Energy Efficiency:

The Smart Way to Reduce Global Warming Pollution in the Northeast

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Executive Summary

Nine Northeast states from Delaware to Maine are currently working to develop a regional cap-and-trade system to limit global warming pollution from power plants. The program, known as the Regional Greenhouse Gas Initiative (RGGI), represents one of the first significant efforts to mitigate the serious impacts of global warming in the United States.

In order to achieve the greatest reduction in pollution at the least cost, energy efficiency must play a prominent role in the Northeast's overall global warming strategy.

According to government forecasts, demand for electricity in the Northeast will increase 23 percent by 2020, making cuts in global warming pollution more difficult and more expensive than they need to be.

- The U.S. Department of Energy (DOE) projects electricity demand will increase 1.4 percent per year between now and 2020.
- To satisfy increasing demand and replace retiring facilities, the Northeast will require over 8,500 MW of new power plants. The DOE predicts that at least 85 percent of these plants will burn natural gas or other fossil fuels, which produce global warming pollution. Increasing demand also makes it more difficult to retire older, high-emitting power plants, which may be needed to ensure that the electric system continues to operate reliably.
- Under these circumstances, DOE forecasts that emissions of carbon dioxide (the leading global warming pollutant) will rise 37 million tons per year by 2020.

The Northeast has enough efficiency resources to slow and eventually halt growth in electricity demand—thus making emission reductions easier to achieve.

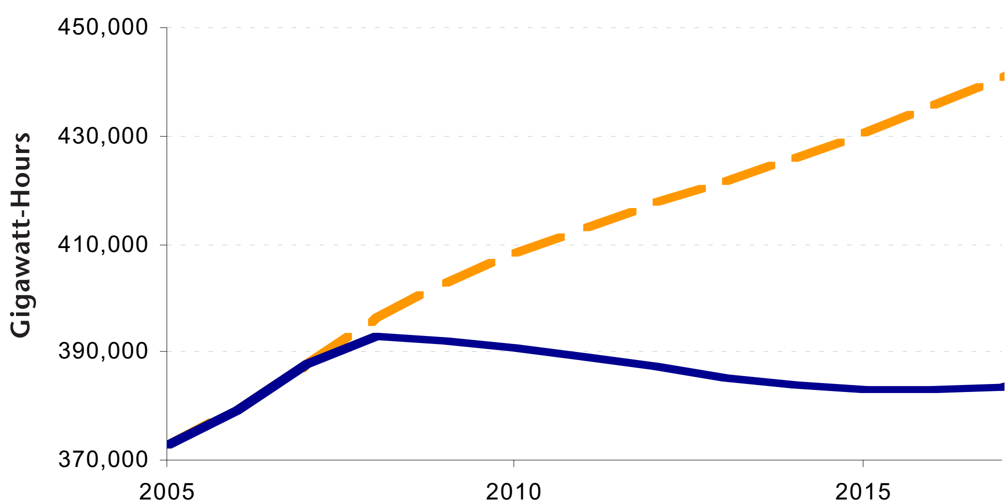
- A variety of state, university and non-profit studies have identified large potential for greater energy efficiency in Northeast states. For example, New England's currently active efficiency programs will capture less than one-fifth of the region's achievable energy savings potential by 2013.

- Deploying the achievable efficiency measures identified in these studies would reduce projected electricity demand in the Northeast by an average of 1.3 percent per year in the next decade, effectively keeping demand at 2007 levels. (See Figure ES-1.)
- Halting growth in electricity demand would reduce upward pressure on regional carbon dioxide emissions and ease the pressure to continue operating older, carbon-inefficient plants to maintain the reliability of the electric system—making progress against global warming easier to achieve.

Efficiency measures make progress against global warming less expensive.

