# Fossil Free by 2033?

A Vision for Marin's Communities, Environment and Economy November, 2006



**County of Marin** Community Development Agency Sustainability Team

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The "Fossil Free by '33" name, and some of the contents herein, is borrowed with permission from the Community Environmental Council (CEC) program that focuses on Santa Barbara County. More information on CEC's program can be found at <a href="http://www.fossilfreeby33.org">www.fossilfreeby33.org</a>.

# Why Fossil Free by 2033?

Turn on the nightly news and chances are that one of the top stories will be related to regional and national dependence on fossil fuels. On the surface the story may be about national security, or melting glaciers and ice caps, or rising gas prices, or unusual weather conditions. A closer look shows the harmful results of a century of fossil fuel use impacting everyday realities throughout the world, including Marin County. Regional news stories about coastal erosion, urban sprawl, and off-shore oil drilling are all rooted in our dependence on fossil fuels.

In keeping with the draft Marin Countywide Plan update's theme of "planning sustainable communities" Marin County Supervisor Charles McGlashan posed the question: could Marin be fossil free, in 2033? And the answer is that notwithstanding the obvious, formidable economic, regulatory and political challenges which make achieving such an aggressive and visionary target a real long shot – it is theoretically possible. While there are many opportunities to make progress toward the fossil-free by 2033 vision, it is unlikely that the goal will be met in full although Marin could become "carbon-neutral" through the use of renewable resources and the purchase of "green tags" or other offsets for energy, gas and vehicle fuel use.

Fortunately, technologies already exist or are quickly being developed that could put us on a smarter energy path today. Marin County believes that the solution must come locally, setting the tone for others around the nation. Our ambitious vision is to lead Marin County down the path toward fossil fuel independence by the year 2033 — just a generation from now.

The vision is daunting, but the County can actually work towards achieving such a target with the support of its residents. This report outlines seven steps that could be taken to work towards reaching the target. While this report is not intended to be a definitive plan, it is meant to set our sights high, stimulate actions, and guide our communities towards energy independence.

Scientific research and a careful look at recent trends shows what we can expect our future to look like without an aggressive change of course.



"Our own energy policy has tied our hands."

-Richard Haass, former director of policy planning at the State Department under President George W. Bush



"Scientists increasingly believe soot to be the most dangerous air pollutant, blaming it for 64,000 deaths per year in the U.S., which is almost twice the number of deaths due to auto crashes."

> -American Lung Association

# **Human Health Impacts of Fossil Fuels**

**Respiratory problems.** When exhaust from our cars and trucks is released into the air and interacts with sunlight, it creates ground level ozone — a respiratory irritant that can cause shortness of breath, wheezing, and coughing. Although these symptoms usually disappear once indoors or when the air quality improves, they can cause continued problems for those who are more sensitive — such as children, the elderly, and people with asthma, emphysema, or heart disease. What's more, burning gasoline and diesel creates particulate matter that has been identified, as the number one airborne carcinogen in California. It has also been associated with heart and respiratory problems among normally healthy people.<sup>1</sup> In 2000, the California Air Resources Board (CARB) estimated that diesel particulate matter was responsible for 70 percent of the state's risk of cancer from airborne toxics.<sup>2</sup>

**Heat-related deaths and illness.** According to the U.N. World Meteorological Organization, each of the 10 hottest years on record has occurred since 1990.<sup>3</sup> Many scientists expect this trend to continue if carbon dioxide and other heat-trapping gases continue to collect in the atmosphere faster than plants and oceans can absorb them. In California, average summer temperatures are expected to rise 2 to 5.5 degrees Fahrenheit by the 2030s.<sup>4</sup> Heat waves are expected to grow more frequent and more intense — even in cooler coastal climates. Those who will be at greatest risk for heat stroke and dehydration include children, the elderly, and those who cannot afford to protect themselves.

**Spread of disease.** Insects breed faster and feed more in warmer temperatures, bringing insect-borne diseases with them as they expand their territories. Cases of West Nile virus were first reported in Marin County in 2004.<sup>5</sup> Other insect-borne diseases such as malaria and dengue fever may also spread.

