PIONEER VALLEY CLEAN ENERGY PLAN

January 2008

Prepared by the Pioneer Valley Planning Commission and
Franklin Regional Council of Governments in collaboration with the
Pioneer Valley Renewable Energy Collaborative

Funding assistance provided by the Renewable Energy Trust
of the Massachusetts Technology Collaborative

The executive summary, plan, and appendices are available at www.pvpc.org and www.frcog.org

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Table of Contents

Acknowledgements

Many people have been working on this plan for the last three years. We wish to thank every one who helped. Some people conducted research, while others analyzed data. Many people reviewed draft chapters of the plan and participated in the development of elements comprising it. People came to educational sessions, shared their ideas on-line or engaged in on-the-ground efforts. Some volunteers went the extra mile. These people include Meleah Geertsma, Kate Neuner, Patricia Canavan, Stan Swiercz, Brittany Smith, Tom Murray, David Celata, Robert Rocheleau, and Co-op Power staff. Without their work, we would not have made as much progress with this plan as we did.

We especially want to thank all the people in the Pioneer Valley Renewable Energy Collaborative for their many hours spent in meetings, in person, online and on the phone. They helped us all to understand more deeply our dependence on petroleum and nuclear-based energy, our need to highlight efficiency, the possibilities and limitations of wind and biomass, and the need for focusing on clean or carbon-neutral energy. In short, they helped us to recognize the opportunity represented in our collective efforts here in the Valley and the possibility that by working in partnerships we can find a better way of relating to the earth through our collective and individual energy choices. They are:

Bart Bales, Bales Energy
Lynn Benander, Co-op Power
Natalie Blais, Congressman Olver
Gordon Boyce, Massachusetts Department of Conservation and Recreation
Dwayne Breger, Massachusetts Division of Energy Resources
Don Campbell, Campbell Assoc
Marybeth Campbell, Massachusetts Technology Collaborative (MTC)
David Caputo, Positronic Design
David Cash, Massachusetts Executive Office of Energy and Environmental Affairs
Stephanie Ciccarello, Town of Amherst
Tina Clarke, Clean Water Action
Laura Dubester, Center for Ecological Technology (CET)
Jonathan Edwards, SmartPower
John Fabel, Entrepreneur
Wayne Feiden, City of Northampton
Kristen Goland, MTC
Carol Jolly, Volunteer
Karen Jones, Pioneer Valley Electric Automobile Association (PVEAA)
Teresa Jones, Greenfield Community College
Paul Lipke, Sustainable Step New England
Peggy MacLeod, CET
Nancy Nylen, CET
Robert Rizzo, Mt Wachusett Community College
Tom Rossmassler, HAP Inc.
Stan Swiercz, Volunteer
John Walsh, Western Massachusetts Electric Company (WMECO)
Sally Wright, University of Massachusetts Renewable Energy Research Laboratory

We are also extremely grateful to the Massachusetts Technology Collaborative www.mtpc.org, and our grant contacts, Kristen Goland and Marybeth Campbell, for funding this initiative.

Thank you,
Catherine Miller, Pioneer Valley Planning Commission
Bill Labich and Peggy Sloan, Franklin Regional Council of Governments

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS

MASSACHUSETTS TECHNOLOGY COLLABORATIVE

PIONEER VALLEY PLANNING COMMISSION
PVPC

Introduction

We began this planning process, with funding from the Massachusetts Technology Collaborative (MTC), focused on how to encourage the development of new renewable energy in the form of electricity in the Pioneer Valley while planning for a sustainable energy future for our region. We developed this goal out of a year-long effort to identify regulatory barriers to renewable electricity in the Pioneer Valley. Over the two year planning process, we learned that we could not develop a clean energy plan in the Pioneer Valley without addressing energy for heat and transport, so this plan addresses all energy needs. We are grateful to the MTC for their financial and technical support. Our methods included research, education, surveys, stakeholder analysis, participatory planning, and provision of technical assistance to advance specific projects.

During the three years spent facilitating the development of this plan, the plan authors learned six key lessons. They are all important and we hope others who seek to replicate our planning process will learn from them.

Everyone involved in this planning process is committed to moving the region toward a sustainable energy future. There was overwhelming support throughout the region for developing clean energy sources and reducing emissions that cause global warming. We did conduct considerable research into the problems of "dirty" energy and global warming, and you can find information in the resources included in our annotated bibliography/ webliography. Even though we encountered no opposition on the need to act for a clean and safe

Lessons learned:

Energy efficiency and conservation must be our first and primary goal.

Global warming is of growing concern to just about everyone, and we all want this plan to result in a significant reduction in greenhouse gas emissions in the Valley.

We need to work toward eliminating our use of nuclear energy because of the threat it represents now and in the future to all the region's citizens.

The peaking of global oil supplies is another issue that, once acknowledged, changes the context for this plan and for our communities in ways that we are still striving to understand.

New technologies will provide greater opportunities for achieving a cleaner energy future than what is possible given current conditions. We understand that our current technologies may be considered gap measures until such time that even cleaner, more efficient measures and facilities can be adopted and sited in our region. But we know we must act now and we do not look to technology to save us, rather we understand it is part of the solution.

Energy planning encompasses energy used for electricity as well as energy for heating and transport. We spent more time building regional consensus on electricity-specific goals than we did on goals pertaining to liquid fuels used for heat or transport, but the action recommendations included in this plan apply to liquid fuels as well as electricity. As this plan is implemented, additional stakeholders from the worlds of transport and home heating should be included.

energy future, we certainly did encounter differences of opinion on what this plan should include.

We do not consider all energy sources the same. The most cost efficient, carbon-free source of energy is that which we do not use, thus efficiency and conservation together receive our highest priority actions. Some sources of energy provide heat and hot water and fuel for motor vehicles, while others generate electricity. Some produce no carbon dioxide when operating, like solar photovoltaics, geothermal, and wind turbines while others like wood-fueled biomass plants are considered carbon neutral. Nuclear energy and fossil fuels such as coal, natural gas, and oil, produce numerous environmental impacts including air and water pollution. Fossil fuels produce greenhouse gas emissions, which are causing global climate change. Our region's successful transition to renewables and a clean energy future must begin with a multi-faceted approach: combining efficiencies and conservation with the local application of technologies that can provide the best and most equitable distribution of energy (electricity, motor fuels, and heating fuels) with the least impacts to community health and the environment.

We hope you will take the time to read this plan, and see it as a beginning. We have tackled some important issues and succeeded in involving hundreds of people during the planning process. We initiated the region's first on-line participatory planning process using innovative web-based software. We polled municipal officials and designed educational sessions to meet their energy information needs. We co-sponsored events and helped to promote local energy committees. We identified thresholds to impacts of different clean energy technologies as a precursor to supporting cities and towns to better attract the energy developments most consistent with their own plans and policies. And, we agreed, as a collaboration of organizations, agencies, and individuals, to encourage a certain number of clean energy generating facilities in our communities.

Pioneer Valley Clean Energy Goals

To achieve a sustainable energy future for the Pioneer Valley we must reduce our energy use and use energy more efficiently. We need a strong and continuous commitment to efficiency and conservation. At the same time, energy efficiency and conservation alone cannot reduce our greenhouse gas emissions and avoid the effects of climate change. We also need to replace our fossil fuel use with renewable energy sources like wind, solar, geothermal, low impact hydro, biomass and bio-fuels. Our actions must also address another critical issue confronting societies across the globe: the end of cheap liquid fossil fuels. Thus, this plan focuses on actions that promote and develop clean energy generation in the region that increases the local circulation of profits generated from proposed developments to support a regional clean energy economy—creating many new local businesses and employment opportunities.

The goals of the Pioneer Valley Clean Energy Plan were developed through a participatory planning process overseen by a group of clean energy experts. They were set within the context of existing state, federal and international clean energy plans and policies.

Goal One: Reduce our region's energy consumption to 2000 levels by the end of 2009 and reduce that by 15 percent between 2010-2020.

Goal Two: Site sufficient new capacity to generate 214 million kilowatt hours of clean energy annually in the Pioneer Valley by the end of 2009 and another 440 million kilowatt hours per year by 2020.

Goal Three: Reduce our region's greenhouse gas emissions by 80 percent below year 2000 levels by 2050.

Goal Four: Create local jobs in the clean energy sector.

Goal One: Reduce Energy Use

Reduce our region's energy consumption to 2000 levels by the end of 2009 and reduce that by 15 percent between 2010-2020 while supporting the growth of new business and industry.

THE BIGGEST BANG FOR OUR BUCK:
Energy efficiency improvements cost 33 percent of the cost to generate power. It costs 3 cents to save a kilowatt-hour and 9 cents to generate it.

Source: Massachusetts DOER, October 2007.

Focusing our energy reduction efforts on energy used during peak periods will yield the greatest savings because that power is the most expensive. If we use less power during peak periods, we can avoid building new plants to meet growing peak energy demand periods. If for one hour a day the region needs five times the energy it usually uses, the region will have to build power plants that have the capacity to generate five times what it usually uses. All that capacity sitting around just waiting to be used is expensive.

Energy audits can now identify specific ways business, industry and homes can invest in efficiency measures that will repay the investment in 1-3 years and significantly reduce energy use and utility costs.

According to the Northeast Energy Efficiency Partnerships Inc. (www.neep.org), further efficiency savings are both possible and economical. In New England investing in efficiency improvements over a ten-year time period could result in savings of 28 percent of the total peak summer capacity and 37 percent of the capacity represented by plants using fossil fuels within the New England Power Pool.

Figure 1: **Energy Use Reduction Schedule**

	Electricity Used in the Pioneer Valley (million kilowatt hours)	Energy Used in the Pioneer Valley for Transportation (trillion btu's)	Non-electric Energy Used for Heating in the Pioneer Valley (trillion btu's)
Most Current Available Data*	5,720 (2005 data)	41.88 (2004 data)	43.15 (2004 data)
2009 Goal (2000 levels)	5,180	39.43	49.23
2020 Goal (15% below 2000 levels)	4,400	33.52	41.85

* We do not have 2007 data, but we believe it is likely higher than 2004 or 2005. We need more and better data to quantify energy use reduction goals.

Source: Massachusetts DOER, October 2007.

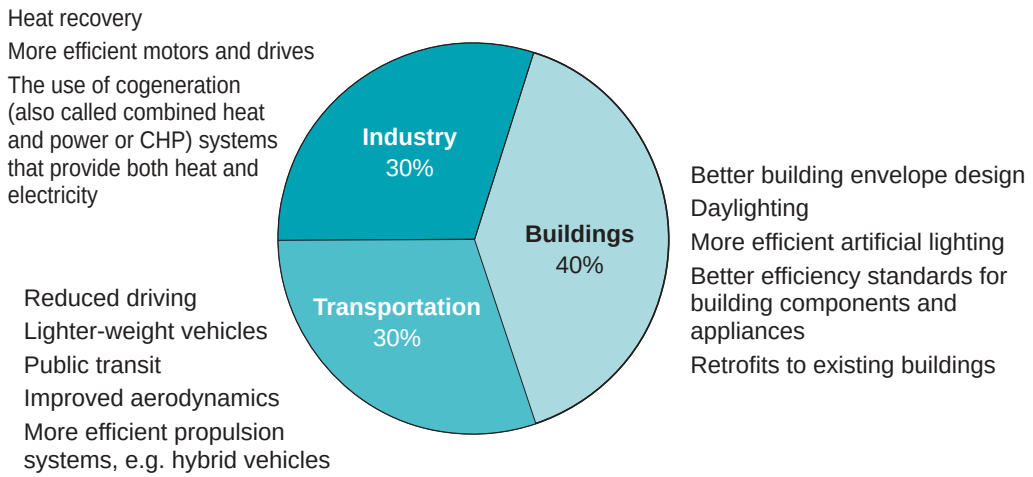
Additional studies conducted by the Massachusetts Division of Energy Resources demonstrate that energy efficiency improvements cost 33 percent of the cost to generate power. In other words 3 cents per kilowatt-hour for efficiency compared to 9 cents for power generation. It is estimated that energy efficiency measures will save consumers $65-$87 million due to lower wholesale supply costs and $1.2 billion in lifetime cost savings from the installation of efficient products.

How was this goal established? Our first goal focuses on energy efficiency and energy conservation because they reduce energy use, energy costs, and the environmental impact of energy generation. Energy conservation and efficiency are the best use of any dollars we can invest in our energy future. We began this planning process with a clean energy generation goal and designed the energy reduction goals to match the new clean generation goal.

