodiesel Project <www.eya.ca/biodiesel/index.php?id=1034>
- 61 **SOURCE:** "Biofuel for the general masses: Fuel aims to cut U.S. oil dependence, lift agriculture," Myra P. Saefong, *MarketWatch* Oct. 14, 2005 <www.marketwatch.com/news/story.asp?guid=%7B1A5E752C%2DAA91%2D4A84%2DBD60%2DD131230A32D5%7D&siteid=mktw&dist=>>
"In blends of B20 [20% biodiesel] or less, it is literally a 'drop in' technology," with no new equipment and no equipment modifications necessary, Anthony Radich, an expert at the Energy Department said in a biodiesel report.
- 62 **SOURCE:** "Biofuel for the general masses" (see above)
- 63 **SOURCE:** "Biofuel for the general masses" (see above)
- 64 **SOURCE:** <www.biodiesel.org/resources/pressreleases/pas/20061010_dodge_ram_b5.pdf>
- 65 **SOURCE:** "City of Berkeley: A Biodiesel Pioneer," EPA <www.epa.gov/region09/waste/biodiesel/california.html#berkeley>
- 66 **SOURCE:** City of Sebastopol, Biodiesel Memo, Feb. 28, 2005
- 67 **SOURCE:** "City's Greenhouse Gas Reduction Surpasses Kyoto Protocol Requirements," City Press Release, Sept. 12, 2005 <www.cityofberkeley.info/mayor/pr/pressrelease2005%2D091205.htm>
- 68 **SOURCE:** Calgary's EcoFuel Biodiesel Project <www.eya.ca/biodiesel/index.php?id=1034>
- 69 **SOURCE:** <http://forums.biodieselnow.com/topic.asp?TOPIC_ID=10767>
More about the Carlsbad Fire Department, including their biodiesel information, is at <www.carlsbadnm.com/fire>
- 70 **SOURCE:** "City switching to biodiesel ," Joshua Molina, News-Press-Staff Writer, *Santa Barbara News-Press*, June 15, 2006 <www.newspress.com/Top/index.jsp>
- 71 **SOURCE:** Kenyon Webster, Planning Director
- 72 **SOURCE:** Information in this section is from the City of Sebastopol website.