**Drought.** Worldwide, regions suffering from serious drought more than doubled in area from the early 1970s to the early 2000s, with much of the change attributed to global warming, according to the National Center for Atmospheric Research.<sup>6</sup> In California, short-term weather patterns notwithstanding, changes in rain patterns and diminishing snow packs are already being observed. An extended drought could have a devastating effect on food resources and drinking water supplies. In the event of two consecutive dry winters (50% of average rainfall) in Marin County, the Marin Municipal Water District predicts a "dire" water situation, and that a drought could bring conditions worse than those in 1976 and 1977, when the county almost went dry.<sup>7</sup>

# Environmental Impacts of Fossil Fuels

**Air pollution.** Car exhaust and sunshine combine to create smog, and California has plenty of each. What's worse, thermal inversions in many parts of the state trap the air and lead to a higher concentration of pollutants. While Marin County enjoys cleaner air than other parts of the state, our region still exceeds allowances for ozone pollution and particulate matter. According to the Environmental Protection Agency (EPA) National Emissions Trends Database, Marin County contributes 68,076 tons of carbon monoxide pollution and 12,588 tons of particulate matter annually. If we continue to rely on fossil fuels, we can expect an increase in car exhaust and emissions, leading to worsening air quality.

**Water pollution.** Oil spills and leaks are two of the water-related risks involved with fossil fuels; other risks are less visible. The United States Environmental Protection Agency (EPA) reported in its 2004 Oil Program Report only 14 out of 67 California oil facilities were in compliance with their pollution prevention requirements.<sup>8</sup>

**Climate change.** When burned, fossil fuels emit into the atmosphere large amounts of carbon dioxide and methane, the major "greenhouse gases." While scientists don't always agree on the details of the phenomenon, they overwhelmingly agree that we are witnessing rapid climate change due to human sources of greenhouse gas emissions. In the last century, temperatures have risen an average of one degree Fahrenheit in most parts of the world, and twice that in polar zones.<sup>9</sup> As these gases continue to accumulate, we may see more extreme weather conditions, including longer and more severe heat waves, hurricanes, mega storms, floods, and droughts.

**Loss of species.** Habitats change with changing climate. As sea levels rise and temperatures increase, changes are already occurring within ecosystems. Warmer oceans are killing coral reefs at an alarming rate, and glaciers are disappearing from the Andes to Alaska. Spring is arriving an average of 10 days earlier in some regions, and scientists are observing that certain species of fish, sea turtles, migratory birds, amphibians and butterflies are altering their reproductive and migratory patterns, or dying off altogether. Scientists also predict that if current trends continue, one of our most iconic Arctic species — polar bears — will become extinct within a few generations.<sup>10</sup>



"An ecological time-bomb is ticking away. World leaders need to recognize that climate change is the single most important long term issue that the planet faces."

-Stephen Byers, co-chair of a recent climate change task force with U.S. Republican Senator Olympia Snowe



"In our lifetime, we will have to deal with a peak in the supply of cheap oil."

-Economist Robert K. Kaufmann of Boston University

# Economic Impacts of Fossil Fuels

**National security.** About 60% of the nation's energy needs are met by fossil fuel imports — much of that from politically unstable regions in the Middle East.<sup>11</sup> Such dependency makes the American economy extremely vulnerable to unfriendly foreign governments, terrorists, blackmail or other disruptions in supply. In addition, protecting these resources requires military commitments that are expensive both financially and in terms of human life. Our nation's two biggest budget items are military expenditures, and interest payments on the national debt, which now stands at \$7.6 trillion. In less than a decade, our country has swung from enjoying a budget surplus to an annual \$424 billion deficit. Another concern: about one quarter of our trade deficit — which now exceeds \$600 billion a year — consists of oil imports.

**The end of cheap oil and gas.** The phrase "peak oil" refers to the point at which less than half of the economically recoverable oil remains in the ground, making it less and less cost-effective to extract. "Peak Oil" for U.S. reserves occurred in the early 1970's.<sup>12</sup> The International Energy Agency predicts that we will reach that point between 2010 and 2020 for standard sources of oil.<sup>13</sup> Others extend the timeframe to 2030 or later, but concede it would occur sooner if China and India continue their rapid growth. In any case, the debate about peak oil is no longer focused on "if," but "when."

**Economic whiplash.** We know from experience that when economies grow, oil demand historically grows with it. We also know that volatile oil prices are often linked to stock market volatility. As oil becomes more expensive and eventually unavailable, we can expect to see a strong effect on our economy and other economies around the world.

