MARIN COUNTYWIDE PLAN

Energy
Technical Background Report

Implementing Sustainable Energy Policies Throughout the General Plan

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Introduction

Purpose

The Marin County Board of Supervisors set "sustainability" as the overarching theme of the 2004 Countywide Plan (CWP) update and adopted a set of sustainability principles to guide the revision of the plan. The purpose of this report is to provide information and a methodology to help translate the goal of energy sustainability into successful practice.

Energy is an essential commodity to every sector of the economy. Energy use affects the consumer directly through payment for energy used and indirectly through goods and services, jobs, income, environmental/health impacts, security, and other external costs. Electricity generation from fossil fuels (coal, oil, natural gas) is the single largest contributor to greenhouse gas emissions. The adverse environmental consequences also extend much further when the entire process is considered, from exploration to end-use.

Since Marin County imports nearly all its energy, most of the expenditures for energy flow out of the County and provide little local economic benefit. The dependence on energy imports also can impose a severe economic penalty to the community if energy prices quickly rise as they did in 2000-2001 costing Marin businesses and citizens an extra $60 million in one year.

Achieving a sustainable energy future requires three elements:

- using energy efficiently and wisely;
- producing as much energy as is feasible with local renewable resources; and
- importing energy from renewable resources for needs that cannot be met locally.

The manner in which the built environment is designed, constructed, and operated has a significant impact on energy use. Built-environment design decisions on every scale—from the region to the city to the neighborhood block, street, and building—determine the rate at which people use energy in their daily lives. Local government policies and programs impact energy efficiency, use of renewable energy, and green building. Renewable and other clean generation technologies are often smaller scale and built closer to the use moving regulatory control from the State to the local governments. In the new century, local governments play an increasingly important role in the development of a sustainable energy future.

1. What is a Sustainable Energy Future?

At the highest level, Marin homes, businesses, and industry would endeavor to use resources efficiently and all our sources of energy would be renewable (i.e., not diminishing), clean, affordable, and equitably produced. This would include the energy embodied in the goods and services and the infrastructure that captures and distributes the energy we use. The ideal is not a precise target but a process that allows us to learn and adapt as our environment changes over time. Our interim targets will be defined by where we're starting from and what is technically, economically, and culturally feasible to achieve within a defined timeframe. The starting point is an assessment of where we are today. Then we can examine where we are headed if we continue with our current practice. Finally, we can define a new future based on a course of action guided by the principles of sustainability.

2. The Energy Planning Process

Energy planning, especially with respect to sustainability, has not been a traditional part of the County planning process. Planners forecasted growth and PG&E would accommodate the growth in their resource plans. Since Marin has been able to import all of its energy, local governments have limited experience with energy resource constraints.

Marin's experience with integrated waste management may provide the closest model for integrated *energy* management. Increasing solid waste flows, diminishing landfill resources, toxics and other issues forced local governments to plan and manage the solid waste stream. Formerly, new landfills accommodated the growth in solid waste. Today, we have adopted recycling strategies to greatly reduce the amount of waste going into landfills. The strategies required changes in policy, technology, administration, management, industry, and behavior in every home and business.

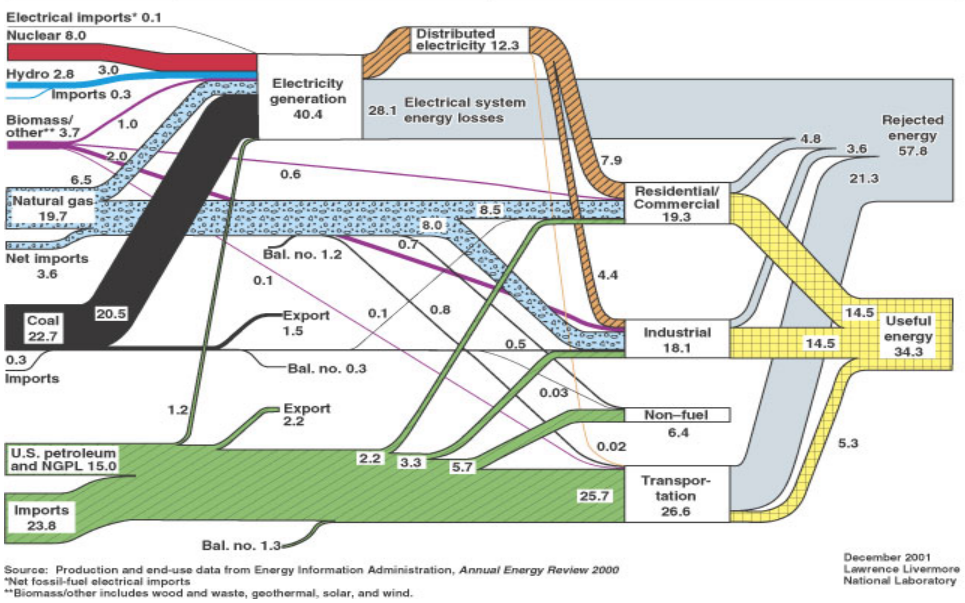
Creating a sustainable energy future requires the same level of integration into our society. The diagram shown below suggests the process necessary to plan and implement an integrated energy strategy. Similar to waste management, we need new information and tools to embark on a sustainable resource path.

Energy Planning Process

PROCESS	ASSESS		DECIDE	IMPLEMENT	EVALUATE
PRODUCTS	Trends, Issues & Strategies Report - Public input Energy Technical Report Methodology, data , background	Strategic Energy Plan Prioritized Targets & Strategies	CWP Update Energy goals, objectives, policies and strategies	Business Plan Work plan for managing, funding and implementing strategies	Status Report Progress Trends & Issues Recommendations
TASKS	Develop methodology & collect data	Analyze impacts & identify decision Criteria	Integrate & adopt policies, targets & strategies	Develop a work plan for implementing strategies	Measure, evaluate & modify programs
TOOLS & INFORMATION	Energy Sources & Uses Local Resources Demographics Trends & Issues: Local & External Public Opinion & Participation Impact variables & indicators Policies & Strategies	Impact-based criteria: Environmental, Economic, Equity, Magnitude, Multiple benefits Feasibility-based criteria: Technical, Economic Jurisdictional, Market, Administrative System Impacts Relationship to transportation, water, land use, etc.	Impact Analysis Prioritized targets & strategies Plan Elements Natural Systems Built Environment Economy, Equity & Culture System Impact Tools Place3s, GIS	Target Markets End-use Sectors New/Existing development High impact markets (3E's) Implementers County & city agencies Special Districts Utilities Public/private partnerships Regional collaborations Resources Technology, funding, suppliers, technical assistance, training,	Indicators Energy, economic, demographic & environmental data Feedback Surveys, evaluations, focus groups, measurement, hearings Trends & Issues Changes & Impacts Barriers & Opportunities

Where Are We Today?

Figure 1. U.S. Energy Flow Trends 2000 (in Quads)[1]



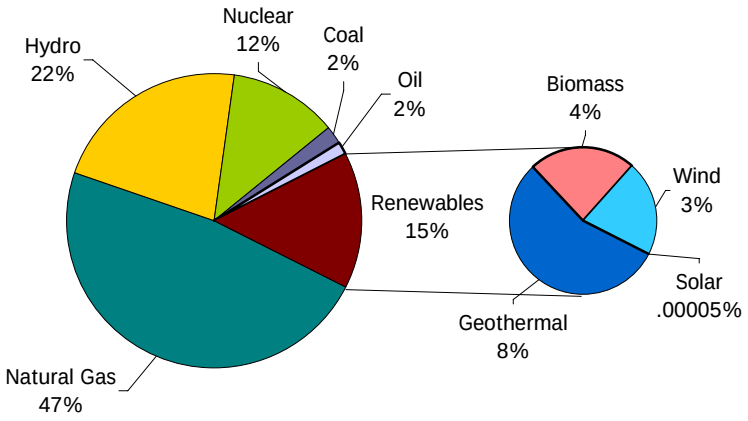
Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2000*
*Net fossil-fuel electrical imports
**Biomass/other includes wood and waste, geothermal, solar, and wind.

[1] The diagram shows the flow of energy in the United States from the sources of energy to the uses. A Marin County-specific flow chart could also highlight what energy we import and from where, the dollar flow out of the community, and the environmental impacts flowing from generation and other activities. At this time, insufficient data is available to create a similar flow chart for Marin County.

Where Our Energy Comes From:

Marin County meets virtually all of its electricity and natural gas needs through imported resources[2]. Pacific Gas & Electric (PG&E) is the sole distributor and principal supplier of electricity and natural gas[3]. California supplies only 16% of its natural gas needs from in-state production. Eighty-four percent of the State's natural gas is imported: Canada (28%), the Southwest (46%) and the Rockies (10%)[4]. California has insufficient pipeline capacity to meet its wintertime peak demands and utilities have compensated by stockpiling natural gas in the summertime.

Figure 2. PG&E Energy Sources, 1999



Source: 1999 California Energy Commission

PG&E generates or purchases electricity generated from a variety of resources. Natural gas (47%), hydroelectric (22%), nuclear (12%), and renewable energy (15%) account for 96% of the generation. The principal sources of PG&E's renewable energy are geothermal, biomass and wind.

Since deregulation in 1998, PG&E sold most of its steam generation facilities and has only retained ownership of plants that meet less than half the electricity demand in its service territory. PG&E's remaining plants include Diablo Canyon Nuclear Power Plant, its hydroelectric facilities[5], and steam combustion turbines in San Francisco and Humboldt Bay. The remainder is made up of purchased power, including all of the renewable generation[6].

[2] Other resources including propane, wood, solar electric contribute less than 1% to Marin's supply mix.
[3] Some electricity is supplied under contracts with Energy Service Providers (ESP) but is still distributed by PG&E. Such contracts were let under the now-suspended Direct Assess rules established by California's restructuring legislation.
[4] Data: California Energy Commission.
[5] Because of adverse environmental impacts associated with large dams, hydroelectric power plants are defined as "renewable" only if the plants are under 30 megawatts or certified as "low-impact hydro" by the Low Impact Hydro Institute.
[6] Deregulation changed the reporting requirements for our sources of energy in California. PG&E only provides generation source information for PG&E owned facilities. Sources of power sold to the utility from independent producers (known as Qualifying

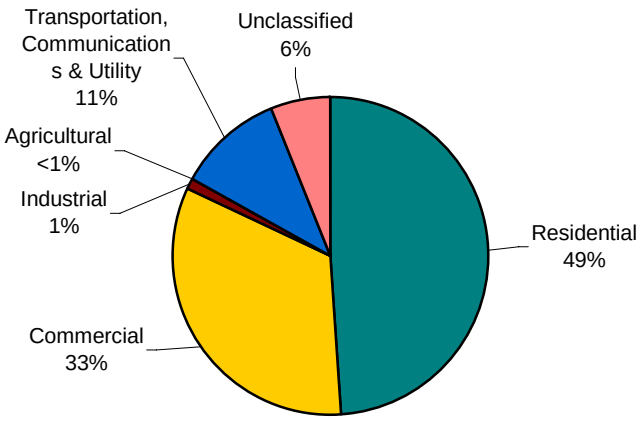
Since Marin has no electricity generation within the County, the unique geographic isolation of Marin requires all electric power to be transmitted from the North and the East via the Solano/Napa/Sonoma areas to the PG&E Ignacio substation. Natural gas is also transported through a single pipeline through Marin. Having no alternatives for any of our electricity and natural gas supplies leaves Marin extremely vulnerable to supply disruptions that could result from either natural or unnatural events.

Where Our Energy Goes

1. Energy Use by Sector

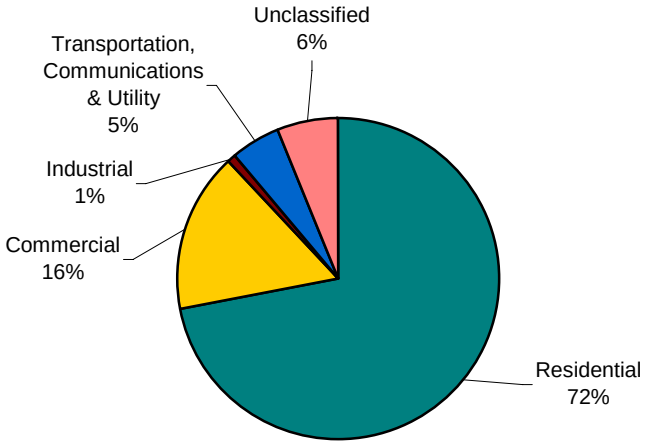
Marin's residential sector uses 49% of the electricity and 72% of the direct natural gas. The commercial sector uses 33% of the electricity and 16 % of the natural gas. Together they account for over 80% of the energy use in the built environment. Adding to that electricity used for water and sanitation pumping accounts for over 90% of the electricity use.