At this time we do not have energy use data for the Pioneer Valley. As a substitute measure, since the Pioneer Valley has one-tenth the population of Massachusetts, we have taken one tenth of the energy use for Massachusetts as a rough approximation of the Pioneer Valley's energy use.

Above is the energy use reduction schedule we will need to meet in 2009 and 2020 to achieve this goal.

Figure 2: **Where Will Our Energy Reductions Come From?**



Source: American Solar Energy Society, Jan 2007

The main "reservoirs" of economical efficiency potential are in lighting and heating in residential, commercial and industrial markets and in transportation efficiencies.

Goal Two: Replace Fossil Fuels

Site sufficient new capacity to generate 214 million kilowatt hours of clean energy annually in the Pioneer Valley by the end of 2009 and another 440 million kilowatt hours by 2020.

Our second goal calls for us to replace the energy we're using from non-renewable sources with clean, renewable energy generated here in the Pioneer Valley. When we use renewable energy instead of non-renewable energy like oil, coal, propane natural gas and gasoline, we keep our air cleaner and reduce our contribution to global warming. When we use locally produced energy, we're supporting our local economy and reducing our dependence on foreign oil. "Clean energy" is defined by the Massachusetts Technology Collaborative as solar, wind, low impact hydro, and biomass-fueled facilities that meet all Massachusetts Department of Environmental Protection requirements. We have also established Project Selection Criteria that further define the characteristics of a clean energy generation project that would best meet this goal.

How was this goal established? The Commonwealth of Massachusetts established a goal to meet 4% of its electricity consumption (roughly 750 megawatts) with new clean energy by 2009 in their Renewable Portfolio Standard. Since the Pioneer Valley is home to approximately 10 percent of the Commonwealth's population, we decided, at first, to assume responsibility for 10 percent of the state goal, or 75 MW. However, people surveyed wanted a more ambitious goal and they wanted us to include fuels for heating and transportation in addition to electricity production, so we increased the goals to 100 megawatts of capacity. Fuels for heating and transportation are usually measured in btu's, but we're measuring everything in megawatts for ease of understanding.

Our goals are expressed in the units of kilowatt-hours (i.e. units of energy as opposed to units of power, rates, or capacity in kilowatts) because both the cost and the impacts are correlated with kilowatt-hours. This allows costs and benefits to be compared across technologies. When one compares the cost of energy produced by various technologies, one compares cents per kilowatt-hour, as shown in the chart on page 8. And when one looks at the impacts of electricity generated with fossil fuels, for instance, emissions are expressed in pounds per kilowatt-hour or per megawatt-hour (see, for example, ISO New England's New England Marginal Emission Rate Analysis http://www.iso-ne.com/genrtion_resrcs/reports/emission/2004_mea_report.pdf) .

To meet this goal, we can build new facilities to generate electricity from solar, wind, low impact hydro, and biomass. We can build new heating systems powered by solar hot water, biomass, and geothermal energy. We can build new biofuel plants to produce renewable transportation and heating fuels. How many of each will be determined by:

- local government and state regulators through the permitting process,
- how much money is available to invest in these resources (some resources are more expensive than others),
- who is ready to make these investments,
- our state and federal policies that provide incentives and establish regulations that can either promote or inhibit development, and
- the inherent advantages and disadvantages of each type of clean power.

See the Energy Options section for information about each clean energy option.

The table on the following page shows energy production costs from currently available technologies. The table is designed to help us compare the total societal costs involved in building each type of energy system. It shows why we will likely choose to meet our goal with a mix of energy resources, given the advantages and disadvantages of each energy option. We probably cannot meet our goal, for example, with 100% solar power, since the costs are so high here in New England where the sun doesn't shine all the time. We probably cannot meet our goal, for example, with 100% biomass plants, since we need to be able to determine that the wood required could be harvested in a sustainable manner, and since there are many concerns about the emissions from these plants. As renewable energy generation technology develops, our choices will increase.

Figure 3: **Energy production and costs from currently available technologies**

	Capacity (MW)	Capacity Factor	Energy Produced per Year (thousand kWh)	Approx. Capital Cost to Build	Annualized Energy Cost* (cents/kWh)
Electric Generation					
Large Utility Biomass Plant	50	0.85	372,300	$135,000,000	7.80
Community Scale Biomass Plant	5	0.75	32,850	$17,500,000	10.70
Small Commercial Wind	3	0.25	6,570	$7,500,000	9.20
Residential Solar Electric	0.002	0.14	2	$17,000	55.60
Non-Electric Energy					
Small Commercial Biodiesel Plant	10 million gallons per year production		1.3 trillion BTUs, equiv. to 381,000 thousand kWh $_{thermal}$	$8,500,000	5.43
Residential Solar Hot Water	3 panel system	4 hours of full sun per day (average over year)	30 million BTUs, equiv. to 215 gals. of heating oil, or 8,792 kWh	$8,000	7.30

Annualized cost are calculated for a term of 20 years at a 5% discount rate. For the biomass plants, assumes a fuel cost at $25/ton for green wood and annual O&M expenditure of 4% capital cost. For the biodiesel plant, assumes a $2/gal feedstock and operational cost.

Source: Massachusetts DOER, October 2007.

The costs provided in this table do not reflect any incentives from federal or state policies which will improve project costs and economics, but the table does accurately reflect the relative costs and economics of the alternative technologies.

Goal Three: Reduce Global Climate Change Emissions

Reduce our region's greenhouse gas emissions by 80 percent below year 2000 levels by 2050.

Research on climate change concludes that the world must reduce greenhouse gas emissions by 80% of 2000 levels by the year 2050. The Massachusetts Climate Protection Plan is no different. It calls for the state to reduce its greenhouse gas emissions to 1990 levels by the year 2010 and then to reduce greenhouse gas emissions 10% below 1990 levels by the year 2020, working toward a 75-85% reduction below current levels. Bill McKibben's Step-it-Up action calls for a reduction of 80% of our greenhouse gas emissions by 2050. The Union of Concerned Scientists calls for the same goal as does the United Nations Intergovernmental Panel on Climate Change (IPCC).

Since the Pioneer Valley is home to 10% of the State's population, we've taken on 10% of the state's goal for greenhouse gas emission reductions. We need to reduce emissions according to this schedule in the Pioneer Valley.

We need to join forces with the Union of Concerned Scientists www.ucsusa.org , the United Nations

Figure 4: **Greenhouse Gas Gross Emissions in the Pioneer Valley in million metric tons of CO2 equivalent (including CO2, methane and NOx)**

2000	9.06
2003	9.58
2007 projections	10.18*
2010 Goal	9.60
2020 Goal	7.65
2030 Goal	5.70
2040 Goal	3.76
2050 Goal	1.81

* if increases continued between 2003 and 2007 as they did between 1999 and 2003

Source: Massachusetts DOER, October 2007.

Intergovernmental Panel on Climate Change www.ipcc.ch, ICLEI Local Governments for Sustainability www.iclei.org , the New England Governors' Conference on Climate Change www.negc.org, and other global climate change organizations. As this plan is implemented and as our region uses less energy and replaces carbon-based energy with clean energy, we will help in the fight against climate change.

Goal Four: Create Local Jobs

Create local jobs in the growing clean energy sector with a focus on living wage opportunities.

Locally-owned businesses contribute more to local economies than large global corporations, whose profits may leave for home offices outside the state. New England has relied on manufacturing jobs in the past. It is easy to see the potential value of local clean energy facilities for our region's 69 communities. The money we pay for conventional energy and fuel costs are quickly sent out of a local economy. Renewable energy and energy efficiency keep more of those dollars in a local community.

The Massachusetts Technology Collaborative, which administers the Renewable Energy Trust, worked with the University of Massachusetts Boston to analyze these growing sectors. The research shows approximately 8,000 jobs in energy efficiency and 2,000 in renewable energy companies in Massachusetts. Economic growth and venture investment in these sectors around the country and around the world points toward significant job creation potential of what is commonly referred to as the "clean energy" sector or in the broader sense, "cleantech".

From "Energy Efficiency, Renewable Energy, and Jobs in Massachusetts: A Growing Opportunity for Massachusetts" MTC, p. 2, 2007.

This plan envisions the rebirth of manufacturing in the region, with a focus on energy efficiency technologies and clean energy production. Moreover, this plan anticipates small businesses and venture capital projects that spin-off from solutions to energy problems explored by the region's colleges and universities. New clean energy-based local businesses would work together with improvements in transportation, home construction, energy efficiency and conservation, and energy production to build the region's economy and sustain communities in the Pioneer Valley.

In August, 2007 the Massachusetts Technology Collaborative (MTC) released a report summarizing the results of a survey they funded of the clean energy sector in Massachusetts. According to the report, the clean energy sector, which Governor Deval Patrick has identified as a key emerging industry for Massachusetts, is about to overtake textiles as the 10th largest in the Commonwealth.

The census, prepared by Global Insight of Lexington for MTC's Renewable Energy Trust, identified 556 entities engaged in renewable energy; energy efficiency and demand response; consulting and support; and university research related to clean energy. Employment in these firms, most of which are young and small, was estimated at 14,400. With an annual job growth rate of 20 percent projected by industry executives, clean energy will soon pass the textile industry, which now employs 15,400 people, as the 10th largest cluster tracked by the Index of the Massachusetts Innovation Economy, which is published by MTC's John Adams Innovation Institute.

Research conducted in 2005 by the Montana State University Center for Applied Economic Research concluded that a biodiesel refinery in Roosevelt County Montana producing 15 million gallons of biodiesel per year would create 31 jobs in the refinery with $1.5 million a year in direct labor income and 158 indirect jobs with $5.5 million in business to business transactions. If that same plant operates using oil from locally grown oil seed crops, 354 jobs would be created with $10.2 million in direct labor income and 567 indirect jobs created with $10.5 million in business to business transactions. They concluded that it was important to keep the investment local to invigorate and sustain the local economy. (www.msubillings.edu/CAER)

The Pioneer Valley, with its wealth of institutions of higher education, has the potential to be a cluster of clean energy technology. With support from organi-

zations like MassVentures http://www.massventures.com, in conjunction with research conducted at the University of Massachusetts and other institutions, many jobs could be created in the clean energy research and business development fields. There is a need for increased funding for the Renewable Energy Research Lab (RERL) http://www.ceere.org/rerl/ and an expansion of its charter, in addition to expanded funding of technology transfer to the commercial sector.

There is a cutting-edge effort by our state's Community Colleges and some secondary technical schools to educate and train people in the various skill-areas necessary to fuel the clean energy transition. Conservative preliminary estimates of future high-paying jobs for energy technicians in the Pioneer Valley over the next three years are 110 positions. In addition, there should be approximately 60 internship opportunities available annually from local clean energy employers.

Bigger isn't always better when it comes to sustainable energy. The Pioneer Valley is host to several large scale renewable project developments and the Clean Energy Planning Process recognizes the important role such development may play in meeting some of our goals. There was, however, a strong consensus among people participating in the Clean Energy Planning Process that they preferred to have green businesses, especially wind and biomass businesses, that are smaller in scale and owned by municipalities, local non-profits, locally-owned businesses, or cooperatives. This preference for small, locally-owned business development is sometimes confusing to government and business leaders charged with addressing the large-scale development required to address the challenges of climate change and peak oil, but there is a large body of evidence that these local businesses bring more long-term value to a community than their larger counterparts.

Most cities and towns in Western Massachusetts have experienced the exodus of larger manufacturers they helped build with their labor and good will. Those businesses which left often severely impacted the local community as many jobs were lost. In our community hearings on the plan, many residents said they did not want large companies owning the wind power from their ridge tops, spoiling their views with machinery they might eventually abandon once they had made their money.

There is research that shows local businesses can be a better option for building local economies, ensuring high labor and environmental standards, and retaining assets in the community. "Large firms are responsible for more than 42 percent of the economy, and place-based jobs account for at least 58 percent," according to Michael Shuman in his book" Small *Mart Revolution: How Local Businesses are Beating the Global Competition*. He goes on to say that because local businesses do not move, they do not cost the community in lost jobs, abandoned buildings, lower property values, tax cuts, and reduced town services; but instead, they are long term wealth generators in their communities. Local firms have stronger environmental and labor standards because the community is better able to shape its laws and regulations without their employers threatening to move. Local firms have local management, use local business services, advertise locally, and share profits locally. They spend two to four times more than non-local businesses within their community and within their state, recirculating capital within the community.

There was a strong consensus among people participating in the Clean Energy planning process that they wanted state and local governments to focus sustainable energy business development on locally owned small businesses that contribute to their local economies and are more likely to keep the local jobs and assets developed in their communities. There are business models where investors can partner with local businesses, cooperatives, non-profits and municipalities to create many of the new green businesses called for in this plan and take advantage of the tax credits in place to support these efforts. A majority of the people participating in the goal-setting process strongly preferred that our public resources be prioritized to support local community-ownership of our sustainable energy resources using a wide variety of business models.