**Property loss & skyrocketing insurance claims.** According to U.N. environmental officials, 2004 was the most expensive year ever for the insurance industry in coping worldwide with hurricanes, typhoons, and other weather-related natural disasters.<sup>14</sup> Coastal communities have an added concern: sea levels are predicted to rise 1.5 to 3 feet over this century,<sup>15</sup> and the U.S. Geological Survey has pinpointed the San Francisco Bay area, including the entire Marin County coast, as one of the regions most at risk from rising sea levels in California.<sup>16</sup> Marin County residents can expect the combination of storms and rising sea levels to threaten homes, harbors, and roads.

# Seven Steps toward Fossil Fuel Independence

# Step #1: Efficiency & Conservation

Energy efficiency and conservation are the quickest, cheapest and cleanest ways to extend Marin County's energy supplies. Simply put, the best way to save energy is to avoid using a lot of it. Many components of conservation and efficiency are attractive because they can be applied *now* in dozens of everyday ways.

<u>Build smarter.</u> According to the U.S. Department of Energy, smarter buildings can use up to 25% less electricity.<sup>17</sup> Simple measures that could be applied to this region include: providing incentives to purchase more efficient appliances and home heating systems, and encouraging the use of "green building" techniques such as passive solar heating, more efficient windows, and better insulation. Buildings can even be designed to be "carbon neutral" meaning that they produce as much energy from renewable sources as they consume.

<u>Improve fuel efficiency.</u> Marin County residents and fleet managers can increase the efficiency of their vehicles up to 20%<sup>18</sup> without changing engine types or fuel types. Simple measures include: ensuring that vehicles are tuned up and tires are properly inflated, changing dirty air filters regularly, and using the correct grade of motor oil.

<u>Promote public transportation.</u> Marin County could conservatively reduce its transportation fuel needs 10% by encouraging alternatives to driving solo. Simple measures include: providing additional incentives to those who carpool and vanpool; increasing the use of public transportation; and expanding programs for car-sharing and flexible work schedules. These strategies will also help address the region's increasing traffic problems.

# **Existing Model Programs:**

<u>Marin Energy Watch Partnership.</u> The Community Development Agency's (CDA) Marin Energy Management Team has been providing energy efficiency services to smaller local governments and school districts since 2003. Examples of services provided include technical assistance, auditing, education and leveraging of existing energy efficiency programs. The program's success in meeting or exceeding almost all goals contributed to CDA's selection as one of PG&E's 18 local government energy partnerships. The partnership will now allow the program to expand its services to include Marin's residential and commercial sectors.

There are several programs that will now operate under the Partnership to offer a range of services to residents, businesses and public agencies. On the commercial and municipal side:



"A sound national energy policy should encourage a clean and diverse portfolio of domestic energy supplies. Renewable energy can help provide for our future needs by harnessing abundant, naturally occurring sources of energy, such as the sun, the wind, geothermal heat, and biomass."

-White House National Energy Policy: Report of National Energy Policy Development Group, President George W. Bush

- 1. The Marin Energy Management Team will continue its success by offering services to special districts, local governments and school districts. The Team will also be able to offer incentives and direct installs for energy saving equipment whereas before they were only allowed to provide technical assistance.
- 2. Some of these direct installs for energy saving equipment will be provided by the Small Business Energy Alliance (SBEA). The program will continue to provide services including free audits, lighting upgrades and HVAC tune-ups. The SBEA will also coordinate with the County's green business program to provide these services to our business community.

On the residential side, two programs will provide assistance and resources.

- 1. The Energy CheckUp program will work with real estate and home inspection professionals to provide energy efficiency audits and resources at the residential time of sale.
- 2. The CA Youth Energy Services Program will provide training and employment to local youth in designated areas. The students become energy specialists who perform energy and water conservation audits and install energy and water efficient hardware for residents in their community.

<u>Green Building Program.</u> CDA's Green Building Program exists to enhance energy efficiency and conservation in residential, commercial, and community facilities by providing free technical assistance. Accomplishments include the addition of a green-points checklist that is now required for all permit applicants, the Single Family Dwelling Energy Efficiency Ordinance aimed to reduce energy use in homes over 3,500 square feet, and the Construction & Demolition ordinance requiring all remodel or demolition projects to recycle or reuse at least 50% of construction material.

To supplement green building efforts, numerous trainings have been coordinated for County staff, energy consultants, building professionals and the public on green building techniques.