Figure 3. Marin Electricity Use, 2000



Facilities or QFs) and from the ISO (Independent System Operator) are no longer reported on a utility system basis, only a statewide basis. The most current information available is from 1999.

Figure 4. Marin Natural Gas Use, 2000



2. Energy Use by Jurisdiction

The following charts show year 2000 energy use in Marin County by jurisdiction. Novato and San Rafael account for 54% of the electricity and 47% of the natural gas used in the County. Only 9% of the electricity and 4% of the natural gas use is in the unincorporated areas of the County.

Figure 5.
Electricity Use by Jurisdiction

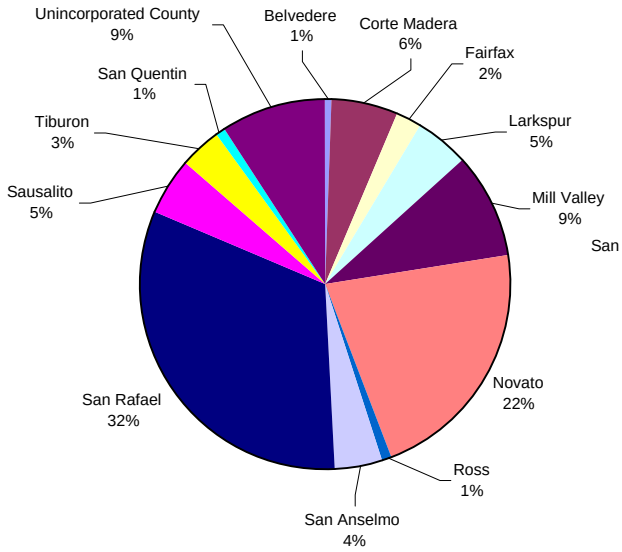
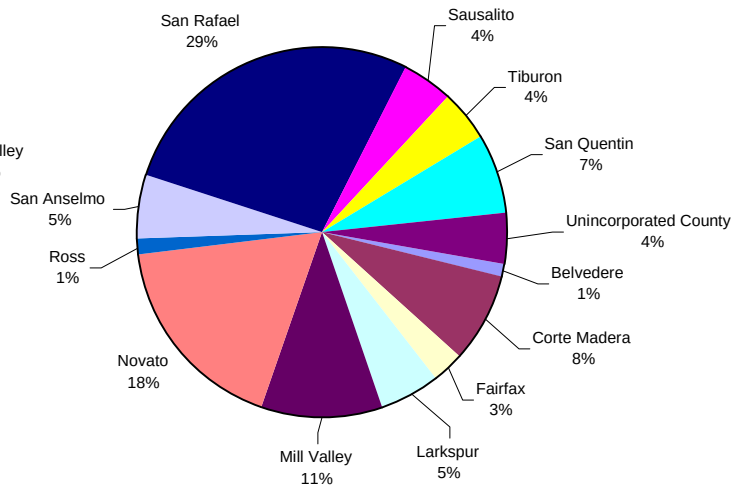


Figure 6.
Natural Gas Use by Jurisdiction



One category of energy use not presented here is called "embodied energy" or "net energy." These terms refer to the energy required to produce and deliver the goods we buy here but are made elsewhere. "Green building" policies and strategies (such as the LEED building standards) are an

example of a method to address this form of energy consumption[7]. Attempting to quantify the embodied energy and impacts of local goods consumed is beyond the scope of this report but should be explored as the planning process continues.

3. Energy Use by End-use

Residential and commercial buildings account for over 80% of electricity and natural gas use in Marin. The charts below show U.S. total energy use by end-use in residential and commercial buildings.

Nationwide in the residential sector, space heating (33%) is the largest end-use of energy followed by water heating (15%) and space cooling (10%). In the commercial sector, lighting (24%) is the largest end-use of energy followed by space heating (16%) and cooling (12%). Local planning and building codes and initiatives can have the greatest impact on reducing space heating and cooling loads of new and existing buildings.

Figure 7.

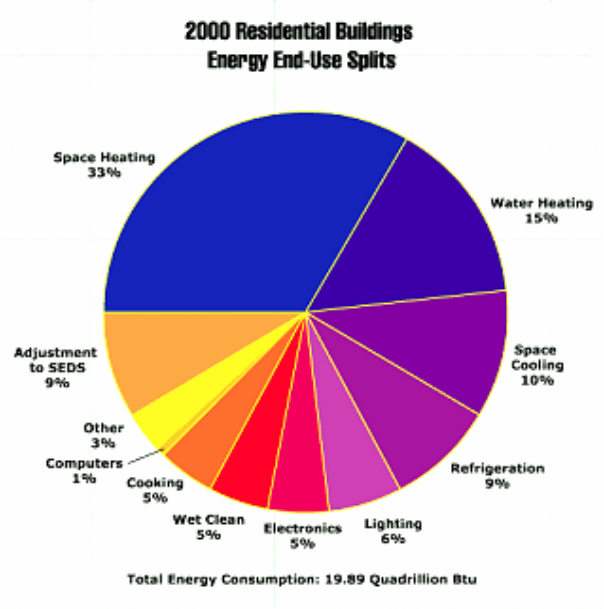
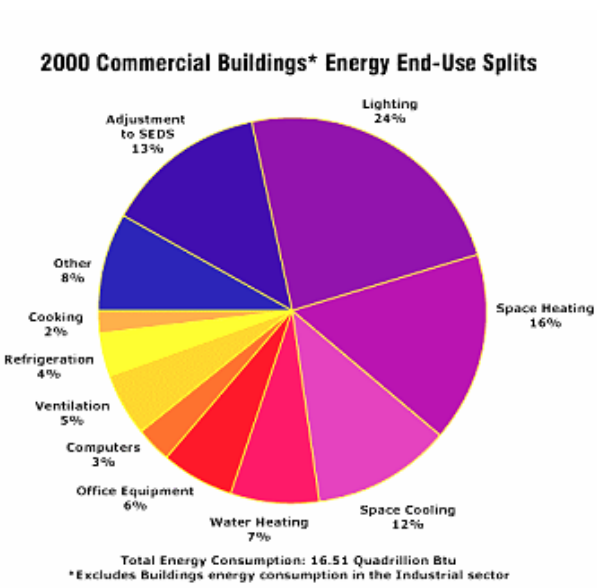


Figure 8.



What Energy Costs Us

Energy use affects us directly through what we pay for the energy we use in our homes and businesses, and indirectly through goods and services, jobs, income, environmental/health impacts and other

[7] For example, the manufacturing of Portland cement is very energy intensive. Any action we take to reduce the amount of Portland cement used in construction (such as increase the use of fly ash in the concrete mix) will save energy and reduce any related environmental impacts.

external costs[8]. The impacts are not equitably distributed. Energy price hikes have greater negative impacts on low income, small and energy intensive businesses. Air pollution resulting from electricity generation directly affects people living close to the generator. However, increases in greenhouse gas emissions affect everyone. This section introduces the societal (economy, equity, environment) impacts that can be considered when prioritizing policies and programs for the County.

Quantifying the societal costs associated with different sources of energy is very complicated and has been the subject of much research and debate through the years. For purpose of local policymaking, understanding the issues and relative costs associated with different sources of energy is more useful than struggling to accurately quantify them. The marketplace (and public policy) often prices goods and services on perceived value rather than actual cost. (Otherwise, people wouldn't pay thousands of dollars more than they need to for cars and other goods.) Therefore, understanding the scope of impacts may be sufficient to guide policy.

1. Economic Impacts

Energy is an essential commodity to every sector of our economy. Since Marin County imports nearly all of its energy, nearly all of the expenditures for energy flow out of the County, providing little local economic benefit. The dependence on energy imports also can impose a severe economic penalty to the community if energy prices quickly rise as they did in 2000-2001 costing Marin businesses and citizens an extra $60 million in one year. Conversely, investment in energy efficiency and local renewable supply can greatly benefit the local economy and provide some control on price fluctuations.

Marin's collective energy bill for natural gas and electricity was about $214 million in 2000 and we spent $142 million for electricity in 2000 and $170 million, in 2001 -- nearly $28 million more in 2001 even though actual consumption dropped by 6.6%. The actual loss to the local economy is much greater since virtually all of the additional cost left the County. Conversely, a California Energy Commission study reported that every dollar invested in energy efficiency returned $2 dollars to the community. Prices are forecasted to remain about 30% higher than 2000 prices for the rest of the decade but could spike periodically if natural gas shortages occur again. This could result in a direct economic loss to Marin's homes and businesses in excess of $500 million over the next 8 years.

2. Equity Impacts

Low-income households are particularly vulnerable to rising energy costs for several reasons:

- energy consumes a larger portion of total income
- homes tend to be older, not weatherized, and have older less efficient appliances
- they lack the means to invest in energy saving appliances and weatherization

[8] External costs exist when the "private calculation of benefits or costs differs from society's valuation of benefits or costs". For example, pollution represents an external cost because damages associated with it are borne by society as a whole and are not reflected in market transactions. For more information, see Jonathan Koomey and Florentin Krause, *Introduction to Environmental Externality Costs,* Energy Analysis Program, Applied Science Division, Lawrence Berkeley Laboratory, 1997. The quote is from Griffin, James M., and Harry B. Steele. 1986. *Energy Economics and Policy*. 2nd Orlando, FL: Academic Press College Division

- renters are in tough position between wanting to make improvements, but not wanting to invest in a home or apartment that they do not own
- building owners are resistant to make changes since they often do not pay the energy bills

3. Environmental Impacts

Electricity generation from fossil fuels (coal, oil, natural gas) is the single largest contributor to greenhouse gas emissions. The adverse environmental impacts extend much further when the entire process is considered, from exploration to end use. All fossil fuels contribute CO_2 , CH_4 , N_2O, NOx , CO, Reactive Organic Gases, hydrocarbons, particulates, trace metals, and thermal pollution. Oil and coal add major sources of sulfur dioxide pollution and ash waste. The environmental and social costs include drilling, refinery, pipeline and tanker accidents and spills[9].

A comprehensive analysis of the societal costs of pollution and other externalities associated with energy production is extremely difficult. Even if you can measure the pollution at the source, tracing the pathways to predict the impacts and translating those into societal costs is complicated at best[10]. Traditionally, we have accounted for these costs through regulation. For example, government requirements for air pollution controls on sources of emissions establish a cost as the price of pollution control. Regulations that set limits on pollution (e.g., air district rules, the Kyoto Protocol) have created markets for trading emission credits (e.g. carbon credits, renewable trading credits) in which the market determines the price of pollution. Neither system captures all the societal costs.

Like other local governments, Marin County is currently using statewide emissions coefficients to determine the County's contribution to greenhouse gas emissions. While this may lack accuracy, at least the data is available and allows the County to establish a relative benchmark to determine if it is moving in the right direction in future years.

Where Are We Headed?

Introduction

The sustainable energy objective is to reduce energy demand and increase the supply of local and imported renewable energy. Another objective is to improve the local economy, the environment, social justice, and the quality of life in Marin's communities. Therefore, general trends that impact local energy demand and supply need to be examined in addition to energy trends that impact the local economy, the environment and society. In addition, there is a need to understand trends and issues that may impact the effective implementation of local energy initiatives.

[9] Appendix D lists the kinds of pollution and other adverse impacts that can occur from exploration to end-use for various sources of energy.

[10] To understand environmental impacts translate into costs, consider the case of sulfur dioxide. SO2 is emitted from oil and coal combustion as a gas. Some of the SO2 is converted through chemical reactions in the atmosphere, to sulfuric acid, some of which then falls in rain into lakes and watersheds. Some of this sulfuric acid is neutralized by buffering actions in the water and soil. The altered acidity of the lakes is the stress. The costs (social, economic, and environmental consequences) are the destruction of fish and other wildlife, mobilization of aluminum, damage to trees, and reduction in recreational value of the forest.

Identifying and assessing relevant trends and issues is fundamental to the planning process[11]. There are numerous demographic, economic, environmental and social indicators to guide land use planning, housing, health care, economic development, and environmental quality. There are indicators for energy on a macro scale (region, state, federal) but there is not a coherent set of tools for local energy planning. This section provides a first step in identifying and organizing trends and issues relevant to Marin County.

Trends and Issues that Impact Local Energy Demand

1. Population Growth, Residential and Commercial Development

The key drivers of energy demand in Marin County are population growth, and residential and commercial development. The County's agricultural and industrial base is small, accounting for only about 2% of the County's energy demand, and is not expected to grow significantly. The population is expected to grow by only 12% by the year 2020. While this level of growth is relatively low compared to other Bay Area counties, it still represents an increase in the demand that will have to be met by imported resources if current energy use is not reduced and local resources are not developed.

