What Can You Do to Promote Alternatives?

According to the studies of governments, universities and other organizations in the United States, Europe and Japan, it is technically and economically feasible for a diverse mix of renewable technologies to completely meet U.S. electricity needs over the coming decades. With climate change occurring at a faster rate than previously predicted and the continued pollution of our water and air, everyone needs to act if things are going to change. You personally *can* make a difference. There are many actions at the individual, local, and state level that you can take to bring about the sustainable future we know is possible.

Starting Small

Many investments that make a big difference in energy consumption can be done at home without much time or expense. According to a 1993 federal government estimate, the U.S. could reduce its electricity use 20-45% by adopting available efficiency technologies.[1] Some examples are:

- Replace regular light bulbs with compact fluorescent bulbs, which cost only a few dollars more, but use 60% less electricity and last 10 times as long.
- Buy energy-efficient appliances, such as ENERGY STAR refrigerators and washers, which use 40-50% less electricity than models manufactured before 1993.[2]
- Weatherize your home or apartment by sealing air leaks around windows, doors, electrical wiring, and plumbing (which can be done inexpensively by weatherstripping and caulking) and increase home insulation. These measures reduce energy used for heating and cooling.
- Install an insulating blanket around hot water tanks and pipes, which can reduce heat loss from the system by 25-45%. Even better, install an on-demand tankless water heater (which heats water immediately and eliminates all standby heat losses), a solar water heater, or a combination of both.

Generating Your Own Renewable Power

Other larger projects can also be done individually, locally, and at the state level. One of the most effective changes that you can make is to install a renewable energy system, such as solar photovoltaic panels, a geothermal heat pump, and/or a small wind turbine, on your house, apartment building, or office. An average household in the U.S. – with electric appliances except for the furnace – consumes about 50kWh/day. The goal is to generate as much of your electricity as reasonably possible (typically 60-100%) from these clean, renewable sources. To install a renewable system, it is first necessary to figure out what technology is best and how to finance it.

Technologies

Photovoltaics (PV)

Several types of photovoltaic panels are presently available. The most efficient of the conventional panels are monocrystalline and polycrystalline silicon. These panels have efficiencies ranging from 12-18%, and use silicon in thick sheets. A typical panel is 150-200 watts (W), 3 ft x 5 ft in dimension, and can generate an around 1 kilowatt hour (kWh) of electricity per day, depending on location.[3] While highly reliable and widely available, the manufacturing time and cost of these thick silicon panels causes them to be more expensive and less flexible than newer alternatives. They are, however, a good investment and one of the most immediate technologies you can install to have a significant impact.

40 KW Solar photovoltaic system on a commercial building in Pittsburgh, PA, Installation and photo by Mountain Solar, Grass Valley, CA.

For more information on these types of panels, see http://www.eere.energy.gov/RE/solar_photovoltaics.html. For a

listing and pricing of available panels, see http://www.affordable-solar.com/solar.panels.htm.

While conventional panels are the easiest to obtain today, much research has been done on "thin film" panels in the last several decades. Recently, a thin film non-silicon panel with 15% efficiency was developed and its production was demonstrated at a pilot-scale plant in South Africa.[4] A manufacturing facility in Germany is set to start producing these panels on a large scale this year. These panels are likely to be the most suitable for residential installations in the future because they use a fraction of the material of conventional panels, cost less, and can be used in more ways. They are expected to be commercially available soon, but the initial manufacturing capacity is unlikely to be able to meet demand. Investment in large-scale facilities and refinement of the panel manufacture process is needed.

Geothermal Heat Pumps

Geothermal heat pumps are systems that use the relatively constant temperature of the earth to heat and cool buildings, reducing the energy typically used for these purposes. These pumps can be used almost anywhere across the U.S., and can reduce a building's energy use by 30-60%. There are two principle types of geothermal heat pump systems – a vertical loop design and horizontal loop design. The vertical loop system is only a few feet wide, but extends deep into the ground (350 ft is an average depth). The horizontal system only extends 12-18 ft. underground, but is significantly wider. The type and size of the system you need depends on your space requirements, local geology, and soil type. For more information on types of geothermal heat pumps, see http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12640.

Geothermal heat pump being installed near Canandaigua, New York. Photo by RadiantMax.

Small Wind Systems

Depending on the size of land on which your house or building sits, one or more small wind turbines could also add to onsite generation. The turbines range from 20W to 100kW, and are usually placed on a ground tower or building roof. Typically, small wind turbines are best suited for rural, suburban and small city areas, rather than large city centers. They can, however, also be used in some areas around large cities. A well-sited 10kW turbine, for instance, will generate on average of 72 kWh per day. For more information on small wind turbine options, see http://www.eere.energy.gov/windandhydro/windpoweringamerica/small_wind.asp and http://www.awea.org/faq/tutorial/wwt_smallwind.html

Financing

With no fuel cost, low maintenance costs, little or no environmental and public health impact, and the elimination of your monthly electricity bill, the principle costs of PV, geothermal, and wind are the capital costs and installation.

