Climate and Energy

An Element of *Sustainable Berkshires*, Long-Range Plan for Berkshire County

ADOPTED 3.20.14

SUSTAINABLE BERKSHIRES
Community Strategies For A Sustainable Future

Sustainable Berkshires is a project of the Berkshire Regional Planning Commission.

Berkshire Regional Planning Commission

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

ACKNOWLEDGEMENTS

REGIONAL CONSORTIUM

1Berkshire
Stuart Chase, *President & CEO*

Berkshire Community Action Council
Kim McMann, *Director of Planning*

Berkshire County Regional Housing Authority
Brad Gordon, *Executive Director & Staff Attorney*

Berkshire County Selectmen's Association
Julie Hannum

Berkshire Health Systems
Ruth Blodgett, Vice President, *BHS Planning and Development*
Ed Perlak (Alternate), *Public Health Grants Administrator*

Berkshire Housing Development Corporation
Elton Ogden, *Executive Director*

Berkshire Metropolitan Planning Organization
Nathaniel Karns, *Executive Director BRPC*

Berkshire Natural Resources Council
Tad Ames, *Executive Director*

Berkshire Regional Planning Commission
James Mullen, *Chairman*

Berkshire County Managers and Administrators
Gregory Federspiel, *Lenox Town Manager*
Adele Gravitz (Alternate), *Lenox Sustainability Coordinator*

Berkshire United Way
Nancy Stoll, *Director of Community Engagement and Evaluation*
Kristine Hazzard (Alternate), *President & CEO*

Center for Ecological Technology
Nancy Nylen, *Associate Director*

City of Pittsfield
Deanna Ruffer, *Community Development Director*
CJ Hoss (Alternate), *City Planner*

City of North Adams
Mike Nuvallie, *Housing and Projects Coordinator*

Compact for Education
Denise Richardello, *V.P. of Enrollment Management*
Mary Nash (Alternate), *Project Coordinator*

Housatonic Heritage
Dan Bolognani, *Executive Director*

MA Fisheries and Wildlife
Andrew Madden, *District Manager*

Multicultural BRIDGE
Gwendolyn Hampton VanSant, *Executive Director & Founder*
Lori Gazzillo (Alternate), *Board President*

Pittsfield Area Council of Churches/Berkshire Association of Churches
Quentin Chin, *Representative*

USDA
Aimee Thayer, *County Executive Director*

SUBCOMMITTEE

Greg Federspiel, *Lenox Town Manager*
Jim McGrath, *Pittsfield Planner, Pittsfield Green Commission*
Bill Girourd, *Becket Building Inspector*
David Carver, *Commercial Property Landlord*
Betsy Kolbert, *National Climate Journalist*
Charley Stevenson, *Integrated EcoStrategy*
Bob Dvorchik, *Western Mass Electric Company*
Beth Goodman, *Ware & Goodman*
Dave Lachowski, *Berkshire Community Action Council Weatherization Program*
Mike Supranowicz, *1Berkshire*

PROJECT CONSULTANTS

Paul Gromer, *CEO, Peregrine Energy Group*
Nancy Nylen, *Associate Director, Center for EcoTechnology*
Wendy Penner, *Center for EcoTechnology*

BERKSHIRE REGIONAL PLANNING

Amy Kacala, *Senior Planner*
Lauren Gaherty, Senior *Planner*
Melissa Provencher, *Senior Planner*
Mark Maloy, *GIS, Data and IT Manager*
Anuja Koirala, *Senior Transportation Planner*

TABLE OF CONTENTS

INTRODUCTION 1
Planning for Climate Change 1
Climate & Energy Through the Sustainability Lenses 2
Climate and Energy Planning Process 4
BERKSHIRE ENERGY BASELINE AND CLIMATE EMISSIONS REDUCTION TARGET 7
Setting a Regional Climate Reduction Target 7
Berkshire County Energy Use and Emissions 8
Berkshire County Climate Emission Reduction Target 13
Policies and Incentives To Support Meeting Climate Targets 17
CLIMATE & ENERGY VISION 19
Achieving the Vision 19
1. CLIMATE CHANGE AWARENESS AND EDUCATION 21
Projected Climate Impacts in the Northeast 21
The Role of Local Action in a Global Crisis 24
Opportunities and Challenges 25
Goals, Policies, and Strategies 26
2. ENERGY EFFICIENCY AND CONSERVATION 29
Maximizing Energy Efficiency and Conservation 29
Opportunities and Challenges 32
Goals, Policies, and Strategies 34
3. SUSTAINABLE ENERGY SUPPLY 39
Renewable Energy Projects in Berkshire County 39
Assessing Renewable Energy Potential 43
Balancing Renewable Energy Development with Other Local Values 49
State Programs for Implementing Projects 52

Greening the Energy Portfolio Without Local Development: The Evolving Role of Power Purchase Agreements 54

Opportunities and Challenges 54

Goals, Policies, and Strategies 57

4. CLIMATE CHANGE ADAPTATION 61

Adapting to Different Climates and Environmental Changes 61

Goals, Policies, and Strategies 63

IMPLEMENTATION 65

INTRODUCTION

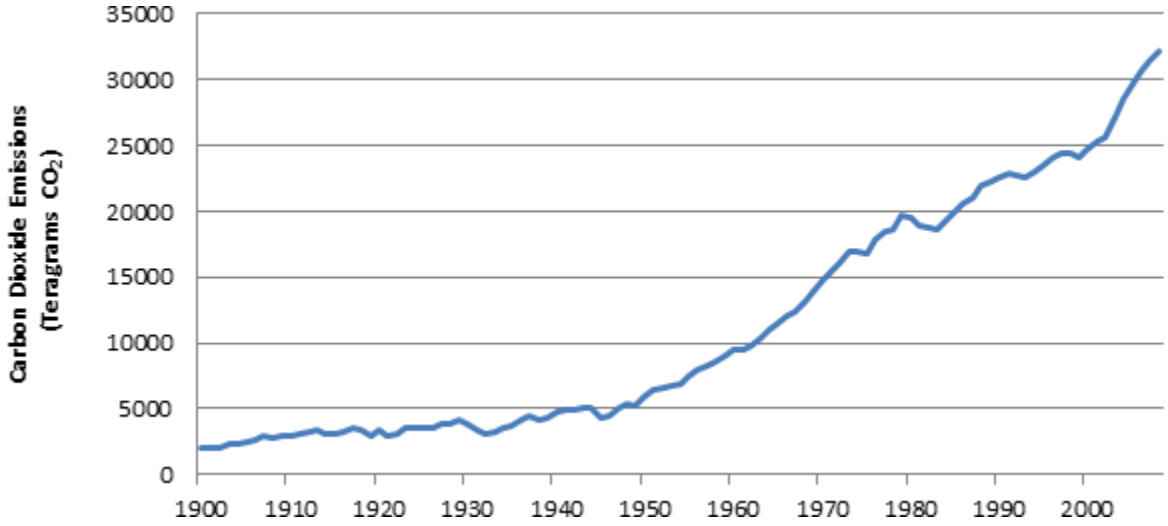
There is global consensus: climate change is real and already having consequences across the globe in the form of increasing temperatures, rising sea levels, more severe storm events, feast or famine patterns of floods and drought, and accelerating biodiversity loss. The Berkshires are not immune to these forces; in recent years we have experienced increased frequency and severity of storm events that have caused flooding which damaged infrastructure, loss and/or shifting of habitat for such emblematic species as the Sugar Maple, and an increase in the number of extreme heat days in summer. This element focuses on ways in which the region can both do its part to reduce climate emissions and build resiliency to minimize the financial, environmental, and social costs of current and projected impacts of climate change to the region.

PLANNING FOR CLIMATE CHANGE

Climate Change and Energy Use

According to the *Massachusetts Clean Energy and Climate Plan for 2020,* the international consensus on climate released in 2007 by the Intergovernmental Panel on Climate Change (IPCC) found that the "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."[1]

Figure CE1: Global Carbon Dioxide (CO_2) Emissions from Fossil-Fuels 1900-2008

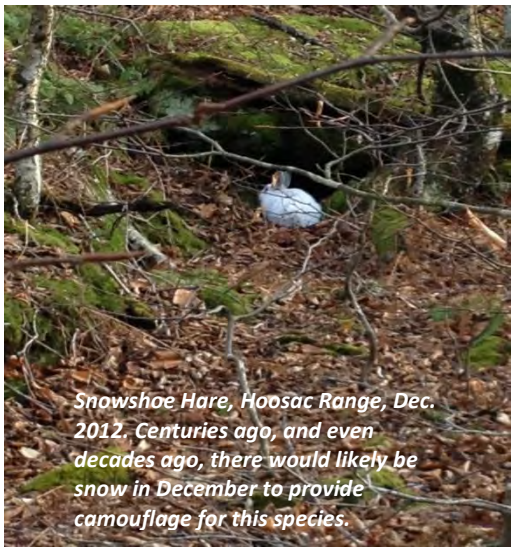


Source: Boden, T.A., G. Marland, and R.J. Andres (2010). Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001_V2010. http://www.epa.gov/climatechange/ghgemissions/global.html

1 4th Assessment Report, Intergovernmental Panel on Climate Change, 2007.

Climate change is expected to impact the Berkshire region in a number of ways:

- Increased number of severe storm events, resulting in greater flooding of property and infrastructure, and greater erosion and sedimentation of waterways.
- Loss and/or shifting of existing habitats, resulting in losses or shifts in plants, fish and wildlife distribution. This includes possible loss of cold water fisheries and greater risk to the maple syrup industry.
- More severe flood/drought cycles, impacting agricultural practices and production.
- Decrease in the number of days for winter-dependent recreation (skiing/snowboarding, snowshoeing, ice fishing, snowmobiling) and businesses.
- Increase in the number of extreme heat days, impacting those with ill health and straining the electric grid system.
- Decrease in snow and increase in winter rain/ice events leading to increase in ice damage and decreased groundwater supplies.



Snowshoe Hare, Hoosac Range, Dec. 2012. Centuries ago, and even decades ago, there would likely be snow in December to provide camouflage for this species.

Planning for Climate Change

Communities and regions can plan to address the causes and effects of climate change. Policies and actions are generally grouped into two categories:

1. **Mitigation:** Actions that work to reduce climate emissions as a way of helping to achieve a lower-emissions scenario in terms of the duration and severity of impacts. This includes reducing fossil fuel energy use and emissions through energy conservation or efficiency as well as by switching more of the energy used to renewable energy sources.
2. **Adaptation:** Actions that work to minimize social, environmental, and economic impacts of climate change. This includes such focus areas as reducing risk of damage from storms and flooding, building resiliency into natural habitats to protect native biodiversity, and developing extreme heat and cold procedures to safeguard human and animal health.

This plan contains goals, policies, and strategies in both categories for the Berkshire region,

Climate & Energy Through the Sustainability Lenses

"Energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the world to thrive." – Sustainable Energy for All (an initiative of the U.N. Secretary General).

Economic Development

- **Savings from energy efficiency inject more money into the local economy.** The economic benefits of efficiency derive from changes in the economy that occur as a result of increased spending on efficiency measures and decreased spending on energy. The majority of these impacts (81-91%) result from the energy savings realized by households and business. Lower energy costs cause other forms of consumer spending (such dining out or discretionary purchasing) to increase. Lower energy bills reduce the costs of doing business in the region, bolstering the global competitiveness of local employers and promoting additional growth.[2]

2 Energy Efficiency: Engine of Economic Growth A Macroeconomic Modeling Assessment. October 2009. Environmental Northeast. Howland, Jamie, Derek Murrow, Lisa Petraglia, and Tyler Comings.

- **Shifting energy from an imported product to a local one.** As noted in the *Massachusetts Clean Energy and Climate Plan for 2020*, the state is at the "end of the energy pipeline," importing almost all of its energy from other parts of North America or the world. We are dependent on producers and market forces. This means that funds spent on importing fuel leave the state and the region, impacting economic stability. The estimated exported economic value of purchasing energy from outside Massachusetts for 2008 was $22 billion state-wide.
- **Job creation through clean energy economy investments**. Massachusetts is in a position to show the way to a clean energy economy and reap direct benefits in economic growth. Between 2007 and 2012 the number of photovoltaic systems installed in Massachusetts increased 20-fold, with jobs in solar manufacturing, installation and services nearly tripling from 1,200 to 3,000. Two-thirds of these jobs are in manufacturing. In total, the Clean Energy Center estimates that at least 11,000 people were employed in the clean energy sector in 2010, up 65% from 2007.

Social Equity and Capital

- **Reducing car dependence supports households without a car to enjoy a more livable and accessible community.** Employment, housing and social opportunities are severely constrained for Berkshire County residents who do own a vehicle due to limited public transit operations and non-existent carpooling or car-sharing programs. Increased transportation options provides for both an environmental and social benefit.
- **Efficiency as a means of reducing monthly housing costs.** Local heating and cooling costs in the region can be very high due to older housing stock, high energy costs, and a greater share of higher priced oil versus natural gas heating systems. Rising poverty rates, a high proportion of senior households living on fixed incomes, and escalating housing costs contribute to a regional housing affordability crisis. Efficiency measures can help keep monthly housing costs down to make housing more affordable.

Environmental Stewardship

- **Combating climate change will help safeguard global biodiversity.** By taking local action to protect biodiversity and reduce climate emissions, the region will be helping to reduce the impact of climate change on global biodiveristy loss. The *Milennium Ecosystem Assessment* (2005) found that the current rate of extinction is 1,000 times historic rates, according to fossil records. As climate change moves forward, particularly if emission reductions are not achieved, this rate is expected to accellerate to ten times the current rate. A recent study anticipates we could be facing an 80% global biodiversity loss by 2080 (*Science Daily*, 2011).

Climate and Energy Planning Process

The goals and policies set forth in this document were identified through a multifaceted public involvement process that engaged state, municipal, non-profit organizations, community leaders, and the public in a strategic discussion of the role and vision for future energy use, conservation, and development in the region.

Public Forums

Climate and energy forums were held on February 26, 2013 in the town of Lenox and February 27, 2013 in the city of North Adams. Forums included a presentation on the region's energy use and portfolio and what the county's reduction target would be based on this use. There was also a small group exercise that asked participants to design the portfolio for the region's GHG reduction strategy, including energy efficiency and renewable energy generation. A summary of the forums is contained in Appendix A.

Attendees at the public forums worked in small groups to complete the "climate action game" – placing game pieces for solar, wind, and efficiency projects, each with a CO2 value, around the county to come up with their energy portfolio of how they'd like the county to meet its climate reduction target. The complete event summary is contained in Appendix A: Climate and Energy Forums

Subcommittee

A subcommittee of eleven representatives from organizations with a focus on climate change and energy were invited to participate in a short-term subcommittee to help develop the Climate and Energy Element of the plan. Members represented the business, municipal, housing and social services sectors, as well as entities working in the energy sector (a public utility company, an energy contractor). The committee met twice to review background information and develop and refine goals, policies and strategies.

Consortium

The consortium met twice to review climate and energy findings and policies before approving the element content and forwarding on to the Commission.

Public Open House

Two open house events were organized and held in North Adams and Lenox to present the draft goals and policies for public review and comment. These also highlighted mapping analysis assessing solar and wind energy generation capacity across the county to show areas with basic site characteristics needed to accommodate renewable energy projects.

Other Public Sources

Since developing its *Wind Energy Policy Siting Guidelines* in 2004, the Berkshire Regional Planning Commission (BRPC) has actively monitored federal and state energy policies, programs and projects that could affect the region. The agency served as the technical advisor for Berkshire communities developing energy plans and pursuing Green Communities designation. During the past 10 years the agency has also facilitated workshops on a variety of energy topics, including energy efficiency, renewable energy technologies and proposals in the region, grant opportunities and municipal aggregation. BRPC has also guided Berkshire communities in developing renewable energy zoning bylaws, including the creation of a model bylaw and working one-on-one with individual towns. Most recently, in addition to the sources listed above, the BRPC drew upon public input received through a workshop on wind energy siting that it co-sponsored with Macalester College in July 2012 and through a public survey conducted by Williams College students in November 2012.

BERKSHIRE ENERGY BASELINE AND CLIMATE EMISSIONS REDUCTION TARGET

In order to understand what the region would need to do to mitigate its climate emissions and reduce them in accordance with state and federal policy goals, we need first understand the current energy and emissions picture in the region. This section reviews regional energy use and associated climate emission trends for the region and translates them into a climate reduction target which would enable the region to do its part towards meeting the statewide goal.

SETTING A REGIONAL CLIMATE REDUCTION TARGET

The state has set for itself the target of reducing CO_2emissions by 25% by 2020 in the Massachusetts Clean Energy and Climate Plan (2010) and Global Warming Solutions Act (2008). However, this target has not necessarily translated to local policy priorities. A central underpinning of the planning process was to engage residents in talking through what they thought was an appropriate and desirable goal for the region as a means of building consensus and support for local action and policy. This was an important conversation to have given the region has, up to this point, been in a reactive stance – feeling pressed to make on the spot decisions on projects and state policy proposals without having had the opportunity to stand back and determine a vision and values for an energy future and how to best address the threats posed by climate change.

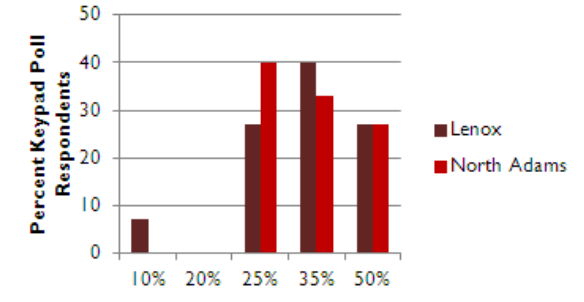
The region answered with the following:

The Berkshires should work as a region to achieve at least a 25% climate emissions reduction by 2020.

Figure CE2: Climate and Energy Workshop Responses. We asked, you answered.

At the public forums held in Lenox and North Adams, attendees used keypad polling devices to submit their responses to questions in the presentation with results immediately displayed to inform group discussion.

Q: The state climate plan sets a goal of 25% reduction in CO_2 emissions from 1990 levels by 2020. What should that goal be for Berkshire County?



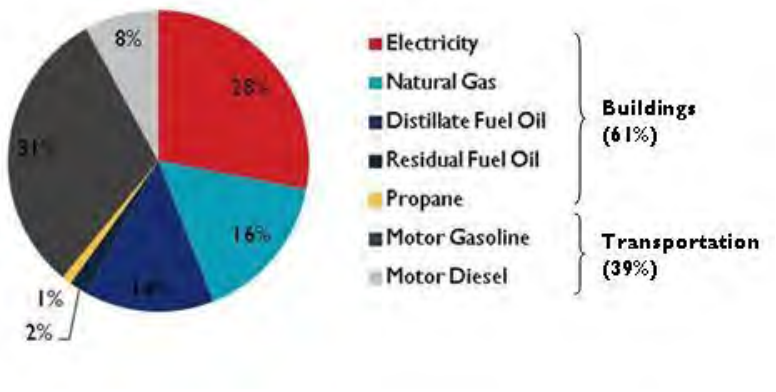
A complete summary of the forums is contained in Appendix A

In saying this, it is understood that larger communities use more energy and so have more opportunities for efficiency measures while rural communities have more potential for renewable energy development. It is a testament to the strong regional identity of the Berkshires that residents support tackling climate reduction as a shared responsibility with each of the 32 communities helping to meet the goal.

BERKSHIRE COUNTY ENERGY USE AND EMISSIONS[3]

Carbon dioxide (CO_2) accounts for more than 82% of all U.S. GHG emissions and is the most easily measured and tracked. For the purposes of this inventory and discussion, CO_2 emissions will be summarized in two categories: buildings and transportation. In the Berkshires, buildings are the largest contributor of CO_2 emissions, accounting for approximately 61% of total CO_2 emissions. The remaining 39% come from the transportation sector[4]. The following sections look at the region's energy use in buildings and transportation, creating an inventory against which we can begin to determine opportunities and targets for reducing energy consumption and CO_2 emissions.

Figure CE3: Emissions by Source, Berkshire County, MA (2011)



Source: BRPC 2009.

Energy Use and Emissions from Buildings

Fortunately, we live in one of the most progressive states in the country in terms of having policy, incentive programs, and formal targets for achieving climate reductions.[5] Massachusetts has, in collaboration with utility companies, invested heavily in efficiency programs and renewable energy incentives. Despite these programs, the trend in county energy use in buildings has stayed relatively flat over the past four years. Between 2008 and 2011 total energy use fell only slightly, from 13 million British thermal units (MMBTUs) to 12.9 million MMBTUs. Use dropped 2% in 2009 and has been climbing slowly since. This small drop coincides with the economic recession of 2008-09.

For the purposes of this discussion, buildings include energy used and emitted from the use of buildings (including heat, lighting, industrial processes) and streetlights. The main fuels used in the region's buildings are natural gas, electricity, fuel oil, and propane. Natural gas accounts for the largest share of the total MMBTU used (40%) followed by electricity (34%), fuel oil (24%), and propane (3%).

However, in discussing how energy use translates into climate emissions, it is essential to understand the relative emissions of different fuel types

[3] A complete energy baseline and reduction target calculation may be found in Appendix B: Regional Energy Baseline.

4 Energy Use and Greenhouse Gas Report, BRPC,2007

5 See Appendix C: Renewable Energy Program Summary for more information.

Table CE1: Conversion Factors Used to Translate Energy Used into CO2 Produced

	MMBTU Factors		CO2 Factors	
Fuel	**Factor**	**Units**	**Factor**	**Units**
Electricity	0.003412	MMBTU/kWh	0.00043681	Tonnes/kWh
Natural Gas	0.1	MMBTU/therm	0.00531162	Tonnes/therm
Oil	0.139	MMBTU/gallon	0.01015150	Tonnes/gallon
Propane	0.091	MMBTU/gallon	0.00576068	Tonnes/gallon

Source: Peregrine Energy, 2013

Energy use in county's buildings in 2011 resulted in CO_2 emissions of nearly 1.1 million metric tons.[6] Over half (52%) of those emissions came from electricity, despite the fact that electricity represents only 34% of the energy used. Conversely, natural gas, while accounting for 40% of the total energy used in buildings, produced only 25% of the building-related CO_2 emissions.

Figure CE4: Energy Use by Fuel Type (2011)

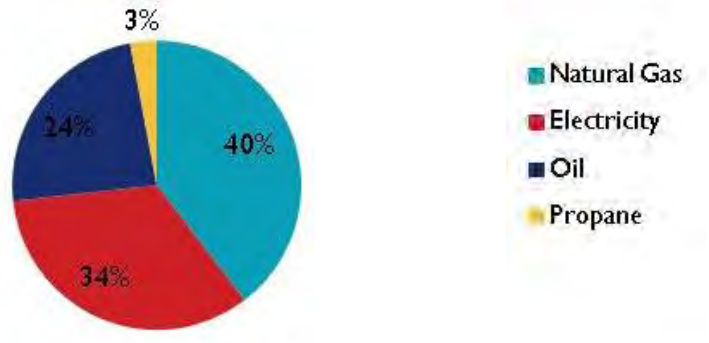
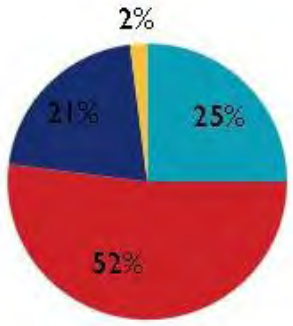


Figure CE5: Emissions by Fuel Type (2011)



Source: Western Massachusetts Electric Co., National Grid, Berkshire Gas, American Community Survey, Energy Information Administration, Massachusetts Department of Environmental Protection, Peregrine Energy Group, 2012.

Of the 52% of emissions from electricity, the business sector accounts for 32% and the residential sector accounts for the remaining 20%. The business sector (commercial and industrial electricity customers) include users of various sizes, ranging from small businesses and commercial building owners to manufacturers, processors, municipalities, school districts and entities with large facilities (such as resorts, hospitals, colleges, and nonprofit organizations).

6 Emissions were calculated using emission factors from the Massachusetts Department of Environmental Protection (electricity) and the Energy Information Administration (natural gas, oil, and propane).

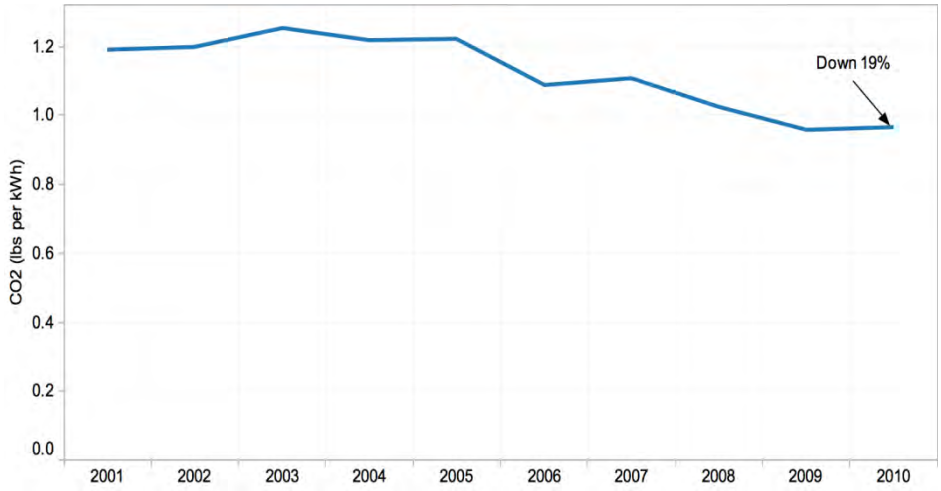
Figure CE6: Building Emissions by Fuel and Customer Sector

Prop. - Bus.

Source: Western Massachusetts Electric Co., National Grid, Berkshire Gas, American Community Survey, Energy Information Administration, Peregrine Energy Group, 2012.

While energy use in the county has been flat, CO_2 emissions have been declining, from 1.13 million metric tons in 2008 to 1.08 million metric tons in 2011. With consumption levels relatively flat, this decline is attributable not to energy efficiency but to the composition of the sources of electricity coming to the region. New England's fleet of power plants has been getting cleaner, primarily through switching from coal and oil-burning power plants to ones that burn natural gas. As a result, we generate less CO_2 for each kilowatt-hour of electricity generated than other parts of the U.S.

Figure CE7: Pounds of CO_2 per Killowatt-Hour (2001-2010)

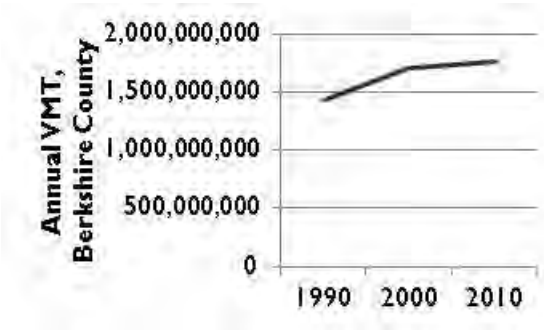


Source: Massachusetts Department of Environmental Protection

Energy Use and Emissions from Transportation

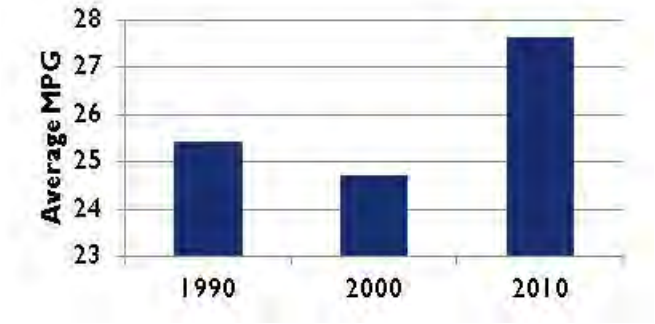
In the Berkshires, where rural terrain and limited access to convenient public transportation necessitates most of the population to drive to jobs, education, goods and services, 39% of the region's CO2 emissions are transportation-related. As illustrated in Figure CE8, the annual VMT has increased over the past two decades, even as the total number of residents declined.

Figure CE8: Berkshire Annual Vehicle Miles Traveled (1990-2010)



Source: MassDOT, 2013

Figure CE9: Average Vehicle Fuel Efficiency (1990-2010)



Source: U.S. EPA

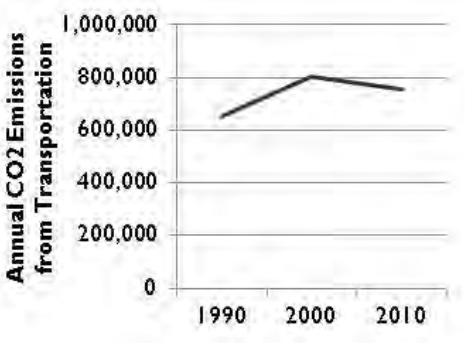
A Call to Action

The US transportation sector creates 33% of the transportation-related emissions in the entire world. On-road emissions in the US are responsible for 70% of the US's share of total emissions. These numbers include only "tailpipe" emissions and not the life-cycle emissions from extracting fossil fuels, manufacturing vehicles, transportation infrastructure maintenance, or other ancillary activities.

CO2 emissions from transportation activities are derived by dividing the total number of vehicle miles traveled for each type of fuel (gasoline or diesel) vehicle by their corresponding average fuel efficiencies to provide a total number of gallons of each fuel used annually in the region. The number of gallons is then multiplied by the CO2 emission factors for each fuel type to yield the total emissions from travel in the region.

Figure CE10: Calculating Annual Vehicle-based CO2 Emissions

Figure CE11: Berkshire Vehicle-based CO2 Emissions (1990-2010)



Source: Berkshire Regional Planning Commission, 2013

Vehicle-related climate emissions spiked between 1990 and 2000 as more SUV and larger vehicles with lower mpg ratings were added into the vehicle mix lowering the county's average mpg (Figure CE9) and as people drove more miles (Figure CE8). Between 2000 and 2010, while miles driven continued to rise, the popularity of hybrids and other efficient vehicles as gas prices rose, helped make a significant improvement in average mpg's which translated into reduced climate emissions in 2010.

Table CE2: CO2 Emissions from Transportation

	1990	2000	2010
Vehicle Miles Traveled			
HPMS* Vehicle Miles Traveled (VMT) per day	4,212,000	5,026,000	5,168,000
Annual VMT	1,537,380,000	1,834,490,000	1,886,320,000
Fuel Efficiency (MPG) and Associated Emissions**			
Gasoline Vehicles	25.4	24.7	27.6
Diesel Vehicles	7.17	7.1	7.27
Gasoline Powered Vehicles (93%)			
Annual VMT	1,429,763,400	1,706,075,700	1,754,277,600
Gallons Consumed	56,289,898	69,071,891	63,560,783
CO2 Emission (MTCO2e)	502,106	616,121	566,962
Diesel Powered Vehicles (7%)			
Annual VMT	107,616,600	128,414,300	132,042,400
Gallons Consumed	15,009,289	18,086,521	18,162,641
CO2 Emission (MTCO2e)	153,095	184,483	185,259
Total CO2 Emission from Transportation (MTCO2e)	655,201	800,604	752,221

Source: * Highway Performance Monitoring System (HPMS) VMT provided by MassDOT **Fleetwide average- U.S. EPA

BERKSHIRE COUNTY CLIMATE EMISSION REDUCTION TARGET

The State Formula for Getting to 25% by 2020

The state has tempered its expectations for how much the transportation sector can reduce its emissions to contribute to the 25% by 2020. Transportation goals are to reduce emissions by 7.3%. This means that more emissions reductions are needed from the built environment (32.8%) in order to reach the combined 25% target.

Table CE3: Statewide 2020 Emission Targets for Buildings and Transportation

	Climate Emissions (MMTCO2e)	Target (Percent)	Target (MMTCO2e)
Transportation	28.9	7.3%	2.1
Buildings	65.5	32.8%	21.5
Total Emissions	94.4	25.0%	23.6

Source: Berkshire Regional Planning Commission, MassDOT's GreenDOT

Transportation emissions are achieved by a mixture of investing in non-auto transportation options to reduce total miles traveled (conservation) and continuing to raise the average mpg of the vehicles in the state (efficiency).

Table CE4: Projected Statewide Transportation Emission Reductions in 2020 and 2050, in MMTCO2e

State Goals	2020 Target	2050 Target	How will this be achieved?
Reduce Greenhouse Gas Emissions	5.3 %	5.7 %	Reduced GHG emissions from construction and operations, more efficient fleets, travel demand management programs, eco-driving, and mitigation of development projects
Promote Healthy Transportation Modes of Walking, Bicycling and Public Transit	0.7 %	1.3 %	Reduced automobile travel resulting from MassDOT transportation investments that improve pedestrian, bicycle, and public transit infrastructure and operations
Support Smart Growth Development	1.3 %	5.3 %	Reduced automobile travel that is enabled by denser, smart growth development patterns
Subtotal	7.3 %	12.3 %	

Source: MassDOT's GreenDOT

Building reductions can also be achieved with conservation and efficiency measures and by increasing the proportion of energy from renewable sources being used in buildings through renewable energy development.