Every new resident increases energy demand, even if the new resident is a new addition to an existing household. Every new residential and commercial building establishes a *minimum* new energy demand for end uses such as space and water heating independent of the number of people occupying the building. New development may require additions to community facilities such as water and sanitation that will increase energy demand as well. Land use policies and building standards will determine how much energy new development will require.

Policymakers have many opportunities to limit the demand for new resources and increase the use of local renewable resources to accommodate the new growth. These opportunities include energy efficient land use planning and better building standards that are discussed in the strategies section of this report. The regional "Smart Growth"[12] planning initiative, principally motivated to enhance multi-modal transportation options, creates multiple energy efficiency benefits as well. More infill and higher housing densities reduces the per unit demand for electricity and natural gas. Smart Growth modeling data captures the energy impacts of the land use options.

2. Other Trends Affecting Demand

Other local trends that may have an impact on energy demand and need to be examined in more detail include:

[11] Trends indicate the general direction, movement or prevailing tendency of a course of events. Fewer but larger dairies, more cars per household, and larger more expensive homes are some examples of possible trends. Issues are topics of concern to the community. Key issues may involve unmet needs or may be subject to dispute. Protection of agricultural lands, traffic congestion, and high cost of housing are examples of issues.

[12] "Smart Growth" has no single definition but common considerations include development that revitalizes central cities and older suburbs, supports and enhances public transit, promotes walking and bicycling, and preserves open spaces and agricultural lands. Smart Growth seeks to revitalize the already-built environment and, to the extent necessary, foster efficient development at the edges of the region with the goal of creating more livable communities with sufficient housing for the region's workforce.

- location of new residential development in warmer microclimates,
- size of new homes,
- increasing number of energy using appliances, and
- the shift to an older population.

Location trends: New residential development may be in hotter summertime microclimates where new homes would have air conditioning and high water use for landscaping. The extra cost of installing air conditioning in new homes is small. Air conditioning (A/C) may be installed in an increasing number of homes even though it may be largely unnecessary. If it is installed, the potential for A/C to be used during the summertime peak demand could be very high.

Home size trends: The CDA has identified a trend toward increasing home sizes and the Board of Supervisors adopted a performance standard to limited the energy demand in new homes over a certain size. Since over 80% of the housing stock in Marin is already built, increasing home size from remodeling is another potential trend to examine.

Appliance trends: The new trend, even among moderate-income home buyers, is to "upscale" their appliances. Even though new appliances may be more efficient, a larger refrigerator or television set can equal or exceed the energy consumption of an older, smaller appliance.

Age trends: Marin's trend toward an older population that spends more time at home may increase residential energy use.

In summary, increasing demand for energy can be caused by trends that are not immediately obvious. While some of these trends do get captured in the California statewide demand forecast, Marin County may have unique conditions that will not be apparent and captured in statewide forecasts. What is presented here is a starting point and there are still many questions to be answered. As with the identification of any trend, correlation does not necessarily mean causation. This is particularly true for energy use since this type of analysis may be unfamiliar to most planners.

Trends and Issues that Impact Energy Supply

1. Introduction

Since Marin County currently imports nearly all of its energy supply, the trends affecting supply are largely external to the County. Historically, the responsibility to provide sufficient, reliable and affordable energy lay with the monopoly utilities and the regulators. The County's role has been limited to the siting of transmission and distribution lines for electricity and pipelines for natural gas[13]. This will change as the County pursues more local renewable supply and the market for distributed generation grows.

[13] The County adopted ordinances over 20 years ago to allow and protect customer-side of the meter supply options such as solar and wind generation, but few systems have been installed in the intervening years, largely due to the low-cost of utility provided energy and the high cost of alternative systems.

For the built environment the two primary forms of energy supply are electricity and natural gas. Marin County meets virtually all of its electricity and natural gas needs through imported resources. Pacific Gas & Electric (PG&E) is the sole distributor and principal supplier of electricity and natural gas[14].

2. Natural Gas Trends

California began deregulation of natural gas in 1992-93 by allowing non-core gas customers (large industrial users and power plants) to buy natural gas in an open market, essentially to get "cheaper" prices. These customers were also no longer required to maintain storage of gas to meet their wintertime requirements. This was significant because California imports 84% of its natural gas and lacks sufficient pipeline capacity to meet winter demand.

Following the restructuring of the electric power industry in 1997, PG&E sold its gas-fired power plants. By 2000, 80% of such plants had been sold by California utilities. Many of the new power plant owners choose not to pay the extra cost to store natural gas. When a restricted gas market forced prices higher in the winter, they were allowed to charge the ratepayers for the increased cost of generation. A combination of events occurred in the winter of 2000-2001 that caused a severe shortage in the supply of natural gas and a tripling of its retail price.

While prices have settled down and some of the issues leading to the natural gas shortages have been resolved, the market remains volatile. Uncertainty in natural gas prices and supply can be expected in the years to come.

The largest end-uses for natural gas in Marin are space and water heating. There is no near-term energy substitute planned for natural gas although substitute fuels have been developed. Conversion of biomass into natural gas can provide a renewable alternative. The most significant action that can be taken to reduce the impact of gas price fluctuations is to reduce consumption of natural gas through efficiency and renewable end-use options, such as climatically appropriate design and solar water heating.

3. Electricity Trends

Recent and dramatic changes in the structure of the electric industry (as evidenced by the recent energy crisis) are forcing local governments into a new energy planning and policy role. The changes include a shift in the structure of the energy industry from highly regulated to highly volatile markets, and a shift from centralized power production to clean distributed generation.

The change in the structure of the energy industry has led to uncertainty in the supply, reliability and affordability of energy -- issues that, in turn, create new adverse local economic and social impacts. State policymakers have responded with many new laws that will affect energy supplies and can create problems and opportunities for local governments.

The shift to decentralized generation creates new land use, health and safety issues and also creates opportunities for increasing local renewable supply. Understanding these trends is critical to defining

[14] Some electricity is supplied under contracts with Energy Service Providers (ESP) but is still distributed by PG&E. Such contracts were let under the now-suspended Direct Assess rules established by California's restructuring legislation.

the new role the County must play and identifying the opportunities to move toward a sustainable future.

Electric Industry Restructuring: Almost everyone is aware of the California "energy crisis" from the front page headlines since 2000. For local policymakers, it is useful to understand the legislative and regulatory changes that led to the crisis, as well as the impact those changes will have on price and supply stability in the future[15]. Appendix A provides a more complete summary of events leading to the crisis. Many of the underlying causes of the crisis are still present and critical institutional issues have no resolution in sight. The notable trends affecting communities include:

- uncertainty in the future supply and reliability of electricity and natural gas;
- higher electricity prices for the next several years to pay off utility and state energy debt and for long term power purchase contracts;
- continuing fluctuations in the price of electricity and natural gas;
- continuing conflicts between state and federal policies, and market interests;
- increasing difficulty in electricity demand forecasting;
- reduced investment in new supply-side options due to the aforementioned market uncertainties.

For the foreseeable future there will be increasing energy costs without any compensating benefits. The adverse impacts of higher costs and supply uncertainties will continue to ripple through the local economy.

Shift From Centralized Power Production To Clean Distributed Generation: The electric utility industry is undergoing another transformation that affects local planning. The old era was characterized by economies of scale achieved by large centralized power generation. The new one is characterized by economies of manufacturing leading to cleaner and smaller distributed generation.

Clean distributed generation (DG) includes such technologies as fuel cells, gas-fired cogeneration, biomass, solar, and wind. DG systems can be placed on the customer's side of the meter and can thereby reduce the customer's demand for energy and even allow a customer to sell power back to the utility. Larger distributed generation systems may serve multiple customers such as in an industrial park, a subdivision, or a commercial zone. Some of these technologies are commercially available today while others are expected to be commercial within the next five to ten years, well within the timeframe of the Countywide Plan update. A common characteristic of these technologies is that they are small-scale and locally sited. Planning and approval for distributed technologies will be largely within the jurisdiction of Marin County and cities.

The County addressed some DG issues in the past, such as protecting solar access and establishing requirements for small wind energy systems. However, the Countywide Plan should address new and emerging issues such as:

[15] While the issues leading up to the energy crisis are subject of much research, debate and litigation, and predicting future impacts is fraught with uncertainty, understanding the changes in policy that led to the crisis, and which of those policies is still in place will provide some measure of understanding of the importance of local action. "How We Got Into The California Energy Crisis" by William Marcus and Jan Hamrin, Center for Resource Solutions, Feb.,2002, provides a good summary of the events leading up to the crisis. It can be downloaded at www.resource-solutions.org.

- policies to promote and approve fuel cells and other small-scale clean generation systems in commercial and industrial applications, in new development and redevelopment areas;
- increased efficiency measures in new and existing buildings;
- code changes to make provisions for and lower the cost of installing new technologies in new and renovated buildings, facilities, and communities.

While Marin's projected growth is low, the County should examine the impact of projected growth on the transmission and distribution infrastructure and identify the potential for distributed generation.

Some of the adverse impacts of not addressing DG issues include localized dirtier air from micro-turbines, more dollars leaving the community in higher energy costs, higher capital costs to retrofit new technologies, and fewer local options as new technologies emerge.

Marin's lack of local infrastructure and community energy capabilities is a natural consequence of the manner in which the energy industry was structured in the last century. The changing structure of the energy industry requires the pursuit of local solutions to protect and advance the quality of life in Marin's communities.

Changing State and Federal Laws and Regulations: State and federal energy laws and regulations have been in a constant state of flux since deregulation and no resolution is expected anytime soon. Many of the short-term solutions, such as a financial bailout of the utilities, long-term power purchase contracts, recovery of alleged fraudulent overcharges, the PG&E bankruptcy, new Federal Energy Regulatory Commission (FERC) rules, are the subject of so much fractious political debate and so many lawsuits that no clear resolution is predictable.

California did adopt a Renewable Portfolio Standard (RPS) in 2002, mandating an increase in the amount of electricity provided from renewable energy sources. The RPS requires each utility to provide at least 20% of its electricity supply from renewable generation by 2010. As of 1999, PG&E reported that about 15% of its supply was from renewable sources. Therefore, PG&E has to add only about 5% more to meet the requirement. Meeting the goals of the RPS will help the County achieve part of its sustainable energy goal.

The State also passed legislation (AB117) that would allow local governments, alone or jointly, to aggregate the retail electric customers in their jurisdictions (defined as "community aggregators") for the purpose of purchasing power. Local governments may not take over the local distribution system but may enter into contracts to provide the energy component of the electric bill. The utility would still do billing and remain the default provider should any customer choose to "opt out" of a community aggregation program. Community aggregators cannot escape state and utility debt obligations resulting from the energy crisis and the long-term power contracts. At this time, it is unclear whether or not community aggregators could buy power less expensively than the utilities. One reason for local governments to consider community aggregation is that it provides a means by which local governments could choose to increase the use of renewable resources above what the utilities are required to buy.

AB117 also allows local governments, or other entities, to apply to administer energy efficiency programs in their jurisdictions. The CPUC is directed to develop a plan and procedure under which local governments could apply by July of 2003.

Trends & Issues that Impact our Community

1. Increasing Cost of Energy

Energy price trends impact the economy, the environment, and social equity both directly and indirectly. Higher energy prices directly reduce the amount of money available to purchase other goods and services. Nearly all the additional money paid for imported energy leaves the County and thereby reduces local spending and, in turn, business income, investment, tax revenue and jobs. Higher energy prices both locally and across the state increase the cost of the goods and services, further reduce spending power, and compound the adverse impact on the local economy.

The economic impacts on different market segments will vary and are not equitably distributed. For example, low or fixed income end users (residents, public institutions, small businesses); energy-intensive uses (restaurants, domestic and agricultural water pumping); and least efficient facilities (older buildings, appliances, processes) are being hurt the most by higher prices. Low- income residents tend to have the least efficient appliances and live in older, less efficient homes. Higher energy prices do not simply reduce disposable income but cut into essential purchases. While the County as a whole will benefit from any local reduction in energy use, this inequitable and severe economic impact on some sectors suggests that an energy efficiency program priority should be placed on the financially hardest hit markets.

The energy crisis by some estimates will cost Californians at least $40 billion (including repayment of debt, high cost long term power contracts, utility bailouts, etc.). Many impacts are not included in this amount. One significant adverse impact on the County sustainability goal results from the loss of capital for renewable energy projects. This problem manifests in multiple ways: the direct loss of potential investment dollars, the state policy to meet the short term generation needs with natural gas-fired plants; hostile state and utility policies toward independent renewable generators; unreliable demand forecasts, and the flight of investment capital resulting from the financial collapse of the energy industry. This issue affects new large scale renewable generation projects in California in the near term.

2. Decreasing Reliability of Supply

While cost is one factor affecting businesses' choice of location, the reliability of the energy supply is a significant factor for some desirable business sectors, such as many of the high tech processes and computer facilities. As the electric grid becomes less reliable, these companies are exploring ways to secure or generate their own reliable and high-quality power. Enhancing and/or providing clean distributed generation opportunities may be a useful tool in retaining or attracting businesses to the extent desired.