# Future Programs:

CDA is in the process of updating the general plan, titled the Countywide Plan. The update is based on guiding principles of sustainability and offers programs and targets for continuing the transition away from fossil fuel dependence in Marin County. The seven steps outlined in this report can be directly linked to programs included in the Countywide Plan. The list below shows how step 1: Efficiency & Conservation, can be promoted via specific programs identified in the Countywide Plan.

1. Programs to Establish a Permanent Sustainable Energy Planning Process, Adopt Energy Efficiency Standards for New and Remodeled Buildings, and Explore Energy Efficiency Standards for Existing Buildings will reduce total and per-capita non-renewable energy waste and peak electricity demand (EN-1.a; EN-1.b; EN-1.d).

- 2. The growth of renewable energy resources will be promoted by Marin's programs to *Provide Incentives for Alternative Energy Production* and *Use Renewable Energy in County Facilities* (EN-2.e; EN-2.f).
- 3. Programs that require *Green Building Practices for Residential and Non-Residential Development* will increasingly require sustainable resource use and construction with non-toxic materials (EN-3.a; EN-3.b).
- 4. Since pumping and treating water for Marin County is very energy intensive, programs that *Support and Integrate Water Conservation Efforts* and *Minimize the Demand for Water in New Development* can result in large energy savings (PFS-2.a; PFS-2.b).
- 5. Programs to *Increase Bus Service* and *Provide Reduced-Cost Transit Passes* can provide more efficient, affordable public transportation service (TR-3.a; TR-3.b).

Amount of Marin County energy needs that could be met by 2033 through conservation & efficiency: 4.7 million mega watt hours (MWh)

# Step #2: Solar

Unlike many other technologies that require a lot of infrastructure and planning, solar panels can be installed immediately and are becoming more affordable; the average payback period for residential systems is now eight to ten years and even fewer for most commercial systems. Financing an installation can result in an immediate net savings, since the debt obligation can be lower than the electricity bill that the new system displaces.

There are a variety of strategies that can be utilized in Marin to assist with launching and financing widespread solar installations countywide. In many cases it may be useful to integrate solar with other renewable technologies and with energy efficiency measures to maximize cost effectiveness.

Strategies include:

- Entering into public-private business relationships with one or more third party investment firms. The firm could provide building owners with a lease/purchase option to finance and install solar on their building.
- Exploring the use of municipal bonds to cover gaps and enhance financial feasibility of commercial, residential and municipal solar installations.
- Soliciting prospective hardware suppliers, installers, and local financial institutions to participate in aggressive solar deployment.
- Entering into long-term agreements with hardware suppliers and qualified contractors to streamline the solar installation process for commercial, residential and municipal facilities.



"The sun is our greatest energy source: powerful, lasting, reliable, and available all over the world. Every hour, the sunlight that reaches the earth is greater than the amount of energy used by every person on the planet in an entire year."

-California Solar Center

<u>Convert rooftops to solar panels.</u> Between available roof space and other unused acreage, Marin County could produce 35% of its electricity needs — and more if we follow the lead of nations like Germany and Spain, which have recently installed large-scale PV facilities with the help of favorable renewable energy laws.

<u>Use the sun to heat water</u>. About 25% of the average residential energy needs are spent heating water for indoor uses, as well as pools and hot tubs.20 Solar thermal technologies — which typically pay off in two to three years — could meet a significant portion of these needs.

## **Existing Model Programs:**

Marin Solar Program. The Marin County Solar Program was developed by CDA to provide free technical assistance for residential. commercial public and solar installations through grant funding provided by the U.S. Department of Energy (DOE) Million Solar Roof, and to provide education and outreach opportunities that promote solar energy throughout the County.

A solar rebate program was also launched through CDA's Solar Program in



July 2005. The rebate rewards residents and businesses of unincorporated Marin County for their installation of photovoltaic systems, solar hot water heaters or solar pool heaters.

<u>County PV System.</u> On March 3, 2003 the County Department of Public Works celebrated the completion of its first large-scale photovoltaic system. The system was installed on top of the County's General Services Building and is capable of producing up to 89 kilowatts, enough to power up to 30 homes. During sunny days, the County's solar electric power system can produce more electricity than the garage complex consumes, allowing the county to receive a credit for electricity it sends back into the power grid.

## Future Programs:

The list below shows how step 2, Solar Energy, can be promoted via specific programs in the Countywide Plan.

