

## Renewable Energy: Getting it Right Ecologically and Economically

Americans are beginning to mobilize for the switch to clean energy in response to the twin problems of fossil fuel scarcity and climate change. In 2008, Massachusetts took the lead with the passage of the Green Communities Act, the Green Jobs Act, the Global Warming Solutions Act, and associated legislation. The landscape for renewable energy has changed in fundamental ways.

“Clean Energy” is the term used to encompass two major sources of power: energy savings through conservation and efficiency, and new power generation from renewable sources.

This year’s Mass Envirothon current issue asks teams to look at ways that the switch to clean energy, sometimes called “repowering,” can be accomplished in an ecologically and economically sound way in their own communities.

### THE CHALLENGE

***RePowering America:*** On July 17, 2008 Nobel Laureate Al Gore put forward an ambitious ten year “generational challenge” for the United States: to produce 100 percent of our electricity from energy sources with zero carbon emissions. See:

[http://www.wecansolveit.org/pages/al\\_gore\\_a\\_generational\\_challenge\\_to\\_repower\\_america/](http://www.wecansolveit.org/pages/al_gore_a_generational_challenge_to_repower_america/)

***An Inclusive Green Economy:*** Who will benefit from the economic changes that repowering America will bring? Green for All, an advocacy group for “a green economy strong enough to lift people out of poverty” claims that “the national effort to curb global warming and oil dependence can simultaneously create good jobs, safer streets and healthier communities.” See: <http://www.greenforall.org/about-us>

Can we repower our communities in the coming decade? What are the opportunities that make environmental and economic sense? What are the tools and resources available?

What would our communities look like in 2020 if we successfully repowered? Where would we get our power, how much would we use, and how would this change our community, ecologically and economically?

What are the first steps you would recommend to your community, to get the transition off to a fast and fair start?

To answer these questions, teams will need to do some research. This guide is divided into two main sections:

- I. General Background and Resources
- II. Questions for Community Investigations

This and other helpful resources (including information for the Mass Envirothon 2007 Current Issue: Conservation and Renewable Energy for Massachusetts Communities) are available online. See

<http://www.maenvirothon.org/currentissue.htm>

## I. General Background and Resources

### A. CHANGES IN THE MASSACHUSETTS ENERGY LANDSCAPE

In the summer of 2008, the Massachusetts legislature passed several new laws that set important goals and provided incentives for clean energy. These new laws put Massachusetts in the forefront of energy policy in the United States. A primary consideration for switching to clean energy is the cost, particularly in tough economic times. The new laws provide a variety of funding and financial incentives for communities to begin to repower, but many communities are not yet aware of these opportunities.

The *2008 Massachusetts Green Communities Act* offers practical tools to “Meet at least 25% of the Commonwealth’s electric load, including both capacity and energy, by the year 2020 with clean, demand side [energy] resources [and] . . . Meet at least 20% of the Commonwealth’s electric load by the year 2020 through new, renewable generation.” See summary at:

[http://www.clf.org/uploadedFiles/CLF%20Green%20Communities%20Summary\\_6-24-08FINAL.pdf](http://www.clf.org/uploadedFiles/CLF%20Green%20Communities%20Summary_6-24-08FINAL.pdf)

The *Massachusetts Green Jobs Act of 2008* offers funding and practical ways to accomplish this vision, including support for workforce development, university partnerships, research & development, and entrepreneurship in clean energy.

The *Global Warming Solutions Act of 2008* requires Massachusetts to cap its greenhouse gas emissions and provides funding for development of clean energy technologies and jobs.

### B. CONSERVATION AND EFFICIENCY

The least expensive source of clean energy is efficiency and conservation. Energy saved in one activity can be used as an energy source for another activity.

**Conservation.** The term <energy conservation> generally refers to changes in everyday practices and lifestyle. These changes seem simple, but can make a big difference in the transition to clean energy, at a very low cost. Mostly, they require an attitude and mindfulness. Turning off the lights when they aren’t needed can save more energy than a changing switching to cfl light bulbs but leaving them on when not needed. Arranging to carpool on a regular basis can save more energy than buying a hybrid vehicle and continuing to drive alone. Here is one list of conservation practices, with links to others: <http://www.nesea.org/buildings/info/elevthings.html>

The term <weatherization> is used to refer to simple do-it-yourself energy-saving practices like weatherstripping windows, installing storm doors, and sealing cracks. For an overview to these simple technologies, see [http://apps1.eere.energy.gov/weatherization/wx\\_technologies.cfm](http://apps1.eere.energy.gov/weatherization/wx_technologies.cfm)

Your own home can be a clean energy source! Try this government-sponsored interactive web site that walks you through a home energy survey: <http://hes.lbl.gov/>

**Efficiency.** The term <energy efficiency> is used to refer to technologies that help us use less energy. These technologies can be as simple as programmable thermostats and as complex as LEED certification.