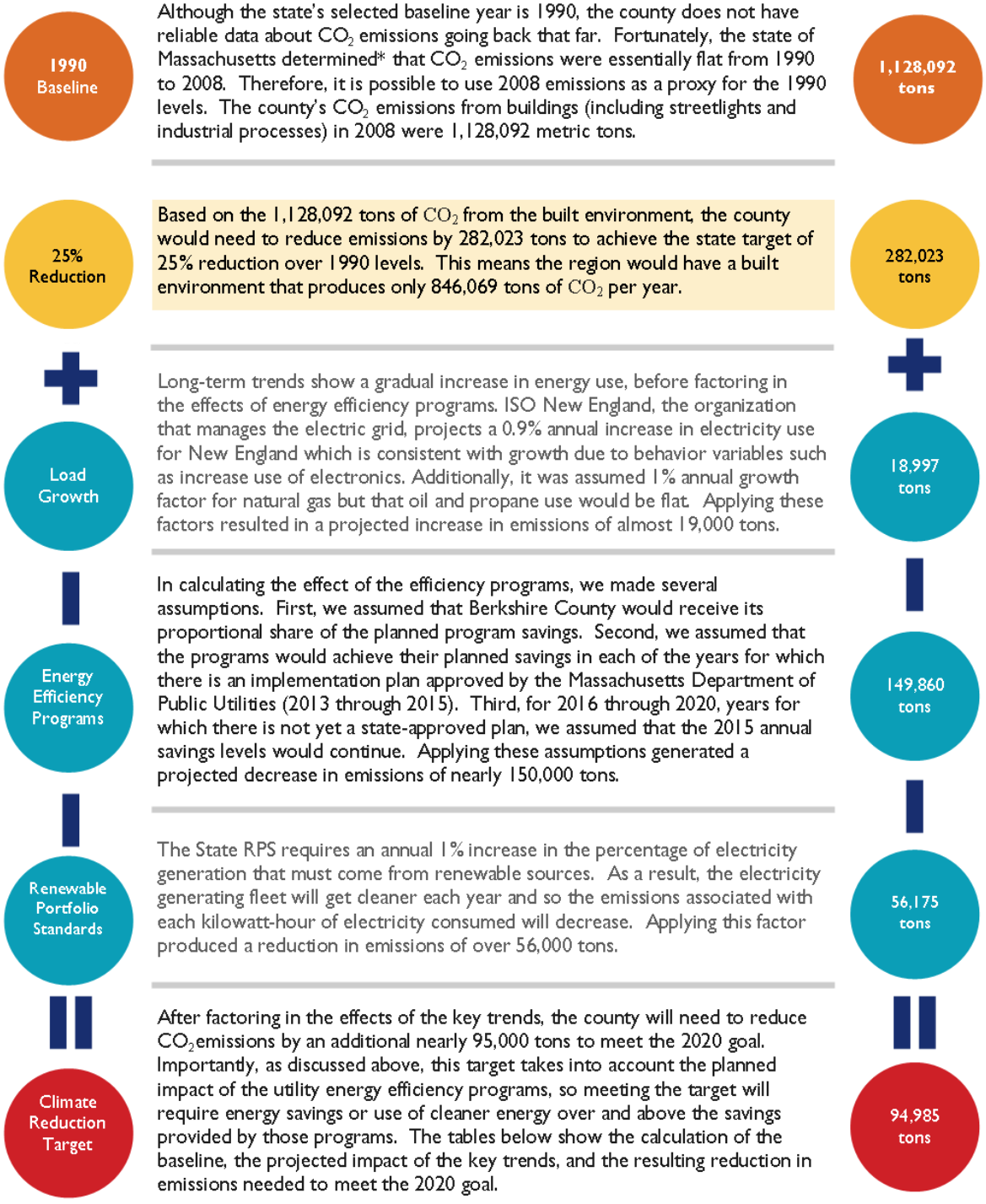
Table CE5: State Renewable Energy Generation Targets and Implementation Progress

Renewable Energy	Target By 2020	As of 7/2013	Climate Impact
Wind	2,000 MW (25% on land, 75% off-shore)	103 MW	Reduces state GHG emissions by 3.1million tons or approximately 12% of power plant emissions
Solar	1,600 MW	281 MW	The solar power currently installed in Massachusetts generates enough electricity to power more than 37,000 homes for a year which, when compared with fossil fuel-generated electricity, is the climate emission equivalent of taking nearly 26,000 cars off the road each year

Source: MA DOER, 2013

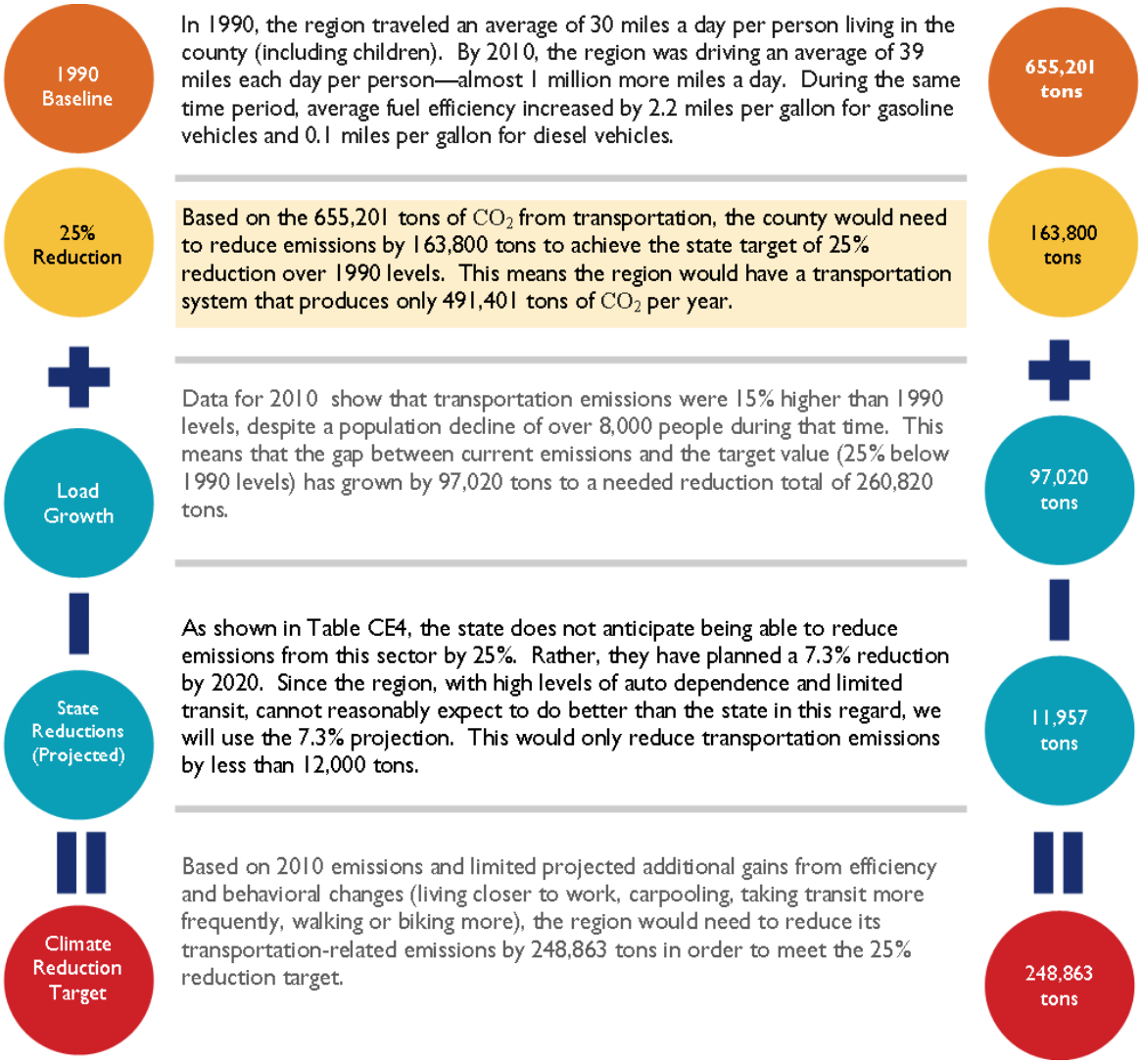
Getting Berkshire County to 25% by 2020

Calculating Climate Reduction Target for Buildings



*Massachusetts Clean Energy and Climate Plan for 2020 (December 29, 2010) pp. 88-89.

Transportation Emission Reductions



Based on these calculations, the region will need to take local action to meet the remaining balance of emission reductions need to meet the 25% target:

Table CE6: Berkshire Climate Reductions Needed to Meet 25% Target by 2020

Built Environment	94,985 tons CO2
Transportation	248,863 tons CO2
Total	**343,848 tons CO2**

Source: Peregrine Energy Group, Berkshire Regional Planning Commission

The high emissions from transportation, compounded by the fact that emissions from this sector have been increasing since 1990, provide a notable challenge for the region meeting its climate reduction. Whereas more urbanized places have density and transit systems to make non-auto travel more viable, the rural nature of the region and limited transit service make this more challenging in the Berkshires. Additionally, state land use regulations for Approval Not Required (ANR) development support rural sprawl along existing roadways, which is how much new development has occurred in recent decades. The region will need to take specific action to pursue a more compact development pattern (see Land Use Element) to help reduce vehicle miles travelled. Even with strong action to reduce VMT, it is certain that the build environment (conservation, efficiency, and renewable energy development) will need to pick up the slack if the region is to meet the 25% reduction target.

POLICIES AND INCENTIVES TO SUPPORT MEETING CLIMATE TARGETS

The Regional Greenhouse Gas Initiative (RGGI)

Massachusetts is a participating state in the nation's first mandatory greenhouse gas pollution management program for power sector CO_2 emissions. Proceeds from its fund are directed at energy projects that include energy efficiency, innovation and renewable energy generation. Five percent of cumulative RGGI investments to date have funded clean and renewable energy programs throughout the northeastern region. These clean and renewable energy measures will avoid the release of more than 121,000 short tons of CO_2 pollution into the atmosphere over their lifetime, the equivalent of taking 21,000 cars off the road. Massachusetts has received more than $150 million from the initiative from 2008-2011.

States participating in RGGI

Massachusetts Policy and Programs

In 2013, Massachusetts was ranked second, after California, for its overall Clean Tech Leadership Index, according to Clean Edge Incorporated, a clean energy industry research group. The index scored states on measures taken to promote energy efficiency, industry policy, technology development and capital investment. Within the index itself, Massachusetts ranked first in two categories, including policy (measuring transportation, building codes, climate change targets and renewable portfolio standards) and capital (focusing on venture capital investment and research). Key indicators considered in the index include clean electricity generation, green building deployment, energy efficiency expenditures, GHG emissions, venture capital activity and the clean energy business sector.

The state has taken a number of legislative steps to both create incentives and eliminate barriers to meeting the climate emissions reduction targets for 2020 and 2050. The following table highlights some notable bills; a more complete listing of legislation and related programs and incentives is contained in Appendix C.

Table CE7: State Climate and Energy Legislation

Legislation	Summary
Massachusetts Renewable Energy Portfolio Standard (RPS)	Sets a statutory obligation for energy suppliers (both regulated distribution utilities and competitive suppliers) to obtain a percentage of electricity from renewable energy sources constructed within the Northeast for their retail customers. ○ 2003-2009: One percent in 2003 with an additional one-half percent annually to reach 4% by 2009. ○ 2009-2020: One percent annually until it reaches 15% in 2020.
Global Warming Solutions Act (2008)	Calls for a 10-25% reduction from 1990 GHG levels by 2020 and an 80% reduction from 1990 levels by 2050.
Green Communities Act (2008)	To boost energy efficiency and encourage investment in renewable energy, this Act: ○ Requires 15% of electricity used in the state be supplied by renewable energy sources located within the Northeast by 2020. ○ Established a pilot program that allows utilities to enter into long-term contracts with renewable energy developers to provide the developers with the predictable, stable prices required by their lenders. ○ Set five criteria that municipalities must meet to become a Massachusetts Green Community. ○ Mandated the creation of a siting commission that will develop recommendations for streamlining zoning for wind energy and other forms of renewable energy.
Green Jobs Act	Authorized $58 million in funding and grants to help support development of the green energy technology industry in Massachusetts. It also mandated an analysis of the potential for renewable energy on state owned lands. This analysis identified the potential for 947 MW of potential wind energy on 44 state-owned sites. It was through this bill that the Mass. Clean Energy Center (CEC) was established to facilitate the development of renewable energy generation.
Clean Energy Biofuels Act	This act gives preferential tax treatment to non-corn-based alternatives to ethanol, requires bio-fuel content in all the diesel and home heating fuel sold in the state, and proposes a new fuel standard for the region that will encourage a range of emissions-reducing technologies for cars and trucks.
Net Metering	Net metering encourages small, behind-the-meter wind and solar generation by crediting owners of renewable generation for the excess electricity they generate at favorable terms. In 2008, new legislation: (1) increased the allowable capacity (or size) of net metering facilities that use renewable resources to create energy from 60 kW to up to 2 MW, (2) increased the value of the credits for electricity generated by these facilities from the wholesale rate to nearly the retail rate, and (3) allowed net metering customers to allocate net metering credits. Additional legislation was passed in 2010 and 2012, which further modified net metering in Massachusetts, most notably raising the overall amount of allowed net metering projects.

CLIMATE & ENERGY VISION

Vision: *The region is a leader in climate change mitigation, having exceeded the state goal of a 25% reduction in CO_2emissions by 2020 through a combination of energy conservation and efficiency and renewable energy generation. The region works to continually reduce its carbon footprint and is constantly innovating and adapting, with a focus on triple bottom line benefits. Energy conscientiousness is the norm rather than the exception. The region has successfully balanced environmental protection and energy development to accommodate both local and global needs over the short and long-terms. Emission reduction investment has helped leverage economic development through increased demand for related goods and services, a commitment to buying local, a reduction in energy expenditures by businesses (and resulting export of dollars from the region) and a responsive workforce and economic development system. Innovation capital has allowed local students and businesses to join the energy- and efficiency-related tech sector. Homes and businesses enjoy the cost and climate savings that come from using less and cleaner energy. Growth patterns, practices, and infrastructure round out these investments - helping support reduced transportation-related emissions while also adapting the region to anticipated impacts brought on by climate change.*

ACHIEVING THE VISION

This vision will be achieved through the collaborative action of the public and private sectors, with residents, businesses and municipal governments working in tandem to pursue strategies that will reduce fossil fuel consumption and expand the development of local, cleaner energy generation sources.

1. **Climate Change Awareness and Education.** This section discusses the significance of global and regional climate changes that will affect our lives.
2. **Energy Efficiency and Conservation**. Fossil fuels will continue to be imported into and consumed in our region for the foreseeable future. This section discusses the careful use of the fuels we use in our homes, businesses, and vehicles.
3. **Sustainable Energy Supply**. Local residents have expressed a desire to locally generate an increasing amount of our energy supply. This section will discuss the balance of developing renewable energy sources against other local interests, such as maintaining our scenic, cultural and natural resources. This section will offer ideas that would increase renewable energy development while doing so on a scale that is appropriate for the Berkshires.
4. **Climate Change Adaptation**. The GHG that have already been admitted into the atmosphere will continue to have long-reaching effects. This section will discuss the necessity of the region to adapt to these impacts despite our efforts to meet our 25% CO_2 reduction goal.

1. CLIMATE CHANGE AWARENESS AND EDUCATION

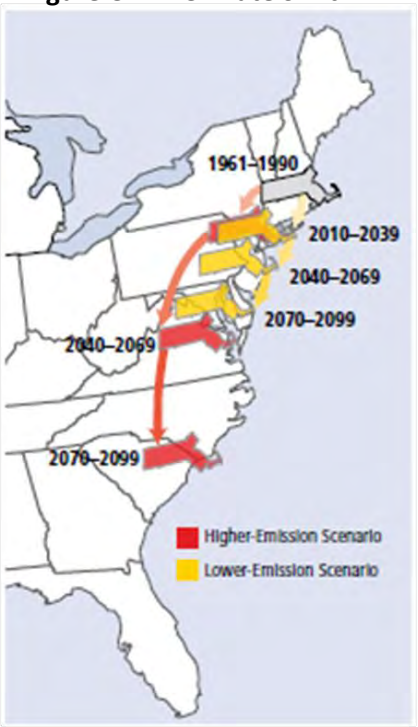
Despite the media attention climate change and its global impacts gets, climate literacy rates are startlingly low in the United States. According to a recent National Public Radio (NPR) piece, two thirds of American students say they know little or nothing about the impacts of fossil fuel consumption on climate change. A recent report from the National Center for Science Education[7] sounds the alarm, and makes clear that our schools desperately need new strategies and resources to address young people's lack of knowledge about our world. This section reviews anticipated impacts for our region and then sets goals and policies for how to improve climate literacy to support climate action in the Berkshires.

PROJECTED CLIMATE IMPACTS IN THE NORTHEAST

In 2009, the US Global Change Research Program released a comprehensive set of reports documenting the projected climate change impacts for different regions of the United States. Massachusetts is included in the Northeast region report, which conveys what impacts the state can expect under a low-emissions scenario, which assumes quick and significant climate action by the country and global community, and a higher-emissions scenario based on current emissions trends. Over the last several decades, the Northeast has experienced noticeable changes in its climate. Since 1970, the average annual temperature rose by 2°F and the average winter temperature increased by 4°F. Predictions for the state are for another 6-14 degree increase in summer temperatures and 8-12 degrees in winter by late century

As seen in the map to the right, under the higher emissions scenario Massachusetts' summers could be as warm as South Carolina's summers are today by the end of this century. [8] Over the same period, Boston is projected to experience an increase in the number of days reaching 100°F — from an average of one per year between 1961 and 1990 to as many as 24 days per year by 2100. Under a higher emissions scenario, Hartford could see as many as 30 days per year with temperatures reaching 100°F. [9]

Figure CE12: Climate Shift



By 2070, the state of Massachusetts could have a climate more comparable to the state of Maryland under a lower-emissions scenario or South Carolina under a higher emissions scenario.

7 National Center for Science Education (2013) Toward a Climate & Energy Literate Society, Recommendations from the Climate and Energy Literacy Summit. McCaffrey, Mark, Minda Berbeco, PhD, and Eugenie Scott, PhD. Oakland, CA.

8 USGCRP (2009). Global Climate Change Impacts in the United States . Karl, T. R., J. M. Melillo, and T. C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

9 USGCRP (2009). Global Climate Change Impacts in the United States . Karl, T. R., J. M. Melillo, and T. C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

Precipitation Changes

Precipitation changes will have far-reaching consequences for Massachusetts and the rest of the east. The Berkshire region will need to prepare for significant changes in precipitation patterns and warmer temperatures. A more detailed discussion on the impacts to the region's natural resources can be found in the Conservation and Recreation Element.

- **Increase in severe storm events:** Overall, the amount of precipitation throughout the Northeast is projected to increase. However, much of this will be attributable to an increase in the number of severe storm events.
- **Increased rain in winter:** Precipitation falling as rain rather than snow in winter will likely increase the number and impact of flooding events. For the region as a whole, the majority of winter precipitation will fall as rain, not snow and with increased icing events. Climate scientists project that these related trends will continue. [10]

Impacts on Human Health

- **Respiratory Illness:** In addition to causing climate change, emissions from the combustion of fossil fuels result in a range of negative human health and ecosystem impacts. The U.S. Environmental Protection Agency (EPA) has established health-based National Ambient Air Quality Standards (NAAQS) for six pervasive pollutants that have well documented health and environmental impacts: ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter (PM), lead, and carbon monoxide (CO). Exposure to each of these pollutants has been linked to adverse health effects. Ozone can also irritate the respiratory system, causing coughing, throat irritation, chest pain and reduced lung function. Ozone can also aggravate asthma, leading to more asthma attacks and increased hospital admissions and emergency room visits for respiratory problems. Fine PM is associated with aggravation of respiratory and cardiovascular disease resulting in increased hospital admissions, emergency room visits and premature mortality.
- **Heat-Induced Illness:** More frequent heat waves and lower air quality can threaten the health of vulnerable people, including the very young, the elderly, outdoor workers, and those without access to air conditioning or adequate health care. [11] People who live in Northeastern cities are particularly at-risk, since the region is generally not as well adapted to heat as warmer regions of the country. Northeastern cities are likely to experience some of the highest numbers of heat-related illnesses and deaths, compared with the rest of the nation. [12]
- **Increase in Insect-borne Illnesses:** More frequent extreme precipitation events would increase the risk of waterborne illnesses caused by sewage overflows and pollutants entering the water supply. Combined with extremely hot days, the increase in heavy rain events is likely to create more favorable conditions for the breeding of mosquitoes that carry West Nile Virus and Eastern Equine Encephalitis. Warmer temperatures favor the expansion of the range of ticks carrying illnesses such as Lyme Disease. [13]
- **Extreme storms:** Extreme storm events can damage infrastructure, such as dams, levees, roads and bridges, and the electrical transmission system and increased damage from falling and damaged trees resulting in property damage and potential loss of life.

---

10 Ibid

11 Ibid

12 CCSP (2008). Analyses of the effects of global change on human health and welfare and human systems . A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, T.J. Wi banks, (Authors). U.S. Environmental Protection Agency, Washington, DC, USA.

13 USGCRP (2009). Global Climate Change Impacts in the United States . Karl, T. R., J. M. Melillo, and T. C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

Impacts on Agriculture and Food Supply

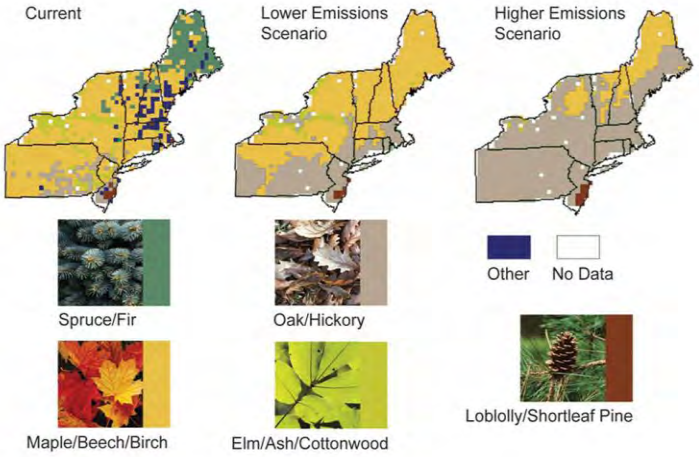
Average temperatures in the Northeast are projected to increase and precipitation patterns are projected to continue to change. These changes are likely to affect the types of crops cultivated in the Northeast.

- **USDA Growing Zones Change:** Most gardeners know the climate regions that define which plants can survive in which regions. Large portions of the region may become unsuitable for growing some fruit varieties and some crops, such as apples, blueberries, grain, and soybeans. Notably by the end of the century, only a small portion of the Northeast may be suitable for maple syrup production. In contrast, the region could see a longer growing season for a number of other crops, which would provide potential benefits to society.
- **Stress on Animals:** Dairy production is important to the Northeast's agricultural economy. Increases in temperature will likely reduce milk yields and slow weight gain in dairy cows. [14] The projected increases in temperature would negatively affect operations, since production costs would increase with reductions in milk and meat production. In addition, without cooler nighttime temperatures, many cows would experience continued heat stress that could ultimately result in loss of cattle.

Impacts on Forests

Heat stress and decreased soil moisture are likely to negatively affect the productive ability of several tree types in the Northeast. Some of the trees that are currently common across the Northeast, such as maple, birch, and beech, could experience a significant northward shift in their growing region. As the ranges for spruce and fir trees shrink, several of the animal species that live in these forests could be at risk of losing their habitats. [15]

Figure CE13: Projected Shifts in Tree Species



Projected shifts in tree species, including the Sugar Maple, which contributes to the region in local Maple Syrup sales as well as showy foliage that draws "Leaf Peepers" in the fall.

Source: USGCRP (2009)

Source: USGCRP (2009)

While warmer temperatures would directly affect tree health, these conditions could also allow certain destructive invasive species to thrive. The hemlock woolly adelgid is of particular concern in the Northeast. This highly destructive insect has worked its way through hemlock forests from Georgia to Maine. Hemlock forests provide habitat for a variety of species, including several unique types of birds (the blue-headed vireo and Blackburnian warbler). The hemlock woolly adelgid could completely wipe

14 Ibid

15 Ibid

out hemlock populations in the Northeast, destroying habitat for these birds, among other species.[16] For a more detailed discussion about how climate change will affect the natural resources of the Berkshires, see the Conservation and Recreation Element of Sustainable Berkshires.

Figure CE14: Location of Ski Resorts in the Northeast

Warmer temperatures could cause most to close by the end of the century.

Source: USGCRP (2009)

Impacts on Winter Recreation

The region has many winter recreation opportunities, including snow sports (skiing, snowmobiling, and snowshoeing) and ice-based activities (ice fishing and skating). These activities contribute about $7.6 billion annually to the Northeastern economy. Projected increases in temperature could reduce snow cover and shorten winter snow seasons, limiting and altering these types of activities. Local ski resorts have already begun diversifying their offerings to include such things as slides, retreats, music festivals and zip lines.

The average length of the ski season may decline to less than 100 days, and winter nights are expected to be warmer. Ski resorts may require more artificial snowmaking to produce snowpack. Artificial snowmaking requires additional water and energy, increasing costs to the resorts. The impacts of these changes may decrease the economic viability of operating ski resorts in the Northeast. [17]

The Role of Local Action in a Global Crisis

At roughly 2% of the U.S. economy and 1.3% of the nation's GHG emissions, Massachusetts could not, on its own, stop global climate change even if it reduced statewide emissions to zero instantly. However, Massachusetts is in a position to show the way to a clean energy economy — and reap direct benefits in economic growth — through the development of smart, targeted policies that reduce emissions by promoting greater energy efficiency, developing renewable energy, and encouraging other alternatives to the combustion of fossil fuels. In the process, Massachusetts will also start to reduce its dependence on fossil fuels, become more energy independent, and jump start its economy with new technologies, new companies, and new jobs. Berkshire County could be an active participant in nation-wide and state-wide efforts.

16 CCSP (2008). The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States . A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M. Ryan, S. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L Meyerson, B. Peterson, and R. Shaw. U.S. Environmental Protection Agency, Washington, DC, USA.

17 USGCRP (2009). Global Climate Change Impacts in the United States . Karl, T. R., J. M. Melillo, and T. C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

OPPORTUNITIES AND CHALLENGES

Cultural Shifts Needed to Adapt and Mitigate Climate Change

Planning for climate change is typically broken down into two categories of action: mitigation, or what communities can do to reduce their carbon emissions now and in the future, and adaptation, or what communities can do to help insulate themselves from or prepare for projected impacts. This is based in the global scientific consensus that even if climate accords were implemented, climate change impacts will still continue to play out based on emissions to date. Despite the enormity of the threat posed by climate change, there is a notable disconnect when it comes to shifting cultural norms and behaviors that contributed to the current crisis. At the same time, public awareness of climate and energy science and policy is very low. The long-term, global scale of the crisis, coupled with the history of scientific debate within American politics and media, has diffused the degree of attention given to the issue. Locally, this means that people tend to plan out their futures with short-term or "business as usual" assumptions rather than a longer term post-fossil fuel energy transition perspective. The concept of climate change can be overwhelming for people who may think that their individual behavioral changes will make no difference in such a large global problem. They have little incentive to embark upon lifestyle changes when they feel their efforts do so little to affect the problem.

Failure to Transition Could Hinder Future Economic Picture for Region

Over the past several decades, the region witnessed a decrease in manufacturing jobs from which it is still reeling both socially and economically. While globalization was a major factor, the region also lost jobs to other areas of the US, such as the Sunbelt and West, where the costs of doing business are lower. Energy costs are a major component of that, and one which continues to threaten the few remaining industrial energy users in the region. While industrial users have been hardest hit as they tend to have higher energy needs, all businesses, schools, and municipalities have felt the rising costs of oil for heating fuel or fleet vehicles – for transportation of people, services, and products – as well as the volatility of electricity costs.

Transitioning the region away from fossil fuels could help the region stand out. As a standout leader, the region may attract green and clean tech businesses or green friendly businesses to locate here. The costs of inaction are therefore a concern to the future of the region. Through this plan, the region can consider nearer-term and longer-term actions to take to gradually achieve an energy transition. This could include aggregation to control costs or portfolio to begin greening the energy used in the region, planning for electric car charging stations and other such infrastructure, as well as a certain degree of energy self-sufficiency to support resilience and insulation to outside volatilities.

GOALS, POLICIES, AND STRATEGIES

GOAL CE1: Support broader understanding of climate change threats and opportunities for individual action.

Policy CE1.1: Improve availability of information about local impacts of climate change, sources of greenhouse gas emissions, and opportunities to reduce impacts.

Strategy A: Make Local Climate Changes Real

Educate local residents to help them understand how climate change will impact the local environment and their personal lives. Educate them on the changes to our surrounding natural world and how these changes might impact their own property and homes. A warming climate will change the composition and abundance of some wildlife species that residents currently enjoy in their backyards or when hiking. It may also change the use and cost of energy, may increase the risk for property flooding, ice damage and other natural hazard damages.

Strategy B: Make Climate and Energy an Ongoing Discussion

Engage the public in sharing ideas related to energy efficiency and renewable energy via conventional and social media. Create an accessible platform using website, social media, mobile device and other appropriate technology aimed at the public to share ideas, knowledge, experiences, success stories and opportunities for energy efficiency and renewable energy. This could also include green living tips to help catalyze individual actions or behavior changes.

Strategy C: Make Climate Change and Energy a Local Issue

Catalogue local impacts of climate change, sources of greenhouse gas emissions, and mitigation and adaptation opportunities/success stories. Currently there is no central information repository that describes the actual impacts of climate change at the local level. A central clearinghouse could help make a global issue relevant at a local scale and provide a mechanism to increase awareness of mitigation opportunities and local success stories.

Strategy D: Work With 1Berkshire to Host Annual Open House / Green Homes / Businesses /Technologies Tour

Help familiarize people with green options, products and professionals by showcasing local project examples, products, incentives, and companies in an annual event. This type of event can help spur community investment in energy efficiency, conservation and green technology in the region while also promoting local businesses offering those goods and services to reinforce buying and hiring local. This annual event could occur around Earth Day for greater press coverage and participation.

Strategy E: Support Local "Green" Committees

Provide technical support to local Green Committees so that they can readily share ideas and experiences and exchange educational materials. Create a central web-based source through which they can communicate with each other to more effectively increase the energy awareness of residents across all of Berkshire County.

Policy CE1.2: Encourage local schools and colleges to integrate climate change- and energy-related topics and career options into curricula.

Strategy A: Integrate Climate Change into Curriculum at All Levels

Work with Compact for Education and Readiness Center trainers, local school district curriculum coordinators and STEM (Science, Technology, Engineering and Math) educators to identify areas of the curriculum where most appropriate to integrate climate and energy topics.

Strategy B: Leverage Climate Education into STEM Career Paths

Create or expand internship opportunities for high school and college students in STEM fields, including trade careers, with local employers, such as local engineering, solar companies, sustainable business consultants, and energy efficiency firms. (See also Economy goals.)

GOAL CE2: Commit to meet or surpass the state's climate emission reduction target.

Policy CE2.1: Adopt this climate and energy plan and work to implement its contents.

Strategy A: Climate and Energy Element Adoption

This element establishes goals and action steps for how Berkshire County can mitigate the impacts of climate change through education, awareness, efficiency and conservation as well as steps to adapt to projected impacts. Successful implementation will require action be taken at all levels: municipalities, regional agencies, businesses, non-profits, local energy committees, and by individuals. Approval of the Sustainable Berkshires Plan by the 32 municipalities in the region is an important first step in achieving the plan and climate reduction target for the region. Each municipal City Council or Board of Selectmen is encouraged to take formal action to support the plan and its contents.

Strategy B: Highlight Climate Reduction Best Practices and Opportunities

Highlight climate reduction success stories to serve as practical examples of what is being done by colleagues in the region. This could include a web and newsletter series of real life examples of the actions that have been taken within the region to contribute to achieving the climate reduction target.

2. ENERGY EFFICIENCY AND CONSERVATION

Climate change mitigation calls for careful management of fuel resources, including reducing total energy use and using energy more efficiently. The choices we make about how we use energy—turning machines off when not in use or choosing to buy energy efficient appliances—will have increasing impacts on the quality of our environment and lives. There are many things we can do to use less energy and use it more wisely. This section reviews resources available to support energy conservation and efficiency and then sets goals, policies and strategies for the region.

MAXIMIZING ENERGY EFFICIENCY AND CONSERVATION

Residents support maximizing energy efficiency as a major step in meeting the regional climate emissions reduction target. Many people use the terms "energy conservation" and "energy efficiency" interchangeably; however, they have different meanings:

Energy Conservation

Energy conservation includes any behavior that results in the use of less energy. The act of turning off the light when you leave a room or keeping your thermostat at 65 degrees in winter are both commonly recommended examples of how to easily use less energy.

Energy Efficiency

Energy efficiency, on the other hand, focuses on creating a product that requires less energy but allows you to continue operating as you would otherwise. This includes replacing a traditional bulb with a compact fluorescent or increasing the amount of insulation in your house to save energy by reducing energy waste.

Significant energy savings come from the *moderate use of better technology*--energy conservation and energy efficiency acting as a team. This savings can be achieved by incrementally changing one's behavior and thinking of energy conservation in terms of moderation and wise use rather than sacrifice. Over time, many small steps combine to result in meaningful savings.

Implementing Energy Efficiency Projects and Conservation Initiatives

In addition to state and federal program supporting energy efficiency and conservation (see Appendix C), the region also has local actors working to make energy-saving improvements and control energy costs.

Non-profit Partners

Center for EcoTechnology (CET)

CET has been an active leader in renewable energy and energy efficiency improvements for decades. In addition to being the local administrating agency for the Mas$ave program for home energy audits and rebates, it has also provided a number of other services and programs over the years including renewable energy feasibility assessments, energy reduction strategies for municipalities and businesses, and served as a state trainer in the Stretch Energy Code, an optional appendix to the state building code.

Berkshire Community Action Council

BCAC offers programs and services to low and moderate income households to help stabilize home energy costs. This includes an active weatherization program as well as an energy star appliance program, and fuel assistance program.