- Efficiency measures are two-thirds less expensive than generating and delivering electricity. In 2002, New England's public benefit fund programs produced energy savings at an average cost of 2.4 cents per kWh. In comparison, wholesale power in New England is projected to cost from 4 to over 5 cents per kWh over the next decade—and over 9 cents per kWh including the cost of transmission infrastructure and energy losses.
- In addition to saving consumers money directly, reduced energy demand leads to lower energy prices. For every 1 percent reduction in national demand for natural gas, prices decline 0.8 percent to 2 percent below otherwise expected levels.
- Deploying identified cost-effective energy efficiency measures over the next decade would reduce Northeast electricity demand by 11 percent and utility natural gas demand by 11 percent versus projections in 2015—reducing the average price of electricity by 0.4 cents per kWh and the average wellhead price of natural gas by 2.6 cents per thousand cubic feet. By 2020, Northeast consumers would save a net of $13 billion, lowering the

Figure ES-1: Forecast Energy Demand—Base Case Compared to Efficiency Scenario



residential consumer's average energy bill by $1.56 a month (before factoring in the cost of a carbon cap).

- At the same time, efficiency measures will improve reliability of electric service and help avoid the need for special reliability payments to generators. Pending approval, new "Locational Installed Capacity" (or LICAP) charges could go into effect in 2006, giving generators an incentive to supply transmission-constrained areas but costing consumers as much as $13 billion over the next five years.
- When consumers spend less on energy—much of which goes outside the region to pay for fossil fuels—they spend more on local goods and services, stimulating the economy. The Regulatory Assistance Project estimates that from 2000 to 2010, existing energy efficiency programs in New England will create $2 billion in economic output, over 1,000 jobs annually, and nearly $700 million in wages—while reducing carbon dioxide pollution by 2 million tons per year.

The economic benefits of efficiency programs will allow for a tighter carbon cap without requiring additional sacrifices by ratepayers.

- Efficiency savings could offset increases in electricity cost caused by the carbon cap, enabling a stronger cap to be set at the same or less cost.
- Combining energy efficiency with a strong carbon cap would encourage high-polluting coal- and oil-fired power plants to reduce their emissions or give way to low-carbon forms of generation, delivering significant cuts in pollution.
- However, energy efficiency won't happen automatically in a cap-and-trade program, because market barriers and other fundamental obstacles prevent efficiency measures from competing with supply-side measures on equal footing.

Northeastern states should make energy efficiency a central part of their plan of attack on global warming.

- The forthcoming carbon cap-and-trade policy under negotiation in the Northeast should explicitly include support of energy efficiency programs in order to be most effective. Emission allowances (that is, permits that allow a facility to emit carbon dioxide) should not be given to generators for free. Instead, they should be sold at market price and the proceeds should be dedicated to fund energy efficiency and other public benefit programs, reducing the overall cost of the program and enabling the Northeast to meet more meaningful pollution reduction targets.
- The cap should reduce global warming pollution to 25 percent below current levels by 2020, growing tighter over time.
- Reductions should be achieved first and foremost from a mandatory cap on

carbon dioxide emitted from fossil-fuel power plants in the Northeast. Electricity imports should be included in the cap to prevent leakage. Offsets outside the regional electricity sector should not be considered until the cap-and-trade program has matured and been proven effective. If offsets are eventually considered, they should meet conservative and rigorous criteria to ensure that they enhance the benefit of the program.

- Northeastern states should pursue a comprehensive set of energy efficiency policies outside of and in parallel to the cap-and-trade program, including but not limited to:
    - o Establishing dedicated efficiency programs (like Efficiency Vermont) that are independent of electricity and gas service providers and ensuring enough funding to tap achievable efficiency potential;
    - o Improving residential and commercial building codes;
    - o Setting minimum appliance efficiency standards;
    - o Stimulating the deployment of combined heat and power technologies; and
    - o Educating consumers about energy efficiency opportunities.

Introduction

Across the Northeast and the world as a whole, there is a growing consensus that action to reduce global warming pollution is necessary and urgent.

Global warming threatens to significantly increase the average temperature in the Northeast and around the world, causing dramatic changes in our economy and quality of life. Within the next century, the impacts of global warming in the Northeast could include coastal flooding, shifts in populations of fish and plants, loss of hardwood trees responsible for fall foliage displays, longer and more severe smog seasons, increased spread of exotic pests, more severe storms, increased precipitation and intermittent drought.

With leadership from Washington D.C. absent, the governors of nine Northeast states (Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont) have initiated a process that offers a good chance to reduce the region's impact on global warming by cleaning up power plants—which emit over one-fifth of the region's global warming pollution.[1] The process, known as the Regional Greenhouse Gas Initiative (RGGI), would cap regional carbon dioxide pollution from electricity generation and set up a trading mechanism to achieve the required emissions reductions in an economically efficient way. (See "Cap and Trade, A Primer" on page 10.)

