



REDUCING GREENHOUSE GAS EMISSIONS: MUNICIPAL SOLUTIONS

FACT SHEET #4: RENEWABLE ENERGY



What is Climate Change?

Our global climate is always changing, but now the rate of change is accelerating much faster than ever before. The Earth's average temperature has increased by 1°F over the past 100 years. Although the change seems small, it has happened very quickly—a mere speck on the Earth's long lifetime. Rapid climate change can have major impacts on many aspects of the environment, such as water quality, agriculture, coastal erosion, and sea level.

Temperature changes naturally as a result of the Earth's CO₂ (carbon dioxide) cycle. Animals and other living things release CO₂ into the air, while other organisms, such as plankton, absorb CO₂ through the ocean. For millions of years, carbon dioxide and the other greenhouse gases (such as methane) were balanced by the Earth's delicate atmosphere. Since the Industrial Age, human activities, such as fossil fuel burning and de-forestation, have disturbed this balance. CO₂ emissions are now so high that they cannot be completely absorbed naturally. As a result, CO₂ is building up in the atmosphere and the Earth is warming (see figure below).

Evidence of climate change is all around us. Severe weather is becoming more common. Not only is the Earth's temperature rising, but the world's oceans are also rising. Signs of high sea levels and beach erosion become more obvious every year. These environmental impacts will become more serious as CO₂ continues to build up.

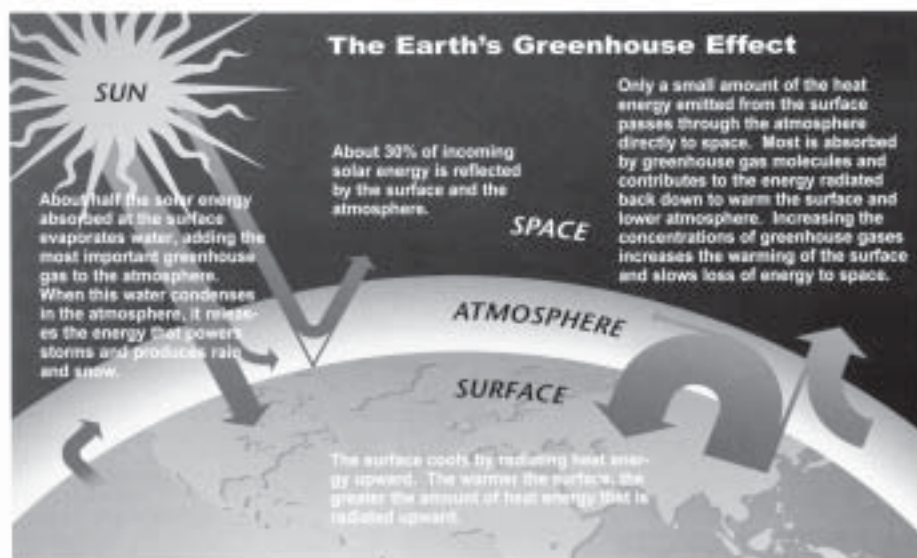
What We Can Do: Renewable Energy

There are many ways to deal with the challenge of climate change. Some programs work to reduce carbon emissions, while others help communities adapt to environmental changes. The Waquoit Bay National Estuarine Research Reserve has identified several priority measures that communities can implement in order to lower the amount of carbon emissions they produce. This fact sheet focuses on renewable energy.

What is Renewable Energy?

Energy consumption contributes directly to climate change by adding more than the natural amount of carbon-based molecules to the atmosphere. The U.S. is the world leader in energy consumption, but there are several ways to lower our use of energy. Renewable energy technologies are advantageous because their sources are either free (sun, wind, or water) or inexpensive (biomass) when compared to fossil fuel sources. Construction time for renewable energy projects can be much shorter than that of traditional power plants. Their capacities can be increased incrementally to better match load growth and they pollute much less than fossil fuels.

There are many technologies for harnessing renewable energy such as hydropower (water), wind turbines, photovoltaic cells (sun), and wood burning and landfill gas reclamation (biomass). These technologies can be applied to a wide range of municipal facilities such as buildings, wastewater treatment plants, and water pumping stations.



Case Study: Wind Power - Princeton, MA

In 1979, a citizen advisory committee in Princeton, Mass, charged the Princeton Municipal Light Department (PMLD) to investigate alternative sources of electricity, rather than purchasing power from the Seabrook Nuclear Power Plant. PMLD studied the potential for wind power in Princeton with help from many agencies, state and federal grants, and the advisory committee itself.



Source: *Solutions for Power*

For nearly four years, PMLD conducted surveys to locate potential wind farm sites, and to monitor wind resources at those sites. Research found that the average wind speed was 14.95 mph, and prevailing winds peaked during the winter months, coinciding with peak energy needs in the town.

In 1984, the citizens of Princeton voted to install eight wind generation machines on part of the Mt. Wachusett State Reservation, generating approximately 320 kW. The wind farm has been in operation for 18 years, saving over 5.8 million pounds of CO₂ emissions. In 1995, a survey showed that the majority of Princeton residents were satisfied with the wind power and were supportive of future investments. Currently, the PMLD is replacing the older, noisier turbines with larger, more energy-efficient models and planning to expand the generation capacity of the facility.

Over the past twenty years, wind electricity prices have dropped from an average of about 25 cents per kilowatt-hour in the United State to one or two cents per kilowatt-hour, making it very cost competitive now with traditional fossil fuel sources.

Case Study: Solar Power - Gardner, MA.

New England Electric System (NEES) began investigating photovoltaic (PV) power in the mid-1980's, in part because of their commitment to alternative energy exploration, and also to investigate how residentially-distributed power generation would affect their existing electric power system.

In 1985, this investigation took the form of a ten year project in Gardner, Mass. in which 30 homes were outfitted with south-facing 2 kW PV systems. The energy production from these systems was monitored from 1988 through 1992, thanks to the contributed funds of the Electric Power Research Institute (EPRI).

Each system was found to generate about 2200 kWh/yr, which at the cost of \$20,000 per system, equates to a generation cost of \$0.91/kWh. These costs are very high by conventional standards, but the focus of the study was to experiment with the technology and determine distribution system impacts, with the realization that costs will continue to fall in the future.

This project was highly successful for a number of reasons. First of all, the systems operated without problems, indicating that small PV generation units do not have a negative impact on the overall electric system. Secondly, because local roofers and electricians provided the labor for the project, Gardner's faltering economy was boosted and local tradesman sharpened their skills. And lastly, this project was a huge success because project participants were very supportive of the clean energy, and had no complaints about visual impacts. This community support in Gardner in turn has led to an increased awareness of the potential of PV in New England.

Sources:

Waquoit Bay National Estuarine Research Reserve, "Global Climate Change: What Communities Can Expect and What They Can Do", Science and Policy Bulletin Number 7, July 2001.

Department of Energy - <http://www.eren.dow.gov/power/profiles.htm#new>

Princeton Municipal Light District, personal communications with John Fitch, general manager