Municipal Partners

Green Committees

Fourteen of the region's 32 communities have active green committees. These volunteer groups work with municipal staff and officials to organize programs for the community from Solarize Mass programs (Pittsfield and Lenox), championing green communities designation or other means of lowering municipal energy use and costs, as well as various water and energy efficiency education and promotion programs

Municipal Staff and Departments

Municipal staff, for those communities large enough to have part- or full-time staff, are a great resource for moving municipalities forward on energy efficiency or renewable energy projects. They help from planning to implementation including working with stakeholders, applying for grants, and managing construction projects to implement changes.

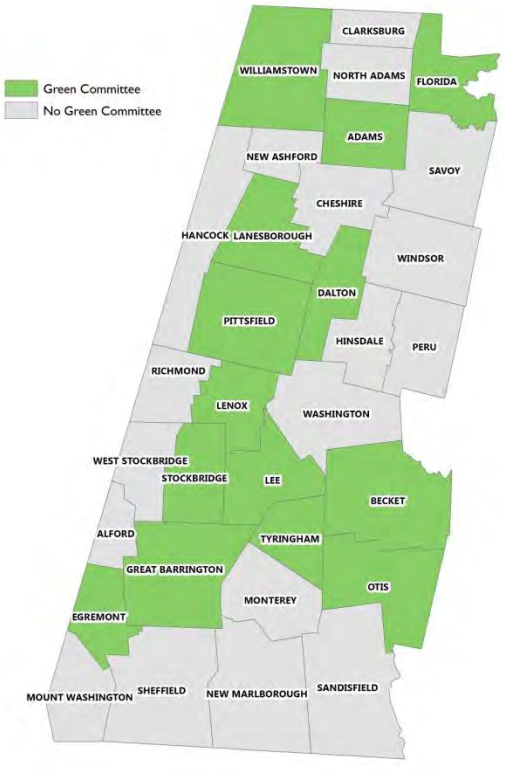


Figure CE15: Communities with Green Committees

Regional Partners

Berkshire Regional Planning Commission

The BRPC works with all municipalities on a variety of planning and administrative needs. In the past, this has including educating communities about how to meet the five criteria to be designated as a "Green Community" by the state, writing and administering grants to conduct energy audits on municipal buildings and make recommended energy efficiency improvements, writing vehicle fleet policies, crafting renewable energy bylaws, and navigating power purchase and environmental service company (ESCO) contracts.

1Berkshire/Berkshire Chamber of Commerce

As economic development advocates, 1Berkshrie and the Chamber have worked with local businesses on renewable energy, energy efficiency, and group power purchasing agreements to help control energy costs in the commercial and industrial sectors.

GREEN COMMUNITIES

In 2008, the state passed the Green Communities Act and paved the way for a new municipal designation: Green Community. In order to achieve this title, municipalities must meet five criteria:

1. **As-of-right Siting**

   Adopt zoning that allows one of the following as-of-right:

   - Ground-mounted solar arrays of 600kW or more
   - Wind Turbines of 250kW or more
   - Renewable energy R&D and/or manufacturing

2. **Expedited Permitting**

   Ensure that permitting procedures for the same would not exceed one year.

3. **Vehicle Fleet Policy**

   Adopt a policy committing to purchase fuel-efficient vehicles as replacements or additions to fleet (exempts police, fire, and public works vehicles)

4. **Energy Baseline and Reduction Strategy**

   Conduct an energy baseline using the free on-line tool Mass Energy Insight and then craft a plan for reducing municipal energy use 20% in 5 years.

5. **Stretch Energy Code**

   Adopt the optional appendix to the state building code which has some incremental improvements to improve energy efficiency of structures.

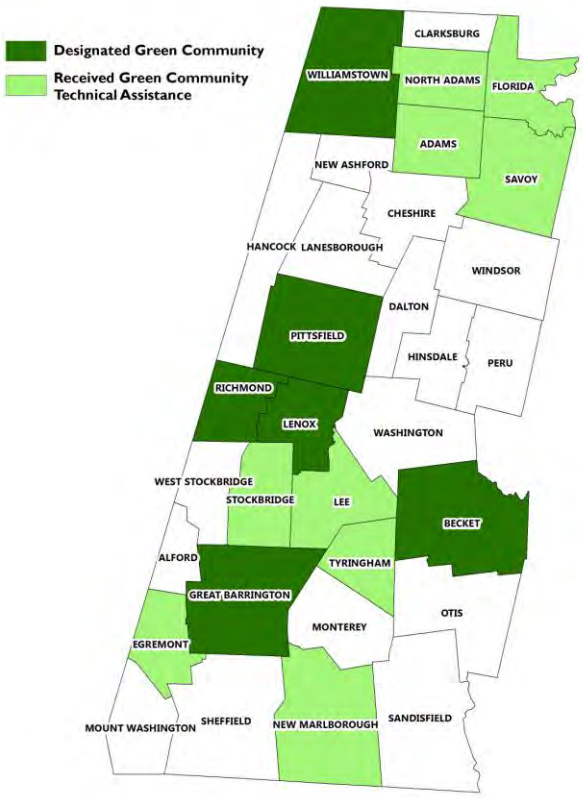


Figure CE16: Green Communities Activity

To date, 14 communities have received Green Communities Technical Assistance, six have achieved designation. To date, grant awards to the six communities through the program have totaled over $1.25 million.

Bright Spots and Barriers

Local permitting and vehicle fleet size and composition make meeting the second and third criterion relatively straightforward. The three "tough spots" for local municipalities have been in grappling through the as-of-right discussions, particularly in communities with no industrial land base to accommodate the manufacturing option; completing the energy baseline and reduction strategies which require staff time, making it difficult for small municipalities to accomplish without dedicated volunteer hours. Finally, stretch energy code discussions have been bogged down with misinformation and pushback from the building community despite all facts and statistics disproving false claims.

Opportunities and Challenges

Barriers to Expanding Reach of Energy Efficiency Measures

There is strong broad-based support for conservation and energy efficiency measures, which should be a cornerstone of any sustainable energy plan. However, achieving a net reduction in energy use from efficiency measures continues to be a challenge. While homes and businesses have made great strides over the past decade by replacing light bulbs and appliances/equipment to more efficient alternatives, net reductions on electricity use have been lessened by growth in the number of electronic devices making energy demands. There have been strong programs for making building envelope and system improvements for residences to reduce heating fuel consumption. However, there is a lack of comparable programs for commercial structures and many businesses have not been able to make similar upgrades to help their bottom lines. State mandated efficiency programs through utilities are set to expire in the next three years, creating a short-term need to reinforce participation in the programs while they exist. However, participation in recent years has been hampered by fluctuating energy costs, notably current low natural gas costs relative to oil, which have reduced demand for energy efficiency programs/measures. If communities want to become more energy efficient as a way to achieve climate emission reduction targets over the long-term, they will also need to find ways to overcome these barriers to broader participation in energy efficiency in all sectors.

Small Businesses and Municipalities Lack Staff Capacity to Reap Efficiency Benefits

The majority of communities in the region, small businesses and non-profits tend to lack the time and technical resources to devote a real focus on energy efficiency. Data driven, lifecycle analysis is often lacking. Existing incentives may be challenging to understand and navigate so technical support is helpful, especially because towns may not have staff resources to invest in this issue.

Building Code Education and Enforcement Gaps

The Massachusetts Building Code is constantly evolving, making it difficult for some building inspectors to keep up with all the changes. This can be a challenge for municipalities whose inspectors work part-time and/or are overextended by working for several towns at a time. Improved education, awareness, and enforcement of the building code, including accurate information on the stretch code, are needed across the region. More education could help counteract misinformation on the stretch code that persists among contractors and residents, even in designated Green Communities. Local successes could be highlighted to help make project examples more tangible. However, state and elected official action may be needed to help address enforcement deficiencies.

Challenges of Reducing Transportation Emissions in a Rural Environment

Fuel use associated with transportation (gasoline and diesel fuel) is a significant contributor to energy consumption and greenhouse gas emissions in the region. Municipalities applying for designation as Green Communities had a difficult time developing a plan for reducing energy use from municipal vehicles, which are primarily police cruisers and large trucks with extremely low fuel efficiency. The rural nature of our region, with dispersed development patterns outside of the downtowns of larger communities in the region, coupled with limited transit service, means people and municipalities struggle to make meaningful reductions for local goods, services, and commuting behavior. There is, however,

opportunity over the long-term to increase the use of rail for freight movement as well as passenger service to and from the region. Rail is a viable alternative to long-distance trucks for freight, meaning truck service can become more localized. Current freight in the region is routed from hubs in Selkirk and Mechanicville NY. The plan could explore the opportunity to have a distribution center within our area to further reduce the distance materials must be transported by truck. Passenger rail extension is currently in planning phases to connect north from New York City to Pittsfield, with several stops in South County. If this moves to implementation, it could help both increase visitation and decrease the number of vehicle trips between NYC and the Berkshires. There has also been some discussion of enhancing east-west passenger rail service between Boston and the Berkshires.

GOALS, POLICIES, AND STRATEGIES

GOAL CE3: Maximize energy efficiency of the built environment as a means of reducing climate emissions from and operating costs to residents, businesses, institutions, and government.

Policy CE3.1: Encourage greater participation in existing energy efficiency and conservation programs through marketing and promoting options available to residents and businesses.

Strategy A: Hire Local for Energy Efficiency

Business advocacy groups should work to promote local companies able to provide energy efficiency services and supplies, perhaps as an in-focus look as part of the larger buy-local campaign. This offers another avenue to ensure energy and energy efficiency projects offer local benefit, in this case through better profit retention in the region's economy and local jobs.

Strategy B: Promote Available Efficiency Programs to Increase Use

Energy efficiency programs and services are available throughout the county. Although there is wide-spread support for energy efficiency measures the existing programs are not being maximized. In collaboration with utilities, existing programs should be more widely promoted to all market sectors to ensure that those entities that are likely to undertake energy efficiency measures are aware of the programs and services that are available to them. These efforts to promote existing programs should also focus on working toward a system that is easy to navigate and transparent.

Strategy C: Track and Report Efficiency Activity and Progress

Work with utilities to analyze type and location of program participants across the region and investments made to better communicate successes and opportunities for action. Currently there is no centralized database to track program participation. By creating such a database targeted efforts can be made to promote the programs to those geographic areas or sectors that may not be aware. Additionally, this information could be utilized to develop targeted campaigns to increase participation in those geographic areas and sectors that may be most likely to participate.

Strategy D: Energy Efficiency Campaigns

Energy efficiency messages have become ubiquitous and somewhat diluted the goals and need for this type of activity. As the region embarks on a mission to achieve its climate reduction target, and with the stated desire to see efficiency featured prominently in actions taken towards that end, pointed effort will need to be made to put the spotlight back on efficiency. One route could be to establish a regional campaign where each municipality has a target and competes to be the first to reach the goal. Another effort could involve a public campaign to promote "smart driving," to help residents identify ways to reduce their miles traveled and to gain efficiency on the miles that they do travel.

Strategy E: Peak Electricity Load and Impacts

Support measures which reduce peak electricity loads and impacts, including electricity conservation measures, feasible power storage technologies, and using efficient peak power generation as required.

Strategy F: Use Technology to Reduce Vehicle Use

Support increased usage of video conferencing and other internet-based methods to reduce the need for travel and resulting transportation emissions, taking advantage of the availability of symmetrical fiber broadband in the Berkshires.

Policy CE3.2: Work to address information or financing obstacles to energy efficiency.

Strategy A: Dedicate Financial Assistance to Businesses

While the MassSave program has been successful in engaging the residential sector, the utility company program administrators (PAs) in the region have had less success in engaging the business sector. The PAs must increase their outreach to commercial and industrial customers by providing free energy audits and greater upfront technical assistance to business owners to help them understand their potential for energy savings and/or renewable energy generation. If the PAs are unable to offer free free audits, they should consider offering audits on a sliding scale, whereby the audits become free to those business owners who implement at least a portion of the recommendations that arise out of the audits. Similarly, the Clean Energy Center should increase its outreach to engage a greater number of small-to-medium-sized businesses.

Strategy B: Green Business Revolving Loan Fund

Establish a revolving loan fund for small businesses with priority given to energy efficiency and "green" development. Regional revolving loan funds currently exist for activities such as Brownfields Cleanup. An additional revolving loan fund could be created to assist small businesses and give priority to energy efficiency and "green" development. Although the return on the investment may be viable, often small businesses lack the upfront capital to employ innovative, cutting edge technologies and often the result is to rely on standard building practices. In addition, sustainability as a region calls for the reuse of buildings whenever possible. Efforts should be made to offset the potential that new development is viewed as more cost effective than improving existing buildings with energy efficiency measures.

Strategy C: Facilitate Flexible Financing Options to Support Deeper Conservation

Standard small business loan products can become a barrier to businesses accessing capital to make energy and efficiency improvements. The region needs to develop or help connect local businesses to special financing programs (grant or loan guarantee) with longer time frames than standard rate of return criteria currently allow. In some cases, this could mean working with small businesses to make better use of programs such as the USDA rural energy program for small businesses. However, not all businesses will be eligible for this program and participation may not be to scale with aspirations set forth for that sector in this plan.

GOAL CE4: Update municipal practices and regulations to support low-emission living.

Policy CE4.1: Encourage and support local governments to adopt Massachusetts Green Community criteria.

Strategy A: Green Communities Technical Assistance

There are five criteria for communities to meet in order to be successfully designated as a Green Community. Once achieved, this designation entitles communities to apply for grants every six months to implement energy conservation and generation projects. Berkshire Regional Planning

Commission and the Center for EcoTechnology (CET) are both able to provide technical assistance at the request of communities to help meet the five criteria. Communities are encouraged to take advantage of these resources and achieve some, if not all, of the five criteria as an energy and cost-saving strategy.

Strategy B: Energy Circuit Rider

Low staffing in many towns make the energy baseline and reduction strategy criteria challenging to meet. A circuit rider that can assist communities with these criteria -get them set up in Mass Energy Insight to conduct the baseline and then assess options for how to achieve the 20% reduction – will be critical, particularly for the smaller towns in the region.

Strategy C: Local Green Community Criteria and Designation Tracking

As communities achieve individual criteria on their path to green community designation, these steps should be tracked and communicated to highlight progress of the region to becoming a Green Communities region. Highlighting local progress of individual communities can serve as motivation for others within the region and should include a tracker of Green Communities grant awards, initiatives they support, and annual savings to the communities.

Strategy D: Stretch Energy Code Municipal Official Outreach and Education

Arrange meetings with local decision makers to encourage adoption of the stretch code and explain the difference between standard and stretch construction, including the costs and benefits, while addressing concerns of those who object. The Stretch Energy Code is an appendix to the Massachusetts Building Code, created by the Massachusetts Board of Building Regulations and Standards (BBRS). It results in cost savings and environmental benefits through improved building energy efficiency. Since its adoption is optional, municipalities in the Commonwealth may adopt the Stretch Energy Code on an individual basis. The Stretch Energy Code was developed to improve the energy efficiency of Massachusetts buildings and its adoption meets one of the five criteria for designation as a Green Community. However, many communities are reluctant to adopt the stretch code and clear, direct explanation of the difference between standard and stretch construction is needed to address the concerns of those who object.

Strategy E: Ongoing Stretch Energy Code Training for Building Inspectors and Trades

Despite state efforts to provide training on the stretch energy code, misinformation persists on its requirements and project impacts. Given that the state is now going to track the international building code and biennial updates, the stretch code will continue to change with the base code. Ongoing efforts should be made to help ensure local code officials as well as local construction trades are able to access training on building and stretch code changes to ensure project information, work and enforcement are successfully moving forward.

Strategy F: Berkshire Climate Compact

Craft a simple climate agreement for municipalities to sign onto committing to implement measures to contribute to the region's climate reduction target. This could include a set of minimum actions a municipality will implement such as greening public buildings, supporting multi-modal transportation efforts, pursuing a renewable energy project, and/or offering special programs to promote efficiency. Actions can and should be taken simultaneously at all levels to produce a timely and comprehensive response. A non-binding memorandum of agreement (MOA) that the city or town will do their part to implement this plan is an important step toward achieving the climate reduction target for the county as a whole.

Strategy G: Model Bylaws and Support

The region should develop and refine model bylaws that meet Green Communities criteria in ways that are consistent with local scale, context and common concerns or considerations. Green Communities designation criteria include as-of-right siting in designated locations for renewable/ alternative energy generation, research & development, or manufacturing facilities and an expedited application and permit process for as-of-right energy facilities. Technical assistance to planning boards to successful adapt model bylaws to community needs will help facilitate the process of Green Community designation for many of the communities within the region.

Strategy H: Municipal and Regional Climate Reduction Progress Report

The goal of meeting or surpassing the state's climate emission reduction targets is quantifiable. Energy data, however, comes from different sources and must be compiled. Mass Energy Insight provides easy access to municipal and school district energy use if enrolled and using the system. Private customer information, however, requires direct contact with the different energy providers in the region. The energy and climate baseline (Appendix B) provides our starting point and details the sources of data. Regular updates to this will be needed in order to track regional progress in achieving the climate reduction target.

Policy CE4.2: Improve transit opportunities.

Strategy A: Municipal and BRTA Partnerships

Consider expanding pilot projects such as the one pioneered by the Town of Lenox to increase ridership.

Strategy B: Increase State Transit Funding to the Region

Currently the region pays in taxes much more than it receives back in terms of funding for transit service. The region should work together to advocate that the state provide equitable funding to all transit operations across the Commonwealth, bringing BRTA to a level of support commensurate to the MBTA.

Policy CE4.3: Encourage and support the emergence and activity of local energy committees in Berkshire County to help implement programs at the municipal level.

Strategy A: Establish a Local Energy Committee Council

Local energy or green committees are typically volunteer groups with little to no annual budget. These groups have expressed an interest in having more networking and information between these groups across the region. With no convening mechanism, this has not happened in any real way. An Energy Committee Council, where representatives could meet and share information or set collaborative goals, would help energize committees and allow for campaign-based efforts across the county. The Council could also host an annual meeting with all members to broaden the dialogue.

Strategy B: Berkshire Energy Day

Convene an annual event that draws together local officials, technical experts, energy providers, individuals and students to share their data, activities and planned actions. This event can also help catalogue local impacts of climate change, sources of greenhouse gas emissions, and mitigation and adaptation opportunities/success stories.

Strategy C: Collaborate to Overcome Rural Challenges

Some of the smaller communities don't have a large enough population to support numerous active committees nor is there likely budget to provide any program activity funds. A more regional approach, where a group of smaller municipalities form a single committee and each contribute operating funds, can allow for enough critical mass to make an effective and supported committee.

3. SUSTAINABLE ENERGY SUPPLY

Conservation and efficiency alone cannot get the region to its climate reduction target; it will also need to increase the amount of energy coming from renewable sources. As noted in prior sections, electricity is the largest single contributor of CO_2 emissions in Berkshire County, accounting for 52% of total emissions. As such, it makes sense to prioritize this fuel source, which can partially be done through renewable energy technologies. Wind, solar, low-impact hydropower, and biomass can generate electricity locally and reduce demand to the electricity grid system. This section reviews the current state of renewable energy projects in the county, explores the region's potential for generation of solar, wind, and hydropower, and then sets forth goals, policies and strategies for the region to pursue to green its energy portfolio and achieve the climate reduction target.

RENEWABLE ENERGY PROJECTS IN BERKSHIRE COUNTY

According to the Massachusetts Clean Energy Center (CEC), there are 337 renewable energy systems in Berkshire County, ranging from small residential systems to large, multi-megawatt projects. The CEC lists only those projects which it has supported, and it is anticipated that several systems exist across the county that are not accounted for in this inventory. The county has experienced a remarkable growth in renewable energy generation, going from just over 1,000 kW in 2005 to more than 43,000 kW by early 2013. Of the 1,300 million kWh of electricity used in Berkshire County each year, almost 91 million kWh are generated by renewable projects in the county, equaling about 7% of the total energy used.

Table CE8: Renewable Energy Systems in Berkshire County (2012)

System Type	Number of Systems	Capacity (kW)	Estimated Annual Generation (kWh)
Biomass	2	420	**2,943,360**
Hydro	4	1,926	**7,423,574**
Solar photovoltaic	327	9,723	**11,072,970**
Wind	5	32,100	**70,299,000**
Totals	**338**	**44,169**	**91,738,904**

Source: Massachusetts Clean Energy Center, 2013

The largest wind installations in the region are the 15 MW Berkshire Wind Project in Hancock and the 28.5-MW Hoosac Wind project in Florida and Monroe. Of the 19 turbines that make up Hoosac Wind, 10 (15 MW capacity) of them are located in Berkshire County, while the remaining are in neighboring Franklin County. Wind turbines have been installed by Jiminy Peak in Hancock (1.5 MW) and Williams Stone Works in Otis (0.6 MW). A small residential wind turbine generating 10 kW is also located within the county. The Town of Otis is developing an additional single wind turbine adjacent to the Williams Stone Works turbine and other multi-turbine projects have been proposed in the towns of Peru and Savoy.

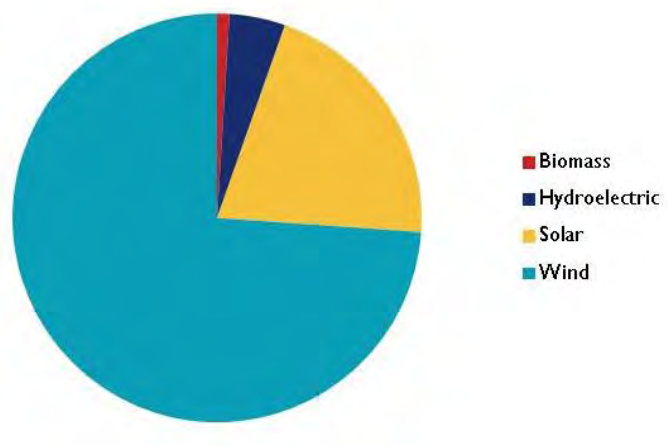
Table CE9: Major Renewable Energy Systems by System Type in Berkshire County (2013)

System	Municipality	Site	Year	Capacity (kW)
Biomass	Pittsfield	City of Pittsfield Anaerobic Digester	2009	195
	Sheffield	Pine Island Farm Anaerobic Digester	2011	225
Hydro	Dalton	Crane & Co.	2013	250
	Dalton	Crane & Co.	2008	176
	Lee	Willow Mill	1872	100
	Stockbridge	Littleville Power	2013	1,400
Solar*	Adams	Hoosac Valley High School	2013	570
	Adams	Adams Landfill	2013	1,100
	Cheshire	Bedard Brothers	2010	28
	Great Barrington	Berkshire South Regional Community Center	2010	76
	Great Barrington	Monument Valley Middle School	2005	51
	Hancock	Hancock Shaker Village	2010	98
	Lee	Big Y	2012	343
	Lee	Country Curtains	2009	126
	North Adams	Mass MoCA building 13	2007	59
	North Adams	Mass MoCA	2013	450
	Pittsfield	Berkshire Community College	2012	400
	Pittsfield	Cooper Center (Compuworks)	2013	23
	Pittsfield	Pittsfield Wastewater Treatment Plant	2011	1,500
	Pittsfield	Quality Printing	2010	126
	Pittsfield	Silver Lake Solar Facility	2010	1,800
	Pittsfield	Unistress Corporations	2009	87
	Pittsfield	Unistress Corporations	2010	75
	Sheffield	Berkshire School	2012	2,000
	West Stockbridge	West Stockbridge Town Hall	2010	58
	Williamstown	Williamstown Elementary School	2003	22
Wind	Florida	Hoosac Wind**	2012	15,000
	Hancock	Berkshire Wind	2011	15,000
	Hancock	Jiminy Peak	2007	1,500
	Otis	Williams Stone Works	2009	600
TOTAL				**43,438**

**Note: This table lists only 20 of the more than 325 solar photovoltaic systems in the county.*
***Hoosac Wind project consists of 19 turbines for capacity of 28.5 MW. Of these, 10 turbines are located in Florida, Berkshire County, for a total of 15 MW. We account for only these 10 turbines in the total renewable in the county.*
Sources: Massachusetts Clean Energy Center, Center for Ecological Technology, Peregrine Energy Group (2013) .

Although the Massachusetts Clean Energy Center indicates that there are more than 325 solar PV installations in Berkshire County (97% of the total number of renewable projects), the current five wind turbine projects in the county generate 77% of the total kilowatt hours generated in the county. The largest solar installations in the county are the 2-megawatt project at the Berkshire School in Sheffield and the 1.8-megawatt project developed by Western Mass Electric Company on the former GE site in Pittsfield. The largest municipal solar system is a 1.5 MW array on the Pittsfield wastewater treatment plant. In addition to the systems listed below, commercial scale solar arrays are being developed on the Lee, Lenox and North Adams landfills, and on other town land in Lee.

Figure CE17: Composition of County Renewable Energy Supply by Type



Source: Massachusetts Clean Energy Center, 2013

Municipal Preparedness for Renewable Energy Projects

To date, nine communities have dealt with permitting larger-scale solar installations and three communities have approved wind developments. From a regulatory standpoint, however, communities are not yet well prepared to handle project proposals. Readiness, ideally, would include some plan or understanding of what projects could be brought forward based on site suitability, have regulations in place to guide the projects to ensure they move forward in locations and ways that the serve the best long-term interests of the community, and that staff and boards understand the steps and technology so as to be able to engage effectively in proposal deliberations.

The importance of proactive local regulatory action is highlighted by existing and proposed state legislation around the development and regulation of renewable energy projects.

- **Solar:** Massachusetts General Laws strongly protects the right of citizens to install solar energy structures and allows for voluntary solar easements to protect solar exposure and access. The Zoning Act (M.G.L. c.40A) singles out solar power structures as those that should not unduly be regulated. Section 3 of the Act states that "No zoning ordinance or by-law shall prohibit or unreasonably regulate the installation of solar energy systems or the building of structures that facilitate the collection of solar energy, except where necessary to protect the public health, safety or welfare." While under this law municipalities may probably not deny solar energy use (except to protect public health, safety or welfare),

they can reasonably regulate solar installations, most reasonably those that are of commercial scale, through design guidelines, zoning restrictions and site plan review.

- **Wind:** In recent years, the state has been pushing towards finding ways to streamline the wind permitting process as projects frequently get embroiled in local and legal conflict that can draw permitting out as long as a decade. This has led to legislation proposals such as wind siting reform and the state's move to create a state appeal board that could potentially overturn local project denials. As home to most of the on-land wind potential, this has been a highly visible debate in the region. The overarching sentiment has been to retain local decision making control over projects; however, this means communities must proactively arm themselves with bylaws, standards, and decision making criterion to make the process as transparent and defensible as possible.

Only 11 Berkshire communities have renewable energy bylaws in place: eleven communities have wind bylaws that require a special permit. By contrast, only three communities, with a fourth community pending, have solar bylaws. To some degree, this is based on local interpretation of Massachusetts General Law Chapter 40A s. 3 which prohibits municipalities from prohibiting or *unreasonably* regulating solar energy systems except where necessary to protect the public health, safety or welfare. Some communities take this to mean they cannot regulate solar. Others in the county and elsewhere in the state focus on the term "unreasonable" as being fairly standard zoning language that still allows for the regulation as long as it conveys fair and balanced rationale for the conditions put in place. This is an emerging legal area in Massachusetts land use regulation which will gain clarity and definition as bylaws meet the Attorney General's approval and are tested in the field.

Table CE10: Berkshire Communities with Renewable Energy Bylaws

	Wind		Solar	
	Residential	**Utility**	**Residential**	**Utility**
Alford	SP	SP	N	N
Becket	SP	SP	N	SPA
Lee	SP	SP	N	N
Monterey	SP	SP	SP	SP
New Ashford	SP	SP	N	N
New Marlborough	SP	SP	SP	SP
Peru	SP	SP	N	N
Savoy	SP	SP	N	N
Washington	SP	N	Pending AG Review	Pending AG Review
Williamstown	SP	SP	N	N
Windsor	SP	SP	N	N

Source: Massachusetts Attorney General's Office, January 2014

SP: Special Permit

SPA: Site Plan Approval (As-of-right)

N: None

ASSESSING RENEWABLE ENERGY POTENTIAL

Wind

The Commonwealth of Mass. has done some analysis for land-based and off-shore wind energy generation. In 2003 True Wind Solutions and AWS Scientific were commissioned to identify and map the most promising sites for wind based on average wind speeds. This statewide study provides a starting point for discussion by showing one factor that needs

The following analysis started with the wind speed map, which showed 41% of the county as having wind speeds of six meters per second or higher, and then factored in a number of other variables that would impact project development, including:

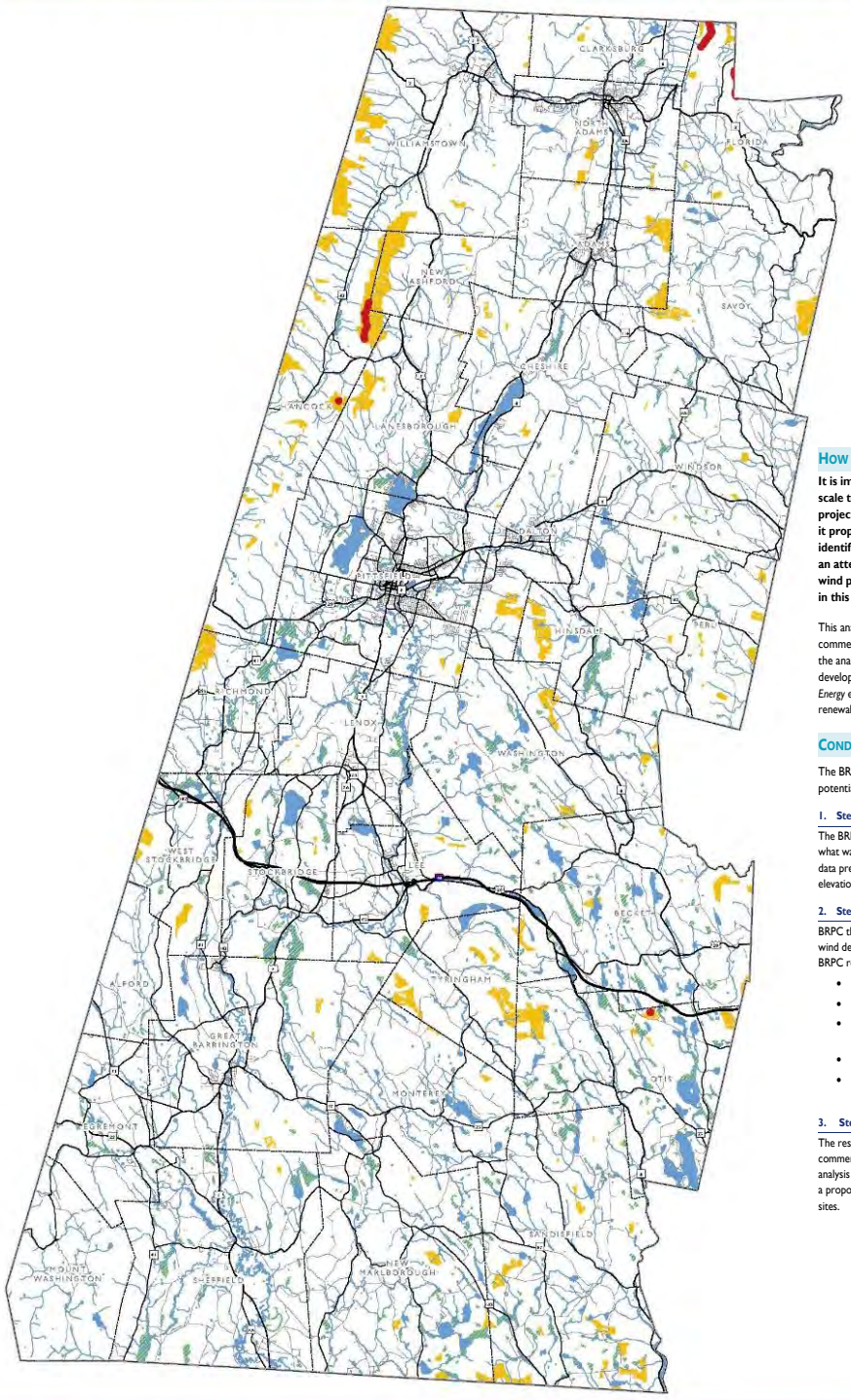
TableCE11: Analysis Considerations for Wind Energy Development

Site selection process:	Factors applied to analysis:
Has enough wind to be viable?	Wind speed 6 meters per second at 70 meters in height above ground elevation
Is clear of major constraints and conflicts?	Land already developed Wetland resources (100 foot buffer) Priority habitat Permanently protected lands Land within ½ mile of an existing residence
Has enough space to accommodate turbine and fall zone?	Parcels at least 30 acres in size.

The results of this work, shown in following map, illustrate that, after conflicts and constraints are removed, approximately only 2% of the county's land area has some potential for commercial wind energy development. In an effort to ground truth the analysis methodology, the results were compared against the location of all the existing wind energy projects in the county and a proposed project in Savoy. All are located within sites that the GIS analysis selected as potential wind energy sites.

WIND ENERGY POTENTIAL

SUSTAINABLE BERKSHIRES



Legend

- Suitable Location for Wind Turbines
- Existing Wind Turbine
- County Boundary
- Community Boundary
- Interstate Highway
- Arterial Road
- Collector Road
- Local Road
- Open Water
- Wetland
- Stream

How to Use the Berkshire Wind Energy Potential Map

It is important to note that this Wind Energy Potential map has been developed on a regional scale to identify potential sites within the county that may support commercial wind energy projects under specific conditions. The map does not possess any regulatory authority nor does it propose or endorse development of wind energy projects on the sites that have been identified. The Berkshire Regional Planning Commission (BRPC) embarked on this analysis in an attempt to better define and determine the *potential* for the county to host commercial scale wind projects that might meet specific natural resource and land use criteria. The criteria used in this analysis is described below.