In order for the cap to be effective in producing benefits for the environment and public health, it should be set at an achievable but ambitious level that forces the development and deployment of new technologies.

The main argument against an aggressive cap is that it will cost too much. But a strategy that couples limits on carbon dioxide emissions with vigorous energy efficiency measures can reduce the cost of the program, enable greater emission reductions, and boost the region's economy.

The Northeast has a variety of exemplary energy efficiency programs that are already producing results. Efficiency programs in New England in 2002 achieved lifetime savings of 10 billion kilowatt-hours (kWh) of electricity at an average cost of 2.4 cents per kWh, according to the Regulatory Assistance Project.[2] Existing New England efficiency programs will create over $2 billion in economic output between

2000 and 2010, while preventing over 18 million tons of carbon dioxide emissions and saving over 44 billion kWh of electricity (enough to power 4.4 million homes for a year).[3] In New York as of the end of 2003, the Energy $mart program reduced state electricity use by one billion kWh per year, lowering peak demand by 880 megawatts (MW) and contributing to the overall stability of New York's electricity system.[4] The program is expected to create an average of 5,500 jobs annually from 1998 to 2006.[5] In the first three years of New Jersey's Clean Energy Program (2001-2003), workers installed equipment with a lifetime energy savings of 7 billion kWh, which will avoid emission of over 4 million tons of carbon dioxide pollution.[6] In 2003, the program provided $100 million in funding for projects that will save consumers $400 million in energy costs over their useful lifetime.[7]

As this report explores, the potential for cost-effective energy efficiency programs in the Northeast remains immense. Developing these resources will increase the stability of the electric grid, accelerate the transition to less carbon-intensive energy sources and improve the economy. And it will make possible the achievement of a meaningful and effective near-term goal for reducing carbon dioxide pollution through the RGGI framework, creating momentum toward the deeper cuts that will be necessary in the long term.

Cap-and-Trade: A Primer

Traditionally, environmental goals have been achieved through direct performance requirements. Regulators established limits on emissions or required facilities to adopt certain technologies to reduce pollution. These rules were then enforced through civil or in some cases criminal penalties.

Beginning in the 1970s, economists and government officials began to experiment with market-based approaches to environmental protection. These market-based approaches made the right to emit pollution a tradable commodity, allowing facilities to generate credits for emission reductions that go above and beyond legal requirements. These credits could then be sold to companies that wished to build new facilities, increase their emissions, or reduce the expense of complying with environmental safeguards.

Cap-and-trade programs are among the market-based approaches with the best track record of success in reducing emissions. In a cap-and-trade system, government first establishes an overall limit on pollutant emissions within an economic sector (the "cap"). This total amount of pollution is then converted into "allowances" to emit a given quantity of the pollutant, which regulated facilities must hold in order to emit pollution. Facilities that reduce their emissions can hold fewer allowances, enabling them to sell their excess allowances to other facilities that may be having a harder time achieving emission reductions. Such trading allows the economic sector covered by the cap-and-trade program to achieve the desired emission reductions at lower aggregate cost. Additionally, regulators can reduce the amount of pollution over time by tightening the cap.

Energy Demand is Rising

As population and the economy in the Northeast continue to grow, so does demand for electricity. Government forecasts predict that much of that energy will come from fossil fuels, increasing the amount of global warming pollution from power plants in the Northeast.

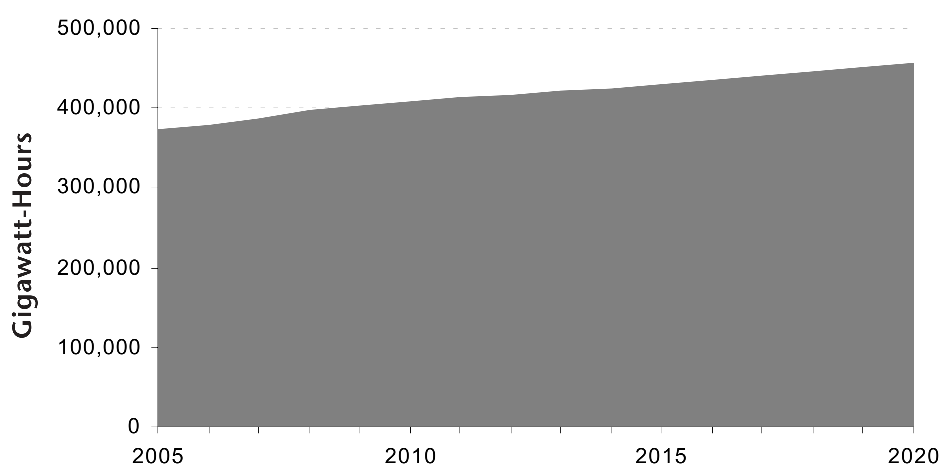
Under these circumstances, attempts to reduce the Northeast's contribution to global warming will be more difficult and more expensive than they have to be.