- 1. A program to *Provide Incentives for Alternative Energy Production* can continue to provide and secure tax exemptions, tax rebates, or other financial incentives for solar systems (EN-2.e).
- 2. An effort to increase the Use of Renewable Energy in County Facilities will utilize local renewable energy resources and shift imported energy to renewable resources such as solar energy (EN-2.f).
- 3. A program to *Protect Solar Access* will continue requiring the protection of passive or active solar design elements and systems from wintertime shading by neighboring structures and trees (EN-2.c).

Amount of Marin County energy needs that could be met by 2033 through solar energy: 922,000 (MWh)

# Step #3: Wind

Wind power is the most cost-competitive renewable energy technology today, with some utility scale wind farms in the U.S. producing energy at costs lower than fossil fuel power plants.18

In Marin County, there is the potential for approximately 2 MW of wind power capacity. Even if these wind power plants generated at full capacity only 25% of the time, this would produce enough power for 1,500 homes. The problem of intermittent supply could be solved by connecting wind generators with other technologies, such as solar, wave energy facilities, or facilities that convert energy to hydrogen. The city of Vancouver celebrates wind power with a large turbine in its downtown center and residential and commercial rooftop systems have overtaken the market in England with great success.

As with all technologies highlighted in this document, wind installations must be utilized in a manner that is consistent with our regions' strong environmental ethic. For example, bird collisions can be mitigated by using newly developed turbine designs and by placing the installations outside of migratory routes or nesting habitat.

## Existing Model Programs:

<u>Wind Code Development.</u> Issues relating to the construction of both wind energy conversion systems (WECS) and small wind energy conversion systems (SWECS) are being addressed in a County ordinance update by CDA. The updated ordinance will address issues such as zoning designations, permitting requirements, turbine height, noise levels, and appropriate technology as well as visual and biological impacts. The goal of the code update is to standardize and streamline the proper issuance of building permits for small wind energy systems so that this clean, renewable energy resource can be utilized in a cost-effective and timely manner.



"Small wind systems can be an important component of a power system that's more affordable, secure, and sustainable."

-American Wind Energy Association (AWEA)



#### Future Programs:

Step 3, Wind Energy, can be promoted via specific programs in the Countywide Plan such as:

- 1. An effort to *Protect Renewable Resources* can evaluate the various constraints involved with developing wind energy projects and adopt measures to protect those resources, such as utility easement (EN-2.b).
- 2. A program to *Explore Renewable Energy Financing Options* can evaluate and implement local financing options such as low-interest loans for future wind systems in the County (EN-2.i).

Amount of Marin County energy needs that could be met by 2033 through wind energy: 4,500 (MWh)

# Step #4: Ocean Energy

As a county surrounded by water, it seems natural to turn our attention to the number of promising ocean energy devices being developed and tested, as long as these technologies are proved to be sensitive to surrounding marine habitats.

<u>Tidal Power.</u> Tidal In-Stream Energy Conversion (TISEC) turbines installed on the sea floor have the potential to generate as much as 1.5 MW each. Proper site planning along with a turbine that makes less then ten rotations per minute make TISEC devices one of the most environmentally friendly energy conversion systems to date.

#### Existing Model Program:

A Tidal Power study was recently conducted by Electric Power Research Institute (EPRI), an independent nonprofit center for electricity and environmental research. The study investigated the economic feasibility of harnessing tidal power that enters the bay through the Golden Gate Bridge. The study found that in total, the project could potentially bring 35.5 MW of power into the bay area, or 11.8 MW into Marin County. <sup>19</sup> This would be enough power to supply 9,100 households within the County.

## Future Programs:

Step 4, Ocean Energy, can be promoted via specific programs in the Countywide Plan such as:

1. A program to *Map Local Renewable Energy Resources, Utility Systems and Demand Areas* can assist in locating and assessing local ocean energy resources (EN-2.a).



"The tides at the Golden Gate Bridge make that spot the best in the entire lower 48 states to produce tidal power."

-Electric Power Research Institute (EPRI) 2. An effort to *Protect Renewable Resources* will identify possible sites for production as well as potential environmental, economic and other constraints involved with using wave and tidal power (EN-2.b).