Projects

Guiding Principles

Virtually no one who participated in this planning process disagreed with the need for the region to host some clean energy generating facilities. Pioneer Valley residents knowledgeable about one or more of the technologies involved, including biomass, low-impact hydro, photovoltaic, wind, and bio-fuels, agree that, combined with comprehensive energy efficiency programs, the siting of new clean energy power facilities in the region is critical. However, broad agreement ends there. There is a continuum of opinion regarding the application of each technology as it is sited on the ground.

Recognizing this diversity of opinion, we used our participatory on-line planning process, supplemented with in-person meetings, advice from our Advisory Committee, and considerable research, to create a set of overarching principles that reflect the plan's goals and which were used as the foundation for the development of our project selection criteria. In addition, in the webliography we provide references for a comprehensive analysis of the true cost of every means of energy production under consideration. For example, the costs of extracting and transporting uranium and managing depleted radioactive fuels must be factored into the cost analysis of nuclear power. Similarly, the manufacturing costs of solar photovoltaic panels must be factored into the costs of solar power. Life cycle analysis allows for an accurate comparison of possible clean energy sources.

On the following page are the Clean Energy Guiding Principles that were developed and prioritized through our online, participatory planning process.

> **"Governor Patrick intends to make Massachusetts a national and global leader in clean energy because he sees it as an economic opportunity as well as an environmental necessity," said Secretary of Energy and Environmental Affairs Ian Bowles. "This census shows that the clean energy sector is off to a good start in Massachusetts. We need the industry to make itself heard, and we in state government need to put in place the regulatory incentives that will make Massachusetts a place where demand for clean energy technologies and products will grow."**
>
> Source: MTC, August 2007.

In an April 2007 survey, 325 people gave a final review of these guiding principles and endorsed them resoundingly.[1] The selection criteria, which are described later on in this section, are offered, like the guiding principles, as a guide to implementers of this plan on how to design a project, program, or policy that will be most appropriate and therefore most acceptable to the communities in the Pioneer Valley. We must note that the field of clean energy and solutions to global warming is in a state of rapid change—new technologies are being imagined, researched, and developed all the time. We do not know all the means which may eventually be used here in the Pioneer Valley to move us to a clean and safe energy future. We know that current technologies have some limitations, but we also recognize the need to act now, and so we accept

[1] 90% (292 people) supported these principles (74% without qualification and 16% (52 people) with reservations; 10% (33 people) opposed these principles.

Our Clean Energy Guiding Principles:

- Reduce energy consumption through conservation and efficiency.
- Reduce dependence on fossil fuels.
- Reduce greenhouse gases.
- Protect and improve the environment and the quality of life in the Pioneer Valley.
- Increase use of solar, wind, small hydro, clean biomass, and clean fuels technologies produced in community-scale facilities.
- Increase local and community-ownership (municipal, membership based non-profits, co-ops, etc.) of renewable energy resources so that profits can remain local and so that affordable energy resources will be available for generations to come.
- Increase access to people from all income levels and encourage a sustainable supply of clean energy that benefits everyone in the community.
- Focus government resources and policies on supporting the cleanest forms of energy and efficiency, making financing of residential and community-scale energy projects easy, affordable, and accessible to all income levels.
- Reduce dependence on nuclear energy.
- Promote a comprehensive public transportation system including expansion of bus lines, public rail transportation, shuttles, car sharing, and safe bike routes and sidewalks and pedestrian paths with an emphasis on energy efficiency and use of renewable fuels.
- Increase urban infill in order to make communities more pedestrian friendly and energy efficient.
- Encourage farmers and large land owners to preserve open space through development of energy production as an additional income stream (such as wind, small hydro, solar, or generation of methane gas from manure to generate electricity or to help produce clean bio-fuels).
- Make the Pioneer Valley one of the leaders in the Country for producing clean energy and improving energy technology.
- Support sustainable local economies that provide living wage employment opportunities and support business and economic growth.

solutions today that may be replaced in the future. And we commit to staying abreast of state-of-the-art knowledge, skills and applications regarding energy technology, information and understanding. We also pledge to update this plan as resources allow.

Selection Criteria

The guiding principles set the parameters for our clean energy universe. Next we developed specific criteria that can be used by community members, project developers, and interested parties to select the most appropriate clean energy projects. These selection criteria define the attributes of a project, program, or policy that, when met, reflect the majority of the overarching principles listed in the previous section. In light of the diversity of viewpoints, this Plan presents the following selection criteria to define the attributes of a project that will likely receive community support and be successful.

Our Clean Energy Selection Criteria:

- Does the action reduce fossil fuel or nuclear energy use?
- Does the action involve a clean renewable technology? "(Clean" as defined by the Massachusetts Technology Collaborative —includes–solar, wind, small low impact hydro, and biomass-fueled facilities that meet all DEP requirements.)
- Does the action involve a community-scale facility with the following characteristics?

  Does it promote community ownership of renewable energy resources?

  Does it support small businesses with fewer than 20 employees? (There was widespread preference for renewable energy projects that provide energy to a single user or district within a municipality or regionally if owned by a municipality, cooperative, non-profit or locally-owned business.)
- Does the action increase employment, gross sales, and patents generated by renewable energy-related businesses in the Pioneer Valley? Does it create local jobs with a living wage?
- Does the action increase the affordability of clean energy to low and moderate-income households?
- If involving transportation, does the strategy promote an expansion of public transportation, pedestrian opportunities, bicycle use, alternative fuels, and zero or low- emission vehicle use?
- Will a farmer or large landowner (> 50 acres) find it easier to maintain their open land due to benefits from this action?
- Will the action maintain the water, air, vegetation, wildlife habitat, and other natural resources inherent to the site and the surrounding region?
- Can the action be implemented within two to three years?

  Does the strategy have strong local proponents?

  Is it consistent with existing local and regional plans?

  Does the action have identified funding sources?

Implementation

To implement this plan, a concerted effort must be taken by many sectors of our community. This section provides guidance and recommendations for execution of this plan. To begin, five characteristics for implementation are detailed. These characteristics should help readers envision the execution of the Clean Energy Plan. In addition, specific action items are provided for each target audience, providing specific guidance for how each group can help execute this plan.

Characteristics of Implementation

1) Collective Action

This plan provides a broad overview of how the Pioneer Valley Region can reduce its total energy consumption and increase its production of clean energy. Moreover, the plan identifies actions to be taken at all levels: municipalities, regional planning agencies, businesses, nonprofits, energy committees, educational institutions, individuals, and the collaborative itself. In order for this plan to succeed, appropriate action must be taken at all levels. Following the release of this plan in January 2008, staff at PVPC and FRCOG will be meeting with select boards or city councils and mayors in the 69 communities of the Pioneer Valley to seek endorsement of a non-binding memorandum of agreement (MOA) that the city or town will do their part to implement this plan (copy available in Appendix and at www.pvpc.org and www.frcog.org).

2) Immediate Action

The ambitious goals detailed in the previous section provide a strong motivation for immediate action. The need for quick implementation is reinforced by the lengthy planning period and high capital costs associated with various measures. Consequently, in order to satisfy the goals of a 15 percent reduction in total energy consumption and a 15 percent reduction in the use of dirty energy, representatives from all sectors should begin implementation as soon as possible. Implementers are encouraged to start with the traditional "low hanging fruit" of energy efficiency, use reduction, and conservation—changing lightbulbs, sealing and insulation, and behavior and process modifications that do not require significant capital outlays. In addition, implementers are encouraged to take advantage of funding whenever possible, recognizing that the broad goals of energy efficiency, clean energy development, reduction in greenhouse gas emissions, and job creation, cover a very broad range of potential funding opportunities.

3) Parallel Action

To ensure an immediate and collective response, implementation of this plan should not be linear. Instead, actions can and should be taken simultaneously at all levels to produce a timely and comprehensive response.

4) Evaluation

Many of the goals presented in this plan have quantifiable outcomes. As a result, in order to properly implement this plan, a system that quantifies regional energy use and the savings yielded by certain measures should be constructed. This system will allow the region to measure and reassess the effectiveness of this plan and modify it as necessary.

If every household in the region (over 263,000 as of the US Census) changed all the light bulbs that are used for at least four hours a day to compact florescent lights (CFLs), it would result in savings of 200 million kilowatt hours.

5) Collaboration

Due to the nonlinear process outlined above, a high level of coordination and communication is needed between sectors to ensure the effective implementation of the plan. This collaboration will allow various sectors to share information, resources, and support.

Action Items

Municipalities:

- Become an ICLEI Local Governments for Sustainability Cities for Climate Protection (CCP) member either as a municipality or as part of a regional planning agency.
- Endorse the clean energy policy statement adopted by PVPC and FRCOG.
- Consider hosting or owning a clean energy generating system or plant in your community where resources and environmental conditions allow. Factors to consider include the availability of close biomass resources and water power, adequate wind, and access to the sun, and proximity to transmission lines. In addition, consider the land's appropriateness as a site for energy production. Is the land not protected or awaiting protection and not of cultural or historic importance?
- Conduct energy audits (if not conducted in the last two years) and work with PVPC and FRCOG (as appropriate) to apply for MTC small renewable funds (or equivalent) to implement efficiency and conservation measures identified in audit.
- Consider a performance contract with an energy service company (ESCO), to conduct comprehensive energy audits of all municipal buildings, and implement recommendations at no upfront cost to community—funded via savings accrued by implementing energy efficiency measures.
- Adopt bylaws or ordinances to require or give incentives to encourage green buildings, energy efficiency, renewable energy production, public transportation, smart growth, clean fuels, efficient vehicles, and sustainable development.
- Include an energy element in your municipalities' comprehensive plan.
- Consider using brownfield sites for renewable energy development.
- Collaborate with PVPC and FRCOG to apply for funds to implement this plan.
- Work with the western Massachusetts legislative delegation to assure prompt adoption and implementation of policy recommendations.
- Establish local residential building code to comply minimally with Energy Star®.
- Purchase clean energy.
- Form an Energy Committee.

Energy Committees

- Collaborate with municipal planning and building departments and boards to develop and adopt bylaws or ordinances, to require or give incentives to encourage green buildings, energy efficiency, renewable energy production, public transportation, smart growth, clean fuels, efficient vehicles, and sustainable development.
- Work with municipal government to conduct energy audits, implement recommended improvements and build renewable energy systems.
- Seek funding to support appropriate siting and installation of renewable energy systems on municipal property and in the community.
- Collaborate with energy committees throughout the region to share ideas, lobby elected officials to assure prompt adoption and implementation of this plan's policy recommendations, and continue the development of a clean energy future for the Pioneer Valley.
- Provide public education regarding clean energy in collaboration with non profits, advocacy groups, planning commissions, and educational institutions.

Regional Planning Agencies

- Staff PVREC.
- Collaborate with members of the collaborative to assure plan implementation
- Take leadership role in securing funding to assist in implementation of planning-related recommendations.
- Support efforts of member municipalities to act on their recommendations.

Businesses

- Perform an energy audit within the next two years, if not done in the last 12 months, and every five years thereafter.
- Implement all feasible recommendations of your energy audit within two years.
- Participate in your municipality's energy conservation and efficiency programs.
- Support green buildings, energy efficiency, smart growth, public transportation, clean fuels, efficient vehicles and sustainable development.
- Donate money to support local energy efficiency efforts, including but not limited to compact fluorescent bulb sales, clean energy home tours, home installation workshops, home energy audits, weatherizing, idling reduction programs, and solar hot water heater sales.
- Incorporate clean energy systems into all operations including siting a clean energy system in or on your building(s) or property
- Purchase clean energy.

Nonprofits/Advocacy Groups

- Perform an energy audit within the next two years, if not done in the last 12 months, and every five years thereafter.
- Implement feasible recommendations of your energy audit within two years.
- Participate in your municipality's energy conservation and efficiency programs.
- Support green buildings, energy efficiency, public transportation, clean fuels, efficient vehicles, and sustainable development.
- Encourage municipalities, businesses, and residents to build new renewable energy systems, become more energy efficient, and conserve more energy.
- Advocate for renewable energy and energy efficiency legislation.
- Provide public educational materials and seminars tailored for municipalities, businesses, and individuals; continue public discussion regarding how the region will respond to climate change and the need to convert energy sources.
- Incorporate clean energy systems into all operations including siting a clean energy system in or on your building(s) or property
- Purchase clean energy.