Costs

With the exception of large-scale wind at developments in favorable areas, renewable technologies are still somewhat more expensive than fossil fuel and existing nuclear power plants in terms of capital cost per kWh. These higher costs are a product of limited government support, continued small scale operation, and limited economic measures.

- Renewable technologies have received a fraction of the subsidies given to other energy sources over the last fifty years. From 1947 through 1999, direct U.S. federal government subsidies totaled $115.07 billion for nuclear power compared to $5.49 billion for wind and solar combined.[5]
- Recent advancements in thin film PV technology, improvements in manufacturing, and increased demand, will result in economies of scale, causing costs for wind and especially for PV to continue to fall.
- The full costs of conventional energy, such as coal and nuclear power, are presently not accounted for in their price (i.e. costs such as climate change, air and water pollution, coal and uranium mining, radioactive waste, risk of reactor accidents and nuclear weapons proliferation). Thus, the price of these conventional fuels today is unnaturally low, and is not a correct basis for decision-making

At present, a polysilicon PV system capable of meeting nearly all of a typical home's electricity needs (a 10 kW system, depending on latitude and system location) will cost between $45,000 and $55,000. When they can be purchased, a thin film system of equivalent capacity is expected to cost between $11,050 and $15,000. Retrofitting a conventional heating and cooling system to a geothermal heat pump system costs about $3,500. To install such a system without a conventional system already in place would start at $7,500. Small wind systems cost on average between $3,000-5,000 per kW. Therefore, a 5 kW turbine system will cost about $20,000.

Financial Incentives

The federal government, as well as many states and cities, have put in place incentives to assist people in purchasing solar, wind, and geothermal renewable energy systems. The incentives tend to be much better at the state and local level. The DSIRE database, funded by the U.S. Department of Energy and managed by the North Carolina Solar Center, is a good reference on state laws and financial incentives - http://www.dsireusa.org/.

There are several types of incentives. For example, a *state rebate program* covers a certain percentage of system cost, and refunds the money directly or as a tax deduction. State rebate programs range from the state of Maryland's small incentive program capped at $3,000 per system to California's Self-Generation Incentive and

Emerging Renewable Rebate programs, which finance up to a 100% of PV and small wind system costs. New Jersey's Clean Energy Rebate Program finances an average of 70% PV and wind system installation costs.

Another type of incentive is a *production rebate program*, which pays people a certain amount per kWh of clean energy generated. Wisconsin, for instance, has a solar buy back production incentive of 22.5¢/kWh. With a typical household system generating 30 kWh/day, this rebate would pay you over $200 per month.

A third type of incentive is *state subsidized loans programs*, which provide loans with no interest or at a low fixed 6% rate to individuals and businesses for renewable energy systems.

Finally, as you use less electricity from the grid, renewable installations reduce your electricity bill. Most states also have *net metering*, which allows the electricity that you produce but do not use to be sold back to your electric company, further reducing your bill Net metering will help you pay your system off over a period of time.

ESTABLISH AND STRENGTHEN STATEWIDE RENEWABLE PORTFOLIO STANDARDS (RPS)

In addition to what can be done individually, there is much that can be done at the local and state level. At present, twenty-two states and the District of Columbia in the U.S. have renewable portfolio standards (RPS) - laws mandating that a certain percentage of electricity consumption or generation come from renewable sources.[6] The standards tend to mandate an increase in renewable generation over a certain time, and range from a small 7.5% by 2019 in Maryland to 33% by 2025 in California. Because the true full costs of conventional energy sources are not included in their price per kWh, an RPS is not a special favor for renewable energy. Instead, it is to make up for these limited economic measures, and to put renewable technologies on an even playing field.

A few states like California are making substantial progress with their state RPS, but most states could do much more. Specifically, states that do not yet have a standard should pass one, and existing standards should be improved to be 25-35% by 2025, with only solar, wind, some geothermal and small-scale sustainable biomass as eligible technologies. Landfill gas, municipal waste, large-scale industrial biomass, and nuclear power should not be included in any state RPS. While advanced hydroelectric energy is a renewable resource, it should also not be included in any state RPS, as it is already well-established technology without that much growth potential. To be effective, an RPS must only support the cleanest and most underfunded technologies, and should include strong enforcement mechanisms. By expressing institutional support for the technologies, state RPS programs have had positive effects beyond what they actually require. In the state of Texas for instance, the small 2% RPS passed in 1999, spurred so much growth in wind development that the standard was tripled in 2005.

- For a map detailing current state RPS programs see http://www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt.
- For more information on the success of California's RPS, see http://www.cpuc.ca.gov/static/energy/electric/renewableenergy/index.htm.
- For more details on the problems with landfill gas, municipal waste, and large-scale biomass see: http://www.energyjustice.net/biomass/.
- For more details on the problems with nuclear power see: http://www.citizen.org/cmep/energy_enviro_nuclear/nuclear_power_plants/

Construction began on these wind turbines at King Mountain Wind Ranch in west central Texas soon after the state passed an RPS in March 1999. The turbines (279MW) began fully operating in December 2001 and provide energy for about 100,000 households a year. Photo by Texas Wind Power Company.