**Green Building.** The buildings we live and work in represent a major use of energy -- for heating and cooling, light, ventilation, and power. Reducing energy use in buildings is a key part of the transition to clean energy. Green buildings are new or renovated buildings that employ, designs, technologies, and materials intended to reduce the environmental impact, including its energy use. For an introduction, see <http://www.masstech.org/cleanenergy/greenbuilding/overview.htm>  
<http://www.nesea.org/buildings/links.html>

The Leadership in Energy and Environmental Design (LEED) Standards, set by the US Green Building Council, provide a way to measure how green a building is.

There is a green building at the site of this year's Envirothon -- The Doyle Center of the Trustees of Reservations in Leominster: [http://www.thetrustees.org/pages/783\\_green\\_construction.cfm](http://www.thetrustees.org/pages/783_green_construction.cfm)

**Smart Growth.** The term <smart growth> is used to refer to all kinds of community development practices that conserve open space, provide more livable environments, and save energy, particularly in transportation and buildings. See [http://www.mass.gov/envir/smart\\_growth\\_toolkit/pages/intro-to-SG.html](http://www.mass.gov/envir/smart_growth_toolkit/pages/intro-to-SG.html)

One energy efficiency technology that is possible in smart growth development is <combined heat & power> (sometimes referred to as <district heating> or <cogeneration>). It offers a way to generate electricity and heat nearby buildings at the same time. See <http://www.epa.gov/chp/> and <http://www.northeastchp.org/nac/>

## C. RENEWABLE ENERGY

The second important source of clean energy is energy from renewable sources. <Renewable energy> sources are sustainable in that they are replenished naturally at essentially the same rate that they are used.

Renewable sources and technologies include:

- solar radiation captured by photovoltaic, thermal electric, and domestic hot water systems, and building designs that use windows and thermal masses for passive solar heating
- wind power captured by a variety of turbine designs
- plant materials (biomass) used in a variety of forms, including split cordwood, wood chips, wood pellets, biodiesel, ethanol, gasification
- hydropower captured by turbines in dams or instream tidal flows and river currents
- geothermal energy systems that use groundwater to assist in building heating and cooling via ground source heat pumps.

Some web sites that offer good background on renewable energy technologies:

<http://www.masstech.org/cleanenergy/technologies.htm>

[http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)

[http://www.ucsusa.org/clean\\_energy/renewable\\_energy\\_basics/energy-101-take-a-tour.html](http://www.ucsusa.org/clean_energy/renewable_energy_basics/energy-101-take-a-tour.html)

The National Energy Education Development (NEED) project offers a vast resource of online and in print materials and kits including basic and advanced activities and background information. See <http://www.need.org/> and look especially for the Energy Infobooks.

A key piece of Envirothon research this year will be to investigate the potential for clean power generation from local energy resources. For each technology, you should investigate

- How does the technology generate usable power?
- The life cycle of the technology, including materials, how it is made, maintenance requirements, how long it lasts, what happens at the end of its useful life
- Scale issues - What size makes sense for most efficient use of this technology?
- Siting issues - What are the site requirements for this technology to work? How good a neighbor is this technology?
- How much does it cost?

See <http://www.mtpe.org/cleanenergy/massenvironment/potential.htm>. Massachusetts information on clean energy technologies is available by going to <http://www.mass.gov> and using the term <renewable energy> in the "search" box. In addition, information on wind power potential for Massachusetts communities is at [http://www.masstech.org/IS/Community\\_Wind/atlas.htm](http://www.masstech.org/IS/Community_Wind/atlas.htm)

## D. ELECTRICITY IN THE TRANSITION TO CLEAN ENERGY

The recent clean energy legislation in Massachusetts emphasizes electrical power, and it is generally expected that electricity will play a key role in the transition to clean energy.

Electricity is actually not an energy source, but a versatile energy carrier. For some basics on electricity see: [http://www.eia.doe.gov/basics/electricity\\_basics.html](http://www.eia.doe.gov/basics/electricity_basics.html) and [http://tonto.eia.doe.gov/energy\\_in\\_brief/electricity.cfm](http://tonto.eia.doe.gov/energy_in_brief/electricity.cfm)

Green Power. Electricity derived from fossil fuels as well as renewable sources is all mixed together in the electrical power distribution system, the “electrical grid”. There is no way to know the exact source of the electrons you are using at any given time. However, electrical customers are increasingly being offered options to support <green electricity> when they buy electrical power. Customers choice to support green power can encourage the development of renewable energy sources. See <http://apps3.eere.energy.gov/greenpower/buying/> and for Massachusetts [www.mass.gov/dpu](http://www.mass.gov/dpu)

The Smart Grid. Repowering advocates emphasize the need for changes in the electricity distribution system that will deliver electricity more safely, more reliably, and with more options. For example, such a <smart grid> will allow for every household with a solar pv panel to sell electricity back to the grid, and be better able to accommodate the power needs of plug-in electric vehicles. For more on the Smart Grid, see <http://www.oe.energy.gov/smartgrid.htm> [http://my.epri.com/portal/server.pt?open=512&objID=386&mode=2&in\\_hi\\_userid=2&cached=true](http://my.epri.com/portal/server.pt?open=512&objID=386&mode=2&in_hi_userid=2&cached=true) <http://www.aceee.org/pubs/e081.htm>