Educational Institutions

- Perform an energy audit within the next two years, if not done in the last 12 months, and every fives years thereafter.
- Implement all feasible recommendations of your energy audit within two years.
- Participate in your municipality's energy conservation and efficiency programs.
- Support green buildings, energy efficiency, public transportation, clean fuels, efficient vehicles, and sustainable development.
- Integrate curriculums, guest speakers, community events on climate change, energy conservation, and clean energy as possible into school/college/university classes and activities.
- Incorporate clean energy systems into all operations including siting a clean energy system in or on your building(s) or property.
- Purchase clean energy.

Individuals

- Request a free energy audit of your property (www.masssave.com) or contact your utility company directly; implement as many recommendations as financially possible.
- Do what your can to reduce energy use, conserve energy, promote energy efficiency and facilitate clean energy. Some actions to start with are:

  Change light bulbs in residence to compact fluorescents.

  Insulate pipes, heating ducts, walls, and attics.

  If you have oil heat or kerosene, have it cleaned and tuned every summer, every two years if you use propane, and every three years if you have natural gas. Wood stoves should be cleaned every year or replaced with a cleaner heat source if they are not EPA-certified.

  When purchasing appliances, purchase Energy Star®.

  Take shorter showers and smaller baths.

  Keep vehicles well-tuned with tires inflated correctly.

  Carpool, walk, take the bus, or ride a bicycle whenever possible.

  Attend meetings via telephone or over the internet instead of driving.

Live close to work or school.

Vote in favor of sustainable development principles and regulations, and/or initiate efforts to reform your local zoning to facilitate clean energy projects in your community and to promote smart growth.

Buy clean energy.

If you purchase a vehicle, purchase one that is energy efficient.

Offset your greenhouse gas emissions using ideas from websites such as www.nativeenergy.com, www.terrapass.com.

Use a whole house fan instead of a large capacity window mount air conditioner because it uses less than a third of the energy.

Install a solar hot water system to heat your water.

- Look at Union of Concerned Scientists' website for great specific actions at all levels for energy efficiency (http://www.ucsusa.org/clean_energy/renewable_energy_basics/energy-solutions-to-fight-global-warming.html).
- Support green buildings, energy efficiency, public transportation, smart growth, clean fuels, efficient vehicles and sustainable development.

Massachusetts Legislators/Policy Makers

- Implement the Massachusetts Climate Action Plan and the following policies, and commit to guiding Massachusetts toward a 20 percent reduction in greenhouse gas emissions by 2010 and an 80 percent reduction by 2050.

Leading by Example: Government Purchasing and Building Policies

- To reduce Commonwealth of Massachusetts building's greenhouse gas emissions 20 percent by 2010 and 80 percent by 2050, adopt LEED Standards (Leadership in Energy and Environmental Design http://www.usgbc.org/DisplayPage.aspx?CategoryID=19) for new construction and major rehabilitations of government facilities and increase incentives for government entities to invest in energy efficiency, on-site renewable energy generation, and other LEED measures for sustainable buildings.
- To reduce Commonwealth of Massachusetts vehicles' greenhouse gas emissions 20 percent by 2010 and 80 percent by 2050, require Massachusetts government entities to purchase vehicles with ultra low emissions when purchasing a new vehicle and to purchase alternative fuel blends for all state owned vehicles and vehicles used in state-reimbursed transportation. Require a minimum blend of B5 (5 percent biodiesel) and E10 (10 percent ethanol) by 2008, increasing to B20 and E50 by 2010.

Conservation and Efficiency

- Provide incentives and low-cost financing for energy efficiency and other LEED measures for sustainable buildings.
- Waive the sales tax for highly efficient appliances, hot water heaters, furnaces, and boilers. Implement aggressive programs for the efficient use of natural gas and heating oil.
- Begin now to update building energy codes for residential and commercial sectors to LEED standards by 2015 and ensure sufficient inspector and contractor capacity, training, and support to enable effective implementation.

Clean, Safe, Renewable Energy

- Increase the Renewable Portfolio Standard (RPS) minimum standard to 20 percent by 2020. Strengthen the state's RPS by mandating that utilities sign long-term contracts for clean power. Develop a standard for clean, safe, renewable energy sources that reflects their true costs, including their impacts on the environment, health and climate. Ensure the RPS continues to provide incentives for the development of new renewable energy production using the cleanest, most energy efficient technologies.
- Provide incentives and low cost financing for increased use of renewable energy for heating and cooling installations, district energy applications, as well as electricity generation, including biomass heating and cooling applications, photovoltaics, solar hot water systems, passive solar heating and cooling, wind electricity generation, and geothermal heating systems.
- Set aggressive state-wide targets and increase incentives for residential, commercial, and institutional construction and renovation.
- Promote district energy systems to provide distributed generation, heating, and cooling to new clustered residential, mixed use development, and industrial parks.

- Encourage renewable self-generation for large energy users especially in areas which are grid constrained.
- Make "interconnect and access" rules favorable to Combined Heat and Power (CHP) generation, and facilitate CHP siting and permitting. Update steam boiler public safety laws that require 24/7 operator attendance, thereby making much distributed scale CHP economically unfeasible.
- Increase net metering laws to include generation up to 2 MW, and provide for reconciliation to be determined based on annual use rather than monthly use.
- Facilitate siting, permitting, and grid interconnection for renewable energy, particularly wind, solar, and biomass installations using the most efficient, cost effective, and least polluting technology available. Consider the full lifecycle costs of all forms of electricity generation and favor renewable sources of energy generation over the combustion of fossil fuels.

"The world's forests need to be seen for what they are . . . giant global utilities, providing essential services to humanity on a vast scale. Rainforests store carbon, which is lost to the atmosphere when they burn, increasing global warming. The life they support cleans the atmosphere of pollutants and feeds it with moisture. They help regulate our climate and sustain the lives of some of the poorest people on this Earth."

Prince Charles

- Create a low interest revolving loan fund to support feasibility studies, business planning, legal structuring, equity development, and financing for community-owned, clean, safe, sustainable energy-related businesses that create living wage jobs. Forgive the loan if the project is not pursued.
- Support the completion of forest management plans for state owned forestlands to enhance the ecological and economic opportunities of the forests and their role in providing sustainable biomass materials for renewable energy projects.
- Establish a subsidized loan program to stimulate private investment in the rural economy of

Massachusetts in developing biomass supply infrastructure including forestry equipment, aggregation yards, and transportation infrastructure.

- Strengthen the "Filthy Five" carbon dioxide standards for the state's six oldest and most polluting power plants (310 CMR 7.29 regulations). Encourage the use of biomass co-firing to reduce carbon dioxide emissions.
- Adopt incentives for sustainable alternative fuel production and use. Adopt a low carbon fuel mandate, similar to the measure adopted in Colorado. Eliminate fuel tax for biodiesel and ethanol blends of 5 percent or more. Establish a production tax credit for biodiesel and cellulosic ethanol produced within Massachusetts.
- Work toward eliminating electricity contracts between Massachusetts and all nuclear power facilities. Ensure that no new nuclear power is sited in the Pioneer Valley.
- Initiate and fund public education on the benefits of energy efficiency and renewable energy and actions that individuals and communities can take to use less energy, reduce their dependence on foreign oil, and increase their use of renewable energy at home, on the road, and at work.
- Support and fund research and development at Massachusetts state higher education institutions on conservation, efficiency, renewable electricity, and biofuels.
- Support and fund efforts to improve school curriculum standards to include essential topics related to sustainable energy.

Transportation, Land Use, and Waste Reduction

- Support policies and laws that promote compact development in urban and suburban areas, protect open space, including watersheds and drinking water discharge areas, wildlife habitat and farmland, and support mixed use districts, town and city centers that are transit-oriented, walkable, and bikeable.
- Enhance street safety: increase traffic calming, increase funding for "Safe Routes to Schools" programs, promote school renovation in town centers rather than new construction at suburban sites, and make bicycle-and pedestrian-friendly roadways a top priority.
- Expand funding for mass transit. Increase transit service in low to moderate income communities. Invest in multimodal networks, suburb-to-suburb connections, pedestrian and bike infrastructure, and collaborative efforts with employers to remove barriers to and provide incentives for non-car commuting.
- Invest in an extensive regional freight and passenger rail system. Support state, regional and local agencies to collaborate with the other New England states and Amtrak to expand rail service between Hartford, Springfield, Northampton, Greenfield, and Brattleboro (and points beyond) and between Pittsfield, North Adams, Greenfield, Northampton, Springfield, Worcester, and Boston.
- Support state efforts to facilitate efficient and affordable transportation of raw materials for industry in our region via rail.
- Encourage private sector purchase of cars with greater fuel efficiency and lower emissions ratings through a revenue-neutral program and tax relief. Reduce sales taxes on the cleanest cars and low-rolling resistance tires, and raise taxes on the most inefficient and polluting vehicles and tires. (According to a California Energy Commission report (www.energy.ca.gov/), the use of low rolling resistance tires on light-duty fleets saves enough fuel to pay for the additional cost of the tires over the life of the tires.)
- Authorize pay-as-you-drive automobile insurance, rewarding drivers financially for fuel efficiency and fewer miles driven. Enact a sliding scale fee on vehicle emissions, (the more you emit the higher the fee).
- Support and fund research and development efforts on sustainable clean fuel and energy crops which support healthy soils, clean water, clean air, and local food systems at Massachusetts state higher education institutions. Support and fund research and development efforts on waste prevention, recycling, and waste system efficiency at Massachusetts state higher education institutions.
- Work with the Governor and Legislators to fund a comprehensive energy efficiency program that has as its basis the recommendations put forth by the New England Energy Efficiency Partnership. Massachusetts is responsible for using half of the electric load in New England. Evaluate the funding required to reduce peak demand by 4,150 MW for Massachusetts by 2020 by doing the following:

  Increase ratepayer funding for energy efficiency (EE) programs with 50 percent incentives.

  Implement and enforce building energy codes.

  Adopt proposed state and federal minimum efficiency appliance standards.

  Expand procurement rules for state and municipal facilities and equipment purchases.

  Adopt or expand the resource acquisition role of energy efficiency to meet specific state and regional electric supply needs and increase incentive rates.
- Provide funding to regional planning agencies and others to develop regulatory tools for Pioneer Valley cities and towns to facilitate energy efficient construction and re-habilitation of homes and other buildings, striving to achieve the goals of Architecture 2030 (www.architecture2030.org).

ICLEI Local Governments for Sustainability

- Provide funding to enable all cities and towns in the Pioneer Valley to join ICLEI-Local Governments for Sustainability and to fully participate in their cities for climate protection program (www.iclei.org).

- Provide funding to continue implementation of a grassroots organizing program that would encourage every household and every business in the Pioneer Valley to reduce their electricity use, by doing such things as getting an energy audit, implementing recommendations of the audit, using Energy Star® appliances, buying locally grown food, using public transportation, encouraging smart growth, switching light bulbs to compact fluorescent lights, and installing clean energy systems.
- Support expansion of existing programs of utilities and not-for-profit groups such as the Center for Ecological Technology (CET) (www.cetonline.org) that conduct home and business energy audits and fund implementation of recommended improvements.
- Provide funding to regional planning agencies to develop and work with communities to adopt zoning bylaws or ordinances and subdivision regulations to facilitate the siting of renewable energy projects that have strong community support (www.cleanair-coolplanet.org).
- When requested by a city or town, support through media and other means the development and siting of clean renewable energy technologies in Pioneer Valley communities that meet a majority of the selection criteria and that will help achieve our clean energy goals by 2020.
- Provide funding to develop a western Massachusetts public information and education campaign for TV, radio, and newspapers featuring local success stories of energy savings, reduction, efficiency, and the generation of clean energy.
- Support the development of sustainable feedstock biofuel plants to increase the supply of liquid fuels for transportation, heating, and energy generation, helping to replace fossil fuels currently used for these purposes.
- Aggressively support the development of start-up energy companies to locate in the Pioneer Valley.

Pioneer Valley Renewable Energy Collaborative

- Continue to meet as necessary, and no less than quarterly to:

  Work to secure funding for plan implementation.

  Assess progress toward plan goals.

  Address issues and adjust the plan as needed.

  Develop recommendations and tactics to support the plan.