Rising Demand Makes Cuts in Global Warming Pollution More Difficult and Costly

According to the U.S. Energy Information Administration (EIA), demand for electricity in the Northeast will increase 23 percent by 2020, an average of 1.4 percent per year.[8] (See Figure 1).

To meet this demand and replace the

Figure 1: Forecast Electricity Demand



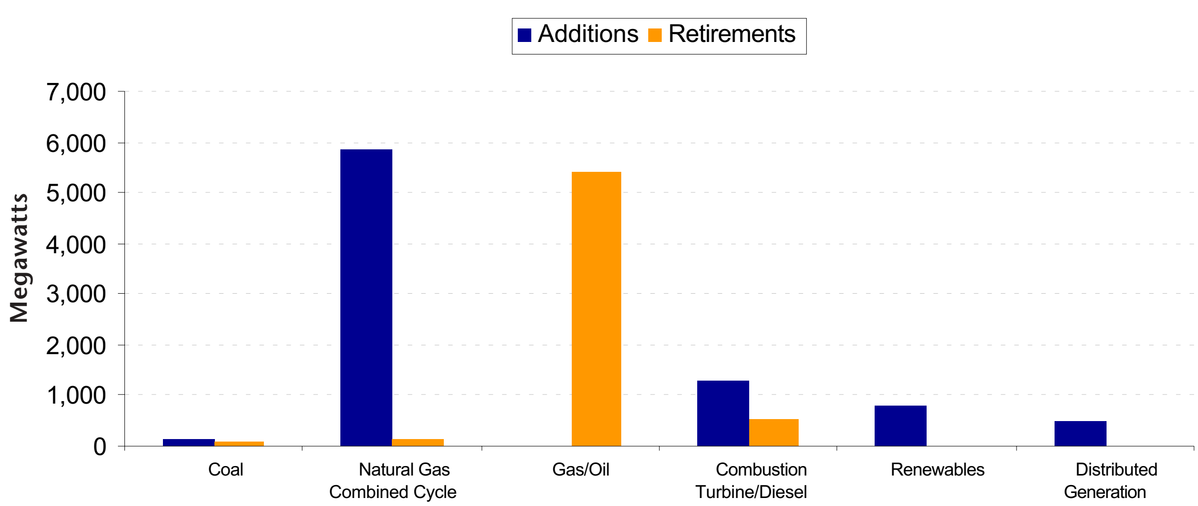
output of facilities that retire, EIA predicts that the Northeast will require over 8,500 MW of new generating capacity. At least 85 percent of these facilities will burn natural gas or other fossil fuels, emitting carbon dioxide—the leading global warming pollutant.[9] (See Figure 2.)

Increasing demand also makes it more difficult to retire older, high-emitting power plants that serve areas with limited transmission capacity. As demand rises in these areas, amid serious questions about the ability of restructured electricity markets to provide adequate supplies, local power plants are increasingly necessary to ensure that the electric system continues to operate reliably. For example, the coal-fired Salem Harbor power plant in Massachusetts serves a transmission-constrained area of eastern Massachusetts. In February 2005, Dominion, the plant's operator, requested permission from the New England Independent System Operator (ISO-NE) to shut down the plant. ISO-NE rejected the application, finding that Salem Harbor was necessary to ensure reliability.[10] To the extent that increased demand aggravates transmission constraints, shutting down other high-emission coal-fired power plants like Salem Harbor will be more difficult.