3. Continuing Erratic State and Federal Policy

The trend toward continued uncertainty in state and federal policy affects the choice of local energy strategies. No one can predict if and when the current fractious and contradictory nature of state and federal energy policies and regulations might find some resolution. The current flux in public policy makes it very difficult for local governments to know what they can count on as they plan local programs.

For example, in the last few years, the electricity market was opened up to retail customers (allowing them to choose different electric suppliers providing green power and lower cost power), then closed (returning most customers to the original utilities), then partially opened again (allowing retail customer aggregation). Recently introduced legislation may close the door again. One new state bill with powerful sponsors calls for a return to the original system of regulation.

Since most bills are amended many times as they move through committees, currently proposed legislation will most likely have changed by the time this is being read. Therefore, the trend is less about the energy policy content or direction than the continuing uncertainty in energy policy. The trend suggests that the unreliability of current state and federal policy should be an important criterion for assessing local sustainable energy strategies.

Trends Affecting Implementation of Local Energy Initiatives

1. Historical Energy Issues and Strategies in Marin's Planning Process

In 1979, the Marin County Board of Supervisors created an Energy Advisory Committee and directed the County Planning Department to prepare an Energy Element for incorporation into the Countywide Plan. The Energy Element was intended to provide a rationale and guidelines for saving energy and increasing the use of renewable energy sources. In 1980 the Board adopted an Energy Element as part of the Countywide Plan and established the goal of creating a sustainable energy future for Marin County. The Plan further specified that the County should reduce energy use by 50% by the year 2000, an ambitious goal that the county did not achieve. Electricity and natural gas use per capita fell only slightly between 1980 and 1987. Petroleum use increased between 1980 and 1987 because of increased vehicle miles traveled and use of vehicles with lower fuel efficiency.

The adopted 1980 Energy Element included a number of policies directing the County to establish mandatory energy conservation programs. In 1982, when implementation programs proposed by staff reached the Board of Supervisors for approval, the Board declared that the County should not require private investments in energy conservation and thereby shifted County policy away from mandatory towards voluntary conservation programs. The County did develop programs and ordinances to implement some of the goals and policies contained in the Energy Element. The County Board of Supervisors adopted a solar access ordinance in 1982 and a wind energy conversion ordinance in 1983. From 1982 to 1984 the County Planning Department employed an energy coordinator who organized conferences and training programs to educate Marin residents about energy conservation techniques. However, these implementation activities fell short of the comprehensive system of energy conservation programs for homes and businesses envisioned in the 1980 Energy Element.

When the Countywide Plan was updated in 1994, staff recommended and the Board of Supervisors adopted a Plan that deleted all energy goals and policies deemed unlikely to be implemented, that eliminated a separate Energy Element, and that rolling surviving energy goals and policies into the other elements of the Plan. The stated goal at the time was to “preserve a focus on energy and natural resource conservation...[and strengthen] the County's energy policies by incorporating them into elements of the Plan, which are the focus of ongoing implementation activities.” The staff felt that the

shift in policy from mandatory to voluntary conservation prevented the implementation of many Energy Element policies. Since the California Government Code requires local plan policies to be linked to implementation programs, staff reasoned that energy policies that could not be implemented should be removed from the Countywide Plan.

2. Local Energy Planning: Coming Full Circle

From the point of view of 2002 it may be hard to understand why the County backed away from implementing its ambitious sustainable energy goals in the 1980s and eliminated many of the conservation policies in the 1994 CWP update. A short review of events from the 1980s to the present may help place the County's actions in context and provide the rationale for again becoming more active in working toward energy sustainability.

Responding to an earlier "energy crisis" in the late 1970s and early 1980s, many California communities hired staff and set up offices dedicated to implementing energy efficiency and renewable energy. By the early 1980s, over 120 local governments -- Marin included -- had established energy offices and programs that actively pursued energy savings and alternative energy options. When energy prices declined in the mid-1980s, energy issues faded from the headlines. Proposition 13 had also been taking a heavy toll on local government finances. Most local governments closed their energy offices so that only a handful of communities were left with local expertise to face the energy crisis of the past few years[16]. There was also great opposition from some stakeholder groups like builders and realtors to mandatory programs that they perceived to hinder their businesses. Energy resource planning had not been a local planning function and had no built-in constituency. With only a handful of exceptions, local energy planning was moved to the back burner.

Over the past 25 years, many communities have included energy policies in General Plan updates but have failed to implement them. In fact, California's Subdivision Map Act requires the design of a subdivision to provide for future passive or natural heating and cooling opportunities (Sec. 66473.1) but few local governments have complied. A lack of good supporting data and a local constituency reduces the political will to enforce energy policies when they conflict with other planning, development and economic interests. Tight local government budgets have also forced limited staff resources to be focused on mandates that are enforced with penalties such as low-income housing and solid waste reduction. Achieving the sustainable energy goal will require unambiguous policies backed up by strong implementing programs for impact assessment, training and enforcement integrated into the normal planning process.

3. Global Warming/Reducing Greenhouse Gas Emissions

On April 23, 2003, the Marin County Board of Supervisors adopted a resolution recognizing both the gravity of global warming and the responsibility for local action. The resolution committed the County to assessing current countywide contributions to greenhouse gas emissions, committed to reducing such gases, and implementing policies and programs necessary to achieve the reductions. Meeting this

[16] There have been a few notable exceptions: Berkeley, San Diego, San Francisco, San Jose and Santa Monica, for example, maintained their capacity to develop and implement energy efficiency programs to benefit their communities. Some among this small group of local governments have been able to respond effectively to the more recent 'energy crisis', and to access State funds made available to further develop local programs.

commitment requires addressing energy efficiency and renewable energy goals and strategies in the CWP update. Electricity generation is the single largest contributor to greenhouse gas emissions in the United States.

4. Energy Intensity Trends and Economic Indicators

Energy intensity is a relative measurement of the amount of energy required to produce a unit of activity such as economic output (goods and services) or end use (heating and cooling). Like worker productivity, it provides a relative indicator of a trend toward greater or lesser efficiency. For example, total electricity consumption in Marin divided by the gross domestic product (GDP) of Marin provides a measure of the Kwh required to produce each $1 of GDP. Viewed over time, this indicator can show whether the local economy is getting more or less energy intensive. For example, California's residential, commercial and industrial sectors have become less energy intensive (more energy efficient or productive) from the 1970's to the present. However the rate of efficiency gains has decreased since about 1990, which correlates to a reduction in spending on utility energy efficiency programs during the same period. As suggested earlier, the trend toward more efficient electrical appliances can be offset or surpassed by a trend toward larger and more appliances. A better understanding of the energy intensity trends in Marin's residential and commercial sectors is needed to optimize sustainable energy strategies.

5. Public Opinion Trends

Public opinion can affect the relative success or failure of some energy strategies, especially those that require a certain level of awareness to implement. Public opinion can also weigh heavily on the cost of implementing certain programs. For example, the media attention to the continuing energy crisis that started in 2000-2001, combined with rising energy costs and a massive statewide advertising campaign for conservation, greatly increased the public awareness of and interest in energy efficiency and renewable energy. Local programs that might not otherwise have been possible without such awareness can now be implemented.

Current events coupled with public information campaigns can dramatically affect the consumption of energy as well. Such campaigns are most effective when coordinated with initiatives to institute permanent reductions in use through hardware changes such as replacement of old inefficient appliances, weatherization and permanent retrofits with energy efficient lighting. (Screw-in compact fluorescent lights are not included because they can be replaced with less efficient and less expensive incandescent lights once they burn out).

The energy crisis of the 1970s, which led to price hikes and shortages, generated much press and led to major energy conservation public information campaigns from the late 1970s through the mid-1980s. A combination of state and federal energy efficiency regulations and the public response led to decreasing per capita energy consumption during these years. The easing of the crisis and lower gas and stabilized electricity prices from the mid-1980s through the 1990s led to a slowing of the energy efficiency trend. Energy conservation attributed to behavioral changes may also have declined in the 1990s. The energy crisis of the past few years brought a return of supply shortages, price hikes, news headlines, and massive public information campaigns. Consumers, showing the significance of behavior-induced conservation, voluntarily reduced electricity consumption in the summer of 2001 by 15 to 20% statewide. Electricity consumption declined 6.6% in Marin County between 2000 and 2001. The significant decline can be attributed to public awareness of the energy crisis, significant price increases,

and a massive statewide public information campaign asking people to conserve energy. In contrast, residential electricity consumption increased 18.5% from 1995 to 2000 with only a 0.7% growth in population.

Strategies that depend, in part, on public awareness and willingness to conserve may be easier and less costly to implement in the near term than major changes in energy sources.

Public Preference for Meeting Electricity Needs Favors Efficiency and Renewables.

The California Power Authority has examined and summarized the technology preferences of Californians for meeting future electricity needs. The opinions expressed at Marin County visioning workshops summarized in the Key Trends, Issues, and Strategies Report support, if not go beyond, the statewide preferences for clean generation and renewable sources of energy.

The Gallup polling organization produced the following report dated November 27, 2001, which discusses the energy preferences of Californians and compares them with the current sources of energy in the state:

> Californians, like others across the country, are concerned that adequate new power plants be built to meet their energy needs. Indeed Gallup polls throughout this year[17] indicate that a majority of people (81%) favor investing in new power plants to deal with projected energy shortages. In addition, the Gallup polls indicate that a larger number (91%) favor an investment in renewable sources of energy such as solar, wind and fuel cells rather than conventional sources (such as nuclear at 42%). Indeed, mandated energy efficiency (e.g., more efficient appliances at 85%) and increased transmission lines (it scored higher in May during the peak of energy shortage concerns[18])..These polls indicate that the people prefer efficiency and especially renewables as a way to address our energy shortages.
>
> It is important to remember that many of California's fossil power plants are over 30 years old and are very inefficient and therefore highly polluting even with controls. They will need to be replaced over the next decade. The issue is whether they will be replaced by renewables and demand side projects or still more gas fired plants.
>
> Based on public preferences, we believe the answer is to replace these old natural gas-fired plants with geothermal, wind, solar and biomass. If only 10% of these natural gas-fired plants are closed down, it will create a 3,000 MW for renewable which is within our goal for the next four years. We urge public policy to make this happen.

[17] "Americans Favor Alternative Energy Methods to Solve Shortages", Gallup News Service, http://www.gallup.com/poll/releases/pr011127.asp.

[18] In a Gallup Poll in May, 2001 conventional options less controversial than nuclear power were tested. For example, 69% of people favored more electrical transmission lines. However, efficiency measures (e.g., mandating more efficient appliances) were favored by more people (87%) and renewable sources (solar, wind and fuel cells) were favored by even more people (91%).

> Reducing demand via energy efficiency is a highly cost-effective strategy. Nationally, utilities have saved 25,000 to 30,000 MW annually, the equivalent of 100 large power plants, over the past five years through energy efficiency programs. These programs averaged 2.8 ¢/kWh, a cost that is less than that of most new power plants.[19]

The energy resource mix of today stands in sharp contrast to people's preferences. Fossil fuels and nuclear power supply 75% of California's energy today, a level of dependence that has serious implications for national security. An additional 16% comes from hydroelectric power, most of which is from large dams. Hydroelectric power brings with it a much larger share of the risk associated with traditional generation because of the annual uncertainty of the water availability. This uncertainty can have significant consequences in the capacity capability and the energy availability between one year and the next. Another 2% comes from biomass, much of which is from direct combustion waste-to-energy plants. Only 7% of the energy comes from the cleanest renewable sources – geothermal, wind, and solar energy.

New plants that have come online since 1999 or are currently under construction are powered from the following sources: 96% natural gas, 2% wind, 1.2% geothermal, 0.6% biomass, and 0.1% hydro. Continuing in this direction will further increase risk and insecurity in the California electricity market, contrary to the preferences of Californians.

The challenge to the energy policy makers is finding a way to meet the people's preferences for renewable energy and efficiency in today's uncertain market situation. Moreover, diversifying the energy mix reduces dependence on natural gas and provides a greater hedge to volatile prices from natural gas fired power plants and greater security from terrorist activities.

Where Do We Want To Go?

Energy Strategies for the Countywide Plan

Introduction

Achieving a sustainable energy future requires three elements:

- use energy efficiently and wisely;
- produce as much energy as is feasible with local renewable resources; and
- import energy from renewable resources for needs that cannot be met locally.

To achieve these goals, we must establish a practical and reliable means to measure and evaluate where we are now, where we want to go, and how we are doing. Simply put, we can't control what we don't measure. Since this function with respect to energy has not been a traditional part of the planning process, establishing a practical and permanent means of energy assessment must be a goal of the current CWP update as well.