This analysis does not envision that all of the sites identified dur ng the analysis will be developed for commercial wind energy projects nor that unident f ed sites wi l not be developed for wind energy. Rather, the analysis and resulting maps are ntended to nform reg onal and municipal policies on wind energy development across the county. As noted in both the *Conservation and Recreation* element and the *Climate and Energy* element of the Sustainable Berkshires Plan, sit ng wind energy projects must be done carefully to balance renewable energy generation while protecting the natural resources of the region.

Conducting the Analysis

The BRPC conducted a coarse GIS analysis to map the general areas in the county that have the greatest potential for wind energy development.

1. Step One: Promising Areas for Commercial Wind Development

The BRPC used GIS generated by True Wind Solutions and AWS Scientific in 2003, which produced a map showing what was considered to be the most promising sites in Massachusetts for wind energy development. BRPC pulled data predicting sites where wind speed exceeded 6 meters per second (mps) at 70 meters in height above ground elevation, conditions cited at that time as being needed to make a commercial wind project economically feasible.

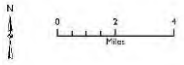
2. Step Two: Selective Criteria

BRPC then removed from these selected areas those lands deemed inappropriate or unsu table for commercial wind development. These criteria are based upon the BRPC's *Wind Power Policy Siting Guidelines* established in 2004. BRPC removed from consideration lands that were:

- Already developed (residential, commercial, industrial lands),
- Wetland resources (lakes, ponds, large wetlands, river & stream corridors),
- Permanently protected from development by ownership or deed restr ct ons (state and municipal forests and parks, conservation organizations, and agr cultural preservation restrictions),
- Within ½ mile of an existing residence, and
- Property parcels that were less than 30 acres n size (based on a turb ne fall zone of 1.5 times the tip of the blade height of 390 feet).

3. Step Three: The Results

The results of th s work are shown on the map, i lustrating that 2% of the county's land area has some potent al for commercial wind energy development using the criteria selected in Step 1 & 2. In an effort to ground truth the analysis methodology, BRPC then overlaid the GIS location of all the existing wind energy projects in the county and a proposed project in Savoy. All are located within sites that the GIS analysis selected as potent al wind energy sites.



10/21/2013

Berkshire Regional Planning Commission

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

Solar

BRPC also conducted a coarse GIS analysis of the county to determine the extent of land that could support ground-mounted solar PV energy projects. Because locating solar arrays, even commercial scale projects, are less complex than wind energy, BRPC considered lands that were both developed and undeveloped as part of the analysis.

Table CE12: Analysis Conditions for Solar Energy Development

Site selection process:	Factors applied to analysis:	
	Ground Mounted	**Rooftop**
Has enough hours of direct sun to be viable?	Sites with slopes less than 10% and Sites with slopes between 10-25% and southeast or southwest aspect	Residences on slopes less than 25% and southern exposure Commercial buildings with footprints of more than 15,000 s.f.
Is clear of major constraints and conflicts?	Land already developed Wetland resources (100 foot buffer) Priority habitat Permanently protected lands	

Ground-mounted Solar

Approximately 25% of the county's land area meets the criteria selected. Of that area, 83% is currently forested and 13% is in some type of agricultural use. Replacing forest or working agricultural lands with solar arrays will require careful planning and community input, as both these land uses are important to the rural character and natural and economic heritage of the region.

Rooftop Solar

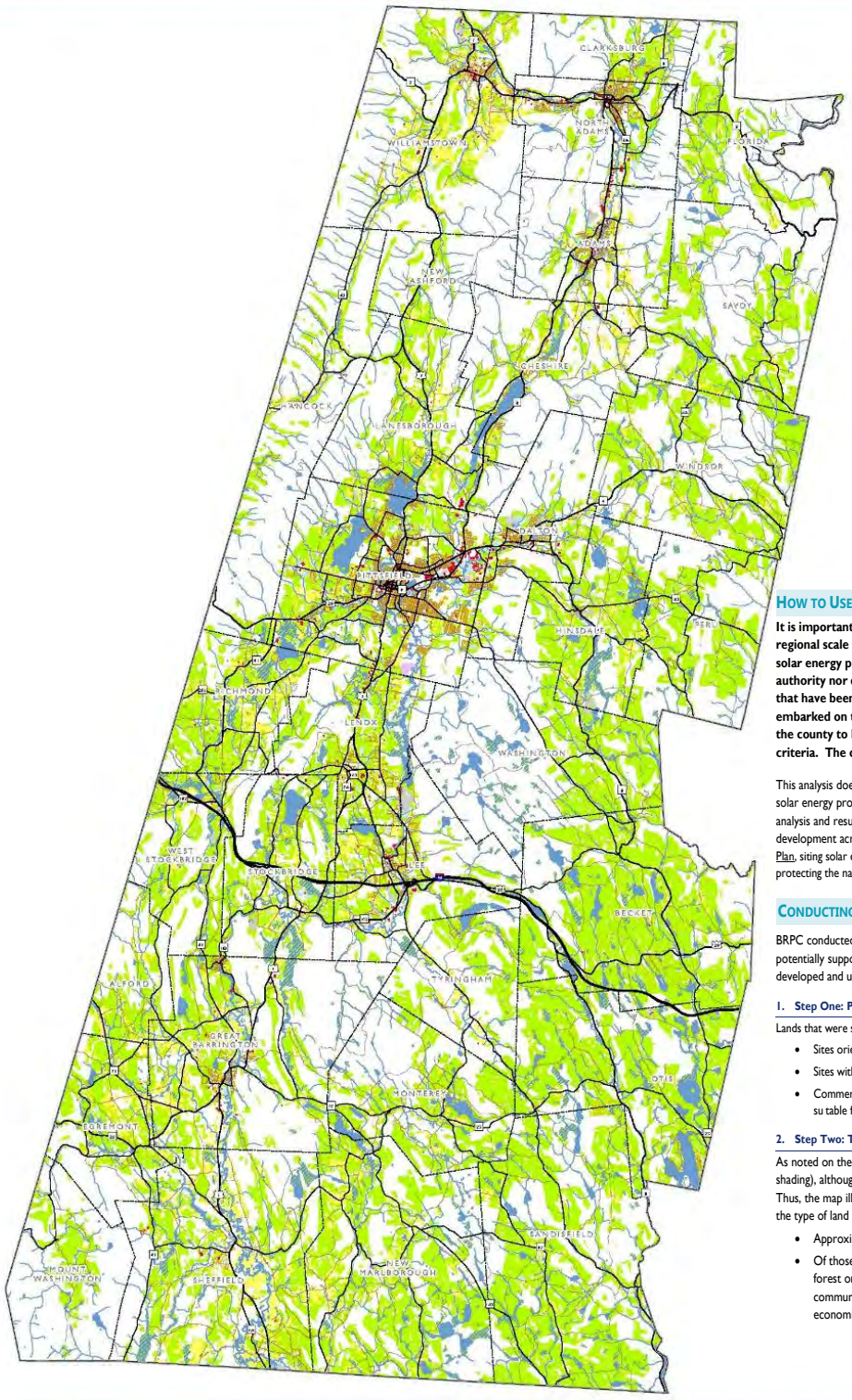
In the county 562 buildings met this criterion, covering 584 acres. It should be noted that this area does not include large open areas surrounding commercial buildings, such as expansive parking lots around shopping malls, and so the calculation for potential solar arrays on commercial properties is underestimated. In some parts of the country parking lots and parking garages are now being considered desirable sites for solar projects, providing not only solar energy generation, but also providing the added benefits of shading and cooling, thus reducing the thermal impacts of such properties. An added benefit could also be providing recharging stations for plug-in electric vehicles.

A "Solar Grove" of solar PV panels over parking provide a dual service of energy generation and shade for cars. (Above) Solar incorporated on the roof of a parking garage at the University of California at San Diego. (Below) Solar shade located on a parking lot in New Jersey.

Residential rooftops were selected for potential roof-mounted solar, although in reality only a small percentage of these buildings could reasonably host arrays. Of the 19,531 houses calculated, at least ¾ of the residential buildings would not be suitable due to directional orientation, and more would be unsuitable due to shading and/or structural deficiencies. Because rooftop solar potential, particularly on residential structures, is difficult to see at the county scale, Appendix D contains maps of the three regional center communities: North Adams, Pittsfield, and Great Barrington.

SOLAR ENERGY POTENTIAL

SUSTAINABLE BERKSHIRES



Legend

Potential Solar Locations

- Residential Rooftop Solar: 386 acres (19,531 homes)
- Commercial Rooftop Solar: 584 acres (562 buildings)

Groud Mounted Solar

Agriculture	20,644 acres
Forest	127,748 acres
Mining	986 acres
Open Land	4,116 acres
Transitional	210 acres
Waste Disposal	283 acres

- County Boundary
- Community Boundary
- Interstate Highway
- Arterial Road
- Collector Road
- Local Road
- Open Water
- Wetland
- Stream

How to Use the Berkshire Solar Energy Potential Map

It is important to note that this Solar Energy Potential map has been developed on a regional scale to identify potential sites within the county that may support photovoltaic solar energy projects under specific conditions. The map does not possess any regulatory authority nor does it propose or endorse development of solar energy projects on the sites that have been identified. The Berkshire Regional Planning Commission (BRPC) embarked on this analysis in an attempt to better define and determine the potential for the county to host solar projects that might meet specific natural resource and land use criteria. The criteria used in this analysis is described below.

This analysis does not envision that all of the sites identified during the analysis will be developed for solar energy projects nor that unidentified sites will not be developed for solar energy. Rather, the analysis and resulting maps are intended to inform regional and municipal policies on solar energy development across the county. As noted in the *Climate and Energy* element of the Sustainable Berkshires Plan, siting solar energy projects must be done carefully to balance renewable energy generation while protecting the natural and agricultural resources of the region.

Conducting the Analysis

BRPC conducted a coarse GIS analysis of the county to determine the extent of land that could potentially support ground-mounted solar PV energy projects. BRPC considered lands that were both developed and undeveloped as part of the analysis.

1. Step One: Promising Areas for Solar Development

Lands that were selected for consideration for PV solar were these:

- Sites oriented southward, and
- Sites with slopes less than 25%.
- Commercial buildings with footprints of more than 15,000 square feet were chosen as potentially su table for roof-mounted solar development (sites show on the map in red).

2. Step Two: The Results

As noted on the map, most of the southward facing slopes are currently forested (represented by green shading), although existing agricultural fields throughout the county are also highlighted (yellow shading). Thus, the map illustrates areas that have the basic criteria for siting ground-mounted arrays along with the type of land use that the array would replace.

- Approximately 25% of the county's land area meets the criteria selected.
- Of those, 83% are currently forested and 13% are in some type of agricultural use. Replacing forest or working agricultural lands with solar arrays will require careful planning and community input, as both these land uses are important to the rural character and natural and economic heritage of the region.

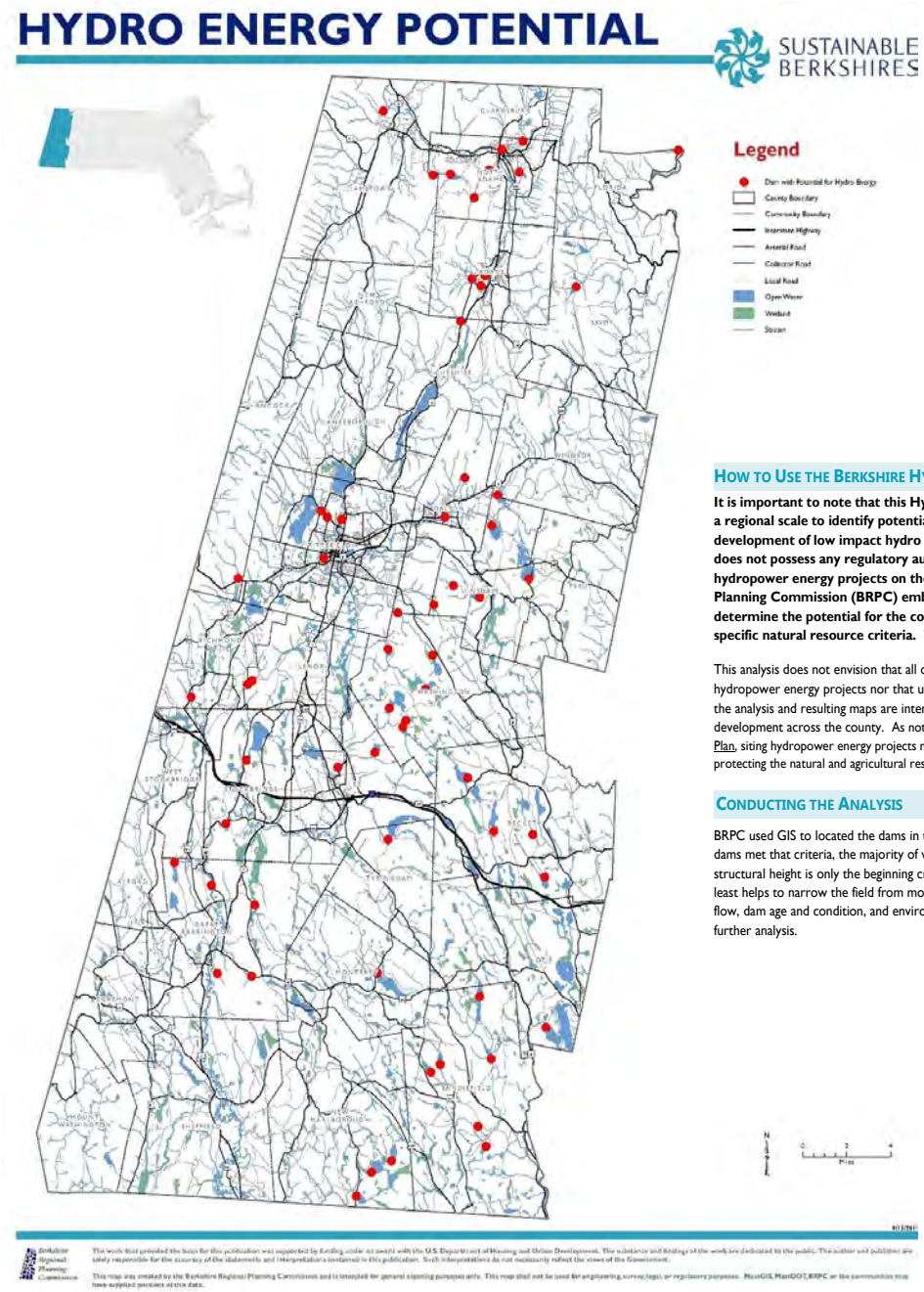
10/21/2013

Berkshire Regional Planning Commission

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

Hydropower

There is great local interest in hydropower, given the number of dams in the county (more than 230) and history of dams as a power source. BRPC used GIS to locate the dams in the county with a structural height of at least 20 feet. Sixty-two dams met that criterion, the majority of which are found in central and southern Berkshire County. The structural height is only the beginning criteria to assess the potential viability of these dams, but this at least helps to narrow the field. Other criteria such as ownership, annual water flows, dam age and condition, and environmental sensitivities would need to be considered as part of a further analysis. The locations of the 62 dams are displayed in the Hydroelectric Potential map.



BALANCING RENEWABLE ENERGY DEVELOPMENT WITH OTHER LOCAL VALUES

The development of renewable energy projects must be done carefully to balance renewable energy generation while protecting the natural resources and public health and safety of the region. As with any development where a larger site is being impacted, there are concerns over the extent of those impacts and how to mitigate them. The new or increased focus on understanding and mitigating impacts from renewable energy projects is, in part, a growing pain of localizing energy generation. Under the fossil fuel energy model, impacts are generally significant but "somewhere else" and in line with the adage out of sight, out of mind. However the region responded that it wants to have a larger renewable energy mix and that the region should take care of its fair share of production to achieve that mix.

Figure CE18: Climate and Energy Workshop Responses

Question: How do you feel about each of the following energy sources as means of energy production for Berkshire County, regardless of where the energy is generated?

Response of Berkshire County residents to a Williams College survey conducted in 2012 (Blazek, et al, 2012)

Local Tools for Limiting or Mitigating Impacts

Moving forward, communities will need to discuss and weigh different values, and are encouraged to do this proactively rather than reactively. Each type of renewable energy carries with it the potential for impacts. While the most polarized voices are often the loudest in public meetings, survey work conducted as part of the planning process showed a majority of people have mild or positive opinions of wind and solar overall – though north county was generally more pro-wind than South County. This means communities have an opportunity to have a civil and informed discussion about renewable energy, where it is most appropriate and how to maximize local benefits and minimize potential adverse impacts.

These conversations are easier by far if they are conducted without any specific project proposal in the wings putting people into a reactive stance. Having well-developed bylaws in place can help communities make sure the development and regulation of renewable energy projects moves forward in a way that serves the best long-term interests of the community. The following table provides guidance of potential impacts or conflicts from each type of energy development and ways bylaws and project negotiations or conditions can help limit or mitigate those impact.

Table CE13: Potential Impacts and Concerns by Generation Type

	Potential Use/Value Conflicts	Basis of Concern	Ways of Limiting or Mitigating Impacts
Wind	***Terrestrial Habitat Disruption/ Fragmentation***	Wind turbines, by their nature, tend to be located on the tops of mountains where there are fast and sustained winds. In the Berkshires, these areas are forested mountains which provide important habitat as mapped by the state in its CAPS and BioMap efforts. In addition to the turbine, each needs a cleared area for a fall zone plus, sometimes new, access roads to the site and interconnection to the power transmission system.	Require to the extent possible that turbines be located in areas already cleared to avoid habitat fragmentation. Require the turbines to be removed and the site to be restored to its pre-existing condition once the wind turbines are no longer operational. Require underground utilities to the extent possible.
	Aesthetics	Beauty is in the eye of the beholder: some find turbines a positive aspect on the landscape; others find them benign or neutral, while still others think they are eyesores that detract from the natural scenery. While completely subjective, balancing competing perspectives can be a difficult challenge for communities.	Require a viewshed map as a part of the special permitting process. Prohibit wind energy facilities from important, historically significant and scenic areas by zoning overlay district. Require underground utilities to the extent possible.
	Sound/Flicker	There are some reports of health impacts from the low, though sustained sound emitted by turbines, particularly in very quiet rural areas where sound tends to travel well. Also of concern to some is the potential impacts of "flicker" or the strobe effect of the sunlight passing through the turning blades, which some attribute to seizure and headache problems.	Require noise analysis as part of special permit process. Require shadow/flicker analysis as part of the special permit process. Set a noise limit on the project. Set a shadow/flicker limit on the project. Require post construction mitigation if adverse noise or shadow/flicker impacts occur as a condition of the special permit.
	Bird & Bat Mortality	The population of some bat species has been decimated due to White Nose Syndrome (WNS), so much so that a 95-100% mortality rate has been found in some bat hibernacula in Western Massachusetts.	Require an avian and bat analysis as part of the special permit process. Impose requirements on a project to protect the vulnerable species identified in the analysis. Require post construction mitigation if adverse impacts occur as a condition of the special permit. New studies indicate that employing relatively small changes to wind turbine cut-in speed and operations can reduce bat mortality 44-93%, while reducing the total annual power output by less than one percent (Arnett, et al, 2010).

	Potential Use/Value Conflicts	Basis of Concern	Ways of Limiting or Mitigating Impacts
	Safety	Two common concerns related to the spinning blades are that they may throw off ice in the winter or that the blades themselves may fall off and crash into nearby property. Two other concerns relate to the turbine tower itself, that it will fall over and that people, particularly youth, may trespass and try to climb up, risking injury.	Require setbacks from structures and roads sufficient to keep people clear of ice throw and blade throw while the turbine is operating. Require signage warning of the dangers of an operating turbine.
Solar	***Aesthetics***	Beauty is in the eye of the beholder: some find solar arrays a positive aspect on the landscape; others find them benign or neutral, while still others think they are eyesores that detract from the natural scenery. Unlike wind, which is more widely visible, solar aesthetic impacts are typically much more localized to surrounding landowners or as visible from the road.	Require vegetative buffers to mask the site, at least from roadways or adjacent properties. Vegetative buffer requirements should specify degree of coverage so that more mature plants are installed to offer immediate coverage rather than small plants which will not provide buffering services for 5-10 years. Require underground utilities to the extent possible
	Agricultural Land Loss	Open flat land in the region is quite often agricultural land, which can be a benefit for farms who want to control electricity costs alone or as a group of farms or sell back to the grid. While solar panels are temporary, they still occupy land in the interim and, if concrete slabs are employed, could have longer-term impacts on the land's agricultural potential.	Raised solar arrays can be developed to allow planting underneath, providing summer shading which can be beneficial for certain crops. Encourage the placement of the solar panels on areas of a farm that are not the most suitable for farming (i.e. area of poor agricultural soil)
	Deforestation	The vast majority of land found to be suitable for ground-mounted solar in the region is currently forested. Therefore, any consideration of these lands as potential solar farms means that some deforestation would be needed.	Selective deforestation could be linked to ecological restoration as succession forest habitat, home to many birds, butterflies, and plant species, has been dwindling in the region. Require to the extent possible that solar panels be located in areas already cleared to avoid habitat fragmentation. Require the solar panels be removed and the site to be restored to its pre-existing condition once the panels are no longer operational
Biomass	***Public Health and Safety***	As with any fuel processing facility, there are safety concerns such as fire, explosion, or spills.	Site in industrial areas with adequate distance from population centers.
	Noise, Truck	In the case of biomass, the biological	Place a limit on the hours of when

	Potential Use/Value Conflicts	Basis of Concern	Ways of Limiting or Mitigating Impacts
	Traffic and Industrial Impacts	material would need to be shipped in, often by truck, which creates truck noise and degrades roadways more quickly, adding maintenance costs to communities. Also, the machinery and processes, including 24-hour lighting of the facility, can impact adjacent uses.	trucks may access the plant Set a designated route for the trucks to travel to avoid traffic on residential areas. Set a noise limit on the plant. Collect a surety from the applicant to repair damages to the roads.
Hydro	***Water Habitat Disruption and Fragmentation***	Hydroelectric turbines are highly regulated through permitting processes in the state. However, two values the region has expressed particular interest in as relates to dams is the role they play in fragmenting waterways. They can negatively impact water and habitat quality, block fish movement and spawning activity, and interrupt canoe/kayak movement.	Require the use of fish passage structures when needed. Curtail hydro operations when anadromous fish return to the rivers – spawning season. Incorporate portage routes for boaters in dam upgrade activities.

Maximize Local Benefit

Berkshire residents have shown more support for commercial wind projects that generate electricity dedicated to a particular site or business over those that generate electricity that is fed into the grid. For example, people view the wind turbines at Jiminy Peak Mountain Resort (Hancock) or Williams Stone (Otis) more favorably than neighboring projects such as Berkshire Wind, which is owned by a consortium of municipalities outside the region and which sells its electricity on the open market. The distinction is that locally-built and used projects are consistent with the self-sufficiency ethic versus the "resource extraction" function of projects built in the region to provide energy and financial benefits elsewhere. However, there is also a fairly clear north-south divide on the topic of wind; in the south where the economy is more strongly linked to tourism and second home market, there is a stronger desire to keep the rural landscape clear. In the central and north portions of the county, where people tend to be year-round residents there is more support for local energy generation, particularly if it can provide energy for local use, use local labor in the construction, and generate local tax revenues to support municipal functions.

State Programs for Implementing Projects

The Massachusetts Clean Energy Center (MassCEC) provides technical assistance and financial aid to the clean energy industry and to those who are interested in planning for and installing renewable energy projects. The Center's more than 20 programs provide planning assistance, seed money and other financing for renewable energy projects, supporting new and innovated businesses. Among the MassCEC programs that have funded projects in the Berkshires are:

Table CE14: State Programs That Have Supported Local Projects

Program	Overview	In the Berkshires
Solarize Mass	Promotes the adoption of small-scale solar electricity in participating communities through voluntary participation by home and business owners who either purchase the solar electricity systems directly or enter into a lease or power purchase agreement (PPA) with the installer. In the first round (2011-2012), a mix of residents and business owners in 17 participating communities signed 803 contracts to install over 5.1 megawatts (MW) of solar PV systems. As a result of the program, the number of small-scale solar electricity projects will more than double in almost every participating community.	Pittsfield and Lenox participated in the 2012 round of Solarize Mass. The towns of Lee and Williamstown are participating in the 2013 round. The towns of Adams and a partnership of Egremont and Great Barrington are participating in the 2014 program. As part of this program, 58 property owners signed contracts in Pittsfield and Lenox for solar arrays for a combined capacity of 465 kW of electricity. (Source: DOER, 2012 Solarize Massachusetts Program Update, 2012.)
Organics to Waste	Methane is a potent greenhouse gas, thought to be more than 20 times more powerful than carbon dioxide in its ability to absorb and trap heat in the earth's atmosphere. This program subsidizes the installation of anaerobic digesters to convert organic waste, such as manure, into energy.	Pine Island Farm in Sheffield has installed an anaerobic digester that uses the farm's cow manure as its feedstock. The system is a combined heat and power system that has a capacity to generate 225 kilowatts, which is much more electricity than the farm demands. The excess electricity is fed into the grid, providing additional income to the farm, while the heat exchange is used to warm water used in the farm operation.
Wastewater treatment plants (WWTPs)	WWTPs present an untapped source of renewable energy, removing and managing hundreds of tons of biosolids per year. When anaerobically digested, those biosolids, which are 60-70% methane, can generate electricity to help bring down the costs of running the plants.	The Pittsfield WWTP has upgraded its anaerobic digestion system and installed a new combined heat system that provides electricity for almost 1/3 of its usage, saving the city $206,000 in electricity costs. The simple pay-back period for the system is eight years, which does not include the renewable energy credits that the city will collect.
Commonwealth Solar Program	Provides rebates to commercial and residential customers who install PV solar panels on their properties. Residential PV systems consist of 60-65% of the rebates issued.	Country Curtains in Lee and CompuWorks in Pittsfield
Commonwealth Solar Hot Water Programs	Provide funding for solar hot water systems for commercial and residential properties	Six systems were installed in the county under the residential program in 2012.
Commonwealth Wind	Provides several types of grants to public and private developers interested in determining the feasibility of wind energy generation projects. Funding will support site assessment analysis, feasibility studies and technical studies for public and private developers, and will support construction for public developers.	Jiminy Peak Ski Resort, Williams Stone Company and the Town of Lenox are examples of entities that have received funding from this program.

Greening the Energy Portfolio Without Local Development: The Evolving Role of Power Purchase Agreements

All electric customers in the state have the right to purchase their electricity from an entity other than their utility company. Customers can directly support renewable energy development by choosing a provider that purchases a larger proportion of electricity from renewable energy projects than their utility company does. Currently, municipalities have two main alternatives to purchasing electricity from a utility company: aggregation and cooperative purchasing.

- **Municipal Aggregation**: The municipality, or group of municipalities, aggregates all electricity customers within their boundaries and allow electricity providers to competitively bid for a contract to supply their electricity. There are two primary motivations for doing so: to procure a lower rate for customers and/or to be able to purchase"greener" electricity by selecting a provider with a higher renewable portfolio. Because the contract locks in a purchase price, there is some degree of risk that cost may go down rather than up and result in paying higher than the fluctuating market rate. This has been true recently as electricity rates have been lower than anticipated a few years ago; however, current projections are that rates will rise. The second use, greening the portfolio, may not yield cost savings but allow communities to demand more renewable energy from their providers. Here the motivation is value- rather than cost-driven but can have a market-based impact by influencing the consumer demand environment.
- **Energy Purchasing Cooperative:** The municipality joins or forms an energy purchasing cooperative whereby involved municipalities purchase electricity rates in "real time," meaning that they pay the price of electricity at the time it is being used rather than over an averaged period of time. If the customer can avoid using large amounts of electricity during the time that it is most expensive, such as the peak demand hours of the day or the peak summer periods, they can achieve great savings. School districts with buildings largely idle, or water treatment facilities that can schedule intense electricity use during the evening and other non-peak times, are examples where substantial savings can result. The Hampshire Council of Governments (COG) offers this service and customers saved $1.6 million over the default electricity rate during 2006-2013 (hampshirecog.org).

Opportunities and Challenges

Many Programs, But Difficult To Navigate

There are numerous programs and incentives available to help building owners reduce their costs through increased efficiency and installation of renewable energy technologies, but these are dispersed through federal and state programs, and the eligibility requirements are often complex and confusing. Many of the programs require detailed energy use information and analysis that building owners do not have. Representatives from the Berkshire commercial electricity sector (businesses, institutions, and municipalities) have stated their desire to consider renewable energy projects but are discouraged from doing so because they do not know where to start. This is especially true for non-profits and small-to-medium sized businesses, which are the backbone of the Berkshire economy.

Need to Assess Region's Renewable Energy Potential and Mix in the Region

There is a balance to be struck when assessing renewable energy potential as part of a sustainable regional energy plan that values environmental, economic and social interests. Currently, private and public developments are being proposed and will move forward or not regardless of this plan effort. Moving forward, however, the plan has the potential to help inform outside entities about the siting and overall portfolio preferences of the region. While wind and large-scale solar PV installations are most

commonly in the news, the region has a number of other potential energy sources inherent to its landscape and development patterns. These include existing dams which could be used for hydroelectricity; forests for biomass; large rooftops for small-scale solar such as old mills and schools. These natural resources have ecological, recreational and scenic value and contribute to tourism and quality of life in the region.

Local Renewable Projects Don't Necessarily Yield Local Benefits

Local objection to renewable energy projects, in some instances, has been based in the sentiment that energy created locally should be used locally and create local benefits (i.e., tax revenues, jobs, etc.). Frequently, proposals have been from outside developers who are generating the energy for corporate profit or municipalities elsewhere. Questions remain as to how to address this issue. Should individual Berkshire communities generate their own energy or can the region work collaboratively to generate our own energy using the assets present in each community?

Expanding Incentives and Improving Technology Means Faster Paybacks

Berkshire residents have indicated at numerous public meetings in recent years that solar PV energy generation is the favored renewable energy technology to reduce our fossil fuel usage, with some residents calling for solar PV on every roof. The upfront cost of installation has historically been a perceived and/or real barrier to installing solar power for many county residents and businesses. Until recently, even with federal, state and local incentives and a significant drop in the price of solar PV systems, few property owners have considered installing solar PV on their buildings. In response to real and perceived barriers, Massachusetts established policies and programs to aid the solar industry and potential customers. As an example, through the MassCEC municipalities assign a Solar Coach who steps in to assist residents by going out to bid for a central contractor, helps market the campaign, and provide information and assistance for participants. The contractor owns the system and generally sells the resident or business the solar-generated electricity at a below-market price. The town of Lenox is a good example of the success of this type of hand-on assistance. Where previously Lenox had received Green Community Grant funds to reduce the upfront installation costs of solar systems, offering $2,000 grants to residents who installed solar on their properties, the town struggled to give away the grants. In 2012, however, Lenox become a Solarize Mass community, and the number of solar installations increased significantly.

CASE STUDY: The Improving Payback Picture for Solar PV

CompuWorks, located in the Cooper Center at the corner of North and Fenn Streets in Pittsfield, has done quite a bit of work on their 19th century commercial building since they purchased it in 1999. The newest work included the installation of 108 new solar panels on the roof in 2012, with a rated capacity of 23 kW of electricity, which is about 10% of the building's usage. However, as co-owner Dave Hall noted, the panels have exceeded their energy output estimates. Dave notes that there are four main factors that make solar arrays a risk-free business decision.

1. A federal tax incentive that allows owners to deduct 30% of the cost on their tax return in first year of the project.
2. Business owners can write off the depreciation value like many other business assets
3. The electricity cost savings.
4. Tradable Solar Renewable Energy Certificates (SRECS) that bring money back to the owner of the project.

Dave sees the solar array as another rent-paying tenant, due to the approximately $5,000 per year that the PV system is due to contribute to the overall cost of owning and maintaining the building through energy cost savings, tax benefits and the cash that the SRECS will bring in.

As co-owner Al Bauman, states, the "economics of solar have changed dramatically in recent years. That's the message that I think will really resonate with other building owners. We looked at solar a few years back and the payback was about 20 years. The array we installed has a payback of around five years. This is the kind of investment that even a landlord that didn't necessarily care about energy reduction can justify purely on the economics."

GOALS, POLICIES, AND STRATEGIES

GOAL CE5: Offer competitive renewable energy costs now and in the future.

Policy CE5.1: Grow market demand and readiness for renewable energy sources.

Strategy A: Use Group Purchasing to Increase Renewable Energy Supply

Group or collective purchasing allows clusters of municipalities to arrange a single contract to purchase energy (Power Purchase Agreements). While group purchasing has often been advocated as a means to secure potentially lower energy costs, it is perhaps more useful as a tool to enable municipalities to ensure that the energy they are buying is from sustainable sources. These contracts can be entered into by a single municipality or a group of several municipalities.

Strategy B: Facilitate Municipal and Community Energy Co-ops

Our older development pattern and structures mean that rooftop solar is not always feasible due to structural or solar orientation reasons. Cost can also be a barrier for individuals or individual businesses. On-structure applications also can eliminate renters as potential participants. Energy co-ops can help spread the cost across a number of homes or businesses and site the energy on a solar-friendly site. Participants can share the energy credits from the project and control their costs. These can be organized by neighborhood or business districts, or can be spearheaded by a group or municipality wishing to supply this service or option to its residents.