  Respond to stakeholder needs.
- Seek financial support to maintain and expand the region's capacity to proactively identify and facilitate renewable energy project development to serve its business, institutional, and municipal facilities. Support for this effort will be sought from contributions within the region, and from the MA Renewable Energy Trust. The support will enable the region to address a significant development gap in community scale renewable energy, which is the early stage effort needed to identify good project opportunities, develop project champions, conduct feasibility studies, and facilitate the project development process.
- The region has a history and unique on-going activities and commitment to support community or cooperative ownership of renewable energy projects. The region will convene an expert committee to prepare a business plan and propose the establishment of a community-based renewable energy investment fund to create a significant local project financing source for community-scale projects developed in the region. Such a financial mechanism will benefit project financial feasibility in the region, maintain project economic benefits locally, and enhance a community's support of renewable energy projects.

"The Time for Collective Action is Now. Governments, corporations, and individuals must act now to forge a new path to a sustainable future with a stable climate and a robust environment. There are many opportunities for taking effective early action at little or no cost. Many of these opportunities also have other environmental or societal benefits. Even if some of the subsequent steps required are more difficult and expensive, their costs are virtually certain to be smaller than the costs of the climate-change damages these measures would avert."

From "Confronting Climate Change: Avoiding the unmanageable and managing the unavoidable" United Nations Foundation, Feb. 2007 Executive Summary, p. 11

PVPC and FRCOG are very interested in continuing to staff the Pioneer Valley Renewable Energy Collaborative (PVREC) to assure implementation of this plan. Individual members of the PVREC, in their capacity as municipal staff, not for profit staff, business owners, and individuals, have shared responsibility for implementation of this plan. There is considerable work to be done to secure funds to enable municipalities, not for profits, and business owners to act on the plan recommendations.

PVPC and FRCOG propose to work with the Collaborative to prepare an unsolicited grant proposal to MTC for implementation of some of the top recommendations of this plan. Other members of the Collaborative are working to secure funding on their own to implement plan recommendations. Senator Stan Rosenberg is looking at the legislative recommendations and will include some or all of them in his work. We have prepared white papers for Congressman John Olver, given his past support for and interest in clean energy and global climate change, in the hopes of securing a line item request for federal funds to implement this plan. We still need to do additional work to develop specific cost estimates and funding sources for the various recommended actions.

Barriers

There are a number of barriers to clean energy and energy conservation, efficiency, and reduced use. There are many reasons why people are not doing as much as they can to reduce greenhouse gas emissions and slow global warming. And there are many reasons why it is hard to create local jobs in the clean energy industry here in the Pioneer Valley. It is important to acknowledge these barriers to the achievement of our goals, so that we can all work together to overcome them. One of the key barriers to the success of any clean energy effort is location, or siting. A local case study of issues related to siting is the proposed Russell Biomass plant.

Siting Issues

From October 2006 to July 2007 several online forums were open on our Pioneer Valley Clean Energy Planning Website. The two most popular discussion groups were the forum on the Russell Biomass Plant with 38 members posting 200 messages, and the general forum with 165 members posting 167 messages. The majority of the discussion online focused on the proposed Russell Biomass Plant, a relatively large-scale facility expected to generate 50 MW of electricity. Here are some of the things we learned.

Opponents to the plant voiced the following concerns:

- Air quality concerns from stack emissions and diesel truck emissions in their river valley because of frequent air inversions that trap hazardous air pollution at ground level.
- Biomass should not be included in a "clean" energy plan because it produces air pollution and greenhouse gases when it's burned.
- Impact of water cooling process on the river; the plant's wet cooling towers would use 885,000 gallons of Westfield River water each day.
- Disruption of a residential neighborhood, near an elementary school and homes, with 840 tractor-trailer trucks a week bringing in wood to the plant.
- Concern about the violations documented in similar plants where they were found to be burning contaminated wood and demolition debris even thought they were not permitted to do so – How can residents know this plant will burn only–"clean" wood now and in the future if permitting becomes more lax allowing these polluting fuels to be burned?
- Concerns about technology: What emissions controls and cooling tower will the plant use?
- Concerns about the decision making process: How do you get reliable information? Who has access to it? Who has input into the siting and permitting decisions? Who is getting money for helping this plant get sited? Are the elected officials in Russell acting in the town's best interest? Did residents get adequate notice before the Select Board signed on to support the biomass plant? Some residents believe they did not get adequate notice before the Select Board signed onto this project.
- The Town of Russell has not had any industry for many years. People who have moved there in the last decade moved to a tranquil, beautiful small town. Their sense of their town's identity is being threatened with this very large industrial development right in their back yard.

Supporters of the plant say:

- Cooley Dickinson Hospital and Mount Wachusett Community College both have very successful biomass plants. The developers have agreed to limit burning to wood chips from forest gleanings and non-toxic pallets. Why can't we believe them?
- Are the down sides of the Russell plant greater than the status quo of foreign oil and nuclear power?
- Biomass is one of the few sources of energy we have in plentiful supply in Western Mass and it's one of the most affordable energy sources to build and operate. It also is an engine for economic development, supporting a large number of forestry and trucking jobs in the region.
- If the people in Russell have decided not to elect the Select Board representative that the biomass plant opponents ran in the last election, and if the elected officials on the Select Board representing the town have voted to support the plant, why would people outside of Russell oppose a plant the majority of the people in Russell are supporting?
- The amount of water required by the plant (885,000 gallons per day) is comparable to the 1.2 million gallons per day of water that evaporates every day from the Westfield River. Studies have shown it's not a problem. The daily August flow is 161 million gallons per day.
- If the plant satisfied the state of Massachusetts' air quality permitting process, it will not compromise the health and safety of the residents in the town. The efforts of the developers to replace old wood burning stoves in town are a good faith effort to improve air quality and alleviate the negative impact on air quality from their plant with a stack 135 feet high dispersing the emissions over a broad range.
- The town of Russell has been an industrial town. With this plant, it's just going back to being what it once was. People who have lived in town for decades want jobs and industry to return to their town. Their sense of their town's identity is being restored.

Given the discussion and different points of view strongly held by residents in the Pioneer Valley, we can learn from the online planning process how we might address identified barriers to clean energy projects. Small-scale distributed generation combined with heat and power biomass plants may be better received in the region than a larger biomass plant that does not use generated heat.

Renewable energy technologies have an enormous potential in the United States and that potential can be realized at a reasonable cost. Market research shows that many customers will purchase renewable power even if it costs somewhat more than conventional power. However, both economic theory and experience point to significant market barriers and market failures that will limit the development of renewables unless special policy measures are enacted to encourage the appropriate application of these technologies.

The hurdles clean energy development projects face can be grouped into four categories:

- Commercialization barriers faced by new technologies competing with mature technologies.
- Price distortions from existing subsidies and unequal tax burdens between renewables and other energy sources.
- Failure of the market to value the public benefits of renewables.
- Market barriers such as inadequate information, lack of access to capital, "split incentives" between building owners and tenants, and high transaction costs for making small purchases.

In addition to siting concerns and market issues, there are other prominent barriers to clean energy (most likely in the form of distributed generation) at the local level.

Examination of municipal-level issues related to distributed generation is in the beginning stages. Conditions vary significantly from municipality to municipality. Nevertheless, general findings show the types of local barriers that may be anticipated upon the emergence of any new technological development. These barriers as applied to distributed generation include:

General

There is a lack of understanding about and awareness of distributed generation technologies in the regulatory and policy-making communities. There is differential knowledge of various distributed genera-

tion technologies and an overall exclusion of biomass from Municipal Zoning By-Laws/ordinances. There is a lack of clarity regarding the threshold between accessory use and primary use for distributed generation facilities and a lack of consistent definition and interpretation of distributed generation as a primary use. There is inconsistent attention to the permitting of power generation in local by-laws and uncertain permitting pathways due to an absence of appropriate use terms to cover distributed generation. Extensive review processes and potential for excessive time delays may arise from the need for special permits, variances, or zoning amendments to accommodate distributed generation facilities. There is inconsistent treatment of wind facilities and lack of height exemptions for wind facilities. Less familiar technologies, such as biomass and landfill gas are omitted and there is a failure to extend protections, in effect for solar and wind, to biomass.

Historic Commissions

There may be a simple absence of consideration for wind power generating facilities. Modern wind towers may be found to be incompatible with historic district requirements. And there may be an absence of exemption from historic district regulation for public utilities.

Environmental

There is a potential for Conservation Commission review and ensuing appeals/time delays along with other possible delays from more rigorous environmental standards imposed on renewable energy versus conventional energy generation.

Local Administration of State Codes

Project proponents might experience possible delays from building, electrical, and plumbing code enforcement where independent engineering review is required. Additional construction costs might emerge from compliance with fire safety requirements. Possible referral by Board of Health to State Department of Environmental Protection of potential air pollution problems where facilities use less clean fuels, as with wood-burning biomass facilities.

Permitting

The majority of Pioneer Valley communities do not have professional planning staff, thus the existing project review system is likely to continue to create difficulty in coping with the substantial number of applications needed for projects to meet clean energy targets. Lack of expertise, difficulty in prioritizing applications, and the fast pace of emerging technology all appear to be issues. Nor is it clear that the system can cope with the activities of small well-resourced and well-organized special interest groups operating on a sub-regional, regional or national scale. Planners, permitters (and elected officials) need to understand the bigger picture, and have the resources to deal with it.

Developers and Research and Development

The situation of small-scale projects and newer technologies remains uncertain. It is far from clear who will bear the risk of taking newer technologies, well funded at research stage through the much more costly and risk proving phase to create large scale facilities.

Public

As seen in the online and in person deliberative planning process used to involve the public in the development of this plan, the public remains conflicted about clean energy proposals. There is a clear need for a substantial awareness campaign, funded by government and with technical input from the various regional renewables bodies, with a view to ensuring a much higher level of public understanding and commitment.

Energy Options

Because it so clearly and concisely explains the importance of energy efficiency as a foundation of every clean energy planning initiative, the following five paragraphs are reprinted with permission from an American Council for an Energy-Efficient Economy (ACEEE) report.

Energy efficiency and renewable energy are the "twin pillars" of sustainable energy policy. Both resources must be developed aggressively if we are to stabilize and reduce carbon dioxide emissions in our lifetimes. Efficiency is essential to slowing the energy demand growth so that rising clean energy supplies can make deep cuts in fossil fuel use. If energy use grows too fast, renewable energy development will chase a receding target. Likewise, unless clean energy supplies come online rapidly, slowing demand growth will only begin to reduce total emissions; reducing the carbon content of energy sources is also needed. Any serious vision of a sustainable energy economy thus requires major commitments to both efficiency and renewables.

> **"Improving energy efficiency represents the most immediate and often the most cost-effective way to reduce oil dependence, improve energy security, and reduce the health and environmental impact of our energy system. By reducing the total energy requirements of the U.S. economy, improved energy efficiency will make increased reliance on renewable energy sources more practical and affordable."**
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> From "American Energy: The Renewable Path to Energy Security"– Worldwatch Institute, Center for American Progress, p. 21. 2007.

Energy efficiency can provide large savings in the short and medium terms, but if opportunities are aggressively pursued, in the long term remaining opportunities will likely be more limited. Renewable energy, on the other hand, can supply some energy in the short term, but its opportunities expand over time. For example, a recent ACEEE study on natural gas markets found that energy efficiency investments can lower natural gas prices by more than 20% over the next eight years, but beyond that substantial renewable energy production is needed to maintain significant price reductions. Likewise, the ACEEE/ Union of Concerned Scientists" Clean *Energy Blueprint* study found that energy efficiency, renewables, and CHP could reduce U.S. electricity use in 2020 by about 2,900 billion kWh.

Efficiency can be acquired relatively cheaply; the cost of saved energy in most efficiency studies is lower on a levelized basis than the cost of existing or new conventional power generation. Renewables are often more expensive per kWh than existing conventional utility power generation, but are increasingly cost competitive with new conventional utility power generation. Combining these two resource types can reduce overall electricity system costs compared to a renewables-only policy approach. Efficiency and renewables can also provide price stability benefits to power systems. Efficiency, by bringing down demand, can moderate wholesale price spikes, reduce average prices, and indirectly reduce the prices of affected generation fuels.

In a complementary way, renewables, which are typically not subject to fossil fuel price volatility, provide their own hedge value. Thus energy prices in a region with aggressive commitments to both efficiency and renewables are likely to see less volatility and lower average power prices, since price spikes will be reduced. Efficiency and renewables also provide complementary economic development benefits by generating investment and employment in different sectors, which expands the total economic stimulus effect. The majority of utility expenditures in most states is exported to national and global energy companies, so efficiency and renew-

able investment is in fact the best way to generate new economic activity within a state's borders.

Efficiency and renewables, because they have different load shape impacts based on time of day and season, can improve overall system operations. On hot summer afternoons, efficiency can help bring down peak load, while solar and wind systems can operate at high output, reducing the use of high cost, high-emission peaking generation. This brings down total electricity prices, acting as a diverse set of price hedges. It also improves system reliability by deploying a diverse set of efficiency and renewable technologies, especially in transmission-constrained "load pockets." Additionally, using energy efficiency and renewable energy as distributed resources can reduce transmission and distribution line losses.