[19] Energy Foundation, *National Energy Policy Factsheet: Utility Energy Efficiency Programs*, downloaded from www.ef.org/national/FactSheetUtility.cfm, 28 September 2001.

To serve the needs of the CWP update, the strategies have been organized into the "goal, policy, implementing program" format for the general plan.

Energy initiatives are classified under three goals:

1. **Assessment (Strategic Energy Planning)**: Assess current and forecasted energy demand and supply, assess impacts, and develop programs. This includes measurement and evaluation programs.
2. **Reduce Energy Use:** Reduce energy use and peak electricity demand through efficiency and conservation (often referred to as "Demand-side management" or "DSM". This program area includes all sectors and all end-uses of energy, both new and existing.
3. **Increase Renewable Energy Use:** Develop local renewable energy resources and shift imported energy needs to renewable energy resources. Develop local generation options in the short term that use imported non-renewable resources more efficiently.

Energy policies and implementing programs are also defined by common methods of implementation:

1. **Standards and Regulations:** mandatory measures requiring compliance justified by social good, cost-effectiveness, need, and equity
2. **Incentives:** price, financing, tax, rebate, market and process incentives providing some form of benefit beyond what the energy product or service alone would provide also justified by social good, cost-effectiveness, need, and equity
3. **Information/Education:** public awareness campaigns for any sector, market segment and demographic, including schools, using any means or media, usually in conjunction with incentive or proscriptive programs.

Goals, Policies, and Programs

Goal 1

Assessment: Establish and maintain a strategic planning process to assess, prioritize, implement, measure, evaluate and modify energy policies and implementation strategies over time. This process includes ongoing assessment of current and forecasted energy demand and supply, relevant issues and trends; technical, economic, and institutional feasibility of strategies; policy and program development; and establishing performance targets and measurements.

Description: Achieving the long-term vision for a sustainable energy future requires the integration of energy policies and programs into the normal business planning and day to day operations of the county. Policies should be unambiguous and defensible. Implementing programs should have performance targets, be measurable, linked to day-to-day operations, describe required resources (financial, human, information), create accountability, and indicate required organizational and legislative changes.

Policy

1.1 **Energy Planning.** Integrate energy resource planning and program implementation into the advanced and current planning functions of the CDA and other related agencies.

Description: If we are to prevent new non-renewable electric generation from being built to meet Marin's demand for electricity, both the county and the state must be able to measure and count on local demand reduction and renewable resource development. As we transition to smaller scale distributed generation, the role of local governments increases dramatically making local resource and impact assessment ever more important.

Current State and Federal Policies and Programs: The U.S. Department of Energy and California Energy Commission do extensive supply and demand forecasting and assessment of energy efficiency and renewable energy potential and realized savings. However, such assessments rarely provide the county and municipal data necessary to assess local potential and design local programs. As of this writing, very little funding is available from state or federal programs for local assessment and strategic energy planning.

The CPUC released a proposed rulemaking (July, 2003) that would require PG&E to provide more detailed energy use and demand data by jurisdiction and sector upon request. Such data will be useful for assessment, program design, and implementation.

Current Local Policies and Programs: The county has received a grant from the DOE "Million Solar Roofs" program to assess solar resources, and identify and address local institutional and market barriers to promote solar development. The county is currently developing a Solar Resources Geographic Information System (GIS) Map of Marin. This will enable the county to locate and quantify the physical potential for solar energy[20]. Wind and biomass will also be analyzed for potential hybrid installations. The county is also planning to install a Weather Station and Data Acquisition System (DAS). Real-time weather stations will be installed to gather data on Marin's microclimates providing a more accurate data for assessment of EE and RE potentials, and corroborate the Solar Resources GIS map data.

Programs

1.1.a *Prepare a "Strategic Energy Plan."* Develop the appropriate tools and methodology; assess current energy use and demand, potential for energy efficiency and local renewable resources; forecast future energy needs based on business-as-usual and sustainable energy scenarios; assess impacts; evaluate and adopt strategies.

1.1.b *Prepare an "Operating Plan."* Develop an operating or business plan to implement the strategies and meet the targets and timeframe outlined in the strategic plan. Work with the government and non-government stakeholders to determine the necessary resources and priorities identify and integrate additional resource and financing requirements and opportunities into the county budget process.

[20] Analysis will include solar insulation in combination with parameters such as topography, vegetation, local weather patterns and microclimates, and building footprints.

1.1.c *Progress Reports and Strategic Plan Updates.* Establish a process and format for periodic reporting on the progress of energy programs and progress toward the overall objectives. Integrate energy indicators into other appropriate documents such as *Marin Profile*.

1.1.d *Renewable Resources Feasibility Assessment.* Assess the physical, technical, economic, and programmatic feasibility of renewable energy resource potential. Incorporate into the planning process the periodic reassessment of each feasibility factor and identify what strategies should be implemented to protect and facilitate renewable resource use. Examples include:

- The county adopted a solar access ordinance to protect a homeowner's right to the solar resource if and when the homeowner chooses to use it.
- While capital cost may be a major limiting factor to the extensive use of solar today, requiring appropriate orientation and stub outs for PV and solar domestic water heating to the roof of new homes may help to lower the cost of such installations in the future.
- The county may have significant potential to exploit tidal power along its bay shore. However, the technology may not be commercially available until the 2010 to 2020 timeframe. The county should identify the land use issues that could prohibit or facilitate tidal power development if and when it becomes feasible and take the necessary steps to preserve the resource option.

1.1.d.1 Map renewable resources in a solar resource Geographic Information System (GIS); map the electric and gas transmission/distribution system, community growth areas requiring new energy services, zoning, energy intensity, and other data useful to deployment of distributed generation (DG) technologies, such as fuel cells, cogeneration, solar, wind, and biomass.

1.1.d.2 Assess issues critical to mitigating potential adverse impacts and creating new opportunities for distributed generation and economic development in the county. Request assistance from state and federal agencies in identifying local siting issues relevant to distributed generation technologies such as fuel cells, small cogeneration systems, and emerging concepts such as the microgrid and "hydrogen economy."

Policy

1.2 **Evaluation, Monitoring and Verification.** Institute a process for data collection and analysis to evaluate program impact and modification to meet sustainability targets.

Program

1.2.a *Evaluation, Monitoring and Verification.* Develop a plan for the ongoing monitoring, evaluation and verification of implementing programs. Include in the initial plan guidelines for monitoring, evaluation and verification of energy programs and

requirements for specific programs in the CWP. Incorporate the resources requirements for monitoring, evaluation and verification into the Operating Plan.

Goal 2

Reduce Energy Use: Reduce energy use and peak electricity demand in all sectors and all end-uses of energy, both new and existing through energy efficiency, conservation and peak load reduction.

Description: Demand-side energy use generally refers to all energy uses on the customer's side of the meter. Energy efficiency, conservation, and peak load reduction are collectively called demand-side management or DSM. Renewable technologies such as solar water heating, passive solar design, solar-electric generation, and wind energy conversion systems (WECS) on the customer's side of the meter are sometimes considered demand-reducing technologies since these activities lower the demand for energy[21]. DSM strategies are implemented in all sectors.

Standards and Regulations

Land Use

Description: Energy and land use are mutually dependent. The availability and affordability of energy resources affect land use patterns and development. Land use patterns and development, in turn, affect energy use. Subdivision and zoning regulations can either hinder or promote the efficient use of energy and local renewable resources. Sustainable energy strategies for land use generally overlap sustainable strategies for transportation, housing and community facilities. Since transportation and housing issues drive the push for "smart growth" strategies much more than energy and are well-documented in the literature, compatible land use strategies are listed here but not discussed in detail[22]. Policy topics include: mixed-use development, infill and redevelopment, compact development and clustering, full utilization of existing infrastructure, street and parking design, multi-modalism, urban forestry and landscaping, open space, climatically-appropriate design and solar access, recycling, location & design of community facilities. These topics are addressed under the housing, transportation, community design, community facilities elements. The PLACES3 software used in the "Smart Growth" planning process also accounts for the energy impacts of land use choices.

Building Design Standards (Residential and Commercial Buildings)

Description: Building energy use includes all activities commonly associated with the operation of the building including space heating and cooling, domestic water heating, lighting, appliances and other miscellaneous uses. This includes the design of the building envelope that affects the ultimate heating/cooling and lighting loads.

[21] For example, a recent study found solar water heating has the greatest technical potential to reduce natural gas consumption in the commercial sector. "California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study," Prepared for Pacific Gas & Electric Company, Prepared by KEMA-XENERGY Inc., May 14, 2003

[22] For further information on land use and energy issues, see "Energy Aware Planning Guide," from the Calif. Energy Commission, January 1993 (Publication No. P700-93-001) available online (www.energy.ca.gov), and "Energy: Preparing an Energy Element for the Comprehensive Plan," by the So. Carolina Energy Office, November 2000, available online (www.state.sc.us/energy), and other documents available from CDA.

Current Programs-State:

1. California law requires minimum energy efficiency standards (Title 24) for all new and remodeled (with limitations) residential and commercial buildings. The original standards were adopted in 1978 and have been updated 4 times, the last in June 2001. The standards are adopted by the California Energy Commission and enforced by local building departments.

2. Solar Access: State law requires protection of solar access but enforcement is also local.

Current Programs-Local:

1. Performance standard: Marin County adopted the Single Family Dwelling Energy Efficiency Ordinance (Ordinance 3356) in 2002 requiring all new and remodeled homes larger than 3500 square feet to meet the Title 24 requirements of a 3,500 sf home. This can be achieved with energy efficiency and/or renewable energy. The impact of this ordinance is limited to homes built in the unincorporated areas of the County.

2. Solar Access: Marin County adopted an ordinance in 1982 to protect passive or active solar design elements and systems from wintertime shading by neighboring structures and trees.

3. Marin Municipal Water District (MMWD) adopted three ordinances to reduce water use. Water efficiency programs reduce energy use as well because water requires significant amounts of electricity for pumping and treatment. Measures that reduce hot water use such as low flow showerheads and faucets further reduce energy use (mostly natural gas in Marin). MMWD ordinances are effective across all jurisdictions within their district. The ordinances are:

a. Water-efficient landscaping plans submitted and approved for new or upsized meters - residential
b. Low-flow toilets and showerheads retrofit upon change of ownership – residential

4. North Marin Water District has an adopted an ordinance requiring homes built after January 1, 1992 to have low-flow showerheads and faucets upon change of ownership. NMWD also has a cash for grass program to encourage customers to limit the water use of lawns, and a toilet rebate program.

New Policies and Programs:

Policy

2.1 **Supplemental Building Standards:** Adopt standards for new and remodeled buildings that exceed current State standards.

Description: Building design standards offers great potential for conserving energy and reducing energy use. Marin can adopt higher standards than those of the State of California that better reflect local conditions, criteria and goals. Buildings account for most of the electricity and natural gas consumption in the county. The initial design and construction of a building will impact the energy efficiency of the building over its lifetime (easily 50 to 100 years or more). Optimizing for energy efficiency and

renewable resources in the initial design costs less and results in the greatest benefits over the building's lifetime.

Programs

2.1.a *Supplemental Commercial Building Standards.* Develop and implement building standards that exceed Title-24 for commercial buildings based on appropriate criteria for the county's specific climate zones, sustainability goals and other appropriate criteria. For example, the LEED (Leadership in Energy and Environmental Design) green building rating system could be adopted as a local standard.

2.1.b *Supplemental Residential Building Standards.* Develop and implement building standards that exceed Title-24 for Residential buildings based on appropriate criteria for the county's specific climate zones, sustainability goals and other appropriate criteria. Establish technical and financial feasibility criteria by which the standards can be periodically improved. For example, a pre-established payback threshold could be established so that new technology could be adopted as the costs come down below the threshold.

2.1.c *Single Family Dwelling Energy Efficiency Ordinance.* Continue to implement the single-family dwelling energy efficiency ordinance that requires all new and remodeled homes larger than 3,500 square feet to meet the State of California Title 24 requirements of a 3,500 square foot home. The requirements can be achieved with energy efficiency and/or renewable energy.

2.1.d *Solar Access.* Continue to implement provisions of Title 22 (Marin County Development Code) to protect passive or active solar design elements and systems from wintertime shading by neighboring structures and trees.

2.1.e *Green Building Rating System.* Adopt a green building rating system for residential remodels and new construction. Fast track design review process could be offered for those that obtain a certain rating.

2.1.f *Existing Building Standards (Change of Ownership).* Adopt standards for existing residential and commercial buildings that require retrofit at change of ownership.