Strategy C: Plan for Electric Vehicle Charging Stations

As electric vehicles become more common, the need for fueling stations will grow. The state has been working to promote municipal use of electric vehicles and the siting of public charging stations, particularly for designated green communities. These grants can and should be used to ensure the region has an adequate supply and distribution of electric vehicle charging stations.

GOAL CE6: Increase regional generation and use of clean, renewable energy.

Policy CE6.1: Work proactively to define the locations, types and parameters within which renewable energy development can move forward in the region.

Strategy A: Ensure Local Regulations in Place

Work with all municipalities to ensure they have regulations in place to be able to effectively review and regulate renewable energy development proposals for both wind and solar. Having regulations in place does not imply that a community is pro or anti-development; rather it simply means that a community is prepared to handle proposals that may come forward in a transparent and predictable way.

Strategy B: Regional Grid Planning for Renewable Energy

Encourage the State, electric utilities and ISO New England to proactively plan for the incorporation of distributed renewable power generation in the local and regional power grids.

Strategy C: Recognize Renewable Energy Projects and Quantify Their Climate Impact

Create and publish a regional renewable energy development inventory that identifies and quantifies the potential for renewable energy use in the region, including local resources that would support site-specific energy generation (e.g. wind, solar, low impact hydro, farm waste, sawmill waste) and non-site specific energy generation (e.g. wood waste or firewood). Quantify the energy generated and the greenhouse gas emission reductions created by these facilities to serve as positive examples

to the public. This could initially contain current projects, but then be expanded upon as new developments occur.

Strategy D: Renewable Energy Project Capacity Assessment
Conduct an assessment of the region's capacity to site large scale land-based renewable energy projects, the most likely candidates being solar, wind energy and biomass. This will include working with the electricity companies to note where interconnection with the existing grid system is able to handle large electricity inputs and where upgrades or improvements in the system are needed to accommodate sites that are best suited for large renewable generation.

Strategy E: Small Wind
Support development of small distributed wind programs and projects in appropriate locations.

Strategy F: Countywide Dam Assessment
There is interest in seeing small-scale hydroelectric generation capacity installed at local dams, while there is also interest in decommissioning dams whose environmental impact outweighs their energy potential. The region has many dams but few have annual stream flows to make for a viable hydroelectric project. Furthermore, permitting is complicated and lengthy. It is in the best interest of the region, however, to conduct an assessment of existing dams across the county to understand the real potential capacity of this renewable option. This will allow entities within the region to clearly understand what is – and is not – possible to inform climate action, energy planning and implementation projects.

Strategy G: Tiered FERC License
Support a tiered FERC licensing approach to hydro-electric facilities in order to better reflect the relative differences in impacts from large versus small scale hydro-electric facilities and whether they are on existing dams or other facilities or newly proposed.

Strategy H: New Hydroelectric Technologies
Investigate newer hydroelectric technologies and incorporate appropriate ones into regional renewable energy programs.

Strategy I: Regional Renewable Siting Guidelines
Continue to refine, in collaboration with municipal and public input, regional siting considerations for the region so that they may be proactively shared with any developers interested in pursuing a project in the region.

Policy CE6.2: Expand awareness of existing renewable energy generation and use across the region and in neighboring counties.

Strategy A: Renewable Project Case Study Tours
Sponsor special tours and other opportunities for area residents and businesses to visit existing renewable facilities and ask questions. This could include programs and audiences aimed at residential development, such as SolarizeMass, municipal projects for town staff and officials, and business applications for municipal, economic, and business leaders looking to do more to green supply and control costs. It could also be shepherded by neighborhoods or business associations, where they can highlight the green energy work that they have done, and perhaps awards can be given to unusual projects.

Strategy B: Keep Up on Emerging Technologies and Promote Promising Options

During the course of the planning process, there was a strong desire to not have the energy plan be immediately dated in the technologies referenced or promoted. While solar, wind, and hydroelectric feature in policies of this plan as generation sources, technological advancement in this area is anticipated. The region should continue to educate itself on alternative/innovative renewable energy sources and evaluate viability for use the region.

Strategy C: Workshops

Hold and widely promote workshops for residential and commercial customers that highlight existing facilities that serve as examples for future customers. Utility companies and renewable energy vendors would be available to offer their services.

Policy CE6.3: Continually track best practices for siting and technologies used to ensure any development in the region is of the highest quality and minimizes any potential negative impacts to the greatest practical extent.

Strategy A: Monitor Wind Turbine Technology Changes and Impact Research

The region, while supportive of green house gas reductions, has a number of concerns with wind energy development. These include potential health impacts, impacts on wildlife from turbine blades and site disturbance associated with development and access, and visual/aesthetic impacts. To help facilitate informed debate and best project design, the region should work to track and share thorough and objective information on all scientifically verifiable findings and technological advancements.

Strategy B: Establish Statewide Guidelines and Regulations

Establish statewide guidelines that reflect current best practices for the siting of wind energy projects and regulations that are protective of human health and wildlife. The process to update or amend guidelines and/or regulations must be flexible to incorporate new information. This is extremely important as wind energy technology is advancing so quickly and as scientific data regarding mitigation of impacts is constantly being updated. The states of Vermont and Maine are currently issuing wind energy facility permits that raise the cut-in speed and curtail wind turbine operations during specific times when bats are active.

Strategy C: Educate on New Technologies and Related Incentives As They Emerge

As new technologies emerge, the region should have a mechanism in place to educate on the new technology and any related new grants or incentives that could help facilitate integration of new energy technologies in the region.

4. CLIMATE CHANGE ADAPTATION

"Adaptation" refers to efforts by society or ecosystems to prepare for or adjust to future climate change. These adjustments can be protective (i.e., guarding against negative impacts of climate change), or opportunistic (i.e., taking advantage of any beneficial effects of climate change).

ADAPTING TO DIFFERENT CLIMATES AND ENVIRONMENTAL CHANGES

Adaptation to changes in climate is nothing new. Throughout history, human societies have repeatedly demonstrated a strong capacity for adapting to different climates and environmental changes--whether by migration to new areas, changing the crops we cultivate, or building different types of shelter.[18] However, the current rate of global climate change is unusually high compared to past changes that society has experienced. In an increasingly interdependent world, negative effects of climate change on one population or economic sector can have repercussions around the world. [19]

Governments and communities have started planning for how to adapt to climate change. Many greenhouse gases remain in the atmosphere for 100 years or more after they are emitted. Because of the long-lasting effects of greenhouse gases, those already emitted into the atmosphere will continue to warm Earth in the 21st century, even if we were to stop emitting additional greenhouse gases today. Therefore, steps can be taken now to prepare for, and respond to, the impacts of climate change that are already occurring, and those that are projected to occur in the decades ahead. [20]

There are limits to the ability to adapt, so actions to mitigate climate change must continue. For example, the relocation of communities or infrastructure may not be feasible in many locations, especially in the short term. Over the long term, adaptation alone may not be sufficient to cope with all the projected impacts of climate change. [21] Adaptation will need to be continuously coupled with actions to lower greenhouse gas emissions.

Climate Threats and Adaptive Responses

Adaptive practices include a wide variety of actions by individuals, communities, or organizations that help prepare for, or respond to, climate change impacts. Many of these measures are things we are already doing but could be stepped up or modified. Some adaptation practices for the major threats posed to our region are listed below to illustrate the idea, but should not be read as a comprehensive list.

---

[18] Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit, and K. Takahashi (2007). Assessment of adaptation practices, options, constraints and capacity. In Climate Change 2007: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.). Cambridge University Press, Cambridge, UK, 717-743.

19 USGCRP (2009). Global Climate Change Impacts in the United States. Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

20 Ibid

21 IPCC (2007). Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability . Contr bution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Table CE15: Sample Adaptation Practices

Agriculture and Food Supply	Breed crop varieties that are more tolerant of heat, drought, and water logging from heavy rainfall or flooding. Protect livestock from higher summer temperatures by providing more shade and improving air flow in barns.[22]
Ecosystems	Protect and increase migration corridors to allow species to migrate as the climate changes. Promote land and wildlife management practices that enhance ecosystem resilience. [23]
Energy	Increase energy efficiency to help offset increases in energy consumption. Harden energy production facilities to withstand increased flood, wind, lightning, winter ice events and other storm-related stresses. [24]
Human Health & Safety	Implement early warning systems and emergency response plans to prepare for changes in the frequency, duration, and intensity of extreme weather events, including flooding. Plant trees and expand green spaces in urban settings to moderate heat increases. [25]
Water Resources	Improve water use efficiency and build additional water storage capacity. [26]http://www.epa.gov/climatechange/impacts-adaptation/adapt-overview.html - ref4 Protect and restore stream and river banks to ensure good water quality and safe guard water quantity.

Efforts by organizations and governments to prepare for climate change impacts have increased significantly across the United States, and the world, in recent years. For example:

- EPA has instituted programs to help communities adapt, including Climate Ready Estuaries and Climate Ready Water Utilities.
- The U.S. Interagency Climate Change Adaptation Task Force is coordinating the efforts for adaptation across government agencies.
- A growing number of states and cities have begun preparing to protect people and infrastructure from climate change impacts. In 2011, EEA and the Massachusetts Climate Change Adaptation Advisory Committee prepared the Massachusetts Climate Change Adaptation Report.
- Many other countries around the world are beginning to adapt.
- Additionally, a number of corporations have begun preparing for climate change impacts.

[22] NRC (2010). Adapting to the Impacts of Climate Change . National Research Council. The National Academies Press, Washington, DC, USA.

[23] Ibid

[24] NRC (2010). Adapting to the Impacts of Climate Change . National Research Council. The National Academies Press, Washington, DC, USA.

[25] Ibid

[26] Ibid

GOALS, POLICIES, AND STRATEGIES

GOAL CE7: Build climate resilience into the region's planning and practices.

Policy CE7.1: Integrate planning for increased temperatures into municipal and regional practice.

Strategy A: Offer Shade and Drinking Water in Public Spaces
With annual temperature ranges anticipated to reach those currently seen in mid-Atlantic or even southern states, the Berkshires will need to place new emphasis on providing shade structures and drinking fountains in parks and public spaces.

Strategy B: Tree Planting
Support tree planting programs to offer shade and reduce carbon. Focus areas can be in town centers or other areas with more impervious surface cover, along waterways to help shade the water, and other areas or uses as communities determine important, such as heritage tree replacement or slope stabilization.

Strategy C: Expand Summer Water Access
Swimming locations are a frequent recreation demand in Open Space and Recreation Plan survey results at the municipal level. Already in limited supply, these areas may also see enhanced user demand as temperatures rise. Communities should work now to ensure public swimming and water access options feature prominently in local recreation plans and advocate for their attention in state plans.

Strategy D: Heat Shelter Network
Identify a number of heat shelters in communities and notify residents as to their locations, with particular emphasis on ensuring information reaches high-risk populations such as the very old, very young, or those with specific health ailments.

Strategy E: Vulnerable Populations Phone Tree
Work with faith-based community, pediatricians' network, Elder Services, and others to create a network or phone tree through which high-risk populations can be contacted on peak heat days to check health and redirect to heat shelters.

Policy CE7.2: Work to reduce impacts caused by hydrologic extremes from increased intensity and frequency of storm events to periods of drought.

Strategy A: Update Stormwater Management Handbook
Advocate for changes to the Massachusetts Stormwater Management Handbook to reflect a changing climate.

Strategy B: Advocate for Updated Floodplain Mapping Statewide
Western Massachusetts has some of the oldest floodplain maps and precipitation data in the country. Precipitation patterns already indicate that what was once a 100-year storm is now a 10-year storm. A comprehensive review and update of floodplain layers in the state should be undertaken to assist communities in planning safe and responsible development.

Strategy C: Green Roofs
Support the assessment and implementation of green roof options in major activity centers where there is a high percentage of impervious surface cover such as downtowns and big box retail centers.

Strategy D: Rainwater Harvesting
Work with municipal or regional water districts to promote residential rainwater harvesting and reduce the use of potable water for home irrigation.

Strategy E: Retain and Protect Reservoirs
Protect historic water reservoirs, even if currently inactive, to serve as emergency water supply during periods of drought.

Strategy F: Make Bridges and Culverts Super Storm-Ready
Prioritize culvert and bridge projects which include proper sizing of stormwater systems in regional transportation funding decisions.

See also *Infrastructure and Services, Housing and Neighborhoods,* and *Conservation and Recreation* elements for policies related to surface and groundwater protection, biodiversity, habitat, and infrastructure investment.

IMPLEMENTATION

On March 20, 2014, the Berkshire Regional Planning Commission adopted the entire Sustainable Berkshires plan, which is comprised of eight elements:

- Economy
- Housing and Neighborhoods
- Climate and Energy
- Conservation and Recreation
- Local Food and Agriculture
- Historic Preservation
- Infrastructure and Services
- Land Use

The new regional plan, including the goals, policies and strategies set forth in this element, will be implemented by a variety of actors over the next decade. The plan contains numerous strategies, some of which are longer-term or "big ticket" items that will take some time and planning; others are already underway or can be implemented immediately. As a regional plan, this is a non-regulatory document whose main purpose is to set a cohesive strategy for the Berkshire region to align actions, priorities, and investments to yield the greatest benefit to the region.

Because implementation will be an active and evolving process over the next decade, the implementation strategy for all eight elements is contained under separate cover to allow it to be used as a working document. Updates to the elements will occur as needed over time to reflect major needs and trends of the region. However, the Implementation addendum to the plan is an administrative document that will serve three functions:

1. A schedule of implementation timeframes, responsible parties, and potential funding sources to be used or pursued;
2. A tracking mechanism for implementation actions taken over time to record progress as it is made; and
3. A planning tool to help the Commission and its other implementation partners pull out certain strategies to pursue in one or three-year action plans to help focus effort and achieve results.

In addition to the implementation addendum, a number of data points will be tracked over time to measure change in certain metrics. These metrics were selected based on available data that relates to the goals and strategies called for in each element. The metric reports will be openly available online through BRPC's Berkshire Benchmarks program website (www.berkshirebenchmarks.org).

Appendices

Climate and Energy Element

A: Climate and Energy Forums

B: Regional Energy Baseline

C: Renewable Energy Program Summary

D: Renewable Energy Potential Analysis

APPENDIX A: CLIMATE AND ENERGY FORUMS

The Berkshire Regional Planning Commission, Peregrine Energy Group and the Center for EcoTechnology hosted two climate and energy forums in late February 2013 – one in Lenox and one in North Adams. Each event followed the same structure: a presentation with Q&A session and a small group activity. Despite this fact, the two meetings could not have been more different. The Lenox forum had an active anti-wind advocacy group in attendance with 4-5 members positioned around the room to ask questions and object to any discussion of wind in both the large- and small-group sessions. The North Adams forum, by contrast, did not have any members of this group in attendance and the flow and results of the meeting were notably different. We note this to provide the reader with context as to why the two nights' findings are so divergent.

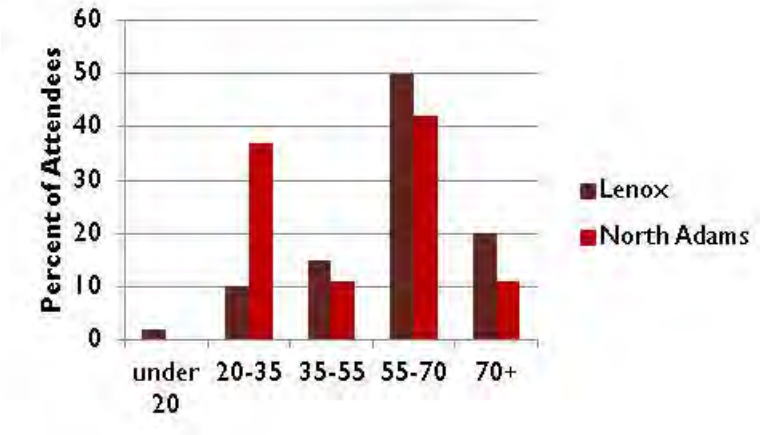
Regardless of the cause, a primary objective of the regional energy plan is to help find the common ground, work through some of this conflict, and regain a sense of self-determination in regards to energy development. The charged reaction to a regional energy plan, which necessarily addresses renewable energy development, was neither a surprise nor new in terms of how other public dialogues on the topic have gone in the region over the past several years. We are glad that we had the opportunity to have a candid discussion about concerns at the Lenox forum in the group discussion. We are less comfortable with how small group dynamics went forward. It is our responsibility to ensure that all attendees are treated respectfully and have a chance to voice their opinions in a safe space. Some attendees voiced a sense of being 'hijacked" after the Lenox meeting concluded, and for that we apologize.

The following summary highlights the input and common ground we heard across the two nights.

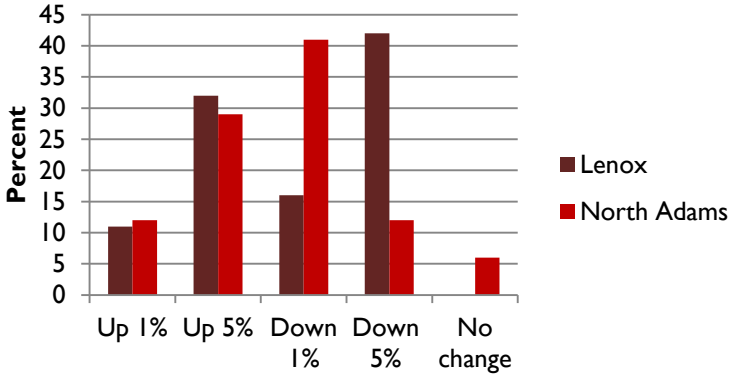
PRESENTATION

Amy Kacala from the Berkshire Regional Planning Commission welcomed the group and provided an overview of the regional energy plan, which is part of a larger three-year comprehensive planning process, *Sustainable Berkshires*. She then introduced Paul Gromer of Peregrine Energy Group, the lead consultant hired to assist with the new energy plan's creation. Mr. Gromer presented an overview of the region's current energy use, including trends over time. A number of keypad polling slides were integrated throughout the presentation, to allow real-time input from forum participants. The results of those votes for the two nights are summarized below.

Warm-up question: How old are you?

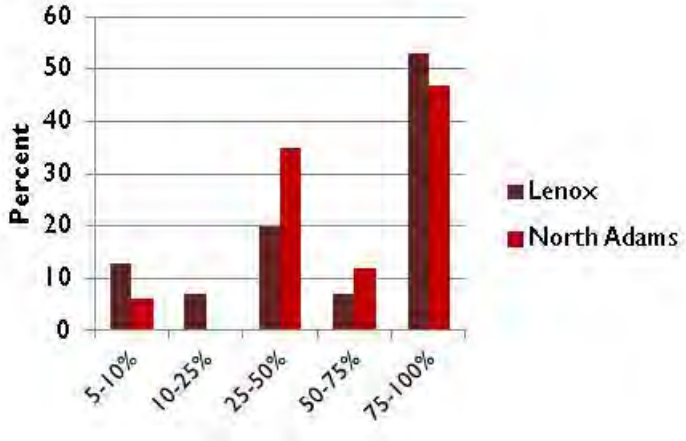


What do you think was the change in total county energy use from 2008-2011?

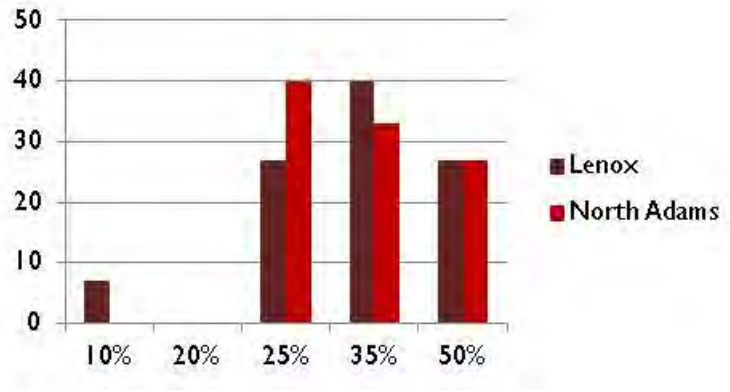


Correct answer: Energy use fell by 1%.

Currently, local projects generate the equivalent of 9% of the electricity used in the county on an annual basis. In the future, how much of our electricity would you like to come from renewable sources?



The state climate plan sets a goal of 25% reduction in CO2 emissions from 1990 levels by 2020. What should the climate reduction goal be for Berkshire County?



There was consensus at both meetings that the region should, at a minimum, work to achieve the 25% reduction target established by the state. Most participants wanted to see the region do even better (35-50%).

DISCUSSION

Audience questions and concerns included:

Data and Sources

At the Lenox meeting, not all of the charts and statistics in the PowerPoint presentation were sourced. Source citations were added for the second night, based on a number of questions in the Lenox session about sources of data. In some cases data questions amounted to comparing apples-to-oranges.

For example, the consultant explained that 7% of the region's electricity is generated by burning oil, as reported by Western Massachusetts Electric Company in its Energy Disclosure Label. One attendee challenged that figure, citing an ISO report stating that less than 1% of our electricity comes from oil-fired plants. However, the difference between the two numbers is that the ISO figure included just electricity from plants that only burn oil. The consultant's figure included both electricity from those plants and electricity generated by burning oil in plants that can burn either or oil or natural gas.

Points of response:

We are confident in our numbers and hope they will be more easily understood in comparison to other published works once we complete a written baseline energy inventory summary.

Process

Underlying anxiety/suspicion that the energy plan was being influenced by outside interests was expressed. Suspected influencing parties included the state (with some indication this was a vehicle through which to redress the wind facilities siting legislation) and energy developers.

Points of response:

- This is one event in a multi-phased outreach process that includes a regional consortium, public street surveys, stakeholder roundtable discussions, and a subcommittee.
- The project is neither funded nor influenced by the state. Rather, the region will be defining the results through the public process (above).

SMALL GROUP EXERCISE: THE CLIMATE ACTION GAME

Attendees divided themselves up in groups of about six people to complete the Climate Action Game. Groups were asked to work together to achieve the region's CO2 reductions based on the energy base line information. Energy use just for buildings (heat and electricity) would have a climate reduction target of 95,000 tons of CO2. The groups had to decide the mix of energy efficiency and renewable energy generation that they thought realistic and preferable to meet this target.

Underlying Assumptions of Game Parameters

Energy efficiency can only get us so far

The game gave players an upper cap in how much of the reduction target could come from energy efficiency. Residential development was given a cap of 15% of all units while commercial development was given a 50% cap.

Residential

- Some structures have already been improved – no double counting. The state and utility companies have been running energy efficiency programs for years and so a certain percentage of units have already been improved.
- Some newer construction doesn't need as much improvement as older buildings – not likely they'll make improvements. A significant amount of new construction in the region over the past decade has been rural sprawl development, a good portion of which are higher-end second homes. It is unlikely these were shoddily constructed so as to immediately need energy efficiency upgrades. Anecdotal evidence from building inspectors in the region points to a problem with shoddy construction overall, but this is attributed to cutting corners for lack of construction budget – which makes these homes unlikely to then turnaround and find the resources to retrofit their new construction.
- Not all property owners will make improvements for financial or other reasons. The majority of rental units in the region are owned by small-scale landlords (1-2 buildings) who typically lack the capital investment to make significant improvements to properties given the economics of the region which keep rental income margins very low. Most programs are also typically only for owner-occupants. For homeowners, again, some proportion have already gone through a program or made improvements on their own for cost-saving reasons. With a large senior population and high levels of poverty in younger age groups, the financial ability
- Some "deep retrofit" efficiency measures have a slow payback. While there are numerous energy efficiency measures homeowners can select, not all have the resources or inclination to try to bring their home as close as possible to Zero Net Energy. So, while there may be technologies or materials that can achieve some improvements above and beyond, even in structures, these are typically not incentivized like the "basic" efficiency tasks and so need to be tempered with economic and social realities.
- We discounted for homes that are projected to go through a program in the future in the climate target – can't count them again in the game.

Commercial

- Not all property owners will opt to take such measures, but there is still a great deal of opportunity in this sector.

Some renewables are more viable to achieve the reduction target by 2020

- The game pieces offered three renewable energy options: ground-mounted solar, community scale wind turbines and commercial scale wind turbines. These were selected as the most commercially viable renewable energy types that we are likely to see, with the current technology and incentives, developed within the 2020 time horizon.
- Other modes, such as geothermal and hydroelectric dams, both of which are also present in our region, were discounted due to the relatively limited capacity, high costs, and long permitting/construction timelines.
- Residential roof-mounted arrays were also not included as an option due to the fact that there is no way to ensure that private individuals would choose to invest in solar on their properties. This is particularly true given the relatively long payback period of solar arrays and the fact that there is no evidence based on residential application activity to assume this will provide a significant contribution to renewable energy capacity development. Additionally, the dynamics of an aging population coupled with escalating poverty rates in the county's younger populations make it unlikely that many households will be able to afford this investment.
- However, given that transportation emissions were not included in the target value (which would be much higher if it were) and that the majority of attendees wanted to see the region not only meet but exceed the 25% reduction target, we view these other modes as options to contribute to our meeting or exceeding the target.

Lenox Results

Tables 1 ,3, 4 and 5

Four tables in Lenox opted for an "all-solar" renewable energy portfolio and did not include any new wind development to help meet their renewable energy target. Three of these tables opted to max out efficiency (15% residential and 50% commercial. The fourth thought 50% was a little ambitious for commercial and instead opted for 15% residential and 20% commercial and simply included additional solar development to make up the difference in climate reductions.

Table 2

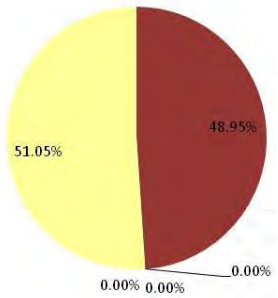
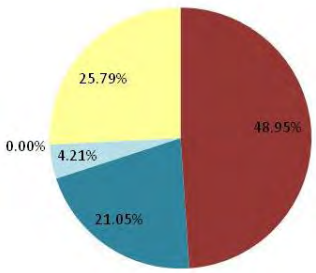
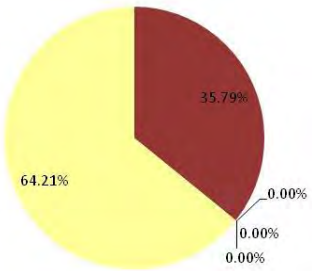
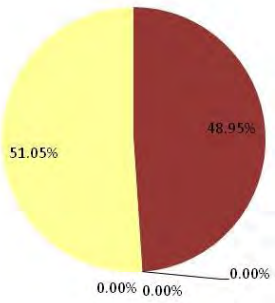
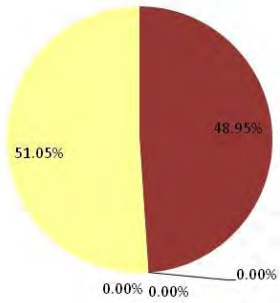
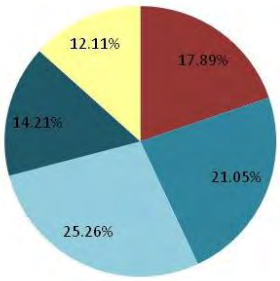
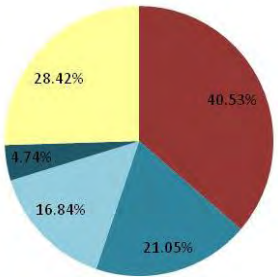
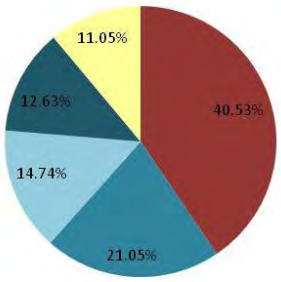
Table two opted to include wind, with one dissenting voter at the table who did not want to see wind included. This table opted to max out efficiency (15% residential and 50% commercial before placing any renewable energy pieces.

North Adams Results

Tables 1, 2 and 3

All tables felt that maxing out energy efficiency measures, while desirable, may not be practical given low participation rates to date. They therefore assumed renewable energy would have to take a more prominent role to meet the climate reductions target. All tables used both wind and solar, though the portfolio combinations varied by table.

Portfolio Comparison

Lenox Table 1	Lenox Table 2	Lenox Table 3	Lenox Table 4
			
Lenox Table 5	**North Adams Table 1**	**North Adams Table 2**	**North Adams Table 3**
			

Common Trends

Climate Reductions Target

The parameters of the game set the reductions target based on local energy use, which was seen as appropriate to participants. This is consistent with the self-sufficient, New Englander culture of the region. For the same reason, however, there is strong resistance/resentment to the notion that the state would expect the Berkshires to subsidize eastern portions of the state in terms of climate reductions. This sentiment is exhibited in the generally more positive attitudes expressed towards "local" energy projects that generate energy for local sites versus outside developers generating energy to "export" to other communities.

Energy Efficiency

Conversation Theme	Rationale	Variables discussed
Max out renewable energy efficiency measures	• Most "bang for your buck" • Win-win for environment and building owners/operators	• Most groups viewed 15% of residences as an achievable target; fewer viewed the 50% target for commercial as realistic. • The "right" programs may not be in place to help reach these goals.

Renewable Energy Siting

Solar

Conversation Theme	Rationale	Sites discussed
Everyone should do their part.	• Solar should be distributed across the county – goal seems more attainable if divide up the 95,000 tons CO2 by 32 communities. • Could each community commit to a specific "quota" based on the climate reductions target – such as 15 acres of solar – and then it's up to each community to figure out how to make that happen	• n/a
Rooftops or disturbed sites preferable to ground mounted applications on open lands.	• Choose "easy" sites first – such as closed landfills and schools. • Choose infill sites versus agricultural lands or deforestation. Maximize large rooftop applications (shopping centers, large municipal buildings, etc) to reduce the number of ground-mount sites needed.	• Lanesborough mall • All large/big box retail centers • Schools • Landfills • GB Fairgrounds • Specialty Minerals

Wind

Conversation Theme	Rationale	Sites discussed
Cluster approach to wind – site new wind energy development near existing turbines	• Already have the impacts • Helps keep it consolidated = more areas that remain undisturbed • Transmission capacity already in place/nearby	• Hancock, Florida-Savoy, Otis
Businesses can benefit from on-site wind	• Wind development more palatable for local businesses when	• Lanesborough mall • All large/big box retail centers • Schools • Landfills • GB Fairgrounds • Specialty Minerals
Site in remote areas	• Minimize impacts to people and environment • Out of sight, out of mind • Acknowledge possible noise impacts on nearby residents	• Savoy, Florida, Adams, Hancock (near route 20), Windsor, Otis, Mount Washington • Variables: access and transmission
Local benefit	• Local energy development, particular one with local impacts needs to create local benefit	• n/a

APPENDIX B: REGIONAL ENERGY BASELINE

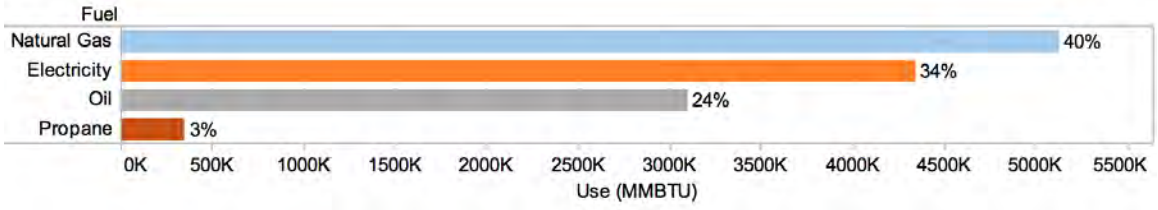
This inventory presents information about energy use in buildings in Berkshire County. The inventory covers natural gas, electricity, fuel oil, and propane and discusses both energy use and greenhouse gas emissions associated with that use. In addition to using energy in buildings, the county also uses energy in transportation.

BERKSHIRE COUNTY ENERGY USE AND CO2 EMISSIONS

Energy and Emissions from the Built Environment

The main fuels used in buildings in the county are natural gas, electricity, fuel oil, and propane. Natural gas accounts for the largest share of the total MMBTU, at 40%, followed by electricity, 34%, fuel oil, 24%, and propane, 3%.

Figure 1: Energy Use by Fuel (2011)



Sources: Western Massachusetts Electric Co., National Grid, Berkshire Gas, American Community Survey, Energy Information Administration, Peregrine Energy Group.

Natural Gas

Natural Gas is supplied by Berkshire Gas Company, which serves over 27,000 customer accounts in the county. Together those customers consume over 51 million therms of gas per year. Residential customers account for forty-two percent of that use and non-residential customers account for 58%.

Table 1. Natural Gas Consumption by Sector

	Use (kWh)			Customer Accounts		
Sector	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
Residential	21,305,646	20,870,648	21,646,478	23,978	24,117	24,256
Non-residential	28,784,923	28,840,196	29,568,300	3,402	3,409	3,430
Total	50,090,569	49,710,844	51,214,778	27,380	27,526	27,686

Source: Berkshire Gas Company

Electricity

The county is served by two electric utilities: National Grid and Western Massachusetts Electric Company. Together these companies serve over 76,000 customer accounts which consume nearly 1.3 billion kilowatt-hours of electricity per year. Residential customers account for 39% of that use and non-residential customers account for 61%.