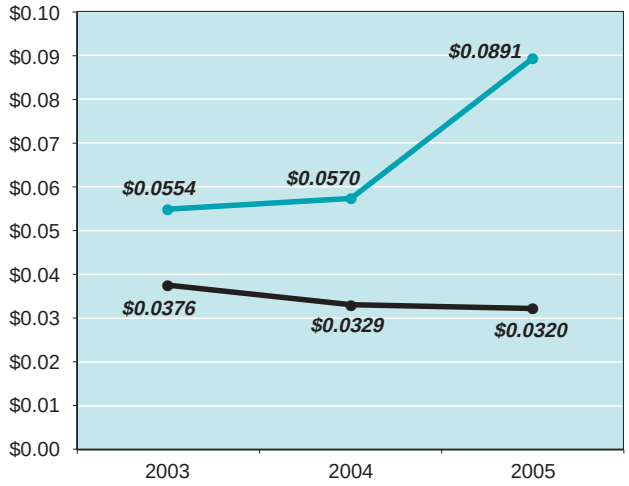
Source: Prindle, B., Eldridge, M., Eckhardt, M., and A. Frederick. 2007. "The Twin Pillars of Sustainable Energy: Synergies between Energy Efficiency and Renewable Energy Technology and Policy. Eo74. Washington, D.C. American Council for an Energy-Efficient Economy. Full report available at www.aceee.org/pubs/e074.htm.

Energy Efficiency & Conservation Potential

As noted previously, the Northeast Energy Efficiency Partnerships Inc. has determined that investments in efficiency improvements over a ten-year time period in New England could result in savings of 28 percent of the total peak summer capacity and 37 percent of the capacity represented by plants using fossil fuels. If a 28 percent reduction is possible for all of New England, we believe it is also possible for the Pioneer Valley.

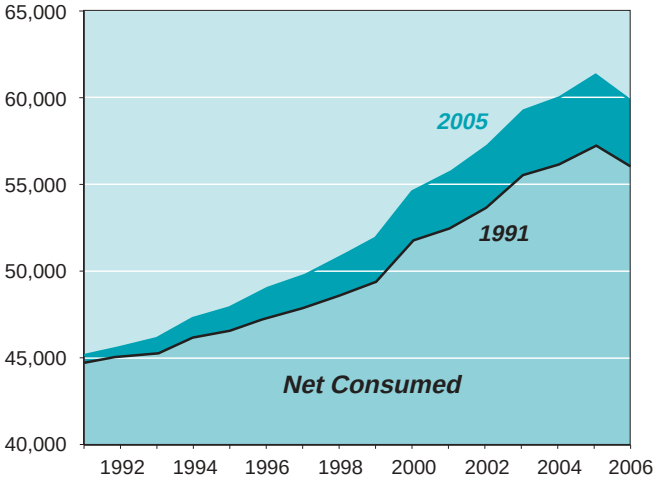
Energy Efficiency avoids the need to produce some quantity of electricity that would have been otherwise demanded by a user of an electric powered device – a lamp, 1,000 HP motor, or a cordless telephone for example. The cost of avoiding a kilowatt or kilowatt-hour of electricity is substantially cheaper than the cost of generating a kilowatt hour. Figure 5 shows the comparative cost of kilowatt hours avoided by Massachusetts' electric energy efficiency programs in the years 2003-2005 and the average cost of electric generation on the spot market for those years. Figure 6 portrays changes in electric generation cost and the cost of energy efficiency per kWh produced or avoided.

Figure 5: **Relative Electricity Cost**



Source: Massachusetts Saving Electricity: A Summary of the Performance of Electric Efficiency Programs Funded by Rate payers between 2003 and 2005, April 2007.

Figure 6: **Cumulative Electric Energy Savings Resulting from MA Energy Efficiency Programs (in GWhs)**



Source: Massachusetts Division of Energy Resources

The following actions should be considered as additional measures that people, institutions, organizations, agencies, and companies can take that will help us meet or exceed our four goals. Additional work needs to be done to quantify the effect of these actions with respect to our goal of reducing our region's energy consumption to 2000 levels by the end of 2009 and an additional 15% reduction from 2010 to 2020, but that does not mean that we should wait to act.

Promote green building and development at the residential, commercial, and municipal levels.
All levels of government and society can work to advance this goal. We need to assess energy efficiency of existing building stock and retrofit municipal buildings for greater energy efficiency. We also need to use both positive and negative reinforcement to encourage the purchase of energy efficient products. We need to use programmable thermostats, install setback controls on heating, cooling, and ventilation systems and support off-peak appliance/equipment use. We need to promote/support natural lighting in buildings, use trees and vegetation to reduce heat/cooling loads on buildings and use cool roofs (high reflectance/emittance materials) and green roofs whenever we can. We need to replace existing lights, traffic signals and exit sign lights with compact fluorescent or LED fixtures and we need to provide energy efficiency training for builders. We also need to build on existing partnerships with the Center for Energy Efficiency and Renewable Energy at UMASS to help local businesses, developers, etc. apply the Center's research. Signing on to Architecture 2030 http://www.architecture2030.org/ is a great way to achieve many of these goals.

Provide financing and funding for energy efficiency.
Some ways this could be achieved are by funding carbon reduction/energy efficiency programs with an "energy tax"; providing loans and financing for energy efficiency, and providing free or subsidized insulation for low-income residences.

Adopt new regulatory measures for energy efficiency.
We need to work together to support amendments to the State Business Energy Tax Credits and State Energy Loan Programs to encourage green building practices and make the tax credits more accessible to organizations. We also need to work toward tax and regulatory policies that reflect the true cost of energy production and manufacturing processes based on a life-cycle analysis and use that information to develop energy efficiency building codes.

Integrate energy conservation into the operations and management of municipal government.
We can do this by considering the establishment of an energy management position at the regional level and by integrating renewable energy and energy efficiency into all planning and development processes. We have established regional energy efficiency and clean energy targets, now our municipalities must also set municipal energy efficiency targets. We can require or encourage municipal employees to favor "green products" when purchasing for municipalities and facilitate the use of energy-service performance contracts, by businesses, government, and non-profit agencies. The city of Cambridge offers a way to do this http://www.cambridgeenergyalliance.org/. Offices, both public and private, can use digital technology to reduce the amount of paper required in order to reduce energy used in the production, distribution, and recycling of paper products.

Advocate for energy conservation / efficiency.
We must help small businesses, non-profit organizations, and public agencies gain access to energy efficiency services while we continue to advocate strengthening the Massachusetts state building code to include all cost-effective energy-efficiency measures. We can work with industry to identify opportunities for improving energy efficiency in process applications and to use waste-heat recovery for co-generation. We can also support small business conservation programs through new agreements in utility franchises.

Promote Energy Star® products/programs.
We should all recruit businesses and organizations into the Energy Star® program with the goal of reducing energy use and then utilize pledges, peer exchanges, and public recognition programs to sustain involvement. We can work with local stores

to promote Energy Star® products and educate consumers about the Energy Star® label and also encourage businesses to take advantage of available utility rebates and join the Energy Star® program with the goal of reducing energy use.

Promote energy conservation at the residential level. We can do this by facilitating the weatherization of homes, making sure that financial assistance is available to low-income households and by implementing neighborhood-based outreach efforts to combine and promote energy and water conservation, solid waste reduction, safety, and livability. Requiring green building and energy-efficiency measures, including Energy Star® appliances, lighting, and heating equipment in city/town-funded affordable housing and other development projects would also help, as would support for residential conservation programs through new agreements in franchises with local utilities. We also need to expand programs to support residential use of LED fixtures and compact fluorescent lights and facilitate the installation of energy conservation measures in multi-family units. It may be necessary to provide green building design assistance and technical resources to residential developers, designers, homebuilders, and residents. We can improve the maintenance of residential heating, ventilation, and air-conditioning equipment by educating consumers and schoolchildren and by working with the state and other partners to offer financing for the purchase of high-efficiency furnaces, heat pumps, air-conditioning systems, replacement windows, insulation, water heaters, appliances, and other large energy-using systems. We must also ensure that standard residential energy audits include review of major appliances, education of residents, and direct installation of efficient lighting and water-saving devices. It would also be worthwhile to explore requiring weatherization of residential properties at time of sale and re-sale.

Renewable Energy Potential

This section provides a summary of each renewable energy technology that can be developed in the Pioneer Valley. For information on existing and proposed projects, see the Pioneer Valley Clean Energy Inventory available at www.pvpc.org and www.frcog.org.

Wind

Wind is one of Massachusetts' primary renewable energy resources, and in many cases the most economical. A well designed wind power project can produce energy (kilowatt-hours) at prices similar to new fossil fuels plants. Many factors go into determining whether a site is appropriate for a wind power project, including wind speed, environmental considerations, land use, distance to residences, and other permitting restrictions. The specifics of siting wind power will not be detailed here – the purpose of this document is not to target any specific places – but a few items will be mentioned in order to help understand the wind energy potential of the Pioneer Valley. In order to begin to understand what constitutes an economical wind project, here is a brief introduction to two important concepts: turbine scale and wind resource.

Turbine Scale

Wind power can be divided into three size ranges, which are used for different applications. Here we focus on medium and commercial-scale wind power. The size is chosen differently depending on the

Wind turbine installation, Jiminy Peak-Berkshire Co.

turbine's purpose. Typical sizes in the three ranges currently available in the US are shown in Figure 7.

In each case, the approximate annual energy production of an example turbine in that scale is given; the example assumes that the turbine is installed at a fairly windy site that has mean wind speeds of 7m/s (15.6 mph). These examples are rough numbers and are only given in order to show the difference that turbine scale makes. For comparison, the average Massachusetts household uses 7,200 kWh/year.

Figure 7: **Windpower Specifications**

Residential: below 30 kW
- Diameter: 1 - 13 m (4 - 43 ft)
- Tower Height: 18 - 37 m (60 - 120 ft)
- Example energy production: ~20,000 kWh/year (10 kW Bergey XL)

Medium: 30 - 500 kW
- Typically used when there is a large electrical load.
- Diameter: 13 - 30 m (43 - 100 ft)
- Tower Height: 35 - 50 m (115 - 164 ft)
- Example energy production: ~500,000 kWh/year (250 kW Fuhrländer FL 250)

Large scale: 500 kW – 2.5 MW
- Diameter: 47 - 90 m (155 - 300 ft)
- Tower Height: 50 - 80 m (164 - 262 ft)
- Example energy production: ~4,000,000 kWh/year (1,800 kW Vestas V80).

Because of the large difference in production (and in particular, the cost of that output), clean energy plans must focus primarily on large scale turbines. While residential-scale wind turbines can be a good option for homes, farms or businesses in windy areas, they cannot form the backbone of a realistic energy plan.

For more information on wind turbines, siting, resource, permitting, and small turbines, see RERL's Community Wind Fact sheet series, www.ceere.org/rerl/about_wind/

Wind Resource: Wind power energy production is highly dependent on wind speed; small changes in wind speed make big changes in annual output. For this reason, the siting of successful wind power projects carefully considers wind speed.