Description: Retrofitting existing buildings offers the greatest opportunity for reducing energy use in Marin. Requiring an energy retrofit at the time a building is sold provides one of the best opportunities to increase energy efficiency. An energy audit and installation of efficiency measures can be combined with existing inspections, financing, and data collection activities. Implementation can be made compatible with MMWD's and NMWD's water conservation ordinance that already requires inspections and installation of water saving measures.

2.1.g *Building Standards Enforcement.* Improve compliance with existing laws.

Description: Standards only achieve the projected energy savings if they are implemented effectively. Enforcement and compliance requires good training of both builders and inspectors, and a process for ongoing assessment.

2.1.h *Professional Green Building Certification.* Adopt minimum green building certification standards for architects and contractors.

Description: Green building design, materials and building techniques require certain knowledge most architects, engineers and contractors did not get through their initial education and training. While many excellent free seminars sponsored by AIA, PG&E and other organizations are offered that quickly teach the basics, only a limited number of contractors and architects will ever take the time to attend. Continuing education is standard practice and a requirement of some design professions. Adopting minimum certification standards in green building as a requirement for issuing building permits could significantly advance awareness and use of green building practices. Many compliance options can be provided including free training seminars, self-study and testing. The industry can be given ample time to comply to reduce any perception of hardship created by a certification requirement.

2.1.i *Public Buildings Supplemental Standards.* Adopt higher standards for public buildings to provide leadership and promote innovation in green design and efficient energy use. The LEED (Leadership in Energy and Environmental Design) Silver certification standard or higher can be used for all new public buildings over a certain size.

Description: Public buildings provide great opportunities to demonstrate and promote the best green design practices as well as reduce government costs. Green buildings are also healthier for those working in them and can increase worker comfort and productivity. The County can adopt the highest LEED standard to guide design and commissioning of new facilities. The State of California and Cities of Los Angeles, Portland, and Seattle, have adopted the LEED Silver standard to be applied to all new civic buildings. The County could also provide leadership in green building by adopting an ordinance declaring that any new County facility will have a minimum rating of LEED Silver.

Incentives For Energy Efficiency and Renewable Energy

Description: Incentives include price, financing, tax, rebate, market and process measures providing some form of benefit beyond what the energy product or service alone would provide. Incentives are justified by social good, cost-effectiveness, need, and equity.

Current programs—Non-local: California has offered various incentive programs including tax credits, rebates, low-interest loans, and technical assistance for building measures and appliances exceeding Title-24 standards. These programs change over time and are administered through multiple entities (CEC, CPUC, PG&E and the private sector). State and federal law specifically mandates funding for special need programs such as low-income weatherization. These fall into the incentive category because they are optional for the end-user and vary greatly in how well they are utilized on the local level.

Current Community Development Agency Programs:

- BEST-Building Energy Efficient Structures Today. Fast track permitting and fee waivers for projects that either:
  - Exceed title 24 by 20%,
  - Install a renewable energy system that meets 75% of building's needs
  - Comply with the BEST Checklist
- Over-the-counter approval of solar electric and water heating systems if the collectors are at the flush mounted to the roof.
- Technical assistance for energy and green building design based on the LEED rating system, Alameda County *Green Building Guidelines* and Environmental Building News' *Green Spec*.
- Rebates for installation of specific energy efficiency and renewable energy measures. This program was in place from January 1, 2002 to January 31, 2003. Over $52,000 in rebates were awarded for energy star appliances, Low-E windows, increased insulation, solar electric and water systems, efficient furnaces, and lighting. This program will save over $100,000, and 920,000 lbs. of CO_2 per year.

Current MMWD and NMWD Programs: MMWD and NMWD has offered various rebate programs for retrofitting residential and commercial buildings with water conserving appliances.

New Policies and Programs:

Policy

2.2 **Energy Efficiency/Renewable Energy Incentives.** Promote sustainable energy practices and support standards and informational programs with appropriate incentive programs for both public and private sector.

Programs

2.2.a *Fee Reductions and Expedited Permit/Approval Processing.* Evaluate and implement opportunities for supporting new programs with fee reductions and expedited processing. Evaluate the impact and value of existing incentives and continue, modify or eliminate as appropriate.

2.2.b *Tax Exemptions and Credits.* Evaluate and implement opportunities for supporting new programs with tax benefits such as property tax exemptions, sales tax rebates and other such locally controlled financial options.

2.2.c *Technical Assistance.* Provide energy efficiency and green building technical assistance for building retrofits and new construction.

2.2.d *Sustainable Energy Financing.* Evaluate and implement opportunities for supporting new programs and promoting sustainable energy practices through financing mechanisms such as pooled project financing, low-interest loans, local government joint ventures.

2.2.e *Affordable Housing Weatherization.* Implement an affordable housing weatherization program to provide technical assistance and weatherization.

2.2.f *Energy Efficiency Program Administration.* Establish a program to administer Public Utility Commission Public Goods Charge funding for energy efficiency programs and rebates for Marin County.

2.2.g *Regional Energy Collaboration.* Establish a regional collaboration among local governments, special districts and other public organizations to share resources, achieve economies of scale, and develop plans and programs that are optimized on a regional scale.

Energy Information/Education

Description: Public awareness campaigns can be for any sector, market segment and demographic, including schools, using any means or media. While information programs can stand alone, they are often used in conjunction with incentive or proscriptive programs.

Current Non-local Programs: California has offered various information/educational programs and materials including public information campaigns using all forms of media. These programs change over time and are administered through multiple entities (CEC, CPUC, PG&E, non-profit groups and the private sector).

Current Local Programs: As of this writing Marin County CDA has offered five trainings for county and city staff, building professionals, and the general public. Approximately 300 people have attended these sessions. Two solar energy workshops will be held in the spring of 2003 was attended by approximately 120 home and business owners and building professionals.

The BEST Library is located in the Reference section of the Civic Center Library. This section includes over 50 books and/or periodicals on energy efficiency, green building, and sustainable living.

The Green Building Resources Exhibit displays green building materials and techniques. It has samples of various materials and where you can find them locally. This exhibit can be found at the Civic Center planning and building counter and at a variety of local events.

Information on the County's programs, valuable educational resources, and links to other sites can be found at www.maringreenbuilding.org and www.marinsolar.org.

The Alameda County *Green Building Guidelines* have been reprinted to provide building professionals, homeowners, and businesses on the values, materials, and techniques of green building.

The Marin County Green Business Program offers technical assistance and marketing opportunities for business that:

- Demonstrate compliance with environmental regulations.
- Conserve energy, water, and other materials.

- Prevent pollution and waste generation.

MMWD has offered various information programs for water efficiency, conservation and water-efficient landscaping.

Policy

2.3 **Green Building Information and Education.** Establish and maintain programs for information, marketing, training and education on green building and sustainable design.

Description: Buildings generally have long lives (50-100+ years). The initial design, materials used, and construction quality will limit how resource efficient that building can be over it's lifetime. Green building materials and practices have grown rapidly in the past 5 years but it is still a relatively young field. The building industry is one of the slowest industries to adopt new technologies and methods. Marin's goal of a sustainable future requires it to stay ahead of the curve by adopting a proactive strategy toward sustainable building. CDA needs to continuously update and train its building staff, and the building industry as the green building movement grows and matures. Since buildings create such a long-term impact on Marin's resource needs, a reasonable impact fee could be adopted to pay for the green design assistance program. Fees could be waived for those submitting their projects to green design review. A variety of incentive and fee structures should be examined.

Programs

2.3.a Design Assistance & Training. Establish a permanent green building design assistance program to promote sustainable design practices and educate building professionals.

2.3.b *Green Building Certification.* Support the National Association of the Remodeling Industry's green building certification program for contractors. List contractors who are NARI certified on the County's website.

2.3.c *Green Building Residential Design Guidelines.* Include green building guidelines in the County's Residential Design Guidelines.

2.3.d *LEED Rating System.* Promote the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system. Maintain Marin County's membership in the USGBC.

2.3.e *Multi-Sector Technical Assistance for existing buildings.* Provide assistance in increasing energy efficiency for existing residential, commercial, and industrial buildings.

2.3.f *Information, marketing & Support.* Develop informational/training programs on an as-needed basis to support other standards and incentive programs.

2.3.g *Sustainable Marin Curriculum.* Promote the development and implementation of a sustainability curriculum in schools and community colleges.

Policy

2.4 **Energy Legislation.** Track important federal and state energy legislation. Adopt resolutions supporting legislation that promotes energy efficiency and renewable energy.

Process Energy (Sectors: Industrial, Agricultural, Commercial, Infrastructure)

Description: Process energy is generally defined as energy used in the process of producing, moving and storing goods. This excludes end uses associated with building operations such as space heating and cooling, domestic water heating, and lighting, but includes refrigeration of goods, pumping, and any industrial or agricultural process.

Industrial and agricultural sector energy use accounts for only about 2% of energy use in the County. However, such energy use may create greater adverse impacts or opportunities that may be worth addressing. For example, financially marginal but locally important agricultural operations can be hurt by high energy costs, price and supply uncertainties, but may also have good opportunities for efficiency and renewables. It is beyond the resources available for this report to examine these sectors in any detail. Generally, there are many opportunities for energy efficiency and renewable resource use in process energy, and many State, utility and private sector initiatives are available to help.

Processes vary too greatly in type, scope and design to establish a set of standards similar to building standards. Within certain types of businesses such as restaurants, supermarkets, and laundries, energy efficient best practices have been developed. Assuring best practices have been considered as a condition for any government approval may be practical to implement and consistent with current requirements for impact analysis and mitigation.

New Policies and Programs:

Policy

2.5 **Process Energy Efficiency**. Evaluate and implement appropriate standards and other requirements to improve energy efficiency, reduce waste, and increase use of renewable resources in commercial, industrial and agricultural processes.

Description: Any new commercial, industrial, agricultural or infrastructure process that requires approval from the County could be required to assess the potential for cost-effective energy efficiency and renewable energy opportunities. For example, a company requesting a variance or conditional use permit for a large commercial laundry could be required to provide an energy analysis prepared by a certified energy professional recommending or attesting to the use efficient and cost-effective process technology (e.g., heat recovery, solar water heating).

Programs

2.5.a *Process Energy Assessment.* Assess the needs and opportunities for recommending specific energy efficiency measures for process energy in the affected sectors. Implement specific initiatives identified by the assessment.

2.5.b *Process Energy Mitigation.* Require an energy efficiency analysis for any new process that needs County approval.

Goal 3

Increase Renewable Energy Use: Develop and provide incentives for local renewable energy resources and shift imported energy needs to renewable energy resources. Develop local generation options in the short term that use imported non-renewable resources more efficiently.

Description: Supply-side energy is generally defined as energy provided to customers or energy provided on the utility side of the meter. Examples, include large central generating facilities such as coal, oil, nuclear, hydroelectric,[23] gas-fired generation; centralized renewable generation from wind, geothermal, biomass, tidal and solar; distributed generation[24] from renewable sources (wind, solar, geothermal, biomass, and small hydroelectric facilities[25]); and distributed generation from non-renewable sources such as natural gas fired cogeneration, microturbines, and diesel. Marin currently has no supply-side generation and no non-renewable generation sources are planned.

Opportunities for local renewable energy resources include:

- solar electric (principally on the customer's side of the meter[26])
- solar domestic water, pool and space heating (offsetting gas or electricity use[22])
- wind turbines (either on the customer or utility side of the meter)
- small hydroelectric
- biomass
- tidal power

[23] For state and federal policy, hydroelectric projects are classified as renewable or non-renewable based on their size, type and ecological impacts.

[24] Distributed generation (DG) is electric generation connected to the distribution level of the transmission and distribution grid usually located at or near the intended place of use. DG systems can be sized to meet a facility's total electrical requirements or they can be sized to partially replace or supplement electrical service from the grid. DG systems typically range in size from less than a kilowatt to tens of megawatts.

[25] Some measures like cogeneration can provide both supply-side and demand-side benefits. They can best be defined by their primary task. For example, cogeneration facilities sized to produce and sell excess electric power can be considered supply-side options even though they are also increasing the efficiency of energy use on the customer's side of the meter.

[26] For purposes of the CWP, solar thermal and photovoltaic (PV) systems installed on the customer's side of the meter that principally supplement or meet the needs of the customer are considered demand reduction technologies. PV systems under 10KW are subject to Net Metering laws that allow a customer to turn their meters backwards when generating more electricity than using and take back from the grid when not. Net metered customers do not get paid for any excess power delivered to the utility so systems are generally sized to the customer's load.

Cogeneration – the combined use of electricity and waste heat - is typically powered by natural gas but can also be powered by biomass. Natural gas fired cogeneration can provide a cleaner more efficient near-term option than traditional centralized power generation.

Fuel cells operate much like a battery by transforming chemical energy into electrical energy directly without a combustion process. Fuel cells are fueled by hydrogen produced from natural gas or electricity. Since the electricity may be produced by renewable or non-renewable resources, fuel cells are not inherently renewable, but provide a means to store energy (in the form of hydrogen) from intermittent renewable sources like solar and wind. Similar to cogeneration, fuel cells powered by natural gas can achieve high efficiencies if the waste heat is utilized on site.