Table 2. Electricity Consumption by Sector, National Grid Customers

	Use (kWh)			# Customers		
Sector	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
Residential	205,102,378	208,560,447	211,876,233	30,170	30,210	30,188
Non-residential	316,764,166	324,667,573	327,954,773	4,827	4,817	4,829
Total	521,866,544	533,228,020	539,831,006	34,997	35,027	35,017

Source: National Grid

Table 3. Electricity Consumption by Sector, Western Massachusetts Electric Customers

	Use (kWh)			# Customers		
Sector	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
Residential	286,637,178	276,220,127	280,955,029	37,041	37,320	37,350
Non-residential	440,827,203	444,768,888	450,470,264	3,928	3,526	4,009
Total	727,464,381	720,989,015	731,425,293	40,969	40,846	41,359

Source: Western Massachusetts Electric

Table 4. Total Electricity Consumption by Sector, Berkshire County

	Use (kWh)			# Customers		
Sector	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
Residential	491,739,556	484,780,574	492,831,262	67,211	67,530	67,538
Non-residential	757,591,369	769,436,461	778,425,037	8,755	8,343	8,838
Total	1,249,330,925	1,254,217,035	1,271,256,299	75,966	75,873	76,376

Sources: National Grid and Western Massachusetts Electric

Oil and Propane

While businesses account for most natural gas and electricity use, residential customers account for the majority of oil and propane use. The county consumes approximately 22 million gallons of oil per year, 73% of which is residential, and nearly eight million gallons of propane per year, 79% of which is residential.

Unlike electricity and natural gas, there is no definitive source for oil and propane use. That use must be estimated using data from the Census and the Energy Information Administration.

Table 5. Oil and Propane Consumption by Sector

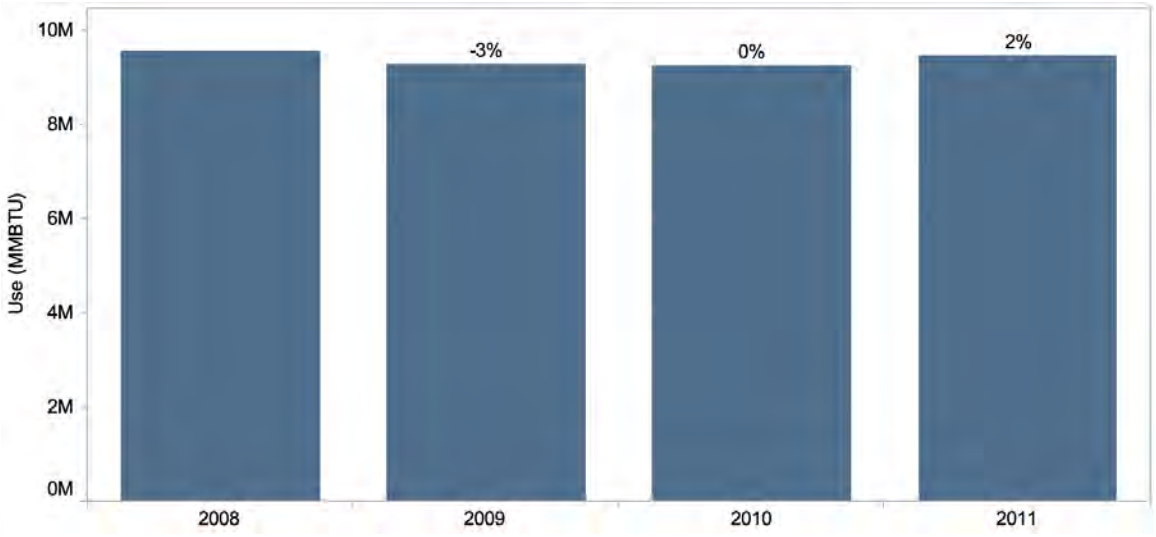
	Oil Use per Year (gal)	Propane Use per Year (gal)
Residential	16,393,675	3,003,175
Non-residential	6,000,017	767,885
Total	22,292,692	3,771,060

Sources: American Community Survey, Energy Information Administration, Peregrine Energy Group

Use Trends Over Time

In 2011, the residents and businesses in Berkshire County used 12.9 million MMBTU of energy in buildings.[1] This use was split nearly evenly between residential and non-residential users, with residential users accounting for 49% of the total and non-residential accounting for 51%. Over the last four years, the trend in energy use in the county has been flat. From 2008 to 2011, total use fell slightly, from 13 million MMBTU to 12.9 million MMBTU. Use dropped 3% in 2009 and has been climbing slowly since.

Figure 2: Energy Use by Year (2008-2011)

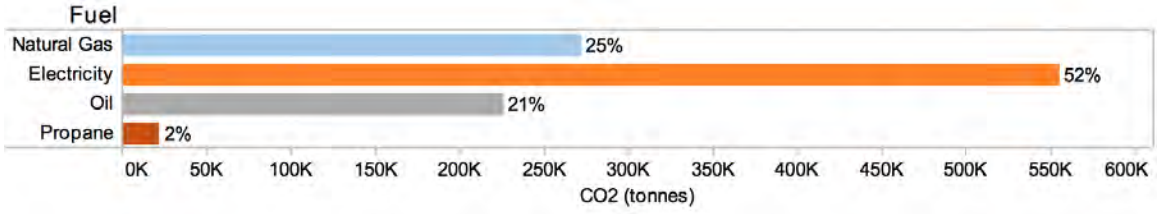


Sources: Western Massachusetts Electric Co., National Grid, Berkshire Gas, American Community Survey, Energy Information Administration, Peregrine Energy Group.

Emissions from Buildings

Energy use in the county in 2011 resulted in CO2 emissions of nearly 1.1 million metric tons.[2] Electricity use is the largest contributor to CO2 emissions, accounting for over 50% of emissions.

Figure 3: CO2 Emissions by Fuel Type (2011)



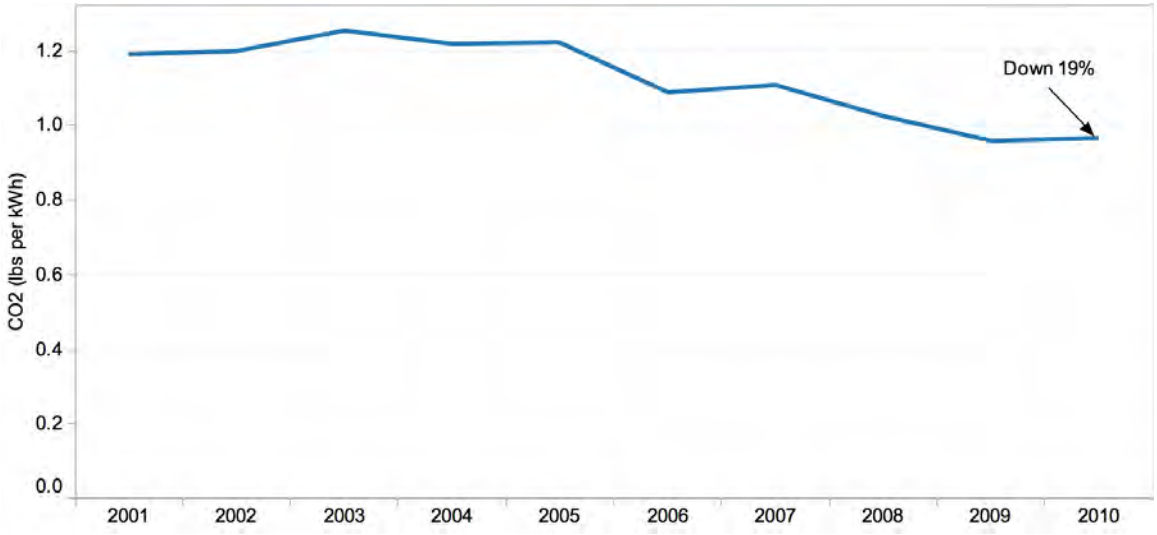
Sources: Western Massachusetts Electric Co., National Grid, Berkshire Gas, American Community Survey, Energy Information Administration, Massachusetts Department of Environmental Protection, Peregrine Energy Group.

[1] Data regarding electricity use was provided by National Grid and Western Massachusetts Electric Company. Data regarding natural gas use was provided by Berkshire Gas Company. Oil and Propane use were estimated based on data from the American Community Survey and the Energy Information Administration.

[2] Emissions were calculated using emission factors from the Massachusetts Department of Environmental Protection (electricity) and the Energy Information Administration (natural gas, oil, and propane).

While energy use in the county has been relatively flat, CO2 emissions have been declining, going from 1.13 million metric tons in 2008 to 1.08 metric tons in 2011. This is because New England's fleet of power plants has been getting cleaner, primarily due to switching from power plants that burn coal and oil to power plants that burn natural gas. As a result, we generate less CO2 for each kilowatt-hour of electricity generated.

Figure 4: Pounds of CO2 per Kilowatt Hour



Source: Massachusetts Department of Environmental Protection

Transportation Energy Use and Emissions

According to the U.S. Department of Transportation, the United States accounts for 5% of the world's population and more than 20% of the global CO2 emissions. The country's transportation sector creates 33% of the transportation-related emissions in the entire world. On-road emissions in the US are responsible for 70% of the US's share of total emissions. These emissions include only "tail pipe" emissions and do not include the life-cycle emissions from extracting fossil fuels, manufacturing vehicles, transportation infrastructure maintenance, or other ancillary activities.

National monthly vehicle miles traveled (VMT) statistics, published by the Federal Highway Administration's Office of Highway Policy Information, indicate there has been a short-term reduction of VMT from a record high of 3.38 billion VMT in 2007 to an estimated 2.97 billion VMT in 2013. However, long-term trends show a continued increase in VMT across all regions of the country. Additionally, an increase in the market share of light duty trucks and SUV's since 1970 (20% to 50%) causes more emissions and reduces energy efficiency. Increased freight trucking volumes, because of the global shift to a just-in-time economy, also reduces fuel efficiency per mile traveled. These national trends, coupled with the rural Berkshire terrain and limited access to convenient public transportation forces most of the population to drive individual vehicles to jobs, education, and services.

Calculating Fuel Usage

CO2 from transportation activities is derived based on the amount of travel and corresponding fuel usage and then applying emission factors. Emissions were calculated for the two predominant fuel types, gasoline and diesel. Vehicle usage (VMT) data was obtained from the Massachusetts Department of Transportation's Highway Performance Monitoring System for Berkshire County. Fuel efficiency statistics (developed by the U.S. Environmental Protection Agency U.S. EPA) were used in conjunction with the VMT to calculate the amount of fuel consumed for both gasoline and diesel vehicles. CO2 emission factors prepared by the U.S. EPA were then applied to the fuel usage quantities to derive the emissions for gasoline and diesel vehicles. Emissions attributed to motor vehicles for calendar years 1990, 2000 and 2010 can be found in Table 6 below

Table 6. CO2 EMISSIONS FROM TRANSPORTATION

	1990	2000	2010
HPMS* Vehicle Miles Traveled (VMT) per day	4,212,000	5,026,000	5,168,000
Annual VMT	1,537,380,000	1,834,490,000	1,886,320,000
Fuel Efficiency**	MPG	MPG	MPG
Gasoline Vehicles	25.4	24.7	27.6
Diesel Vehicles	7.17	7.1	7.27
Gasoline Powered Vehicles (93%)			
Annual VMT	1,429,763,400	1,706,075,700	1,754,277,600
Gallons Consumed	56,289,898	69,071,891	63,560,783
CO2 Emission (MTCO2e)	502,106	616,121	566,962
Diesel Powered Vehicles (7%)			
Annual VMT	107,616,600	128,414,300	132,042,400
Gallons Consumed	15,009,289	18,086,521	18,162,641
CO2 Emission (MTCO2e)	153,095	184,483	185,259
Total CO2 Emission from Transportation (MTCO2e)	655,201	800,604	752,221

** Highway Performance Monitoring System (HPMS) VMT provided by MassDOT*

***Fleetwide average- U.S. EPA*

The Berkshire Metropolitan Planning Organization (MPO), the transportation planning entity responsible for Berkshire County, must monitor and improve efforts to reduce emissions through the four-year Regional Transportation Plan (RTP) and the annual Transportation Improvement Program (TIP). Both of these federal transportation planning certification documents are checked against guidance from the Commonwealth's Global Warming Solutions Act (GWSA) of 2008 and the Federal government's current transportation enabling legislation, MAP-21. The performance of the RTP and the TIP are monitored by Massachusetts air quality modeling for conformity to the Federal Clean Air Act. In general, most of the Berkshires' federally funded projects, like road reconstruction and bus purchases, are not a part of the

regional air quality model. However, new roads or transit service expansion would need to demonstrate a benefit to air quality in the regional model.

EMISSION REDUCTIONS NEEDED TO MEET GOAL

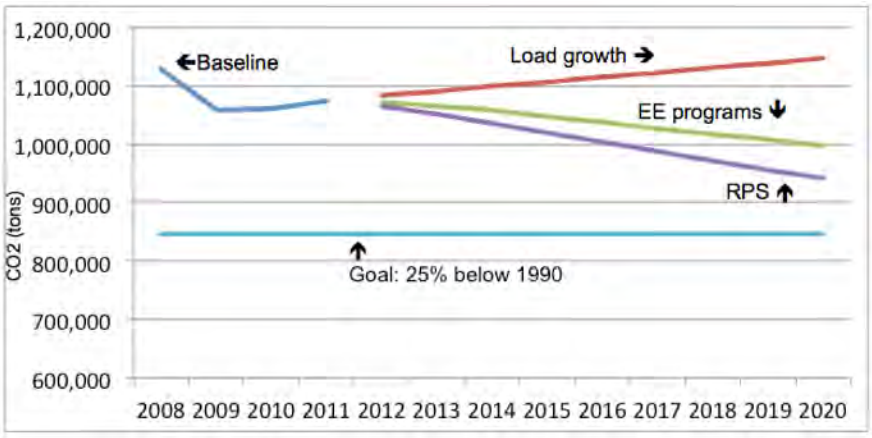
If Berkshire County establishes the same climate goal as the state, it will seek a 20% reduction in CO2 emissions from 1990 levels by 2020.

For the emissions associated with energy use in buildings, this will require a reduction in emissions of approximately 95,000 metric tons.

To calculate the tons of CO2 reduction that will be needed to meet the 20% goal, it is necessary to determine first the baseline emissions, the total from which the county must reduce 20%. Then, it is necessary to calculate how emission levels are likely to change between now and 2020 due to key external trends. These trends include the effects of natural growth in energy use, energy savings from utility energy efficiency programs, and the increases in the use of renewable energy required by the state Renewable Portfolio Standard (RPS).

The chart below shows the baseline and the impacts of load growth, energy efficiency programs, and the increases in the RPS. Each of these elements is discussed further in the text that follows.

Figure 5. Emission Reductions Needed to Meet Goal



Source: Peregrine Energy Group

Baseline

Although the baseline year is 1990, the county does not have reliable data about CO2 emissions going back that far. Fortunately, the state of Massachusetts in its climate plan determined that C02 emissions were essentially flat from 1990 to 2008.[3] Therefore, it is possible to use 2008 emissions as a proxy for the 1990 levels. The County's CO2 emissions in 2008 were 1,128,092 metric tons.

[3] Massachusetts Clean Energy and Climate Plan for 2020 (December 29, 2010) pp. 88-89.

Growth in Energy Use

Long-term trends show a gradual increase in energy use, before factoring in the effects of energy efficiency programs. ISO New England, the organization that manages the electric grid, projects a 0.9% annual increase in electricity use for New England. To project the increase in emissions due to expected growth, we applied ISO New England's growth factor for electricity and a one percent annual growth factor for natural gas. We assumed that oil and propane use would be flat. Applying these factors resulted in a projected increase in emissions of approximately 18,000 tons.

Effect of Energy Efficiency Programs

The utility energy efficiency programs will reduce energy use, and thus emissions, in the county and so reduce the tons of emission reductions needed to meet the 2020 goal. In calculating the effect of the efficiency programs, we made several assumptions. First, we assumed that Berkshire County would receive its proportional share of the planned program savings. Second, we assumed that the programs would achieve their planned savings in each of the years for which there is an implementation plan approved by the Massachusetts Department of Public Utilities (2013 through 2015). Third, for 2016 through 2020, years for which there is not yet a state-approved plan, we assumed that the 2015 annual savings levels would continue. Applying these assumptions generated a projected decrease in emissions of nearly 150,000 tons.

Effect of Increases in the Renewable Portfolio Standard (RPS)

The state RPS requires an annual 1% increase in the percentage of electricity generation that must come from renewable sources. As a result, the electricity generating fleet will get cleaner each year and so the emissions associated with each kilowatt-hour of electricity consumed will decrease. Applying this factor produced a reduction in emissions of over 56,000 tons.

After factoring in the effects of the key trends, the county will need to reduce CO2 emissions by nearly 95,000 tons to meet the 2020 goal. Importantly, as discussed above, this target takes into account the planned impact of the utility energy efficiency programs, so meeting the target will require energy savings over and above the savings provided by those programs. The tables below show the calculation of the baseline, the projected impact of the key trends, and the resulting reduction in emissions needed to meet the 2020 goal.

Table 7. Emission Reductions Needed from Built Environment to Meet 2020 Goal

Reduction from baseline

	CO2 (tons)
Baseline	1,128,092
2020 Goal	846,069
Reduction needed	**282,023**

Reduction net of key trends

	CO2 (tons)
Baseline	1,128,092
Load growth to 2020	18,997
EE program savings	-149,860
RPS increases	-56,175
2020 Projection	**941,045**
2020 Goal	846,060
Reduction needed	94,985

Source: Peregrine Energy Group, 2013

MEANS OF ACHIEVING THE CLIMATE REDUCTION TARGET

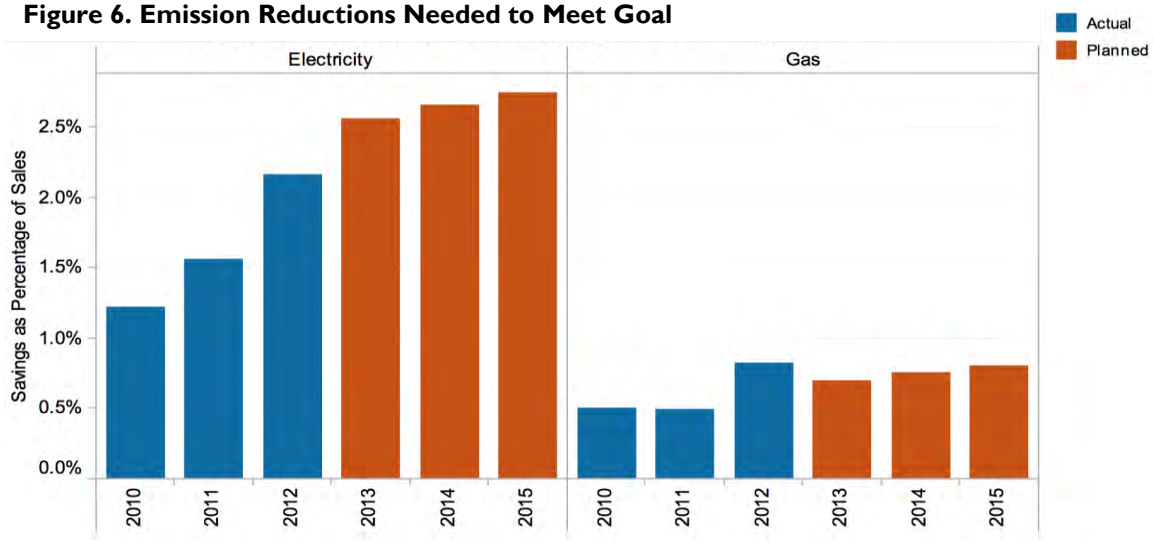
Energy Efficiency

Utility Programs

In the area of energy efficiency, Berkshire County benefits from the nation-leading programs operated by Massachusetts electric and gas utilities. In 2013, Massachusetts utilities will invest a total of $650 million in energy efficiency across the state.[4] The programs provide services for all types of customers and buildings, from single-family residential to large commercial buildings and manufacturing facilities.

While Berkshire-County-specific data is not available, it is possible to see the impact of the efficiency programs by looking at energy savings from the programs as a percentage of utility sales. In 2012, National Grid and Western Massachusetts Electric Company delivered electricity savings that equaled 2.16% of projected sales across their entire service territories. Berkshire Gas delivered gas savings of nearly 1% of sales in its territory. As shown in the chart below, these savings have been increasing over time and are projected to continue to increase.[5] As long as Berkshire County receives its proportionate share of energy efficiency program services, it will see similar savings as a percentage of electricity and gas use in the county.

Figure 6. Emission Reductions Needed to Meet Goal



Sources: Massachusetts Energy Efficiency Advisory Council, Peregrine Energy Group.

While programs are available for both residential and business customers, for the electricity programs the bulk of the savings come from business customers – 75% of the total. For the gas programs, the savings are split more evenly: 55% business and 45% residential.

[4] Massachusetts Joint Statewide Three-Year Energy Efficiency Plan (April 30, 2012).

[5] 2010 – 2012 savings from EEAC Consultant Team report to Massachusetts Energy Efficiency Advisory Council (July 10, 2012); 2013 – 2015 savings from EEAC Consultant Team report to Massachusetts Energy Efficiency Advisory Council (November 13, 2012).

While both electric and gas utilities offer robust energy efficiency programs, there is currently no equivalent for oil or propane. This is because of significant differences between the industries. Electric and gas utilities are regulated monopolies, and state regulators can (and do) require that they offer energy efficiency programs and include a charge in utility rates to pay for the programs. Oil and propane, on the other hand, are delivered by private companies. The state currently has no way to include an "energy efficiency charge" in oil and propane prices and no way to require oil and propane companies to offer programs. Over the last several years a bill has been considered by the Massachusetts legislature that would create oil energy efficiency programs, but that bill has not been enacted.

Programs for Low-Income Residents

Berkshire Community Action Council (BCAC) operates dedicated efficiency and fuel assistance programs for low-income residents, including both homeowners and tenants. In 2012, BCAC provided weatherization assistance to 1,358 households, high-efficiency appliances to 668 households, and fuel assistance to 7,535 households. In an exception to the general rule, these programs are "fuel-blind," meaning that they are available to customers that use oil and propane for heat as well as to those that use electricity and natural gas.

Municipal Initiatives

City and town buildings are a significant contributor to energy use in the county. Municipal and school buildings account for approximately 7% of non-residential electricity and natural gas use.[6] Many of these buildings also use oil or propane, but specific figures are not available.

Many cities and towns in the county are pursuing energy efficiency initiatives that will reduce their energy use. Six municipalities have achieved "Green Communities" designation, which requires, among other things, that the municipality develop a plan to reduce municipal energy use by 20% over five years. The Green Communities are Pittsfield, Lenox, Becket, Williamstown, Richmond, and Great Barrington. These communities and others are implementing energy efficiency projects in municipal buildings, including lighting and heating system upgrades and adding insulation.

Some towns have also launched energy efficiency and renewable energy initiatives for their residents. These include campaigns in Lenox (Lenox Unplugged), Williamstown (Take Charge, The COOL Challenge), North Adams (Take Charge), and Pittsfield (Powering Pittsfield). All of these grassroots initiatives have worked with the Center for EcoTechnology to reach residents with information and inspire them to act to reduce energy use and greenhouse gas emissions. The programs in Williamstown and Pittsfield serve businesses in addition to residents.

Municipalities can also contribute to mobile source emission reductions through policy and procurement changes. Anti-idling policies that reinforce the statewide prohibition of vehicle idling for more than five minutes can be instituted and reinforced on school grounds and in other public places with signage. Municipalities also reduce emissions by purchasing energy efficient vehicles to replace aging ones, a step encouraged by the Green Communities program. As a simple example, one Berkshire town replaced an 8-cylinder Crown Victoria police car with a 6-cylinder model, reducing gas consumption by as much as 20% in a vehicle that operates nearly 24/7. Another example of procurement changes is a state bus retrofitting program that upgrades school bus engines to reduce diesel fuel emissions. The bus engine retrofitting program is available to all communities and school bus subcontractors in the Commonwealth.

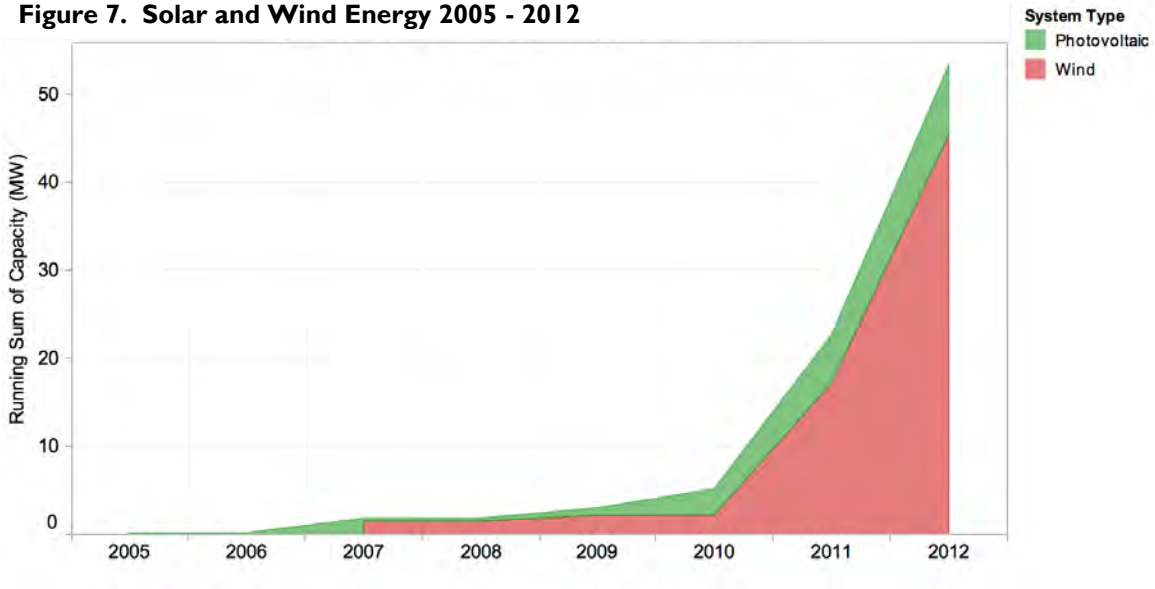
[6] Data from Massachusetts Energy Insight.

Renewable Energy

Berkshire County has seen a remarkable growth in renewable energy generation, going from just over 1 megawatt in 2005 to nearly 55 megawatts by the end of 2012.[7] Together those projects generate over 125 million kilowatt-hours per year, which is equivalent to approximately 10% of the county's annual consumption of electricity.

Solar leads in number of projects with 327 installations, 97% of the total. However, wind leads in number of megawatts installed with over 45 megawatts, 81% of the total, and in annual kilowatt-hour generation, 88% of the total. Figure 6 shows a running total of megawatts installed from 2005 through 2012 from solar and wind. Table 8 shows the number of systems, capacity and annual generation for solar, wind, biomass, and hydro.

Figure 7. Solar and Wind Energy 2005 - 2012



Sources: Massachusetts Clean Energy Center, Peregrine Energy Group.

Table 8. Renewable Energy Systems

System Type	Number of Systems	Capacity (kW)	Estimated Annual Generation (kWh)
Biomass	2	420	2,943,360
Hydro	4	1,926	7,423,574
Photovoltaic	327	9,723	11,072,970
Wind	5	32,100	70,299,000
Total	***338***	***44,169***	***91,738,904***

Sources: Massachusetts Clean Energy Center, Peregrine Energy Group.

The 337 renewable energy systems in the county range from small residential systems to large, multi-megawatt projects. The largest solar installations in the county are the 2-megawatt project at the Berkshire School in Sheffield and the 1.8-megawatt project developed by Western Mass Electric

[7] Massachusetts Clean Energy Center.

Company on the former GE site in Pittsfield. The largest municipal solar system is a 1.5 MW array on the Pittsfield wastewater treatment plant. Several other large projects are under development.

The largest wind installations in the county are the 15-megawatt Berkshire Wind Project in Hancock and the 28.3-megawatt Hoosac Wind project in Florida and Monroe. Wind turbines have been installed by Jiminy Peak in Hancock (1.5 MW) and William Stone Works in Otis (0.6 MW).

Table 9. Major Renewable Energy Systems in Berkshire County (2013)

System	Municipality	Site	Year	Capacity (kW)
Biomass	Pittsfield	City of Pittsfield Anaerobic Digester	2009	195
	Sheffield	Pine Island Farm Anaerobic Digester	2011	225
Hydro	Dalton	Crane & Co.	2013	250
	Dalton	Crane & Co.	2008	176
	Lee	Willow Mill	1872	100
	Stockbridge	Littleville Power	2013	1,400
Solar*	Adams	Hoosac Valley High School	2013	570
	Adams	Adams Landfill	2013	1,100
	Cheshire	Bedard Brothers	2010	28
	Great Barrington	Berkshire South Regional Community Center	2010	76
	Great Barrington	Monument Valley Middle School	2005	51
	Hancock	Hancock Shaker Village	2010	98
	Lee	Big Y	2012	343
	Lee	Country Curtains	2009	126
	North Adams	Mass MoCA building 13	2007	59
	North Adams	Mass MoCA	2013	450
	Pittsfield	Berkshire Community College	2012	400
	Pittsfield	Cooper Center (Compuworks)	2013	23
	Pittsfield	Pittsfield Wastewater Treatment Plant	2011	1,500
	Pittsfield	Quality Printing	2010	126
	Pittsfield	Silver Lake Solar Facility	2010	1,800
	Pittsfield	Unistress Corporations	2009	87
	Pittsfield	Unistress Corporations	2010	75
	Sheffield	Berkshire School	2012	2,000
	West Stockbridge	West Stockbridge Town Hall	2010	58
	Williamstown	Williamstown Elementary School	2003	22
Wind	Florida	Hoosac Wind**	2012	15,000
	Hancock	Berkshire Wind	2011	15,000
	Hancock	Jiminy Peak	2007	1,500
	Otis	Williams Stone Works	2009	600
TOTAL				**43,438**

**Note: This table lists only 20 of the more than 325 solar photovoltaic systems in the county.*

***Hoosac Wind project consists of 19 turbines for capacity of 28.5 MW. Of these, 10 turbines are located in Florida, Berkshire County, for a total of 15 MW. We account for only these 10 turbines in the total renewable in the county.*

Sources: Massachusetts Clean Energy Center, Center for Ecological Technology, Peregrine Energy Group (2013)

APPENDIX C: RENEWABLE ENERGY AND EFFICIENCY PROGRAMS

NATIONAL INITIATIVES

The National Action Plan

The National Action Plan for Energy Efficiency (2006) was a private-public initiative to create a sustainable, aggressive national commitment to energy efficiency through the collaborative efforts of gas and electric utilities, utility regulators, and other partner organizations. The intent of the commitment was to take advantage of opportunities in homes, buildings, and schools across the nation to reduce energy use, save billions on customer energy bills, and reduce the need for new power supplies.

The Action Plan was led by a diverse Leadership Group of more than 60 leading gas and electric utilities, state agencies, energy consumers, energy service providers, environmental groups, and energy efficiency organizations. The Leadership Group identified key barriers limiting greater investment in cost-effective energy efficiency, made five key policy recommendations to overcome the barriers, and documented policy and regulatory options for greater attention and investment in energy efficiency. Many Leadership Group organizations were joined by other states, utilities, and key stakeholders across 49 states in making aggressive commitments to energy efficiency and endorsing the recommendations of the Action Plan.

Action Plan reports, guides, tools, and factsheets are available to help state policy-makers, energy consumers, utilities, environmental groups, and others understand options for:

- Advancing a Comprehensive Policy and Program Framework
- Setting High-Level State Policy Goals for Saving Energy
- Establishing and Implementing Effective Efficiency Programs
- Addressing Utility Barriers
- Adopting Additional State Policies

Energy Star

ENERGY STAR is a U.S. Environmental Protection Agency (EPA) voluntary program that helps businesses and individuals save money and protect our climate through superior energy efficiency. The ENERGY STAR program was established by EPA in 1992, under the authority of the Clean Air Act Section 103(g) which directs the EPA Administrator to "conduct a basic engineering research and technology program to develop, evaluate, and demonstrate non–regulatory strategies and technologies for reducing air pollution." In 2005, Congress enacted the Energy Policy Act. Section 131 of the Act amends Section 324 (42 USC 6294) of the Energy Policy and Conservation Act, and "established at the Department of Energy and the Environmental Protection Agency a voluntary program to identify and promote energy–efficient products and buildings in order to reduce energy consumption, improve energy security, and reduce pollution through voluntary labeling of or other forms of communication about products and buildings that meet the highest energy efficiency standards."

Under EPA's leadership, American consumers, businesses, and organizations have made investments in energy efficiency that are transforming the market for efficient products and practices, creating jobs, and

stimulating the economy. Now in its 20th year, the ENERGY STAR program has boosted the adoption of energy efficient products, practices, and services through valuable partnerships, objective measurement tools, and consumer education.

REGIONAL INITIATIVES

The Regional Greenhouse Gas Initiative (RGGI)

The Regional Greenhouse Gas Initiative (RGGI) is the first market-based regulatory program in the United States to reduce greenhouse gas emissions. RGGI is a cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont to cap and reduce CO_2 emissions from the power sector. States sell nearly all emission allowances through auctions and invest proceeds in consumer benefits: energy efficiency, renewable energy, and other clean energy technologies. RGGI is spurring innovation in the clean energy economy and creating green jobs in each state.

Massachusetts Investment Plan

Massachusetts, through the Department of Environmental Protection (DEP) and the Department of Energy Resources (DOER), has developed a plan for the distribution of RGGI auction proceeds to a range of consumer benefit programs, with the largest distribution going to utility-administered energy efficiency programs.

As directed by Chapter 169 of the Acts of 2008: An Act Relative to Green Communities (the Green Communities Act), at least 80% of the state's 2010 RGGI proceeds were dedicated to energy efficiency programs developed in the statewide three-year Energy Efficiency Investment Plans:

- 2010 Annual Report of the Massachusetts Energy Efficiency Advisory Council
- Energy Efficiency in Massachusetts: Our First Fuel (DOER)
- Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan
- Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan
- Three-Year Energy Efficiency Plan Orders (DPU)

Allocations to the electric efficiency Program Administrators (PA) are made based on each PA's kilowatt sales relative to total electric kilowatt sales statewide. The bulk of the proceeds from the 2009 auctions, which yielded more than $50 million, was also distributed to the PAs and dedicated to the electric utility-administered energy efficiency programs.