Amount of Marin County energy needs that could be met by 2033 through ocean energy: 58,500 (MWh)

# Step #5: Hybrids, Hydrogen & Biofuels

More than half of the energy needed in Marin County is used for our cars, trucks, buses and other transportation modes. We cannot envision a fossil-free future without changing the design of our vehicles and the fuels we put in them. For example:

<u>Hybrid vehicles.</u> Already becoming commonplace on our roads, today's hybrids run on gasoline and generate electricity in the process — allowing them to get about 35 to 70 miles per gallon. Future hybrids will be even more fuel efficient than their predecessors. If this region encouraged a large-scale increase in hybrid vehicle ownership, we could decrease our transportation fuel needs by at least 10%.

<u>Hydrogen and hydrogen fuel cells.</u> Pure hydrogen does not occur naturally and is not a direct fuel source because it must be derived from some other substance, such as natural gas — or more preferably, water. Once the hydrogen is created, fuel cells are one way to convert it to electricity safely and cleanly. Last year, Governor Arnold Schwarzenegger announced his plan to establish a network that provides every Californian with access to hydrogen fuel along the State's major highways, with a significant and increasing percentage of that hydrogen produced from clean, renewable sources. Our region could be part of this vision by creating large-scale wind, solar, and ocean energy facilities that convert water to hydrogen and oxygen.

<u>Biofuels.</u> As the name suggests, these fuels are made from living materials — usually soybeans, corn, or even wood. The resulting fuels include biodiesel, ethanol, and methanol. Biodiesel can be used in vehicles that currently run on diesel with little or no alterations to the vehicle. Flexible Fuel Vehicles (FFVs) can use either gasoline or ethanol or methanol, and are becoming more common in the eastern U.S. and Midwest.

#### **Existing Model Programs:**

County Hybrids and Biodiesel. The Department of Public Works (DPW) operates and maintains a fleet that includes County vehicles as well as standby generators. In 2002, the Department began purchasing hybrid vehicles to add to the fleet when old vehicles were ready for replacement. Funding from the Bay Area Air Quality Management District (BAAQMD) has aided this effort by providing \$2,000 towards the purchase of each hybrid vehicle. By the end of 2005, the fleet included twenty hybrid vehicles consisting of six Toyota Prius' and fourteen Honda hybrids.



"I am going to encourage the building of a hydrogen highway to take us to the environmental future...I intend to show the world that economic growth and the environment can coexist."

-California Governor Arnold Schwarzenegger In 2004, a pilot program began to test biodiesel fuel for diesel vehicles in the County fleet. A fuel consisting of 20% biodiesel and 80% standard diesel (B20) was used for the first year of the pilot program. A 30% biodiesel (B30) fuel was tested as part of the pilot program, but due to problems, a 20% mix is now being used.

## Future Programs:

Step 5, Hybrids, Hydrogen & Biofuels, can be promoted via programs in the Countywide Plan such as:

- 1. A reduction in vehicle trips and emissions as well as improved vehicle efficiency can be achieved through programs to *Utilize Clean Air Technology* and *Consider Model Clean Vehicle Requirements* (AIR-3.b; AIR-3.c).
- 2. Programs to Support Green Fuels and Encourage Zero and Encourage Partial Zero and Low-Emission Vehicle Use will minimize environmental disruption and energy use related to transportation (TR-4.c; TR-4.d).

Amount of Marin County transportation energy needs that could be met by 2033 through hybrids, hydrogen & biofuels : 2 million (MWh)

# Step #6: Waste to Energy

Technologies that convert waste products to energy are rapidly growing in Europe and are beginning to take root in the U.S. Unlike the incinerators of the past, today's leading technologies convert waste to energy through technologically advanced techniques.

<u>Anaerobic digestion</u>. When properly collected, animal manure or human waste can produce useable bio-gas which can then be burned for energy in turbines or fuel cells. Additionally many of these systems are suitable for cogeneration, where waste heat from the turbines is captured and used for space heating, further reducing utility loads. Landfill waste also generates biogas. This energy generation source is becoming an increasingly popular avenue to generate power at local landfills.

## Lignocellulosic bio-mass

Bio-fuel production in the U.S. currently accounts for approximately 2.8 percent of transportation fuel. Today's bio-fuel technologies rely on starch and sugar based food crops such as corn and sugar cane as key input factors in the manufacturing process. Unfortunately, Marin lacks the potential to convert corn and sugar cane into low emission bio-fuels due to the limited availability of food crops.