Standards and Regulations

Description: The land use and building code issues associated with solar technologies, such as subdivision design and solar access, have been addressed in the current CWP and in the consultant report on barriers in the current plan and codes. This section focuses on distributed generation (DG) technologies that have not been addressed in other sections of the CWP update.

Emerging DG technologies such as fuel cells are becoming commercially viable but have limited market penetration. While natural gas fired cogeneration is an old technology, scaling it down to the size to meet the load of an apartment building or single home is relatively new. Some DG technologies like natural gas fired micro turbines, while relatively clean, still raise air quality concerns. Diesel-fired generators have clear adverse air impacts. While the need to develop guidelines for local government land use and permitting issues has been identified by state and federal agencies, little work has been done toward that end. New DG technologies that have not been addressed in the planning and building codes may be subject to conditional use permits, variances and other unnecessary and costly requirements. Current codes also may not protect DG resources and technology from conflicting uses or simple set asides that would make DG more practical and cost-effective. For example, in a redevelopment area, land may need to be set aside with access to utility interties and easements to deliver hot water or steam to multiple buildings in a district. In a home, space may be needed next to the water heater with gas stub outs appropriate for a fuel cell generator that would heat water as well as generate electricity.

Other than solar access protection, California currently has no laws to protect major energy resource sites nor provides guidance on planning for DG. Oregon does mandate local renewable resource protection and we can look to their laws for some guidance. The CWP should adopt a policies to protect major renewable energy resource sites in Marin, promote appropriate DG technologies and commit to adopting rules and regulations to protect and facilitate their use when sufficient information is obtained to do so.

Policy

3.1 **Promote Clean Distributed Generation (DG) and Enhance the Opportunities for Future Distributed Generation Technologies.** Promote the use of clean distributed generation through planning and building codes, and permitting processes that facilitate the siting and use of distributed generation in buildings and communities.

Programs

3.1.a *Develop Land Use Regulations to Facilitate Use of Clean Distributed Generation Technologies.* Develop appropriate guidelines and codes for utility easements, rights of way, land set-asides, and other appropriate measures to ensure that available and planned DG technologies can be effectively incorporated into new developments and redevelopment areas. Develop and adopt clear and uncomplicated rules to permit specific clean DG technologies in new and existing buildings.

3.1.b *Develop Building Codes to Facilitate Use of Distributed Generation in Residential and Commercial Buildings.* In conjunction with the appropriate code organizations, review and modify existing building codes (electrical, mechanical, fire, etc.) to remove barriers to use of emerging distributed technologies.

Policy

3.2 **Protect Development of Future Indigenous Renewable Energy Opportunities.** Preserve opportunities for future development of renewable energy sources such as tidal, biomass, and small hydroelectric.

Description: Marin County has potential for indigenous renewable energy resources such as solar, wind, tidal, biomass, and small hydro. Only policies to protect solar and small wind-electric applications have been adopted to date. Development of the other resources may be limited by current and future land use policies. For example, Marin is estimated to have a potential for at least 100MW of tidal power. One technology is anticipated to be tested in the San Francisco Bay by 2006 and may be commercially viable by 2010. While commercial development is still some years away, the location and scale of land-based facilities required to exploit the resource is known. The county should take steps to ensure that the possible future use of this resource is not precluded by current development policies.

Programs

3.2.a *Identify and Assess Significant Indigenous Energy Resources and Potential Conflicting Uses.* Identify significant energy resources such as tidal power and wind; identify and assess conflicting uses and land use, interconnection, environmental, economic and other issues affecting their development.

3.2.b *Develop and Adopt a Plan to Protect Significant Indigenous Resources.* Develop and adopt appropriate policies and procedures to limit conflicting uses and protect indigenous renewable resources. Establish utility easements, rights of way, land set-asides, and other appropriate measures to protect the future use of these resources.

Incentives For Clean Distributed Generation

Description: Incentives include price, financing, tax, rebate, market and process measures providing some form of benefit beyond what the energy product or service alone would provide. Incentives are justified by social good, cost-effectiveness, need, and equity.

Current programs -Non-local: California has offered various incentive programs for DG including tax credits, rebates, low-interest loans, and technical assistance. These programs change over time and are administered through multiple entities (CEC, CPUC, PG&E and the private sector).

New Policies and Programs:

Policy

3.3 **Renewable Energy Incentives.** Promote sustainable energy practices and support standards and informational programs with appropriate incentive programs for both the public and private sectors.

Programs

3.3.a *Fee Reductions and Expedited Permit Processing.* Evaluate and implement opportunities for supporting new distributed generation programs with fee reductions and expedited processing. Evaluate the impact and value of existing incentives and continue, modify or eliminate as appropriate.

3.3.b *Tax Exemptions and Credits.* Evaluate and implement opportunities for supporting new programs with tax benefits such as property tax exemptions, sales tax rebates and other locally controlled financial options.

3.3.c *Technical Assistance.* Provide technical assistance on distributed generation as part of the green building technical assistance program.

3.3.d *Identify, Finance and Develop Distributed Generation Opportunities in Local Government.* Provide leadership and set an example by financing and installing innovative DG technologies using tax-free low interest loans and other available financial options.

Policy

3.4 **Imported Renewable Resources.** Identify, evaluate and recommend options for purchasing renewable resources for that portion of Marin's energy demand that is met by imported energy.

Programs

3.4.a *Evaluate the Feasibility of Purchasing More Renewable Energy Through Community Choice Aggregation.* Evaluate the feasibility of becoming a community choice aggregator to purchase more renewable energy on behalf of citizens and businesses than the state has mandated.

3.4.b *Renewable Energy Certificates.* Evaluate the feasibility of purchasing renewable energy certificates to reduce Marin County government's contribution to greenhouse gas emissions.

Appendices

Appendix A: A Methodology for Prioritizing Energy Strategies

This report began with a simple definition of a sustainable energy future: "At the highest level, Marin homes, businesses, and industry would endeavor to use resources efficiently and all sources of energy would be renewable, clean, affordable, and equitably produced... The ideal is not a precise target but a process that allows learning and adaptation as the environment changes over time. Interim targets will be defined by a starting point and what is technically, economically, and culturally feasible to achieve within a defined timeframe." An initial set of strategies is proposed in the "Key Trends, Issues, and Strategies Report" issued in January 2003. Other strategies are culled from successful initiatives that other communities have pursued. The next task is to screen these strategies for effectiveness within the timeframe and resource parameters of the CWP update. The screening process can be broken into three components:

1. Choose and weight the criteria for assessing the strategies based on local conditions.
2. Do an initial screening to eliminate, combine and modify the strategies to narrow the field to those that best reflect the criteria.
3. Rank the strategies and use the highest ranking strategies to set the objectives, define the policies and implementing programs.

The first two steps can be achieved quickly with a small team meeting to roughly assess and choose a manageable and targeted set of strategies for further ranking. Additional available information needed to help assess the smaller set of strategies can be gathered next. Finally, the strategies can be ranked and chosen by a second meeting of the team.

Establishing Assessment Criteria

The purpose of assessment criteria is to identify strategies with greatest net benefits and the most likely to be effectively implemented. Based on the guiding principles, the screening criteria might include:

- Energy-use reduction potential
- Renewable energy supply potential
- Rate of energy-use reduction or supply increase
- Ability to quantify impacts
- Environmental impacts
- Equity impacts
- Economic impacts (cost-effectiveness to the public)
- Technical feasibility
- Financial feasibility (cost-effectiveness to the individual)
- Security impacts
- Enforceability

The California Energy Commission developed a simple ranking system using similar criteria for the Southern California Association of Governments[27] . First, a weight or importance is assigned to each criterion. Every strategy is then rated for each criterion. The following sample matrix provides a means for a team to quickly prioritize strategies:

Sample Scoring Matrix For Strategies

Title:

Description:

Scoring:

CRITERION	WEIGHT	X	RATING	=	SCORE	COMMENTS
1. Energy-use reduction potential	4	X	5	=	20	
2. Renewable energy supply potential	4	X		=		
3. Rate of reduction or supply	3	X	1	=	3	
4. Ability to quantify impacts	2	X	1	=	2	
5. Environmental impacts	4	X	3	=	12	
6. Equity impacts	4	X	3	=	12	
7. Economic impacts (cost-effectiveness to public)	2	X	1	=	2	
8. Technical feasibility	3	X	5	=	15	
9. Financial feasibility (Cost-effectiveness to individual)	3	X	5	=	15	
10. Security impacts	1	X	1	=	1	
11. Enforceability	3	X	5	=	15	
TOTAL SCORE					77	

Weight: 1-4 with 4 most important Rating (positive impact): low=1, medium=3, high=5

Once all strategies have been rated and sorted by rank, the team can determine how many of the top strategies should be adopted. Existing policies can be compared to the prioritized strategies; then recommendations for modifications, additions or deletions can be made.

[27] Regional Energy Reference Document (Staff Draft), December 1993

Appendix B:
The Shifting Structure of the Energy Industry: A Summary of the Events Leading to the California Energy Crisis and the Implications for Local Government Policy

While almost everyone is aware of the California "energy crisis" from front page headlines since 2000, far fewer understand the legislative and regulatory changes that led to the crisis, and the impact those changes will have on price and supply stability in the future[28]. Much analysis of the "California deregulation experiment" has been and continues to be written. While far from complete, this summary of events attempts to frame the issues relevant to local governments moving forward.

A. The Natural Gas Market

Deregulation in the energy industries began in the early 1990's with the natural gas market. In 1992-93 California began allowing non-core gas customers (large industrial users and power plants) to buy natural gas in an open market, essentially to get "cheaper" prices. These customers were also no longer required to maintain storage of gas to meet their wintertime requirements. This was significant because California imports 84% of its natural gas and lacks sufficient pipeline capacity to meet winter demand. Utilities had been required to build up stores of natural gas in the summertime to meet wintertime demand. The new rules let the non-core customers choose to pay for storage or not. At the time, large industrial users and power plants had the option of shifting to oil if natural gas was not available. New air quality rules in the 1990's restricted most the non-core customers to natural gas. As long as the utilities owned the power plants it was assumed they would do the prudent thing and store sufficient gas to meet their needs.

California initiated the restructuring of the electric power industry in 1997. The investor-owned electric utilities (IOUs), whose profit historically was based on a percentage of their capital investment in power plants, were shifted to a profit based on a percentage of kilowatt-hours sold. Depending on who is telling the story, they were permitted or encouraged to sell off their gas-fired power plants. By 2000, 80% of such plants had been sold by California utilities. Many of the new power plant owners choose not to pay the extra cost to store natural gas. They didn't care if a restricted gas market forced prices higher in the winter since they were allowed to pass increased cost of generation through to the ratepayers.

[28] While the issues leading up to the energy crisis are subject of much research, debate and litigation, and predicting future impacts is fraught with uncertainty, understanding the changes in policy that led to the crisis, and which of those policies is still in place will provide some measure of understanding of the importance of local action. "How We Got Into The California Energy Crisis" by William Marcus and Jan Hamrin, Center for Resource Solutions, Feb.,2002, provides a good summary of the events leading up to the crisis. It can be downloaded at www.resource-solutions.org.

A combination of events occurred in the winter of 2000-2001 that caused a severe shortage in the supply of natural gas leading to skyrocketing prices: a colder winter, a pipeline accident reducing the El Paso pipeline to 85% of capacity (a 5% statewide reduction in supply), lack of storage by power plants and large industrial users (only 11% of gas stored in prior years), the Federal Energy Regulatory Commission had removed all price caps for short-term sales of gas pipeline capacity in the spring of 2000 and allowed the pipeline company to sell off excess capacity to out of state distributors.

California natural gas prices rose to unprecedented heights, from typical levels of 25-50 cents/MMBtu. to a range from $15 to greater than $60/MMbtu. All of that money went to the owners of pipeline capacity. The prices served the economic function of rationing demand down to meet the supply -- closing one industrial customer after another across the west coast. While California spot gas prices finally settled somewhat by Christmas of 2000 they remained volatile and ranged from $2-$8/MMbtu higher than national prices.