- Cape Light Compact-$4,008,173
- National Grid -$19,595,514
- NSTAR -$17,368,751
- Unitil -$890,706
- Western Massachusetts Electric Co. -$2,672,116

2012 STATE ENERGY EFFICIENCY SCORECARD

Massachusetts retained the top spot in the State Scorecard rankings for the second year in a row, having overtaken California in 2011, based largely on its continued commitment to energy efficiency under its Green Communities Act of 2008. Among other things, the Act spurred greater investments in energy efficiency programs by requiring utilities to save a large and growing percentage of energy every year through efficiency measures.

The remainder of the state's 2009 RGGI proceeds was used for additional energy efficiency and renewable energy purposes (e.g., Green Communities Division activities).

In addition, more than $28 million in proceeds from the two auctions held in 2008 was allocated to the following programs:

- Green Communities Program start-up and Green Communities Program Grants for cities and towns ($10 million).
- Ramp-up of utility-administered energy efficiency programs ($5.9 million), as required to support the Green Communities Act.
- Assistance to municipalities for energy efficiency projects identified in DOER audits, but previously unfunded ($2.7 million).
- Heating system replacements in low-income households, through DHCD's HeartWAP program ($4 million).
- Workforce development and training programs focused on energy efficiency for homes, businesses and public buildings ($1.9 million for the Energy Efficiency Skills and Innovation Initiative), as well as seed grants and other support for innovative delivery models that will allow the energy efficiency industry to reach a new level of capacity ($3 million).
- Program administration to cover administration of the programs (note: very small portions of the above amounts may also be used to fund administration of the programs, e.g., Green Communities Program start-up).

STATE INITIATIVES

Energy Efficiency Advisory Council

The Massachusetts Energy Efficiency Advisory Council (EEAC) was created by the Green Communities Act of 2008 ("Act")[1]. Eleven voting members represent a variety of energy efficiency stakeholders. Eleven non-voting members include representatives from the investor-owned electric and gas utilities and energy efficiency service providers, known as Program Administrators (PAs), and other stakeholder groups. The EEAC is chaired by the Massachusetts Department of Energy Resources (DOER). Its primary role is to achieve and fulfill the efficiency requirements, goals, and obligations of the Act. This includes guiding the development of comprehensive, statewide three-year and annual plans and programs for acquiring all cost-effective energy efficiency, and monitoring the implementation.

The EEAC is responsible for guiding the PAs in carrying out the requirements of the Act; the PAs are responsible for delivering the programs and taking the actions that result in measurable, verifiable energy savings. As regulated utilities, the PAs must also receive approval from the Department of Public Utilities (DPU) for their efficiency program spending and related issues of cost recovery.

Three-Year Energy Efficiency Plan Goals

The 2010 plan projected the following results by the end of 2012:

- **$6 billion in total lifetime benefits to the citizens and businesses of Massachusetts** ($3.8 billion in net benefits are expected to be generated, after a projected $2.1 billion in total investments by programs and participants).
- **Electric savings of over 2600 GWh over three years**, with 2012 savings representing 2.4 percent of annual retail energy sales. Lifetime electric savings from the three-year plan are projected to exceed 30,000 GWh[2].

1 An Act Relative to Green Communities, Chapter 169 of the Acts of 2008.

- **Natural gas savings of nearly 60 million therms over three years**, with 2012 savings representing 1.15 percent of annual retail gas sales. Lifetime gas savings from the three-year plan are projected to reach nearly 900 million therms.
- **Greenhouse gas reductions of nearly 1.6 million metric tons over three years**, which is approximately 1.7 percent of the statewide GHG emission inventory and almost 7 percent of the Global Warming Solutions Act goal. Lifetime greenhouse gas reductions from the three-year plan are nearly 20 million metric tons.

Table 1. Massachusetts Three-Year Plan Goals

Three-Year Plan Goals	2010	2011	2012	Total
Total Benefits (million $)	1,409	2,022	2,536	5,967
Annual Electric Savings (GWh)	625	907	1,104	2,636
Annual Gas Savings (million therms)	14	18	26	58
Annual GHG Reductions (metric tons)	376,000	538,000	677,000	1,591,000

'Annual' refers to the savings resulting from installed efficiency measures operating for one year. Because most measures operate for several years, savings from each year's program activity accumulate, and may be summed.

The 2013-2015 Three Year Plan includes four significant updates or changes from the 2010-2012 plan.

- **Enhanced Integration of Gas and Electric Energy Efficiency Services Plan:** The Program Administrators will strive to develop effective strategies and seek further synergies to provide customers with a streamlined experience, where electric and gas opportunities are provided to customers simultaneously. The filing of one joint electric and gas statewide Plan for 2013-2015 speaks to the commitment and success of the Program Administrators in embracing seamless program delivery for customers.
- **Program Consolidation:** The Program Administrators plan to consolidate the residential sector programs into two primary categories: Whole House and Products. Similarly, the Program Administrators also plan to consolidate the commercial & industrial ("C&I") sector programs into two primary categories: New Construction and Retrofit. The primary purpose and benefit of this consolidation is greater implementation flexibility to address shifts in market conditions and consumer demand. For purposes of transparency, and to satisfy the priority placed by the Council on data, the Program Administrators will continue to track and report spending and savings associated with each major initiative within each program, but overall program level reporting will be done in the aggregate.
- **Budget/Savings Goals: Comparison to 2010-2012:** For electric Program Administrators, the proposed three-year annual savings for the period 2013-2015 is more than one million megawatt hours ("MWh") greater than the combined 2010-2012 levels. The 2013 planned savings is somewhat higher than 2012 (75,000 MWh). As compared to 2010-2012, this Plan includes a budget of approximately an additional $1 billion in order to increase savings and reach the Commonwealth's energy efficiency goals. Electric budgets in 2013 include a $15 million increase over 2012. These changes equal an additional $2.36 billion in projected benefits in 2013-2015 as compared to 2010-2012.
- For gas Program Administrators, the proposed three-year annual savings for the period 2013-2015 is almost 19,000,000 therms greater than the combined 2010-2012 levels. The 2013 planned savings relates closely to 2012 MTM savings levels to account for the setting of challenging but achievable goals. As compared to 2010-2012, this Plan will include just under $230 million dollars in additional budget in order

to increase savings and reach the Commonwealth's energy efficiency goals. Gas budgets in 2013 include a less than $40 million increase over 2012. These changes equal an additional $277 million in projected benefits in 2013-2015 as compared to 2010-2012.

- In setting their goals, the Program Administrators sought to set goals that are challenging and aggressive, but sustainable, in accordance with the Council's priorities. The total projected additional benefits in this 2013-2015 Plan are over $2.63 billion more than the benefits in 2010-2012.
- **Efforts Remain Challenging:** The Program Administrators seek to ensure that the goals remain aggressive and sustainable, and that the programs continue to grow and seek greater efficiencies, all while complying with the provisions of the Act.

Regional Transportation Planning –

The 1990 Clean Air Act Amendments (CAAA) require the Berkshire MPO to perform air quality conformity determinations as part of the approval of Regional Transportation Plans (RTP's) and Transportation Improvement Programs (TIP's). Conformity insures that Federal funding and approval goes to transportation improvement activities consistent with the Commonwealth's State Implementation Plan (SIP). The Berkshires must reduce its emissions of volatile organic compounds (VOC) and nitrogen oxides (NOx) because they are the two most significant precursors of ozone formation. Reductions are required to meet national air-quality standards. We do not have CO2 standards from the Clean Air Act.

As part of our regional transportation planning process, the Berkshire MPO certifies that all transportation improvements in the 2012 RTP do not violate any standards, do not increase existing air quality violations, and will not delay the timely attainment of emission reductions in the region. The Massachusetts SIP identifies a control strategy period and a maintenance period that provides mobile emission source budgets. Transit operating policies are the responsibility of the Berkshire Regional Transit Authority.

MassDOT uses emission factors in the MOBILE 6.2 model, provided by EPA, to determine motor vehicle emission budgets. Emission factors for motor vehicle budgets are specific to pollutant types, model year, temperature, and travel speeds. The model includes vehicle inspection information, vehicle fleet mix, and age. The new EPA MOVES model may be a good tool for the region to periodically assess.

Transportation Control Measures are the actions included in the SIP that include infrastructure improvements or policy implementations. The Massachusetts strategy for meeting air quality standards does not include specific control measure projects, but rather general policies that include vehicle maintenance and inspection, the California Emission Vehicle Program, reformulated fuels, vapor recovery at gas stations, and certain Federal vehicle standards.

The Berkshire MPO must participate in Massachusetts' air quality modeling as well as also provide opportunities for public involvement in the air quality modeling process. There are requirements in the modeling process that include model selection, input quantification, CO hotspots, regionally significant projects, exempt projects, exceptions to exempt projects, and the latest planning assumptions and consistency assumptions with the SIP. Overall, the western Massachusetts air quality conformity model must be checked against data in the Federal Highway Performance Monitoring System (HPMS) that tracks daily Vehicle Miles Traveled (VMT) and assures consistency with Federal regulations. These HPMS factors, calculated on a regional basis, are applied to the model output of future scenarios and change as base-year models and HPMS data are updated and improved.

Only "regionally significant" projects are included in the western Massachusetts travel demand model. The final Federal conformity regulations define these projects as being on a facility that serves regional transportation needs, planned developments, and transportation terminals, including at a minimum all principal arterial highways and all fixed guide way transit facilities that offer an alternative to regional highway travel. It is not surprising that the Berkshire MPO has few projects of this nature due to the rural character of the region.

Projects in the Berkshire 2012 RTP that are included in the western Massachusetts air quality improvement model include intersections and turn lane improvements on Main Street in Great Barrington, the Berkshire Medical Center Area improvement project in Pittsfield, realigning State Road and replacing the Brown Bridge in Great Barrington, installing passing lanes on Route 8 in Cheshire between the Mall Road and the former weigh station, safety and capacity improvements on East Street between Elm Street and Merrill Road in Pittsfield, and constructing a connector road from West Street to West Housatonic Street parallel to the Housatonic Railroad. The Western Massachusetts air quality model is in conformity as of the 2012 Regional Transportation Plan.

The Berkshire MPO also monitors and evaluates the Greenhouse Gas (GHG) impacts of transportation projects that are programmed in its 4-year Transportation Improvement Program (TIP). The TIP includes larger, regionally-significant projects with already documented aggregate GHG impacts from the RTP. The TIP also contains projects that have more minor impacts on air quality, like intersection improvements that alleviate congestion and decrease emissions. The Berkshire MPO participates in the Western Massachusetts air quality conformity analysis as part of the process to prioritize funding during the annual TIP development.

In order to monitor and evaluate the GHG impacts of TIP projects, the MPO classifies projects into categories like traffic operational improvements, pedestrian and bicycle infrastructure, park and ride lots, bus replacements, and new public transportation service. For example, the MPO calculated GHG reductions for a Congestion Mitigation and Air Quality project at the Main Street and Castle/Bridge Street intersection in Great Barrington as part of the 2014-2017 TIP adoption. First, the existing morning and evening peak delay per vehicle is calculated. In our example, the afternoon peak period delay experienced for all vehicles totals 57,137 seconds, or 15.88 hours. The proposed improvements at the subject intersection reduce the total peak hour delay to 34,476 seconds, or 9.58 hours. We can assume that ten hours of the day approximates the total daily delay reduction of 226,610 seconds or 62.95 hours with the improvement.

Using the Mobile 6 western Massachusetts air quality modeling factors, the reduction in delay translates into a reduction of 65 Kg in summer VOC emissions, 29 Kg summer NOx emissions, 768 winter CO emissions, and 21,849 Kg Summer CO2 emissions. The end result of the intersection improvement will eliminate the equivalent of CO2 emissions from 2,449 gallons of gasoline, the electricity used by three homes for a year, or the same amount of carbon sequestered by 560 trees grown from saplings for 10 years.

The MPO, within the regulatory framework of MAP-21, should monitor performance of the transportation system and report on a variety of metrics periodically. Specific metrics that pertain to climate change should include annual GHG's from mobile sources, reduced emissions from alternatives to single-occupancy vehicles, VMT, and vehicle occupancy. A "smart growth" data measure that combines land use and reduced environmental impacts from mobile GHG emissions is the percentage of

households and employment centers within 200 feet of non-local roads as classified by the National Functional Classification System.

Landmark Renewable Energy Legislation

The Massachusetts Renewable Energy Portfolio Standard (RPS)

The RPS is a statutory obligation that suppliers (both regulated distribution utilities and competitive suppliers) obtain a percentage of electricity from renewable energy sources constructed within the Northeast for their retail customers. The RPS began with an obligation of one percent in 2003, and then increased by one-half percent annually until it reached 4% in 2009. This increase was renewed as a part of the Green Communities Act of 2008 and the annual obligation was set to increase by 1% annually until it reaches 15% in 2020. In 2010, the three largest energy technologies included in the RPS Class I (electricity utilities and supply providers) were wind energy (38.5% of total), landfill gas (32%) and biomass (25%), with an increasing amount of renewable energy being imported from New York State.

In 2010, the state created the RPS Solar Carve-Out program, which is a market-based incentive to support residential, commercial, public, and non-profit entities in developing solar photovoltaic (PV) systems across the Commonwealth. A solar renewable energy certificate is awarded to the projects for each 1,000 kW of energy produced. The program was originally capped at 400 MW, but the state is currently considering ways to continue the program now that the cap has been reached. To participate in the Solar Carve-Out solar photovoltaic generation units must meet the following eligibility criteria:

- Have a capacity of 6 MW (dc) or less per parcel of land,
- Be located in Massachusetts,
- Use some of its generation on-site and be interconnected to the utility grid, and
- Have a Commercial Operation date of 2008, or later.

Global Warming Solutions Act

In 2008, Governor Patrick signed into law the Massachusetts Global Warming Solutions Act, which established the most aggressive greenhouse gas (GHG) emission targets for a single state in the U.S. The Act called for a 10-25% reduction from 1990 GHG levels by 2020 and an 80% reduction from 1990 levels by 2050. In 2010 Massachusetts released its *Clean Energy and Climate Action Plan* outlining steps to reach a more ambitious 25% reduction goal.

The Green Communities Act

Also in 2008, Massachusetts enacted the Green Communities Act to boost energy efficiency and encourage investment in renewable energy. This Act required that 15% of electricity used in the state be supplied by renewable energy sources located within the Northeast by 2020 and established a pilot program that allows utilities to enter into long-term contracts with renewable energy developers to provide the developers with the predictable, stable prices required by their lenders.

This Act sets a set of five criteria that municipalities must meet to become a Massachusetts Green Community. Two of the five criteria address the development of renewable or alternative energy facilities. Criterion 1 requires municipalities to establish zoning laws that allow the siting of renewable or alternative energy facilities that generate, conduct research on or manufacture renewable/alternative components as a "by-right" land use. Criterion 2 requires that some type of expedited permit process exists that will streamline the siting and development of renewable/ alternative energy facilities.

Municipalities that become Green Communities have access to a special grant program that funds energy efficiency and renewable energy projects.

The Green Communities Act also mandated the creation of a siting commission that will develop recommendations for streamlining zoning for wind energy and other forms of renewable energy.

Power Purchasing

All electric customers in the state have the right to purchase their electricity from an entity other than their utility company. Purchasing electricity from other power providers can result in cost savings. Many of the larger commercial and industrial customers in the county have purchased electricity in this manner and historically have reaped substantial savings. Savings are due to market forces, and there is no guarantee that savings will result by switching in the future. Few residential or small commercial customers have taken the opportunity, due largely to unawareness of the option and/or feeling uneasy leaving their utility. Customers can also more directly support renewable energy development by choosing a provider that purchases a larger proportion of electricity from renewable energy projects than their utility company does.

At this current time, municipalities have two major options for the purchase of electricity other than from their utility company. The first option is referred to as aggregation, whereby the municipality aggregates all the electricity customers within their boundaries and go out to bid for electricity on their behalf. To date only the town of Lanesborough has done this. A group of Berkshire municipalities have banded together to aggregate all the customers in all the communities in the belief that the total amassed number of customers participating in the bid will yield a lower electricity rate for them. As of September 2013, this aggregation was still being created and proceeding through the state permitting process. As part of the bidding process, the aggregation could request that the electricity mix they purchase has a larger percentage of renewable energy than is currently provided by the utility companies.

The second option that municipalities have to save on the cost of electricity is to purchase it from a cooperative. The Hampshire Council of Governments (COG) offers electricity rates in "real time," meaning that they pay the price of electricity being used in real time instead of over an averaged period of time. If the customer can avoid using large amounts of electricity during the time that it is most expensive, such as the peak demand hours of the day or the peak summer periods, the customers can achieve great savings. School districts with buildings largely idle, or water treatment facilities that can schedule intense electricity use during the evening and other non-peak times, are examples where substantial savings can result. Real-time customers of the Hampshire COG have saved $1.6 million over the default electricity rate between 2006 and 2013 (hampshirecog.org).

Green Jobs Act

This bill authorizes $58 million in funding and grants to help support development of the green energy technology industry in Massachusetts. It also mandated an analysis of the potential for renewable energy on state owned lands. This analysis identified the potential for 947 MW of potential wind energy on 44 state-owned sites. It was through this bill that the Mass. Clean Energy Center (CEC) was established to facilitate the development of renewable energy generation.

Net Metering

Net metering encourages small, behind-the-meter wind and solar generation by crediting owners of renewable generation for the excess electricity they generate at favorable terms. In 2008, new legislation: (1) increased the allowable capacity (or size) of net metering facilities that use renewable resources to create energy from 60 kW to up to 2 MW, (2) increased the value of the credits for electricity generated by these facilities from the wholesale rate to nearly the retail rate, and (3) allowed net metering customers to allocate net metering credits. Additional legislation was passed in 2010 and 2012, which further modified net metering in Massachusetts, most notably raising the overall amount of allowed net metering projects.

Massachusetts Clean Energy Center (MassCEC)

The MassCEC provides technical assistance and financial aid to the clean energy industry and to those who are interested in planning for and installing renewable energy projects. The Center's more than 20 programs provide planning assistance, seed money and other financing for renewable energy projects, supporting new and innovated businesses. Among the MassCEC programs that have funded projects in the Berkshires are:

- **Solarize Mass** seeks to increase the adoption of small-scale solar electricity in participating communities through a competitive tiered pricing structure that increases the savings for everyone as more home and business owners sign contracts. Home and business owners who want to participate can either purchase the solar electricity systems directly or enter into a lease or power purchase agreement (PPA) with the installer. Under a lease or PPA, the installer will own, operate and maintain the system, while the home or business owner agrees to purchase the power generated by the system at an agreed-upon rate. In the first round (2011-2012), a mix of residents and business owners in 17 participating communities statewide signed 803 contracts to install over 5.1 megawatts (MW) of solar PV systems. As a result of the program, the number of small-scale solar electricity projects will more than double in almost every participating community. Pittsfield and Lenox participated in the 2012 round of Solarize Mass, the towns of Lee and Williamstown are participating in the 2013 round, and the towns of Adams and a partnership of Egremont and Great Barrington are participating in the 2014 program. As part of this program, 58 property owners signed contracts in Pittsfield and Lenox for solar arrays for a combined capacity of 465 kW of electricity. (Source: DOER, 2012 Solarize Massachusetts Program Update, 2012.)
- **Organics to Waste** – Methane is a potent greenhouse gas, thought to be more than 20 times more powerful than carbon dioxide in its ability to absorb and trap heat in the earth's atmosphere. This gas is present in livestock manure. Pine Island Farm in Sheffield has installed an anaerobic digester that uses the farm's cow manure as its feedstock. The system is a combined heat and power system that has a capacity to generate 225 kilowatts, which is much more than the electricity than the farm demands. The excess electricity is fed into the grid, providing additional income to the farm, while the heat exchange is used to warm water used in the farm operation. Although approximately half of the cost of the system was funded through grants, and the return-on-investment period is approximately five years, the upfront cost of the system has been a financial challenge.
- **Wastewater Treatment Plants (WWTPs)** – WWTPs present an untapped source of renewable energy, removing and managing hundreds of tons of biosolids per year. When anaerobically digested, those biosolids, which are 60-70% methane, can generate electricity to help bring down the costs of running the plants. The Pittsfield WWTP has upgraded its anaerobic digestion system and installed a new combined heat system that provides electricity for almost 1/3 of its usage, saving the city $206,000 in electricity costs. The simple pay-back period for the system is eight years, which does not include the renewable energy credits that the city will collect.

- **Commonwealth Solar Program** – This program provides rebates to commercial and residential customers who install PV solar panels on their properties. Residential PV systems consist of 60-65% of the rebates issued. Examples of large systems that have been installed in the county are at Country Curtains in Lee and Compuworks in Pittsfield.
- **Commonwealth Solar Hot Water Programs** – These programs provide funding for solar hot water systems for commercial and residential properties. Six systems were installed in the county under the residential program in 2012.
- **Commonwealth Wind** – This program provides several types of grants to public and private developers interested in determining the feasibility of wind energy generation projects. Funding will support site assessment analysis, feasibility studies and technical studies for public and private developers, and will support construction for public developers. Jiminy Peak Ski Resort, Williams Stone Company and the Town of Lenox are examples of entities that have received funding from this program.

Clean Energy Biofuels Act

This act gives preferential tax treatment to non-corn-based alternatives to ethanol, requires bio-fuel content in all the diesel and home heating fuel sold in the state, and proposes a new fuel standard for the region that will encourage a range of emissions-reducing technologies for cars and trucks.

Electric Vehicle and Hybrid Vehicle Plug-In Stations

Much of the Berkshires' population is concentrated in the region's urban and town center areas, yet there are only two electric vehicle charging stations in the county -- one at Johnson Nissan in Pittsfield and one at the Big Y grocery store in Lee. The City of Pittsfield was offered a station but declined to accept and install it. At this time, there does not appear to be a great demand for charging stations, but this could change if electric vehicles continue to increase.

Regional transportation planners should work with local communities to analyze market and technology trends in order to assess the demand for electric vehicle charging stations throughout the county.

Municipal Initiatives

City and town buildings are a significant contributor to energy use in the county. Municipal and school buildings account for approximately 7% of non-residential electricity and natural gas use.[2] Many of these buildings also use oil or propane, but specific figures are not available. Many cities and towns in the county are pursuing energy efficiency initiatives that will reduce their energy use. Six municipalities have achieved "Green Communities" designation, which requires, among other things, that the municipality develop a plan to reduce municipal energy use by 20% over five years. The Green Communities are Pittsfield, Lenox, Becket, Williamstown, Richmond, and Great Barrington. Green Communities have access to a special grant program that funds energy conservation and efficiency projects in the town, as well as renewable energy projects. These communities and others across the state are implementing energy efficiency projects in municipal buildings, including lighting and heating system upgrades and adding insulation. The majority of towns have invested in energy efficiency for their

D9-11b
Electric Vehicle
Charging

2 Data from Massachusetts Energy Insight.

municipal buildings, including schools, town offices, police and fire stations. Several have also promoted energy efficiency for their residents and businesses.

Municipal Projects

As described above, all of the designated Green Communities have conducted energy inventories and established plans for reducing their baseline municipal energy use. Efficiency initiatives in other towns include: in Egremont, stimulus funding for heating system upgrade at the town highway garage building and assessments and lighting upgrades at all town buildings; energy efficiency and weatherization of New Ashford town hall; Peru conducted energy surveys of the town hall, garage, salt containment building, and old highway garage; North Adams is installing energy efficient lighting at their skating rink. Otis received two grants; state and stimulus funding totaling $350,000. The town was able to insulate and replace doors and windows at the town hall building, upgrade the steam hot water system with high efficiency boilers and as a result reduced cost by approximately 60%. Over the last four years Lee has participated in the WMECO lighting program with $40,000 worth of energy efficiency improvements that have helped reduce costs.

Massachusetts has established a system whereby municipalities can procure the services of energy service companies (ESCOs) to aid them in assessing and tracking the energy consumption within their municipal buildings and treatment facilities. The ESCO develops a plan unique to the municipality that will reduce energy consumption and works with the municipality to establish a funding program that will reduce or eliminate the upfront capital costs associated with implementing the plan. The ESCO funds the project over a long-term period, usually seven to 10 years, and is paid through the energy cost savings that the municipality realizes through implementation of the plan. For example, if the purchase of energy-efficient furnaces or boilers is part of the plan, the purchase is funded over several years through the energy cost savings. Cost savings are guaranteed by the ESCO. If cost savings do not materialize as projected by the plan, the ESCO, not the municipality, assumes that loss. Several municipalities across the state have engaged the services of ESCOs, including Springfield, but as of September 2013 none in Berkshire County have done so.

Municipalities can also contribute to transportation-related emission reductions through a series of policy and procurement changes. Anti-idling policies can be established that reinforce the statewide prohibition of vehicle idling for more than five minutes. Many communities already have such policies in place on school grounds, and expanding that policy town-wide can easily be instated. Erecting signs to note the prohibition in key areas where idling is common will alert drivers. Municipalities can also reduce emissions by purchasing energy efficient vehicles to replace aging ones, as is encouraged through the Green Communities program. As a simple example, one Berkshire town replaced an 8-cylinder Crown Victoria police car with a 6-cyclinder model, instantly reducing the gas consumption of that vehicle by 20% without losing any functionality. A bus retrofitting program to reduce diesel fuel emissions is available to all communities and bus subcontractors in the state,

Residential Campaigns

Some towns have launched energy efficiency and renewable energy initiatives geared toward residents. These include campaigns in Lenox (Lenox Unplugged), Williamstown (Take Charge, The COOL Challenge), North Adams (Take Charge), and Pittsfield (Powering Pittsfield). All of these grassroots initiatives have worked with the Center for EcoTechnology to reach residents with information and

inspire them to act to reduce energy use and greenhouse gas emissions. These campaigns have taken a variety of forms ranging from promoting energy efficient lighting to no cost utility sponsored home energy assessments and weatherization incentives provided by the MassSave program. New England Green Start has been promoted as a way for residents to support local renewable energy initiatives with towns in Berkshire County. This program allows National Grid customers to pay a premium on their electric bill to support the development and generation of energy from local renewable sources.

Commercial Campaigns

The COOL Business program in Williamstown and Powering Pittsfield in Pittsfield included specific components to provide outreach and support to businesses to help promote energy efficiency. Each of these programs provided dedicated time and resources to assist businesses in understanding and taking advantage of utility sponsored energy efficiency programs.

EFFICIENCY PROGRAMS

Utility Programs

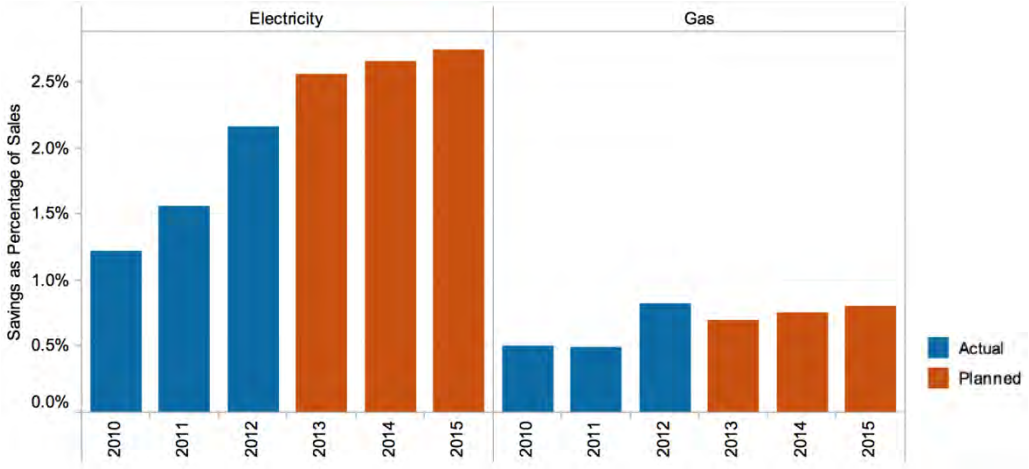
In the area of energy efficiency, Berkshire County benefits from the nation-leading programs operated by Massachusetts electric and gas utilities. In 2013, Massachusetts utilities will invest a total of $650 million in energy efficiency across the state.[3] The programs provide services for all types of customers and buildings, from single-family residential to large commercial buildings and manufacturing facilities. The utility companies in the county are currently providing cost-share incentives to weatherize the buildings of its customers and purchase more efficient furnaces, and offering no-interest loans for additional energy efficiency measures. Berkshire Gas offers 75% of the cost of insulation up to $2,000 to residential gas customers, while National Grid and WMECO and National Grid provide the same cost share to residential customers heating with electric, oil and propane.

While Berkshire County-specific data is not available, it is possible to see the impact of the efficiency programs by looking at energy savings from the programs as a percentage of utility sales. In 2012, National Grid and Western Massachusetts Electric Company delivered electricity savings that equaled 2.16% of projected sales across their entire service territories. Berkshire Gas delivered gas savings of nearly 1% of sales in its territory. As shown in the chart below, these savings have been increasing over time and are projected to continue to increase.[4] As long as Berkshire County receives its proportionate share of energy efficiency program services, it will see similar savings as a percentage of electricity and gas use in the county.

3 Massachusetts Joint Statewide Three-Year Energy Efficiency Plan (April 30, 2012).

4 2010 – 2012 savings from EEAC Consultant Team report to Massachusetts Energy Efficiency Advisory Council (July 10, 2012); 2013 – 2015 savings from EEAC Consultant Team report to Massachusetts Energy Efficiency Advisory Council (November 13, 2012).

Figure 1: Efficiency Program Savings as a Percentage of Utility Sales



Sources: Massachusetts Energy Efficiency Advisory Council, Peregrine Energy Group.

While programs are available for both residential and business customers, for the electricity programs the bulk of the savings come from business customers; 75% of the total. For the gas programs, the savings are split more evenly: 55% business and 45% residential.

Programs for Low Income Residents

Berkshire Community Action Council (BCAC) operates dedicated efficiency and fuel assistance programs for low-income residents, including both homeowners and tenants. In 2012, BCAC provided weatherization assistance to 1,358 households, high-efficiency appliances to 668 households, and fuel assistance to 7,535 households. In this case, "households" include both single family homes and rental units.

APPENDIX D: RENEWABLE ENERGY POTENTIAL ANALYSIS

This appendix describes the method used to explore the region's potential for generation of solar, wind, and hydropower.

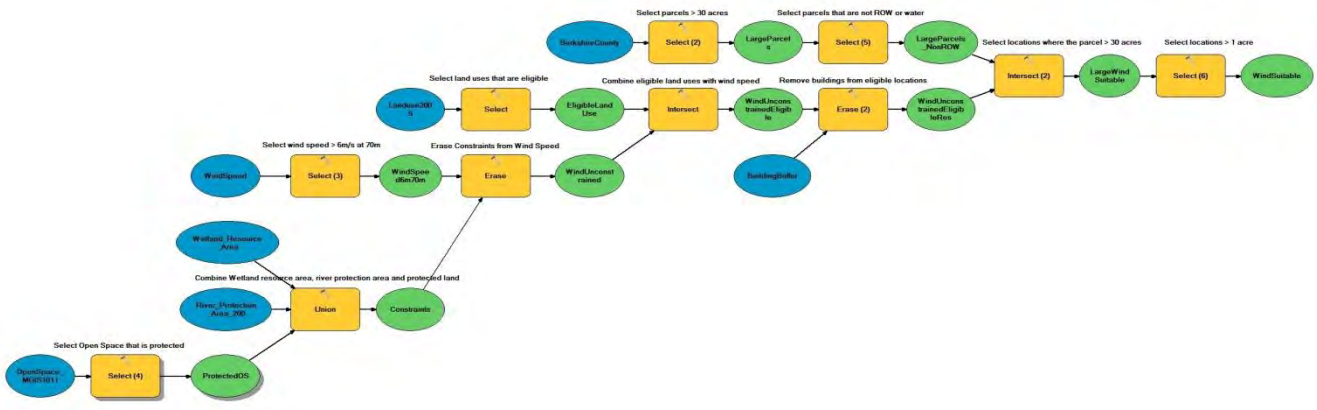
WIND ENERGY POTENTIAL

The Commonwealth of Mass. has done some analysis for land-based and off-shore wind energy generation. In 2003 True Wind Solutions and AWS Scientific were commissioned to identify and map the most promising sites for wind, and in 2009 Navigant Consulting was commissioned to identify the most promising sites on state-owned lands. In an effort to conduct further analysis, the Berkshire Regional Planning Commission (BRPC) utilized GIS capabilities to refine the work begun by previous efforts. BRPC used True Wind's GIS data as the basis upon which to work, choosing sites where wind speed exceeded 6 meters per second at 70 meters in height above ground elevation.

BRPC then removed from these selected areas those lands deemed inappropriate or unsuitable for commercial wind development, such as land already developed, wetland resources, priority habitat, permanently protected lands, and land within ½ mile of an existing residence. Parcels that were at least 30 acres in size were then selected and highlighted. The GIS model used to determine wind energy potential is shown below.