"Marin County's Straus Family Creamery installed a methane digester in 2000, which has met or exceeded all expectations. The dairy uses the methane to power the plant, saving Straus \$6,000 dollars a month in energy bills.

> -California Energy Commission

Marin does possesses significant potential for the development of lignocelluosic biomass. Current research is focusing on emerging technologies that have the potential to use a much broader definition of lignocelluosic biomass materials such as wood waste, tree and yard trimmings. Lawrence Livermore Labs, UC Davis, UC Berkeley and NASA Ames are all actively participating in cutting edge research and development programs that are expected to produce commercially viable lignocelluosic fuel production technologies within 5 to 10 years.

#### Existing Model Program:

The only active waste disposal site serving Marin County is Redwood Landfill, located north of Novato. The Redwood Landfill captures methane at its facility, and prevents the methane from entering the atmosphere, where it would otherwise act as a greenhouse gas far more powerful than carbon dioxide. If the carbon dioxide emitted from burning methane is captured and sequestered, the cycle is completely clean.

The Environmental Protection Agency (EPA) estimates a 70-75% methane capture efficiency rate in Marin County.<sup>20</sup> Using this captured methane to produce energy could generate enough power for 4,600 homes.

## Future Programs:

Step 6, Waste to Energy, can be promoted via programs in the Countywide Plan such as:

Marin will require landfill methane recovery, and determine the potential to use methane recovery for use in energy production with a program to *Reduce Methane Emissions Released from Waste Disposal* (AIR-4.c)

Amount of Marin County energy needs that could be met by 2033 through waste to energy: 102,500 (MWh)

# Step #7: Renewable Energy Purchases

#### PG&E and Green Tags

Recent California law calls for 20 percent of the electricity from the state's investor owned utilities to be generated from renewable sources by 2017. Our remaining regional electricity needs not met via steps #1 through #6 would be met by the utility. The remaining 80 percent of utility provided electricity not generated by renewable sources could be off-set through the purchase of "green tags".

Green tags finance renewable energy generation in projects throughout the County. Under another scenario, the County may elect to form a joint powers authority (via CCA, described below, or some other arrangement) that could purchase and own energy generating facilities directly.



<u>Community Choice Aggregation (CCA).</u> The County is currently exploring the creation of a CCA. The CCA would give Marin residents and businesses the power to choose cost-effective renewable resources of energy over fossil fuel resources and maintain more control over the generation sources of electricity vital to sustaining our local economy. A CCA in Marin would likely incorporate many of the components of this report and make their implementation simpler to achieve. The CCA could also purchase power from renewable sources outside of the County.

A CCA has the potential to help create long-term price stability, promote locally-owned clean distributed energy generation, increase jobs and keep our energy dollars in the community. It can also help us reduce our greenhouse gas emissions and take responsible pragmatic actions toward becoming a sustainable community.

#### Future Programs:

Step 7, Renewables Generated by Utilities, can be promoted via programs in the Countywide Plan such as:

An effort to *Explore Community Choice Aggregation* can accelerate the use of renewable energy resources if it proves to be a cost-effective and low risk strategy (EN-2.g).

Amount of Marin County energy needs that could be met by 2033 through renewable energy purchases: 4,200,000 (MWh)

# **How Can Results Be Achieved?**

There are various programs in place that will help the County decrease its use of fossil fuels. In 1999, the Marin County Board of Supervisors approved a set of sustainability recommendations that committed the County to undertake actions such as using sustainability as the foundation of the Countywide Plan update, setting goals to reduce its greenhouse gas emissions and improving internal County operations.

In 2002, the Marin County Board of Supervisors signed a resolution to join the Cities for Climate Protection Campaign (CCP). The campaign is administered under the International Council for Local Environmental Initiatives (ICLEI) and attempts to reduce international greenhouse gas emissions through actions by local governments.

CCP calls on municipalities to analyze their greenhouse gas emission levels and set a reduction target before developing and implementing a local action plan. Currently, Marin County is developing a comprehensive local action plan that describes policies, programs and measures that Marin will implement in order to meet its target.

In the spring of 2006 the Marin Board of Supervisors signed the Urban Environmental Accords, joining more than 70 other local governments from around the world in working towards goals for sustainability.