Intermittency and Variability

The issues of intermittency and variability that arise when more than 20% of a state's electricity comes from wind, solar, and some geothermal, can and will be addressed. A recent analysis by the International Energy Agency (IEA) - an intergovernmental body of 26 countries committed to advancing security of energy supply, economic growth, and environmental sustainability - concluded that *intermittency is not a technical barrier to renewable energy*.[7]

Presently, the best options for addressing intermittency are small-scale decentralized generation, links across geographic areas, a diverse mix of technologies harnessing different resources at different times, and the continued development of storage technologies. Significant advances have already been made. The first three recommended measures alone can allow non-hydro renewable technologies to well exceed 20% of generating capacity by 2020 without impacting grid reliability or stability. In the longer term, storage remains the most significant issue. Currently, the best options for storage are hydroelectric pumped water and compressed air. Hydroelectric pumped storage moves water from lower to higher reservoirs when extra electricity is being produced, and releases it when that energy is needed. These systems are well-established, low in cost, up to 80% efficient, and have an enormous capacity for storage. Also, because energy is stored in times of excess generation, pumped storage systems do not compete with hydro generation. Using advanced hydro technology, these systems can also have minimal environmental impact. Air compression systems work on a similar principle, compressing air and storing it in airtight underground caverns during times of less demand, and releasing it to run turbines when needed. These technologies have

undergone significant developments recently, being designed to store energy from wind farms. In the longer term, the development of extensive regional grids will increasingly stabilize geographically distributed generation, and the production of hydrogen will likely become an important energy storage mechanism.

DEMAND LOCAL GREENPOWER PROGRAMS

Greenpower programs can be an alternative or supplement to onsite generation and a state RPS. These programs - typically run by electric companies - offer electricity from larger local and regional renewable energy installations. For a Greenpower program to be effective and sustainable, it should offer its electricity primarily from regional wind or concentrated solar generation facilities. It is necessary to sign up for these programs if they are offered in your area. If they are not offering anything, that would be a goal to work towards. Some examples of successful Greenpower programs around the country are the Austin Energy GreenChoice Program (http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Choice/index.htm) and the TVA GreenSwitch Program (http://www.tva.gov/greenpowerswitch/), which works with utilities in Alabama, Georgia, Tennessee, Kentucky, Mississippi, and North Carolina.

Austin Energy receives electricity from 165 huge wind turbines located in West Texas for its Green Choice renewable energy program. 65 of these turbines are located at the Sweetwater installation in Nolan County, Texas, pictured above. Photo by Catamount Energy.

WAYS TO GET THERE

- *Install your own renewable energy generation* – solar, wind, or geothermal heat pumps – on your home or office.
- *Campaign to increase your state's financial incentives for renewable technologies*. To have significant impact, states should offer a rebate program of 30-60% of system cost, and low or no interest (state subsidized) loans. Demanding financial incentives for these technologies is asserting that the state government should account for the full societal costs of energy generation, and even the playing field by helping wind and solar.
- *Campaign to pass and/or strengthen your state RPS* to mandate that 25-35% of electricity come from solar, wind, and some geothermal and small-scale sustainable biomass (no large-scale industrial biomass, landfill gas, municipal waste, nuclear) by 2025
- *Campaign to pass city and county resolutions supporting renewable energy*, develop local financing programs, overhaul city buildings for efficiency, install municipal renewable generation, and enter into long-term contracts with renewable generators. For municipal investment in solar and wind, check out the revenue bond model used successfully in San Francisco, http://www.votesolar.org/sf.html.
- *Urge mayors and city councils to implement commitments they have made and advocate for changes at the state level.* In March 2005, 10 mayors announced the U.S. Mayors Climate Protection Agreement, whose goal is to meet or exceed the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol (7% reduction from 1990 levels by 2012). As of June 23, 2006, 250 mayors representing over 46.3 million Americans have signed on. Click here to see if your mayor is one of these, http://www.ci.seattle.wa.us/mayor/climate/quotes.htm#mayors
- *Campaign your electric company to offer a Greenpower program* based primarily on regional wind and concentrated solar power.
- *Campaign to increase investment in large-scale thin film solar panel manufacture*, http://www.nrel.gov/ncpv/pv_manufacturing/research_development.html
- *Start student campaigns for renewable onsite generation and green power purchase programs at universities* in your area. Students at over 20 universities across the Southeast have begun serious campaigns towards these goals, and many of them have already been successful. To see some of these campaigns, click here: http://www.cleanenergy.org/programs/programs.cfm?ID=39&parent=3&ps=Yes
- *Hold local weekly meetings, table at community events, schedule a teach-in on renewable technologies and climate change, network with local renewable system installers in your area, and/or form a local organization with a web presence*. Share information about the ability of renewable energy to meet our needs, its advantages over coal and nuclear power, the urgency of climate change, and the concrete actions that individuals can do.

For more information on how "Renewable Energy is Capable of Meeting Our Energy Needs" see http://www.citizen.org/documents/RenewableEnergy.pdf

For the documents referenced in this fact sheet, please see http://www.citizen.org/cmep/energy_enviro_nuclear/renewables/articles.cfm?ID=15456

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