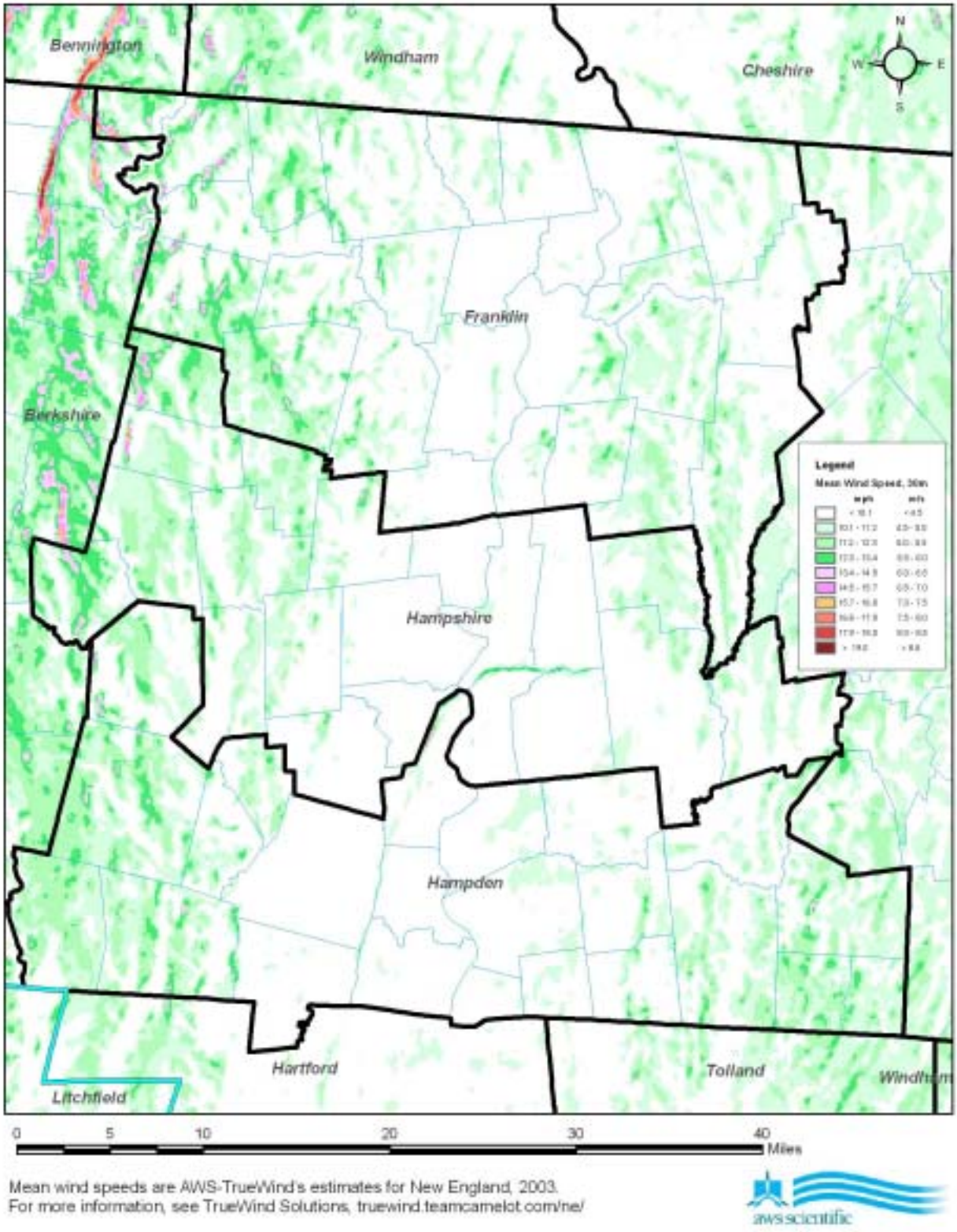
Massachusetts' best wind resource are at higher elevations, the coastlines, and offshore; the maps on the following pages show estimated wind speeds in the three-county area (Franklin, Hampshire and Hampden.) One map shows estimated wind speeds at a height of 70 meters and is used as a screening tool to suggest where it is appropriate to consider large-scale turbines. The other map shows winds at 30 meters height, and is used to screen sites for small, residential wind turbines.

Compared to Berkshire, Worcester, and particularly the coastal counties, the three counties along the Connecticut River Valley do not have a plentiful wind resource. However, there are several areas that could host wind power projects, and a few communities are considering community-owned or sponsored wind turbines. In order to get a sense of scale, consider the example of four communities hosting projects of one to five full-scale turbines; in this example, the turbines could produce in the range of forty million kilowatt hours per year, or about 5,600 households' worth of electricity.[2]

Two facts may result in future wind development beyond these few locations. First, small-scale wind turbines remain an option for a number of regional farms, ridgelines and open fields. Individual small-scale wind turbines yield a much more modest energy output. Nevertheless, these turbines can still be economically profitable. Moreover, if developed thoroughly in the Pioneer Valley, small-scale wind can have a significant effect on the region's clean energy production. Second, as new and more efficient technologies develop in this burgeoning industry, sites deemed unfit for wind production may prove to be feasible locations for wind turbines in the future.

[2] To estimate this number, multiply the following assumed numbers: (4 towns) x (average project size: 3 turbines) x (average turbine size: 1,500 kW) x (average capacity factor: 27%) x (availability: 95%) x (8,760 hrs/year) = 40,444,920 kWh/year. Divide that by the average Massachusetts household's annual consumption of 7,200 kWh/year to get the number of households served. For an introduction to the meaning behind these numbers, see RERL's community wind fact sheet "Capacity Factor, Intermittency, and what happens when the wind doesn't blow?" at this address: www.ceere.org/rerl/about_wind/)

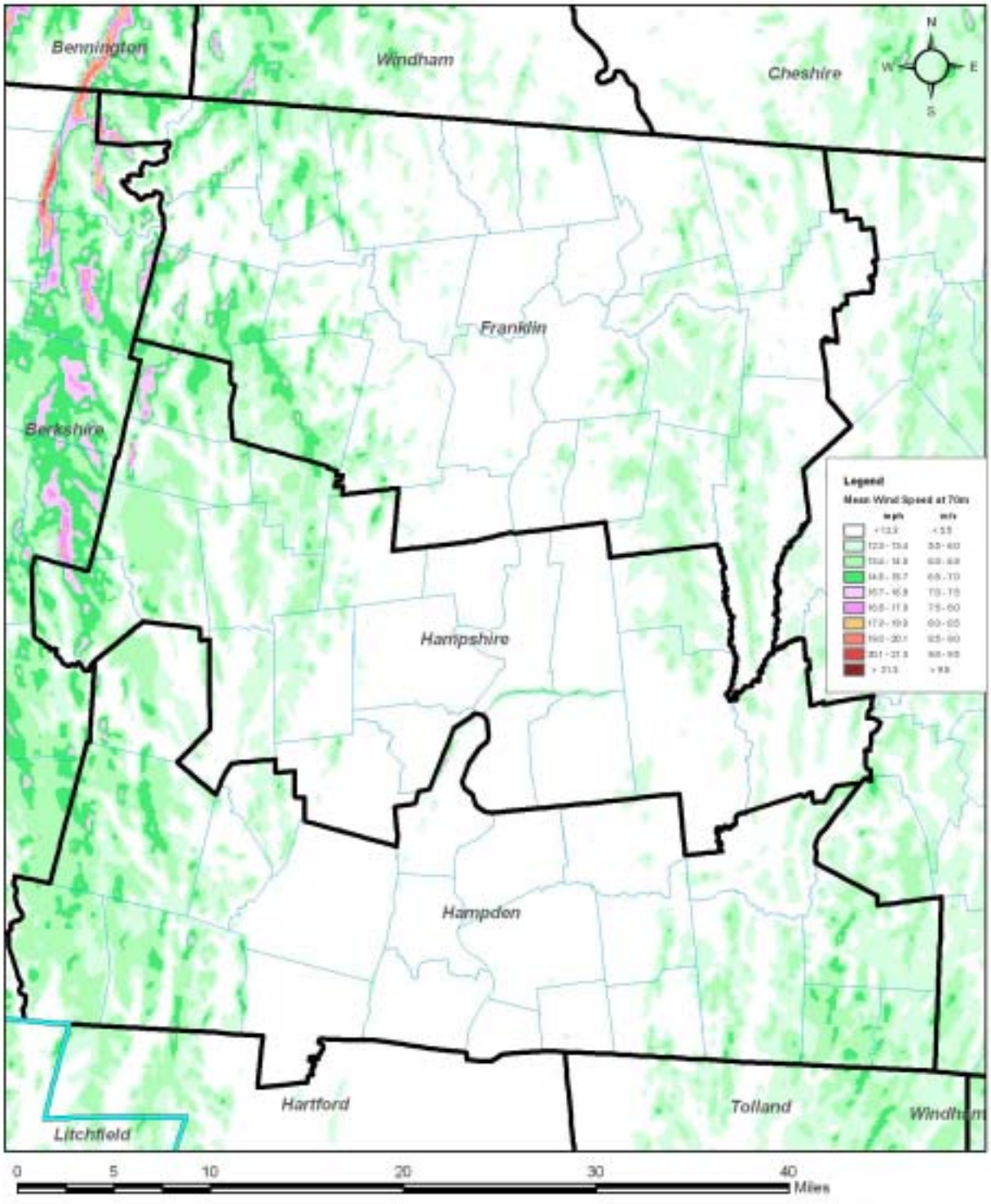
Estimated Mean Wind Speed at 30 Meters



Mean wind speeds are AWS-TrueWind's estimates for New England, 2003.
For more information, see TrueWind Solutions, truewind.teamcamelot.com/ne/

aws scientific

Estimated Mean Wind Speed at 70 Meters



Mean wind speeds are AWS-TrueWind's estimates for New England, 2003.
For more information, see TrueWind Solutions, truewind.teamcamelot.com/ne/

aws scientific

One issue associated with wind development, which deserves serious consideration and discussion, are impacts on neighboring properties and scenic character. Local residents have expressed concerns about the siting of wind turbines in their neighborhoods. As part of the development of this clean energy plan, we started a very frank discussion about some of the issues involved in the balance between aesthetic and environmental concerns and the development of clean energy. This is an important conversation, and one that should continue. Communities will need to decide whether commercial or small scale wind developments should be sited in their town.

Landfill Gas/Co-Generation

Landfills produce various gases (LFG) through the decomposition of biological materials. In order to avoid dangerous explosions and limit the amount of LFG that migrates into the atmosphere, LFG is traditionally collected and flared. However, LFG can be turned into energy by drilling wellheads into the dump field and burning the gas for energy. Although relatively small in output, these facilities can provide energy from an untapped resource that would otherwise be flared and wasted. Given the benefits of burning LFG for energy instead of merely flaring the gas, Landfill Gas/Co-Generation should be pursued as an alternative energy option at all regional landfills where the process is feasible. There are seven sites either currently producing or permitted to burn LFG for energy in the Pioneer Valley: two in Chicopee and one in Granby are functioning as of plan release (2007). Four more are in the works in the communities of Northampton, Westfield, Palmer and South Hadley. This means that all large landfills in the region have been (or are being) developed. As technology changes, it may become cost effective to develop the clean energy potential of smaller landfills.

Chicopee Landfill Gas Generator Highlights

One of the most advanced low-emission biomass projects in New England

Began operating in January 2004

5.7 megawatt capacity

Produces enough energy to power approximately 2,150 homes annually

Owned and operated by the Chicopee Municipal Light Plant.

Hydropower

Hydropower is a clean, renewable energy source that can also produce regular water supplies and flood controls. Despite high capital associated with the construction of a hydropower facility, hydropower generation is considered quite cost-competitive due to facilities' long lifecycles and low operation and maintenance costs. The Pioneer Valley has broadly accepted and utilized the benefits of hydropower facilities for decades. There currently exist 35 hydropower plants in the Pioneer Valley, which produce 30.27 MW of electricity (2002). In certain situations, hydropower can have negative impacts if structures interfere with fish migration, result in low dissolved oxygen levels, or destroy regional habitats. However, many of these negative externalities can be avoided or minimized in the Pioneer Valley river system. Thus, hydropower stands as a modest potential contributor to increasing the region's clean energy production.

Currently, no small-scale hydropower projects are under development in the Pioneer Valley. However, the region should certainly study and develop viable sites—provided that these facilities do not significantly interfere with wildlife habitats. There is a need for thorough research into the clean energy generating potential of all regions of the Commonwealth.

According to a 1995 study prepared for the U.S. Department of Energy, "U.S. Hydropower Resource Assessment for Massachusetts", by the Idaho National Engineering Laboratory that used modeling software, there are at least 130 sites in Massachusetts river basins that have the potential to generate hydropower. The basin with the most undeveloped hydropower potential is the Connecticut River with 68 sites and an estimated 294 million kilowatt hours per year[3] of capacity. The Connecticut River Basin total is driven by three sites that have more than half the basin's total undeveloped potential. Over half of

[3] Based on a seasonal average capacity factor of 0.4.

the estimated potential capacity across the entire state comes from sites that are currently undeveloped where impoundments might need to be constructed.

The Low Impact Hydropower Institute in Portland, Maine certifies "low impact" hydropower facilities using low impact certification criteria. Low impact facilities are not necessarily small hydro. Large hydropower facilities can be "low impact" if they meet a set of eight criteria according to the Low Impact Hydropower Institute. A site that meets these criteria would reflect a reduction in the long-term environmental impacts often associated with hydropower projects independent of their size:

- The facility (dam and powerhouse) should provide river flows that are healthy for fish, wildlife, and water quality, including seasonal flow fluctuations where appropriate.
- Water quality in the river is protected including the demonstration that the impoundment has not contributed to a state finding that the river has impaired water quality.
- The facility provides effective fish passage and protects fish from entrainment.
- Sufficient action has been taken to protect, mitigate, and enhance environmental conditions in the watershed.
- The facility does not negatively impact state or federal threatened or endangered species.
- The facility does not inappropriately impact cultural resources.
- The facility provides free access to the water and accommodates recreational activities on the public's river.
- The facility is not sited at dam locations that have been identified for removal due to their environmental impacts.