Sustainable practices have also been incorporated within Marin County's internal operations in a variety of ways. The County of Marin Operations Report, released in April 2006, lists specific actions that have lowered energy consumption, reduced waste, reduced pesticide use, led to the recycling of numerous products, diversified the workforce and increased affordable housing in the county. Potential opportunities to expand existing programs were also identified. By applying the principles of sustainability to all operations, County agencies share common goals while also individually determining the best methods to achieve sustainability within the context of their own operations.

As mentioned previously, Marin County's draft Countywide Plan (CWP) update adopts sustainability as the guiding principle and offers programs and targets that provide a solid foundation for continuing the transition towards sustainable growth in Marin County. The seven steps outlined in this report have been directly linked to implementation programs included in the Countywide Plan. The plan is scheduled to be complete and adopted in 2007. Implementation of programs and progress toward targets will be tracked and reported on at regular intervals.

To make significant progress toward reaching the 'fossil free' or carbon-neutral vision, an investment in local renewable technologies would likely need to combine with larger power purchase strategies such as CCA and the purchase of 'green tags' or similar offsets. As technologies develop, however, new opportunities could open up that are not anticipated today. Fortunately, there are many opportunities available now, along with model programs already in place to help Marin work towards reaching the vision.



I Ne Wath Marin County Energy Needo by 2022			
Marin		gy Needs by 2003. million MM/h Electricity	
	2	million MAVIn Electricity	
+	1	million MWVN Transportation Fuels	
+	3	million MWh Natural Gas	
=	12	million MWh needed by 2033	
Sources of Conservation and Renewable Energy by 2033:			
	4,700,000	MWh Efficiency & Conservation	
+	4,500	MWh Wind	
+	922,000	MWh Solar	
+	58,500	MWh Ocean Energy	
+	2,000,000	MWh Hybrids, Hydrogen & Biofuels	
+	102,500	MWh Waste to Energy	
+	4,223,106	MWh Renewable Energy Purchases	
=	12,000,000	MWh possible by 2033	
) simp	All of Marin Cou olicity of working	inty's energy needs have been converted to megawatt hours (MWh) for the g with a common unit. For example, a gallon of gasoline is equal to 0.036 MWh and a cubic foot of natural gas is equal to 0.029 MWh.	

# References

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<sup>2</sup> California Air Resources Board

<sup>3</sup> <u>http://www.meteo.bg/reports/reports/wmo/PR.718 E.pdf</u>

<sup>4</sup> Union of Concerned Scientists, *Climate Change in California: Choosing Our Future* (2004)

<sup>5</sup> County of Marin Agriculture and Open Space Preservation <u>http://www.co.marin.ca.us/depts/BS/main/sups/sdistr5/agriculture.cfm</u>

<sup>6</sup> <u>http://www.ucar.edu/news/releases/2005/drought\_research.shtml</u>

<sup>7</sup> Marin Municipal Water District, www.co.marin.ca.us/depts/GJ/Main/cvgrjr/2004gj/Water Anywhere.pdf

<sup>8</sup> United States Environmental Protection Agency <u>http://www.epa.gov/region09/waste/sfund/oilpp/oilprogreport-fy04.pdf</u>

<sup>9</sup> Intergovernmental Panel on Climate Change (IPCC), *Third Assessment Report,* (2001)

<sup>10</sup> Arctic Climate Impact Assessment

<sup>11</sup> U.S. Department of Energy Information Administration, *Energy Outlook*, (2005)

<sup>12</sup> The Association for the Study of Peak Oil (ASPO) <u>http://www.peakoil.ie/downloads/newsletters/newsletter23\_200211.pdf</u>

<sup>13</sup> International Energy Agency, World Energy Outlook, (1998)

<sup>14</sup> United Nations Environment Programme press release, (December 15, 2004)

<sup>15</sup> Intergovernmental Panel on Climate Change (IPCC), *Third Assessment Report,* (2001)

<sup>16</sup> U.S. Geological Survey, http://pubs.usgs.gov/of/of00-178/pages/res.html

<sup>17</sup> U.S. Department of Energy Efficiency and Renewable Energy Office, www.rebuild.org/index.asp

<sup>18</sup> U.S. Department of Energy and Environmental Protection Agency, www.fueleconomy.gov/feg/maintain.shtml

<sup>19</sup> Electric Power Research Institute (EPRI)

<sup>20</sup> U.S. EPA, <u>http://www.epa.gov/climateleaders/docs/protocol-solid\_waste\_landfill.pdf</u>