EIA forecasts that only 70 MW of coal-fired generators in the Northeast will be retired before 2020. Despite the replacement of oil-fired generators with more efficient natural gas combined cycle plants, DOE forecasts that carbon dioxide emissions from electricity generation will increase 37 million tons per year by 2020 under this scenario.

Under these circumstances, reducing global warming pollution from the electricity sector is bound to be difficult and expensive.

Figure 2: Forecast Power Plant Additions and Retirements in the Northeast through 2020



A Note On Electricity Units

Megawatts (MW) are the standard measure of a power plant's generating capacity, or the amount of power it could produce if operating at full speed. Utilities measure their ability to supply demand on the grid at any one time in terms of MW. One MW equals 1,000 kilowatts (kW). One thousand MW equals one gigawatt (GW).

Power plant output and electricity consumption over a fixed length of time are measured in terms of megawatt-hours (MWh). For example, a 50 MW power plant operating at full capacity for one hour produces 50 MWh of electricity. If that plant operates for a year at full capacity, it generates 438,000 MWh of electricity (50 MW capacity x 8,760 hours/year). To give a sense of scale, an average household uses about 10 MWh of electricity each year.

Most plants do not operate at full capacity all the time; they may be shut down for maintenance or they may be operated at only part of their maximum generating potential because their power is not needed or their power source (such as wind) is not available. The actual amount of power that a plant generates compared to its full potential is reported as its capacity factor. Thus a 50 MW plant with a 33 percent capacity factor would produce 144,540 MWh of electricity in a year (50 MW x 8,760 hours/year x 33% capacity factor).

Energy Efficiency Reduces Demand

Reducing carbon dioxide emissions from power plants doesn't have to be like swimming upstream. By tapping into regional potential for energy efficiency, the Northeast can reduce growth in electricity demand and in global warming pollution.

Efficiency programs produce long-lasting enhancements to buildings and equipment that save energy, reducing energy waste without reducing levels of service. Efficient products deliver the same amounts of light, heat, cooling, work, and access to information and entertainment as their counterparts—with less energy input.

The Northeast has a great deal of potential for additional energy efficiency measures, building on current programs to reduce—and eventually halt—growth in electricity demand.

The Northeast Has Enough Efficiency Resources to Eventually Halt Growth in Electricity Demand

Many Northeast states already have active energy efficiency programs. However, vast energy efficiency resources in the Northeast remain to be tapped.

According to an analysis by Optimal Energy, Inc. for Northeast Energy Efficiency Partnerships, New England's currently active efficiency programs will capture less than one-fifth of the region's achievable energy savings by 2013.[11] New York, New Jersey and Delaware have similarly large potential to save more energy.

There are three ways to look at energy efficiency potential: technically possible measures, economical measures, and achievable measures. Technically possible measures include all options regardless of cost; economical measures include all options that would make economic sense; and achievable measures take into account market and public acceptance barriers that limit how fast and how deeply economically sensible efficiency measures can actually penetrate society.

The Northeast has enormous economical efficiency potential. The New York State Energy Research and Development Agency (NYSERDA) found economic potential for savings of at least 50 million MWh per year by 2012, over 30 percent of forecast demand in New York and enough energy to supply 5 million households.[12]

Similarly, the New Jersey Board of Public Utilities and Rutgers University found that New Jersey could economically save close to 12 million MWh per year in 2020, 17 percent of 2004 demand.[13]