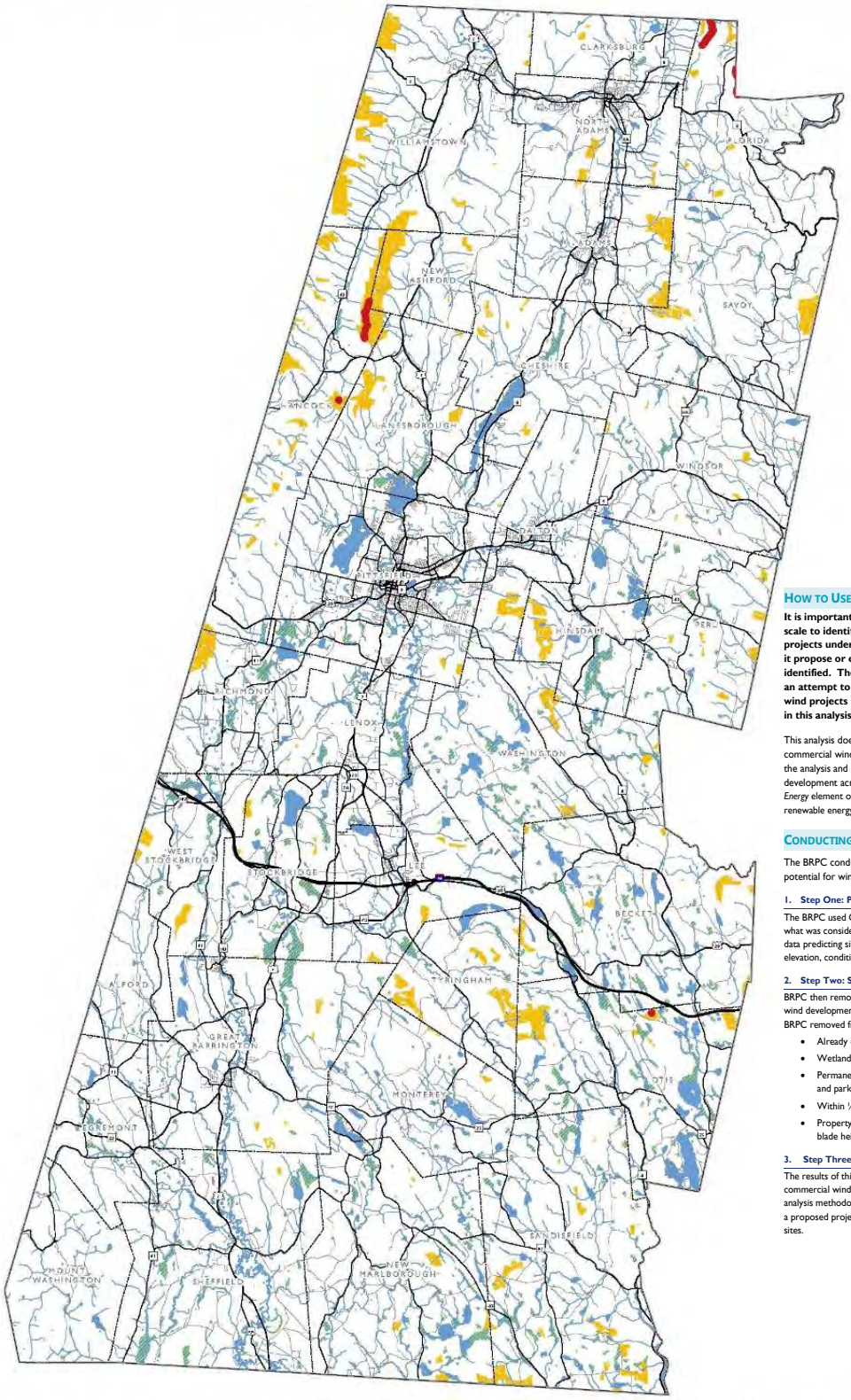
The results of this work are shown in on the Wind Energy Potential map on the following page, illustrating that 2% of the county's land area has some potential for commercial wind energy development. In an effort to ground truth the analysis methodology, BRPC then overlaid the GIS location of all the existing wind energy projects in the county and a proposed project in Savoy. All are located within sites that the GIS analysis selected as potential wind energy sites. As noted in the Conservation and Recreation Element of Sustainable Berkshires, siting wind energy projects must be done carefully to balance renewable energy generation while protecting the natural resources of the region.

Figure 1. GIS Model for Wind Energy Potential



WIND ENERGY POTENTIAL

SUSTAINABLE BERKSHIRES



Legend

- Suitable Location for Wind Turbines
- Existing Wind Turbine
- County Boundary
- Community Boundary
- Interstate Highway
- Arterial Road
- Collector Road
- Local Road
- Open Water
- Wetland
- Stream

How to Use the Berkshire Wind Energy Potential Map

It is important to note that this Wind Energy Potential map has been developed on a regional scale to identify potential sites within the county that may support commercial wind energy projects under specific conditions. The map does not possess any regulatory authority nor does it propose or endorse development of wind energy projects on the sites that have been identified. The Berkshire Regional Planning Commission (BRPC) embarked on this analysis in an attempt to better define and determine the *potential* for the county to host commercial scale wind projects that might meet specific natural resource and land use criteria. The criteria used in this analysis is described below.

This analysis does not envision that all of the sites identified during the analysis will be developed for commercial wind energy projects nor that unidentified sites will not be developed for wind energy. Rather, the analysis and resulting maps are intended to inform regional and municipal policies on wind energy development across the county. As noted in both the *Conservation and Recreation* element and the *Climate and Energy* element of the Sustainable Berkshires Plan, siting wind energy projects must be done carefully to balance renewable energy generation while protecting the natural resources of the region.

Conducting the Analysis

The BRPC conducted a coarse GIS analysis to map the general areas in the county that have the greatest potential for wind energy development.

1. Step One: Promising Areas for Commercial Wind Development

The BRPC used GIS generated by True Wind Solutions and AWS Scientific in 2003, which produced a map showing what was considered to be the most promising sites in Massachusetts for wind energy development. BRPC pulled data predicting sites where wind speed exceeded 6 meters per second (mps) at 70 meters in height above ground elevation, conditions cited at that time as being needed to make a commercial wind project economically feasible.

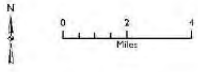
2. Step Two: Selective Criteria

BRPC then removed from these selected areas those lands deemed inappropriate or unsuitable for commercial wind development. These criteria are based upon the BRPC's *Wind Power Policy Siting Guidelines* established in 2004. BRPC removed from consideration lands that were:

- Already developed (residential, commercial, industrial lands),
- Wetland resources (lakes, ponds, large wetlands, river & stream corridors),
- Permanently protected from development by ownership or deed restrictions (state and municipal forests and parks, conservation organizations, and agricultural preservation restrictions),
- Within ½ mile of an existing residence, and
- Property parcels that were less than 30 acres in size (based on a turbine fall zone of 1.5 times the tip of the blade height of 390 feet).

3. Step Three: The Results

The results of this work are shown on the map, illustrating that 2% of the county's land area has some potential for commercial wind energy development using the criteria selected in Step 1 & 2. In an effort to ground truth the analysis methodology, BRPC then overlaid the GIS location of all the existing wind energy projects in the county and a proposed project in Savoy. All are located within sites that the GIS analysis selected as potential wind energy sites.



10/21/2013

Berkshire Regional Planning Commission

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

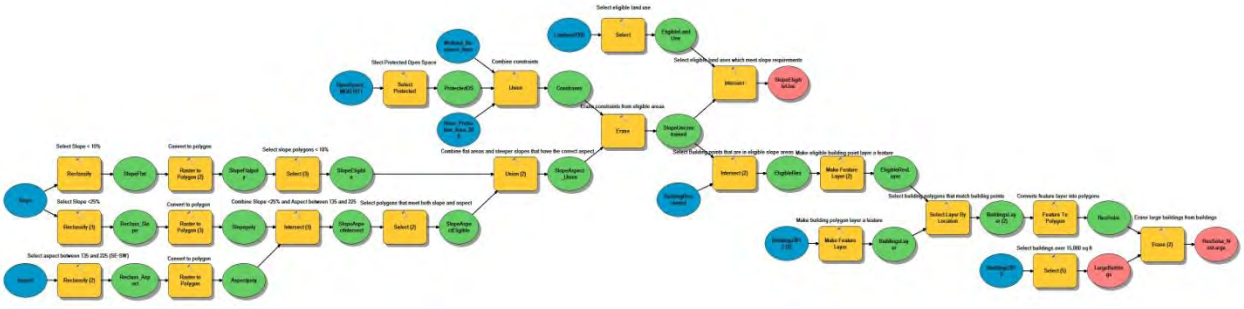
SOLAR PHOTOVOLTAIC ENERGY POTENTIAL

BRPC also conducted a coarse GIS analysis of Berkshire County to determine the extent of land that could support ground-mounted solar PV energy projects. Like the wind energy analysis, permanently protected lands and wetland resources were removed from consideration. Because locating solar arrays, even commercial scale projects, is less complex than wind energy facilities, BRPC considered lands that were both developed and undeveloped as part of the analysis. Criteria used to identify potential solar PV sites included sites that had slopes less than 25% and were oriented southward. As noted on the map, most of the southward facing slopes are currently forested (represented by green shading), although existing agricultural fields throughout the county are also highlighted (yellow shading). Thus, the map illustrates areas that have the basic criteria for siting ground-mounted arrays along with the type of land use that the array would replace. Approximately 25% of the county's land area meets the criteria selected. Of this area, 83% is currently forested and 13% is in some type of agricultural use. The Solar Energy Potential map is found on the following page, and the GIS model used to determine this potential is shown below. Replacing forest or working agricultural lands with solar arrays will require careful planning and community input, as both these land uses are important to the rural character and natural and economic heritage of the region.

Commercial buildings that had footprints of more than 15,000 square feet were chosen as potentially suitable for roof-mounted solar development. In the county 562 buildings met this criterion, covering 584 acres. This area does not include large open areas surrounding commercial buildings, such as expansive parking lots around shopping malls, and so the calculation for potential solar arrays on commercial properties is underestimated. In some parts of the country, parking lots and parking garages are now being considered desirable sites for solar projects, providing not only solar energy generation, but also providing the added benefits of shading and cooling, thus reducing the thermal impacts of such properties. An added benefit could also be providing recharging stations for plug-in electric vehicles.

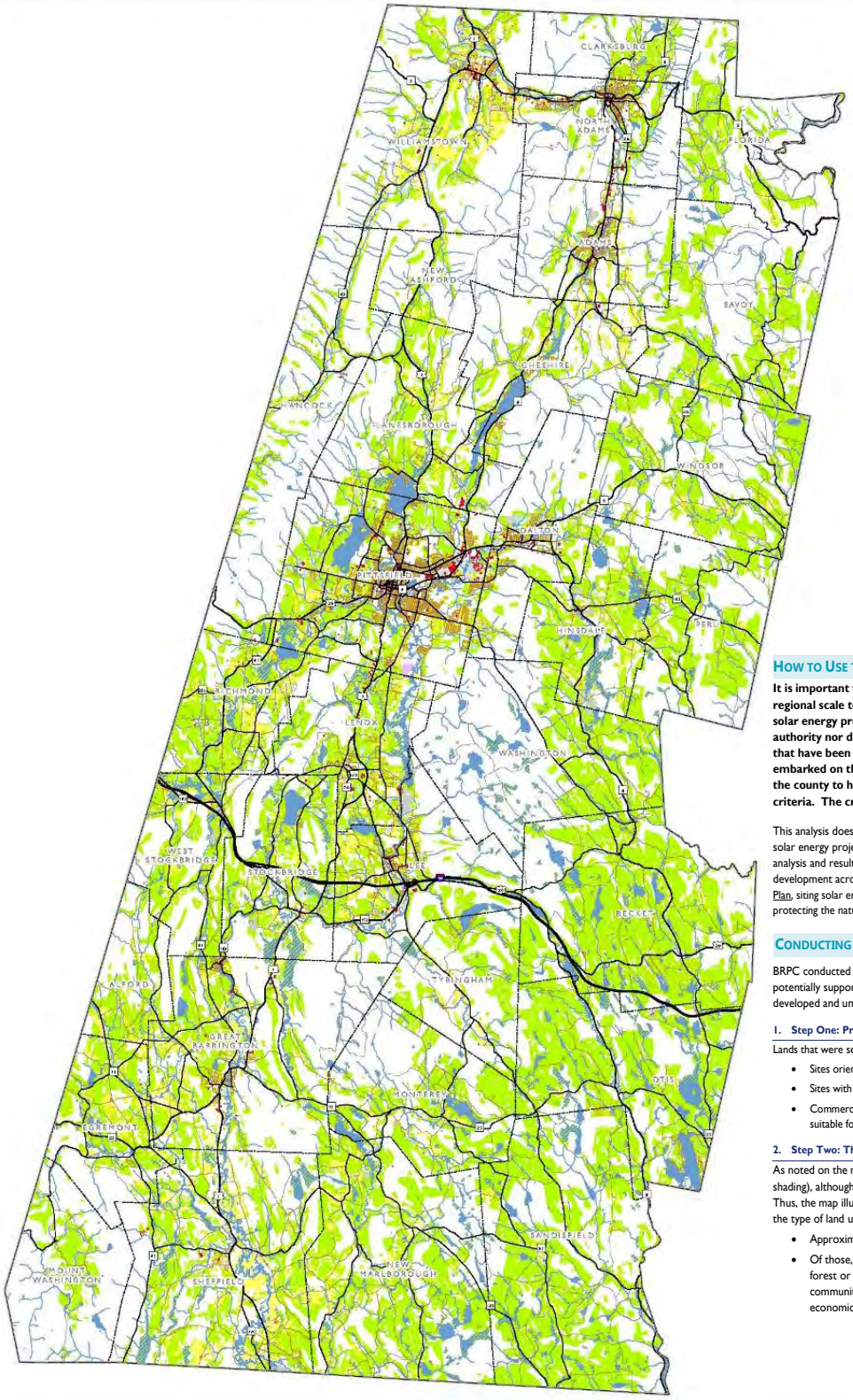
Residential rooftops were selected for potential roof-mounted solar, although in reality only a small percentage of these buildings could reasonably host arrays. Of the 19,531 houses calculated, at least ¾ of the residential buildings would not be suitable due to directional orientation, and more would be unsuitable due to shading and/or structural deficiencies. Due to the scale of the maps generated, the roof-mounted sites do not show up on the county-wide map. To illustrate samples of the scale and distribution of roof-mounted solar potential on a municipal level, the maps for North Adams, Pittsfield and Great Barrington are shown on the page following the county-wide map.

Figure 2. Solar PV Potential



SOLAR ENERGY POTENTIAL

SUSTAINABLE BERKSHIRES



Legend

Potential Solar Locations

- Residential Rooftop Solar: 386 acres (19,531 homes)
- Commercial Rooftop Solar: 584 acres (562 buildings)

Groud Mounted Solar

Agriculture	20,644 acres
Forest	127,748 acres
Mining	986 acres
Open Land	4,116 acres
Transitional	210 acres
Waste Disposal	283 acres

- County Boundary
- Community Boundary
- Interstate Highway
- Arterial Road
- Collector Road
- Local Road
- Open Water
- Wetland
- Stream

How to Use the Berkshire Solar Energy Potential Map

It is important to note that this Solar Energy Potential map has been developed on a regional scale to identify potential sites within the county that may support photovoltaic solar energy projects under specific conditions. The map does not possess any regulatory authority nor does it propose or endorse development of solar energy projects on the sites that have been identified. The Berkshire Regional Planning Commission (BRPC) embarked on this analysis in an attempt to better define and determine the potential for the county to host solar projects that might meet specific natural resource and land use criteria. The criteria used in this analysis is described below.

This analysis does not envision that all of the sites identified during the analysis will be developed for solar energy projects nor that unidentified sites will not be developed for solar energy. Rather, the analysis and resulting maps are intended to inform regional and municipal policies on solar energy development across the county. As noted in the *Climate and Energy* element of the Sustainable Berkshires Plan, siting solar energy projects must be done carefully to balance renewable energy generation while protecting the natural and agricultural resources of the region.

Conducting the Analysis

BRPC conducted a coarse GIS analysis of the county to determine the extent of land that could potentially support ground-mounted solar PV energy projects. BRPC considered lands that were both developed and undeveloped as part of the analysis.

1. Step One: Promising Areas for Solar Development

Lands that were selected for consideration for PV solar were these:

- Sites oriented southward, and
- Sites with slopes less than 25%.
- Commercial buildings with footprints of more than 15,000 square feet were chosen as potentially suitable for roof-mounted solar development (sites show on the map in red).

2. Step Two: The Results

As noted on the map, most of the southward facing slopes are currently forested (represented by green shading), although existing agricultural fields throughout the county are also highlighted (yellow shading). Thus, the map illustrates areas that have the basic criteria for siting ground-mounted arrays along with the type of land use that the array would replace.

- Approximately 25% of the county's land area meets the criteria selected.
- Of those, 83% are currently forested and 13% are in some type of agricultural use. Replacing forest or working agricultural lands with solar arrays will require careful planning and community input, as both these land uses are important to the rural character and natural and economic heritage of the region.

10/21/2013

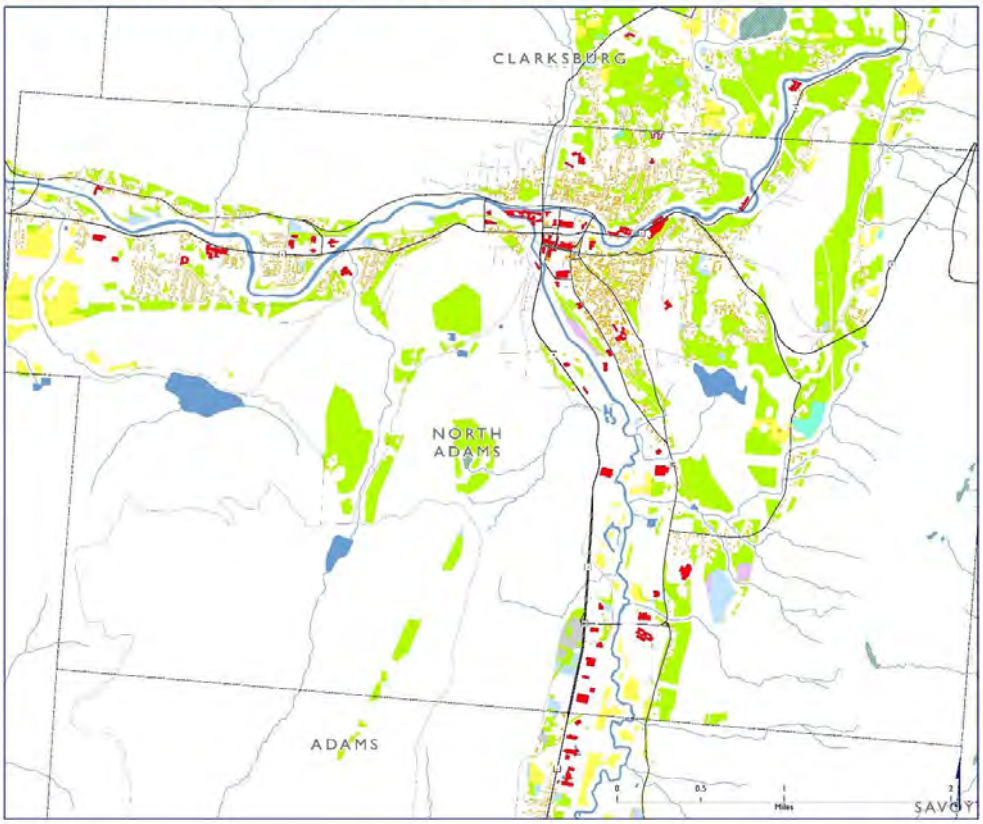
Berkshire Regional Planning Commission

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.

SOLAR ENERGY POTENTIAL

NORTH ADAMS

SUSTAINABLE BERKSHIRES



Legend

Potential Solar Locations
- Residential Rooftop Solar
- Commercial Rooftop Solar

Ground Mounted Solar
- Agriculture
- Forest
- Mining
- Open Land
- Transitional
- Waste Disposal

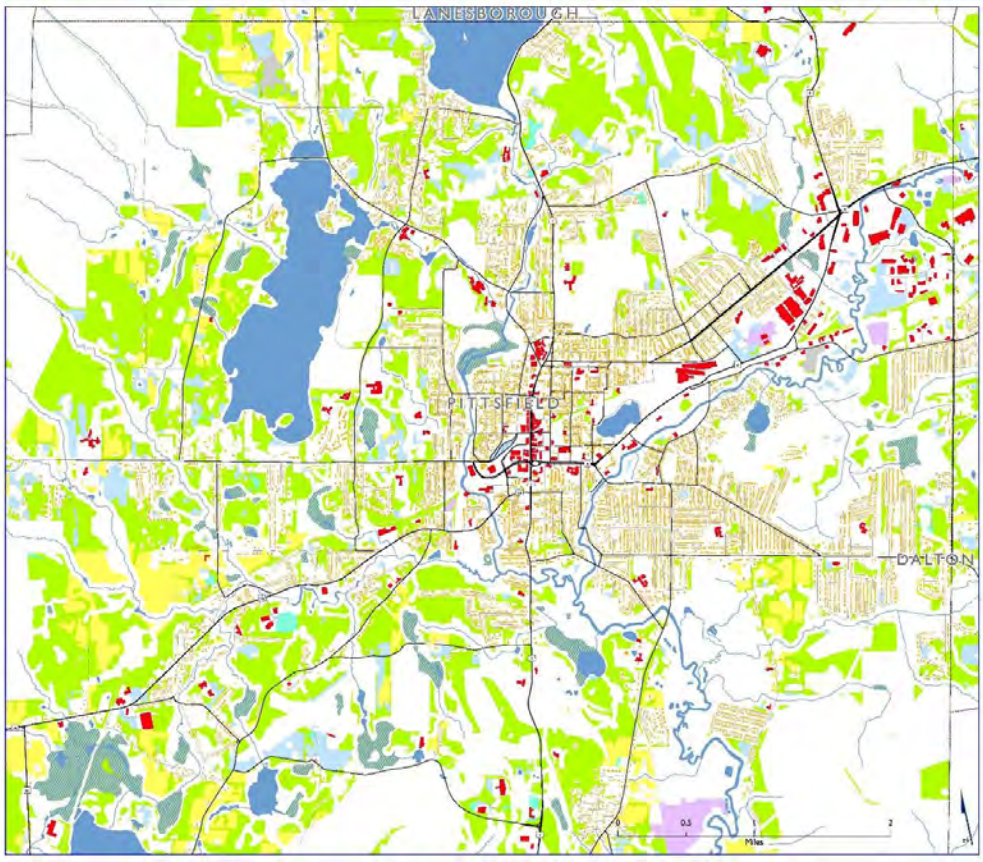
- County Boundary
- Community Boundary
- Interstate Highway
- Arterial Road
- Collector Road
- Local Road
- Open Water
- Wetland
- Stream

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.
This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the communities may have supplied portions of this data.

SOLAR ENERGY POTENTIAL

PITTSFIELD

SUSTAINABLE BERKSHIRES



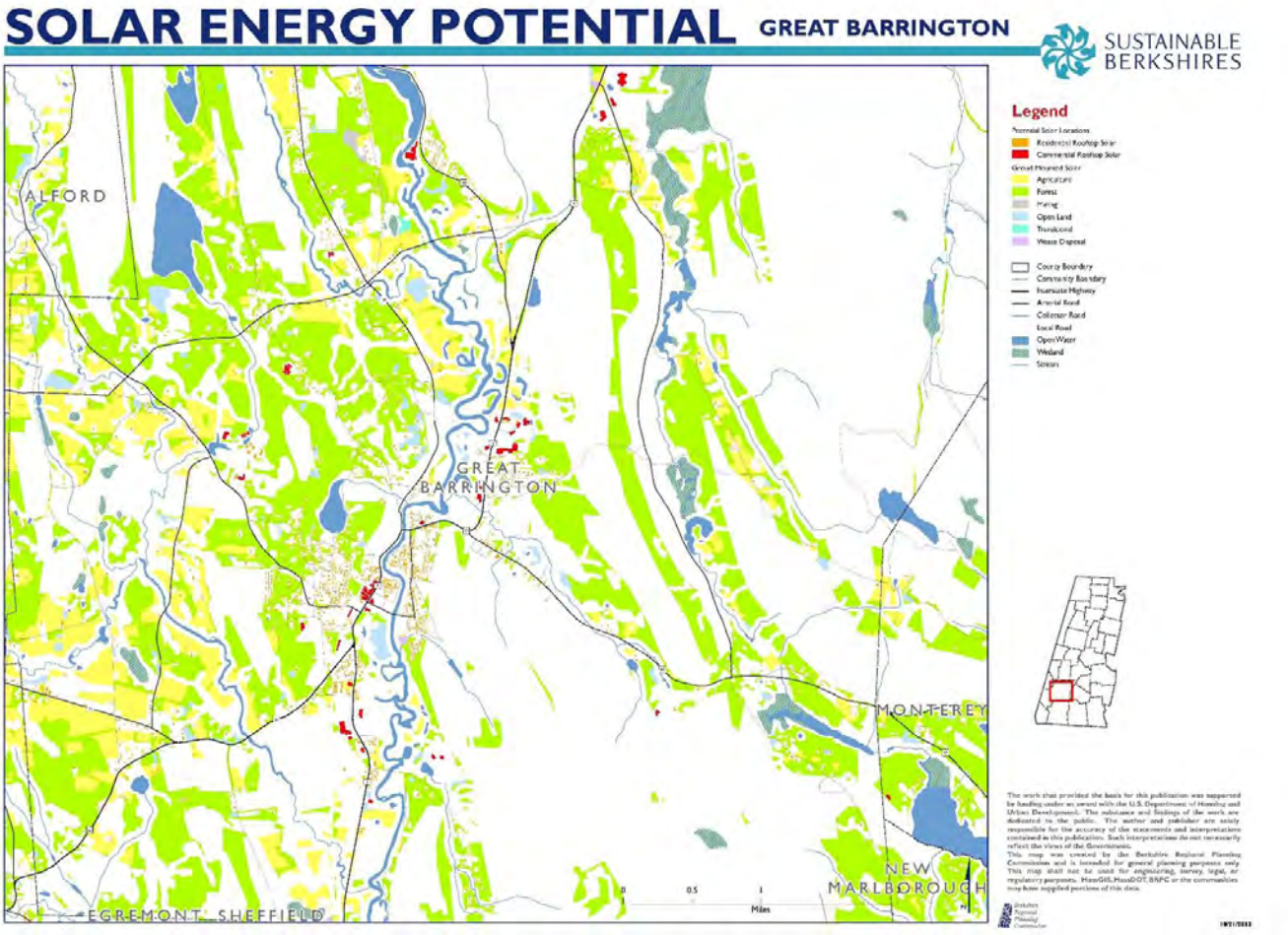
Legend

Potential Solar Locations
- Residential Rooftop Solar
- Commercial Rooftop Solar

Ground Mounted Solar
- Agriculture
- Forest
- Mining
- Open Land
- Transitional
- Waste Disposal

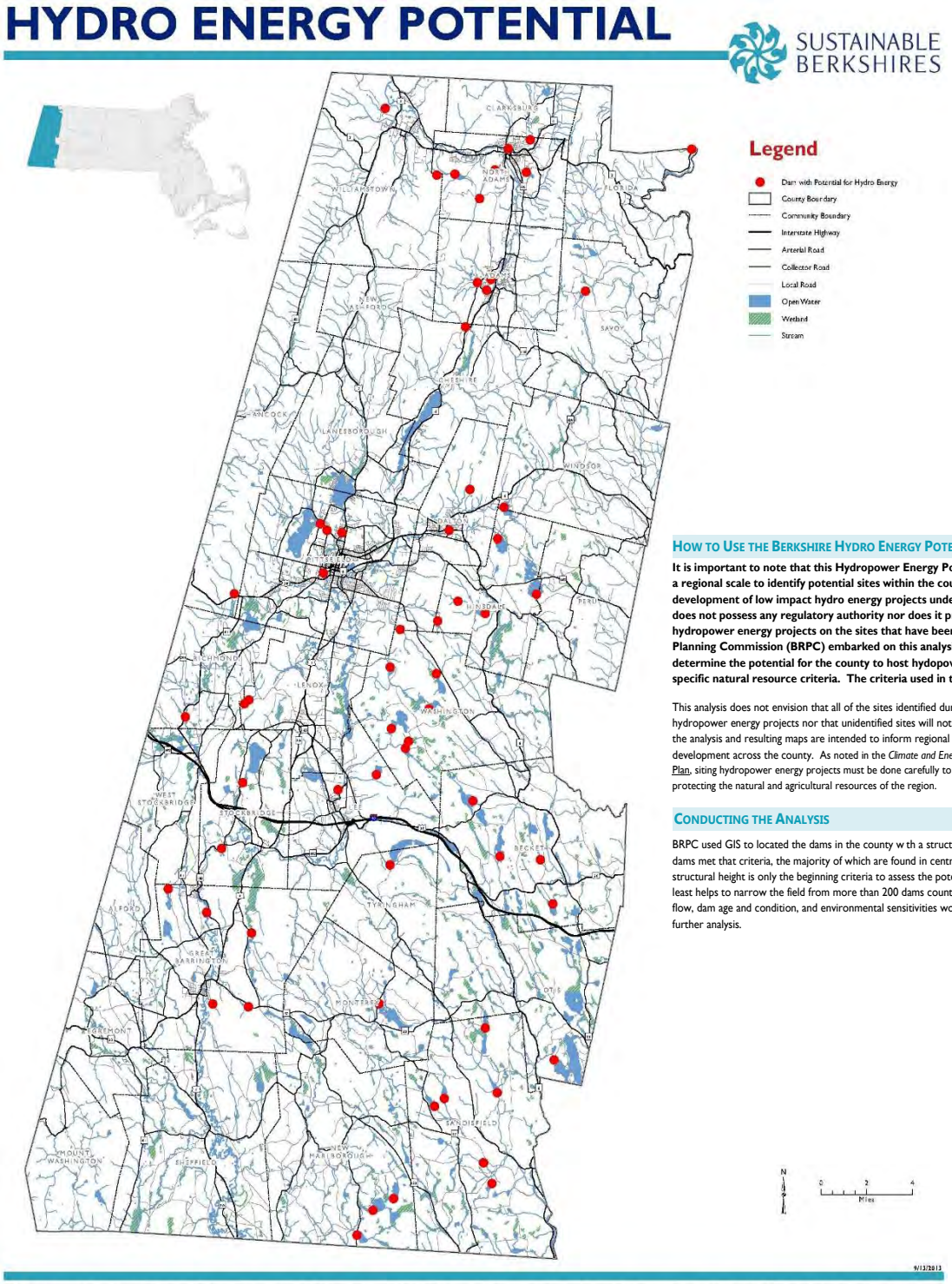
- County Boundary
- Community Boundary
- Interstate Highway
- Arterial Road
- Collector Road
- Local Road
- Open Water
- Wetland
- Stream

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.
This map was created by the Berkshire Regional Planning Commission and is intended for general planning purposes only. This map shall not be used for engineering, survey, legal, or regulatory purposes. MassGIS, MassDOT, BRPC or the communities may have supplied portions of this data.


SOLAR ENERGY POTENTIAL
GREAT BARRINGTON
SUSTAINABLE BERKSHIRES
Legend
Potential Solar Locations
Residential Rooftop Solar
Commercial Rooftop Solar
Ground Mounted Solar
Agriculture
Forest
Mining
Open Land
Transitional
Waste Disposal
County Boundary
Community Boundary
Interstate Highway
Arterial Road
Collector Road
Local Road
Open Water
Wetland
Stream
ALFORD
GREAT BARRINGTON
MONTEREY
NEW MARLBOROUGH
EGREMONT
SHEFFIELD
0
0.5
1
Miles
N

HYDROPOWER ENERGY POTENTIAL

BRPC used GIS to locate the dams in the county with a structural height of at least 20 feet. Sixty-two dams met that criterion, the majority of which are found in central and southern Berkshire County. The structural height is only the beginning criterion to assess the potential viability of these dams, but this at least helps to narrow the field from the 231dams countywide listed in the county-wide GIS data. Other criteria such as ownership, flow, dam age and condition, and environmental sensitivities would need to be considered as part of a further analysis.



HOW TO USE THE BERKSHIRE HYDRO ENERGY POTENTIAL MAP

It is important to note that this Hydropower Energy Potential map has been developed on a regional scale to identify potential sites within the county that may support the development of low impact hydro energy projects under specific conditions. The map does not possess any regulatory authority nor does it propose or endorse development of hydropower energy projects on the sites that have been identified. The Berkshire Regional Planning Commission (BRPC) embarked on this analysis in an attempt to better define and determine the potential for the county to host hydopower projects that might meet specific natural resource criteria. The criteria used in this analysis is described below.

This analysis does not envision that all of the sites identified during the analysis will be developed for hydropower energy projects nor that unidentified sites will not be developed for hydropower. Rather, the analysis and resulting maps are intended to inform regional and municipal policies on hydropower development across the county. As noted in the *Climate and Energy* element of the Sustainable Berkshires Plan, siting hydropower energy projects must be done carefully to balance renewable energy generation while protecting the natural and agricultural resources of the region.

CONDUCTING THE ANALYSIS

BRPC used GIS to located the dams in the county w th a structural height of at least 20 feet. Sixty-two dams met that criteria, the majority of which are found in central and southern Berkshire County. The structural height is only the beginning criteria to assess the potential viability of these dams, but this at least helps to narrow the field from more than 200 dams countywide. Other criteria such as ownership, flow, dam age and condition, and environmental sensitivities would need to be considered as part of a further analysis.

Berkshire Regional Planning Commission

The work that provided the basis for this publication was supported by funding under an award with the U.S. Department of Housing and Urban Development. The substance and findings of the work are dedicated to the public. The author and publisher are solely responsible for the accuracy of the statements and interpretations contained in this publication. Such interpretations do not necessarily reflect the views of the Government.