Solar Electric Photovoltaic

Passive solar buildings use the sun to directly heat buildings that are constructed with extremely good insulation, or what is called, a tight building shell. They can significantly reduce the cost of heating, cooling, and lighting a building. Active solar energy systems can generate hot water or electricity. Solar hot water systems are the least expensive, most cost-effective systems to install. They use the sun to pre-heat hot water, reducing the cost significantly. Solar electric or photovoltaic cells (PV) convert heat energy from sunlight directly into electricity for use at a single structure or for transfer into the electric grid.

One of the greatest benefits of solar technology is its minimal environmental impact. Once installed, solar technology requires no additional energy. Consequently, the only negative impact solar technology has on the environment is during its construction. Moreover, solar technology is traditionally installed on or near existing structures. As a result, solar power has minimal land use impacts. Nevertheless, like any technology, solar energy does have certain drawbacks. The primary drawback for solar technology is the cost of installation. Despite consistent advances in the development of solar systems, solar electric systems are very expensive to install.

Notwithstanding the current price of solar energy, this technology presents itself as a promising contributor to the region's clean energy future. Market analysts predict that as technological developments improve efficiency and lower manufacturing costs, use of solar technology will continue to expand. This maturation of the solar energy market should be encouraged at the local, state and federal level through incentives for both manufacturers to develop better technology and energy users to purchase the technology.

The current amount of solar technology operating in the region is difficult to comprehensively measure. However, there are several commercial and large-scale residential PV installations known of in the region generating an estimated 50 kilowatt hours of electricity. The estimated build out of clean energy

from solar PV is limited only by the amount of appropriately oriented south-facing roof and other flat space available.

Solar Hot Water

Solar thermal water heating equipment can pay for itself in 5-10 years and provide free hot water thereafter. Solar water heaters have a life span of 30-40 years. In most cases the solar collectors will outlast the roof on which they are placed. Solar generated hot water can also be used to heat a home using an in-floor radiant heating system. Solar water heating systems viewed over time are free because they will increase the value of a home or business and the increased value will be retained. Owning a solar thermal system will protect consumers from future increases in fuel costs. 70-85% of domestic water heating needs for a building can be supplied by solar thermal systems. Up to 75% of home heating needs can be met by solar thermal heating systems. Solar thermal systems are about four times more efficient at producing energy than photovoltaic systems. For a relatively modest initial investment solar thermal systems are once again being employed by home and business owners in the pioneer valley to dent the juggernaut of ratcheting energy prices. Like solar photovoltaics, there is no measurable limit on the amount of energy we can generate from solar hot water in the Pioneer Valley.

Biomass

Biomass refers to biological material that can be used to produce energy. This can include wood, animal waste, and agricultural crops; which are burned for heat and/or electricity or processed into liquid or gaseous biofuels. In New England we are fortunate to have abundant forest resources, which have the potential to supply great quantities of sustainably harvested wood chips and other products.

The development of new bioenergy industries could provide clean energy services to millions of people who currently lack them, while generating income and creating jobs in poorer areas of the world. But rapid growth in liquid biofuels production will raise agricultural commodity prices and could have negative economic and social effects, particularly on the poor who spend a large share of their income on food…In many countries, the current structure of agricultural markets means that the bulk of the profits go to a small portion of the population. Unless ownership is shared more equitably, this divide could become as true for energy commodities as it is for food commodities today.

US Report on Sustainable Bioenergy:
A Framework for Decision Makers. April 2007

Unlike fossil fuels, wood is renewable when sustainably harvested, and when wood combustion and growth rates are equal there is no net emission of CO_2. Replacing fossil-derived energy with biomass can reduce greenhouse gas emissions. Unlike other renewable energy technologies, biomass facilities require a regular supply of operating fuel from local sources, which requires significant amounts of capital and labor to produce and directly benefits the local economy. By providing markets for low value forest products, biomass facilities increase the ability of land managers to manage for wildlife, fire prevention and forest health.

The Sustainable Forest Bioenergy Initiative (SFBI) is an effort by the Department of Conservation and Recreation and the Division of Energy Resources to facilitate the development of biomass markets in Massachusetts. Initial work suggests that there is great potential for future biomass energy development because the estimated sustainable annual biomass harvest is larger than current use, and other industries would benefit from outlets for wood disposal. Renewable Portfolio Standards provide a financial incentive to construct new biomass power plants. Such plants will likely be small by fossil-fuel standards, but may increasingly produce both useful heat and electricity. There is also great potential for the production of cellulosic ethanol and other biofuels.

Massachusetts currently has only one operating biomass electricity plant, Pine Tree Power in Fitchburg (16 MW), although a number of other plants operate in New England. Public Service of New Hampshire's 50 MW Schiller plant opened in 2006 in Portsmouth. In the Pioneer Valley the Cooley Dickinson Hospital in Northampton has been generating heat using biomass for over 20 years.

Draft results of the SFBI work suggest that roughly 1,116 - 1,314 million kilowatt hours per year of biomass energy could be developed in the western half of Massachusetts. This biomass build out in Massachusetts and the Pioneer Valley could include large power plants between 25 and 50 MW, combined heat and power plants between 5 and 10 MW, and numerous small 1-5 MMBtu/hr heat-only systems. The actual number, size and location of these facilities will depend upon fuel supply, transportation infrastructure, site opportunities, economic incentives, local permitting, and other social and environmental factors. A detaied report on Biomass is included in the Appendix.

Biofuels

Biofuels are liquid or gas fuels made from organic fats and oils from plants and animals. Biofuels can be used for transportation or heating. Sugar cane, sugar beets, corn, soy beans, oil seeds such as canola, palm, mustard, cotton, etc., switch grass, and wood are some of the common plant sources of biomass that can be made into biofuels. While manure and fat are typical animal sources of biomass that can be made into biofuels. Biofuels are one type of bioenergy. Biofuels replace fossil fuels, increase national security and provide local jobs. When produced sustainably, they reduce greenhouse gas emissions and provide a sustainable fuel supply for the future.

For the last 100 years we've increasingly relied on fossil fuels for transportation. Prior to that transportation was fueled by biomass, as horses and other animals that provided transportation ate grasses and grains for their fuel. As our supply of fossil fuels become less plentiful and more expensive, we're turning back to biofuels for transportation. Conversations have begun looking at how we can effectively use our land to provide food and fuel once again to sustain our communities.

The United Nations issued a report in April 2007 on Sustainable Bioenergy. It said:

The gradual move away from oil has begun. Over the next 15-20 years we may see biofuels providing a full 25 percent of the world's energy needs.

Bioenergy is being used all over the world. In some instances it is truly sustainable, and in others it is highly destructive. A wide range of bioenergy types currently exist, as well as a variety of production and utilization systems that have very different social, economic, and environmental impacts.

The ability of various bioenergy types to reduce greenhouse gas emissions and conserve energy varies widely. Where forests are cleared to make way for new energy crops, or with raw materials that use more energy to be produced and processed than they ultimately generate, the emissions and energy costs can be even higher than those from fossil fuels. Unless new policies are enacted to protect threatened lands, secure socially acceptable land use, and steer bioenergy development in a sustainable direction overall, the environmental and social damage could in some cases outweigh the benefits.

Biodiesel is a fuel made from either virgin or recycled plant oils and animal fats that can be used in diesel engines and oil heat systems. Northeast Biodiesel is working to manufacture high quality Biodiesel from waste vegetable oil generated by restaurants in the Pioneer Valley and beyond. From a locally owned refinery in Greenfield millions of gallons of biodiesel will provide a clean fuel for trucks and cars throughout the eastern United States.

Biodiesel's environmental benefits:

- Greenest" of all the liquid fuels [addresses environmental sustainability]
- Reduces soot and hydrocarbons (HC) by 60% [addresses asthma in children]
- Cancer Causing Exhaust reduced by >90% [quality and longevity of life]
- Green House Gases reduced by > 78% [global warming]
- Sulphur (acid rain) reduced by > 99.9% [improved biodiversity]
- Energy Return on Energy Invested for biodiesel: > 320% (NREL data)

At this time we can not produce a comparable Pioneer Valley specific renewable energy build out for biofuels because they can be developed from so many different sources and that research has not been completed. We know that biofuels will play a role in our clean energy transition, so we include mention of them here.

Where Do We Go From Here?

Community Adoption Process

We are seeking endorsement of this plan from all key constituencies including but not limited to: all 69 cities and towns in Franklin, Hampshire and Hampden counties; the thirteen colleges and the University of Massachusetts, our elected officials, the Western Massachusetts Economic Development Council, Plan for Progress Trustees, the Valley Development Council, community organizations that work on clean energy, and other groups or individuals who want to commit to make this plan a reality. The Plan will be adopted when an official representative of the entity wishing to pledge their commitment to do their part to achieve the goals of this plan, signs the appropriate memorandum of agreement (MOA), or clean energy action pledge.

Evaluation

This plan will be evaluated on an annual basis by the members of the Pioneer Valley Renewable Energy Collaborative using three separate metrics:

- degree to which the Clean Energy Plan is adopted/endorsed by private and public stakeholders in the Pioneer Valley;
- continued cooperation of members of the Pioneer Valley Renewable Energy Collaborative in the plan's facilitation; and,
- the degree to which the four goals are achieved by 2010 and by 2020, modifying actions as necessary given bi-annual assessments.

The Pioneer Valley Renewable Energy Collaborative will assess how well the region is achieving the four goals of the Clean Energy Plan using the following measures.

Goal One: Energy Conservation and Efficiency

Given resource constraints, we do not have a direct way to measure how much energy is being used in the Pioneer Valley. As a result we will continue to use the fact that the Pioneer Valley is home to approximately 10% of the state's population and use ten percent of the state of Massachusetts energy consumption as a reasonable estimate for setting our goals.

To measure electricity and natural gas consumption reductions, we will ask utilities in the Pioneer Valley to report on the electricity used in the Pioneer Valley, specifically, the number of requests they receive each year for energy audits, the number of audits they have completed, the number of entities that implement the audit recommendations, and the total energy consumption reduced by implementing those measures. If we are unable to acquire the data directly from our area utilities, we will use surrogate measures, such as 10% of the states' activity. As part of the implementation process, we hope to set specific targets for each year. We will also track the number of municipalities working with energy service companies (ESCOs) to conduct comprehensive energy audits of municipal buildings.

To measure building energy use reduction, we will track the number of Energy Star® and LEED certified green buildings constructed in the region each year.

To measure transportation energy use reduction, we will track vehicle miles traveled in the region, as well as bike paths built, on-street bike lanes marked, expansion of bus routes, and use of established or creation of new car-pooling or car-sharing programs, such as MassRides and zip cars.

Goal Two: Renewable Energy Production

To measure clean electricity production, we will ask MTC to report to us on the renewable projects implemented in our region.

To measure renewable energy production, we will track local projects such as the Northeast Biodiesel factory being built in Greenfield, and other similar initiatives. We'll total their gWh production equivalents to see if we are meeting the established goals.

Goal Three: Greenhouse Gas Reduction

Greenhouse gases will be reduced as we use less fuel for electricity, heat, and transport. Thus we will evaluate our success toward accomplishing the goal of greenhouse gas reduction by tracking the amounts of fuel consumed. To measure the amount of fuel used to produce electricity, we will track the fuels used through the state's system and continue to assume that we use 10% of the total. (Unless we are able to measure use in the region directly by then).

To measure the amount of fuel used for heating and air conditioning, we will ask fuel dealers to report the amount of natural gas, propane, and #2 heating oil used in the Pioneer Valley each year.

To measure the gas and diesel fuel used in transportation, we will ask fuel dealers to report the amount of gas and diesel fuel used in the Pioneer Valley each year and track VMT reductions in the region.

Goal Four: Green Jobs and Green Businesses stimulating our regional economy

To measure the creation of clean energy jobs in the Pioneer Valley, we will use the data MTC collects to track green jobs created and green businesses developed and we will study the economic impact, job quality, and environmental impact of local distributed clean energy projects and clean energy projects owned by foreign companies to determine how best to invest our development resources.

Comprehensive Action and Contact Information

The most important part of "where we go from here" is that, both individually and collectively, the Pioneer Valley implements the recommendations of this plan. For those readers with questions or who are interested in getting more information regarding how they can help implement this plan, please contact the following individuals and agencies:

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