B. The Electric Market

On the electric side, talk of deregulation first began about 1993 with large industrial customers pushing for an open market to obtain lower prices. The utilities in turn began posturing to protect their markets. The environmental community was frustrated with the slow response by regulators to environmental problems caused by electricity generation. Independent energy producers were frustrated by a lack of regulatory support for cogeneration and renewable energy facilities. Consumer groups generally felt consumers were the losers in the regulatory balancing act. The California Public Utilities Commission (CPUC) and the Federal Energy Regulatory Commission (FERC) at that time felt state regulation was reducing efficiency in the electricity sector and an open market would reduce prices. In April of 1994 the CPUC released a plan for electric utility industry restructuring and began hearings. The plan was modeled after a British plan for privatizing the power industry (which ultimately led to widespread profit-taking and subsequent new price controls.) The CPUC's proposal was widely viewed as onerous to all but large industrial users and the utilities, and led the state legislature to become involved. The legislature, in a hurried attempt to appease all parties, guided by inaccurate state forecasting data, and failing to understand the complexity of the issues, passed AB 1890 (the state restructuring bill) in 1997.

State officials were also lulled into a false sense of security by optimistically low electricity demand forecasts from the California Energy Commission (CEC). The CEC, which had historically forecast lower demand than predicted by the utilities, made some faulty assumptions in 1995 that proved disastrously low in 2000. These included:

- Almost 1400 MW of renewable and cogeneration capacity (that was to be acquired through an auction ordered by the CPUC) was never purchased because the utilities petitioned the FERC to kill the auction[29].
- Nearly 2300 MW of excess capacity from Northwest and Southwest sources was optimistically projected in the CEC forecast. In the year 2000, very little excess energy was available

[29] Edison claimed that it did not need power until 2004. One month later, SCE cancelled the energy efficiency programs on which that forecast was based. California spent $90 million of ratepayer money in AB 1890 (the state restructuring bill) to offset liability costs incurred by the utilities for killing these contracts and didn't get a single kilowatt-hour.

- Over 2000 MW of energy efficiency was forecast that the private utilities never acquired[30].

Thus, a projected surplus in the year 2000 became a 2000 MW deficit.

Turning over power production in the State's fossil fuel plants from the utilities, which had historically been charged with keeping the lights on, to unregulated companies, which have no responsibility for ensuring the public interest, created a host of other problems that exacerbated the crisis. For example, the utilities maintained service schedules that would ensure the power plants would be available during times of critical summer peak demand. The emerging evidence suggests that at least some of the new owners scheduled downtime whenever they chose and could cause prices to rise by keeping plants off line at critical times. Additional evidence suggests that energy traders were able to "game" the market to push prices up and reap profits.

Rules to protect residential customers from price hikes (enacted as part of the restructuring legislation) also created shortfalls between what utilities had to pay for wholesale power and what they could recover from residential customers. Inaction at the federal level (FERC) allowed prices to run wild for many months. Power suppliers refused to sell to cash poor California utilities. The State rushed through new legislation allowing it to step in and purchase wholesale power (through the Department of Water Resources). The State also rushed to negotiate and sign long-term power purchase contracts during the peak of the crisis for prices significantly higher than 2002 market prices. They are now attempting to renegotiate these contracts. The State is also pursuing recovery of alleged overcharges by the major power generators and trading companies through FERC and lawsuits.

The State negotiated financial bailouts with the utilities. PG&E chose to file for bankruptcy rather than work with the State and, through bankruptcy, is attempting to further reduce the State's regulatory oversight. SCE did negotiate and accept a bailout proposed by the CPUC, which is subject to a lawsuit. Neither case is resolved as of this writing. The State moved to spend hundreds of millions to promote new energy efficiency initiatives, fast tracked power plant siting, and issued bonds to help pay for past debt and future long-term power contracts. The final cost to Californians of the 2000-2002 energy crisis is estimated to be about $40 billion. That does not take into account the economic ripple effect from loss in sales, business investment, jobs, etc. created by high energy prices and rolling blackouts.

While the factors contributing to the energy crisis are more numerous and complex that described here, the above summary may be sufficient to convey the complexity, the magnitude, and the impact of the structure of the energy industry affecting our community. Most importantly, while the energy crisis may have dropped from the headlines, many of the underline causes of the crisis are still with us and critical institutional issues have no resolution in sight. The following excerpt from "Clean Growth:

[30] PG&E and Edison were projected to acquire 100-150 MW per year each, at the same time as they were cutting their budgets in response to performance-based ratemaking incentives and acquiring only 40-70 MW per year each. Even with the lower energy efficiency budgets, the utilities did not spend what they had been allocated. Every megawatt of unpursued conservation equals about 1.2 MW of needed new power plants with reserves and system losses.
Additional note: 2500 MW of interruptible service contracts were signed with large commercial and industrial customers by Edison as a method of inducing large customers to stay with the Company through attractive multi- year contracts. Though many customers claim they were told they would never actually have to be interrupted, Edison asserted to the CEC, CPUC and FERC that these contracts were as good as new power generation.

Clean Energy for California's Economic Future," the draft Energy Resource Investment Plan from the California Power Authority (CPA) released January 17th, 2002 states the case succinctly:

> The uncertainty in California's energy future may be much greater than some expect. A CEC staff report has said that in the summer of 2003 the capacity available to cover peak demand and minimum operating reserves could theoretically vary from a 17000 MW surplus to a 17000 MW deficit.
>
> We see the significant uncertainty in the future supply of electricity continuing for several reasons.
>
> a. In recent months, credit ratings of power suppliers have faltered and plant cancellations or postponements have become common.
> b. Private, essentially unregulated, generating companies can build or fail to build plants as they choose based solely on whether it fits their financial balance sheet. As a result, plants rise or fall with the price of electricity.
> c. Generating companies also have the legal right to sell power from their California plants out of state.
> d. Generators may spend as little as they wish on maintenance.
> e. Suppliers have no responsibility to have any reserves at all. It is, at present, not their responsibility to "keep the lights on." Furthermore, the generating companies know perhaps better than we that keeping us on short rations mean higher prices for them, while a surplus means lower prices and lower profits for them.
>
> Forecasting the demand for electricity in the future has also become very difficult:
>
> a. The surge in conservation by Californians continues to reduce consumption below historic levels. Energy consumption, even in the winter, is running up to 5% below a year ago. However, the degree to which conservation will continue into the future is uncertain.
> b. In addition, the long-term effects of the recent increase in electric rates have yet to be quantified.
> c. Energy saving technologies are better known, are affordable, and will continue to be acquired by consumers as appliances and equipment are replaced.

In the new market structure, with no one responsible for capacity assurance, and after the market meltdown, with the prospect of continuing sky-high prices and inflated returns, power plant expansions were announced with great fanfare. The CEC informed us that some 30,000 MW of new natural gas-fired plants were in the permitting and construction pipeline. And indeed some 3,000 MW were added in 2001.

Since later 2001, power plant additions and constructions projects are being canceled and delayed with alarming regularity. It is now doubtful that any of the planned generating company projects, except those nearly completed, will be built unless they have a guaranteed market - namely a long-term contract with the DWR (or in the future with the distribution utilities). The 30,000 MW may suddenly become 3,000 or at most 6,000 MW.

Appendix C: Marin Energy Use Data

2000 Residential Energy Use

Jurisdiction	Customer Count	Natural Gas 1,000 Therms	Electricity 1,000 Kwh	Percent Natural Gas	Percent Electricity	Percent of Customers	Natural Gas by Customers	Electricity by Customers
Belvedere	1,068	1,065	9,123	1.7%	1.4%	1.0%	997	8,542
Corte Madera	4,120	2,481	22,709	4.1%	3.5%	4.0%	602	5,512
Fairfax	3,867	2,315	20,937	3.8%	3.2%	3.8%	599	5,414
Larkspur	6,185	3,189	33,555	5.2%	5.1%	6.0%	516	5,425
Mill Valley	13,009	8,570	80,620	14.1%	12.3%	12.6%	659	6,197
Novato	21,293	12,582	140,320	20.7%	21.5%	20.7%	591	6,590
Ross	873	1,148	10,835	1.9%	1.7%	0.8%	1,315	12,411
San Anselmo	6,291	4,301	40,143	7.1%	6.1%	6.1%	684	6,381
San Rafael	27,796	16,185	161,825	26.6%	24.7%	27.0%	582	5,822
Sausalito	6,075	2,931	30,849	4.8%	4.7%	5.9%	482	5,078
Tiburon	4,938	3,608	35,740	5.9%	5.5%	4.8%	731	7,238
Unincorporated County	7,527	2,548	67,213	4.2%	10.3%	7.3%	339	8,930
County Total	103,042	60,922	653,869	100.0%	100.0%	100.0%	591	6,346

2000 Non-Residential Energy Use

Jurisdiction	Customer Count	Natural Gas 1,000 Therms	Electricity 1,000 Kwh	Percent Natural Gas	Percent Electricity	Percent of Customers
Belvedere	92	38	965	0.1%	0.1%	0.6%
Corte Madera	740	4,755	59,320	14.4%	7.4%	4.4%
Fairfax	399	331	10,925	1.0%	1.4%	2.4%
Larkspur	847	1,617	38,068	4.9%	4.8%	5.1%
Mill Valley	1389	1,461	50,962	4.4%	6.4%	8.3%
Novato	3522	4,239	173,602	12.8%	21.7%	21.2%
Ross	126	134	2,159	0.4%	0.3%	0.8%
San Anselmo	711	806	19,377	2.4%	2.4%	4.3%
San Rafael	5961	9,771	307,828	29.6%	38.4%	35.8%
Sausalito	1306	1,160	45,003	3.5%	5.6%	7.8%
Tiburon	514	497	14,662	1.5%	1.8%	3.1%
San Quentin	11	6,591	12,896	20.0%	1.6%	0.1%
Unincorporated County	1027	1,596	65,568	4.8%	8.2%	6.2%
County Total	16645	32,998	801,333	100.0%	100.0%	100.0%

2000 Total Energy Use

Jurisdiction	Customer Count	Natural Gas 1,000 Therms	Electricity 1,000 Kwh	Percent Natural Gas	Percent Electricity	Percent of Customers
Belvedere	1,160	1,103	10,088	1.2%	0.7%	1.0%
Corte Madera	4,860	7,235	82,029	7.7%	5.6%	4.1%
Fairfax	4,266	2,646	31,862	2.8%	2.2%	3.6%
Larkspur	7,032	4,806	71,623	5.1%	4.9%	5.9%
Mill Valley	14,398	10,031	131,581	10.7%	9.0%	12.0%
Novato	24,815	16,822	313,921	17.9%	21.6%	20.7%
Ross	999	1,281	12,994	1.4%	0.9%	0.8%
San Anselmo	7,002	5,107	59,520	5.4%	4.1%	5.9%
San Rafael	33,757	25,956	469,653	27.6%	32.3%	28.2%
Sausalito	7,381	4,091	75,851	4.4%	5.2%	6.2%
Tiburon	5,452	4,105	50,402	4.4%	3.5%	4.6%
San Quentin	11	6,591	12,896	7.0%	0.9%	0.0%
Unincorporated County	8,554	4,144	132,781	4.4%	9.1%	7.1%
County Total	119,687	93,919	1,455,202	100.0%	100.0%	100.0%

Appendix D: Environmental Impacts from Fossil Fuels

Table I. Environmental Insults From Fossil Fuels

	All Fuels	Natural Gas	Oil	Coal
Exploration/Harvesting	CO_2 , CH_4 , N_2O NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution	drilling accidents, drilling sludge disposal	drilling accidents, SO_2, drilling sludge disposal	mining injuries, land degradation, SO_2
Processing/Refining	CO_2 , CH_4 , N_2O, NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution	refinery accidents, refinery waste disposal	SO_2, refinery accidents, refinery waste disposal	SO_2
Transport/Distribution	CO_2, CH_4 , N_2O, NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution	pipeline accidents, LNG explosions	pipeline and tanker accidents, oil spills, SO_2	train accidents, SO_2
Conversion/Marketing/ End Use	CO_2 , CH_4 , N_2O, NOx , CO, ROG, HCs, particulates, trace metals, thermal pollution		ash disposal, SO_2	ash disposal, SO_2

ROG = Reactive Organic Gases, HC = hydrocarbons

Table II. Environmental Insults From Existing Nuclear Power, Hydroelectric, and Wind Generation

	Nuclear Power	Hydro-Electric	Wind
Exploration/Harvesting	mining accidents, radioactive tailing disposal, land degradation, indirect fossil fuel emissions (from fuel used in harvesting)	N/A	
Processing/Refining	processing accidents, indirect fossil fuel emissions	N/A	
Transport/Distribution	truck accidents, risk of proliferation, indirect fossil fuel emissions	N/A	
Conversion/ Marketing/ End Use	Risk of catastrophic accidents, creation of low and high level radioactive wastes	may inhibit fish migration	may kill birds; noise pollution
Decommissioning	disposal of low and high level radioactive wastes[31], indirect fossil fuel emissions	concrete disposal	

31 All U.S. nuclear reactors are charged an annual fee to cover decommissioning and disposal of radioactive wastes. However, neither a disposal site or disposal method has yet been chosen, and no large reactor has ever been decommissioned. It is therefore unknown if the actual costs will correspond to the value of this fee.