## E. “GETTING IT RIGHT”

The laws of ecology tell us that “You can’t do just one thing.” Repowering will bring multiple changes in the ecology and economy of communities, close to home and far away. There will be decisions to be made, and not all of them will be easy. For example:

- Increased heating with firewood rather than oil will reduce climate-changing carbon emissions but could cause local air pollution and put pressure on forest ecosystems.
- A dam to provide sustainable hydropower changes stream ecology.
- Wind turbines bring energy independence but can spoil a historic vista or fragment a biodiverse landscape.
- Building a new biomass power plant in Massachusetts can destroy the peaceful character of small town as well as reduce “mountaintop removal” coal mining in Appalachia.
- Installing insulation and energy-efficient south-facing windows can slow the oil industry’s devastation of the Ogoni delta region of Nigeria as well as provide a job for a local carpenter.

“Getting it right” means using the transition to clean energy as an opportunity to build healthier communities as well as to protect the environment in several ways at once.

Before you recommend a form of clean energy technology to your community, you should evaluate it from several perspectives:

- Ecological considerations - For example, are there practical limits of the resource? What waste and byproducts will be generated and have to be dealt with? How will this new power generation affect the local ecosystem we depend on?
- Social considerations - For example, what kinds of jobs will be generated, and where will they be? What education and training will be required? Will use of this technology disrupt the community?
- Economic considerations - For example, how much power can these sources generate, at what cost? How long will it take to get the new power generation on line? If we adopt this technology, will it preclude adoption of other technologies later?

## II. STRATEGIES & QUESTIONS FOR COMMUNITY INVESTIGATION

### 1. Plan Your Research!

Get started early. Most successful Envirothon teams start early and pace themselves in their preparations for Current Issue presentations. Plan your work with a calendar. Here are some suggestions:

- Make a list of research tasks. The criteria for the Community Research Award can be used as a guide.
- Leave more time than you think you will need to arrange visits and interviews. Arrangements with town boards and busy resource people can take time.
- Use teamwork: Split up the tasks and share what you find.
- Begin planning action projects by early winter.

### 2. Estimate Your Community's Current Energy Use

This is a rough estimate and should be fun. You will probably be more accurate if you try several different approaches and use several different sources information.

- What energy sources do you use for heat, light, and power (including transportation)?
- How much of each kind do you use?
- What clean energy is already in use?

#### Resources for your estimate:

- Government search engines ("search" boxes) at:
  - The US Energy Information Administration <http://www.eia.doe.gov/>. (an amazing resource)
  - Massachusetts government <http://www.mass.gov>
  - Mass Technology Collaborative <http://www.masstech.org/search.asp>
- Household energy records for electricity, heating fuels, gasoline from your team members' families, averaged and multiplied by the number of households and vehicles in town.
- Town and school district energy records. (Don't forget community energy uses like the water supply and wastewater treatment!)
- Interviews with business managers in town.
- Information from your electric utility on renewable energy use.

### 3. Become Knowledgeable About Clean Energy Sources and Technologies

Resource links for this task are in the first section of this document under

- B. CONSERVATION AND EFFICIENCY
- C. RENEWABLE ENERGY
- D. ELECTRICITY IN THE TRANSITION TO CLEAN ENERGY

#### **4. Survey Your Community's Assets for the Transition to Clean Energy**

**PEOPLE** within your community will be your most important resource for the transition to clean energy:

- Look for individuals, organizations, businesses, local government. These might include:
  - town energy and climate action committees
  - town planning boards
  - town department of public works
  - town building inspectors
  - utilities, especially incentive programs for energy saving
  - schools/training programs/public education organizations
  - regional planning agencies
- Listen for evidence of technical knowledge and skills, entrepreneurial skills, voluntarism and can-do spirit, enthusiasm (and concern) for the future
- Ask about clean energy plans and initiatives that are already underway, such as town master plans, regional planning agency initiatives, business initiatives. Watch your local newspaper!

**GEOGRAPHY AND NATURAL RESOURCES.** Consult maps, get out and explore, for places that are favorable for renewable energy generation

- wind
- moving water
- biomass
- advantageous geographic location for economic development

**EXISTING CLEAN ENERGY INFRASTRUCTURE.** People will be your best resource for locating examples of

- green buildings
- land use and transportation systems that reflects smart growth principles
- already-built renewable energy generation capacity

#### **5. Investigate Specific Opportunities for Repowering.**

Ask these questions:

- What is the potential for clean energy here? How much power could be saved and generated?
- What is the economic cost and benefit? How much would it cost? How long would it take to pay back the cost? What jobs would be created or changed, how and where?
- What is the environmental cost and benefit? How will it affect the ecosystem and ecosystem services that your community depends on? How much could your community's carbon emissions be reduced? How will it affect ecosystems elsewhere if you generate this power locally rather than far away?
- What is the process that must be gone through for this power potential to be realized? What permits will be needed? What public input will be necessary? Are there incentives available to make this new power possible?

**6. With this research and reflection you will be ready to make recommendations for priority actions that your community should take for the transition to clean energy!**