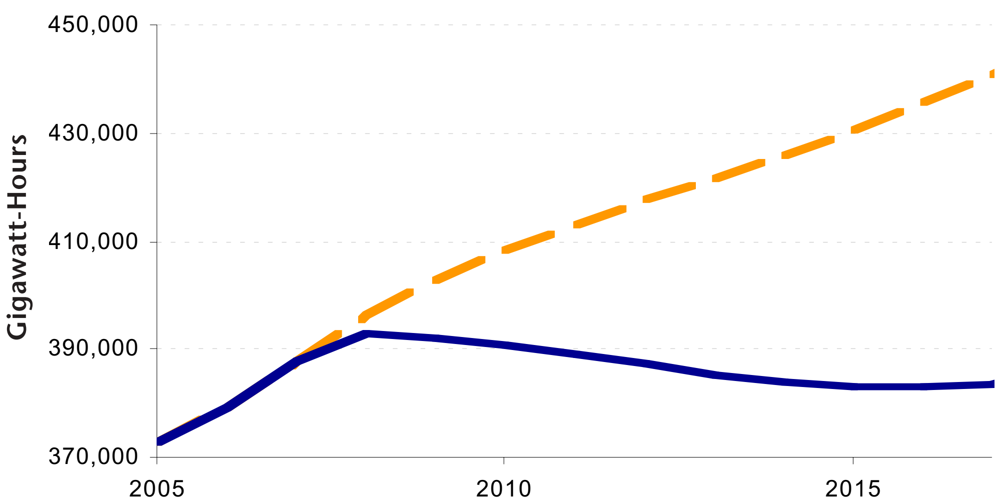
A majority of these efficiency measures are achievable as well. Optimal Energy Inc. and Northeast Energy Efficiency Partnerships found that achievable energy efficiency measures in New England could reduce regional energy demand by over 34 million MWh by 2013—more than offsetting the region's forecasted demand growth. Achievable measures could produce savings equivalent to the output of 28 combined cycle power plants (300 MW each) and return electricity demand to 1993 levels.[14]

Reviewing a set of leading recent studies on achievable efficiency potential nationwide, the American Council for an Energy Efficient Economy concludes that the typical state could reasonably achieve energy savings of 24 percent below forecast levels within 20 years.[15]

Compiling the estimates of the economically achievable energy efficiency potential from the Northeast efficiency studies leads to the conclusion that the Northeast could reasonably reduce projected electricity demand by 1.3 percent per year in the next decade, effectively halting growth in demand at 2007 levels. At this pace, by 2015 energy demand would be 11 percent lower than forecast levels. (See Figure 3.) (See Methodology on page 26 for modeling details.)

New technologies continue to emerge that can sustain this trend, given policies and programs that support their deployment.[16]

Figure 3: Forecast Energy Demand: Base Case Compared to Economically Achievable Efficiency Potential



Energy Efficiency—Can It Be Done?

Energy efficiency—because it represents energy saved, rather than energy produced—can seem less tangible than a power plant. However, energy efficiency resources are real and produce valuable results. With active development, support and regional coordination, efficiency measures can be a critical part of meeting the Northeast's energy needs.

Efficiency Programs Deliver Results

Efficiency programs tap into proven resources that deliver valuable energy savings to consumers.

Efficiency Vermont provides a great example of a successful and well-designed efficiency program. Efficiency Vermont is the nation's first statewide energy efficiency utility, specializing in assisting homeowners and businesses to identify and take advantage of cost-effective energy saving opportunities. Through technical assistance and financial incentives, Efficiency Vermont develops energy efficiency potential.

Efficiency Vermont is funded by a surcharge on consumers' electricity bills. The funds are administered by an independent non-profit organization under contract to the Vermont Public Service Board, and all work undergoes independent financial and savings verification audits, ensuring that the public's money is being well spent.

In 2004, Efficiency Vermont worked with 12 percent of the state's electric ratepayers to complete efficiency investments that resulted in:[17]

- 58 million kWh of annual savings, achieved at 37 percent of the cost utilities would have paid to purchase that energy on the wholesale market and deliver it to customers;
- Reducing growth in the state's energy needs by 44 percent and cutting summer peak energy demand by 9 MW; and
- $38 million in lifetime economic value—bringing the total value of efficiency measures installed over five years to $172 million.

The type of work Efficiency Vermont does is exemplified by the renovation of Enosburg Falls Middle and High School. Black River Design called on Efficiency Vermont to help optimize the energy efficiency of the project. Efficiency Vermont developed a design that capitalized on opportunities for cost-effective heating, ventilating, cooling and lighting—resulting in significant savings and a quality building. The school district spent $57,600, with incentives from Efficiency Vermont totaling $62,000, achieving annual energy cost savings of $32,600—a 56 percent return on the investment.

Efficiency Measures Need Active Support

If consumers have access to products that use less electricity, they may be able to pay higher rates for the electricity those products consume and still emerge with lower overall bills. However, there are many well-documented market barriers that prevent consumers from taking advantage of these efficiency opportunities (including information barriers; split incentives between builders and homeowners and landlords and tenants, in which one buys the equipment and the other must pay operating costs; and the need to pay for improved energy efficiency up-front versus over time).

Photo courtesy of Efficiency Vermont

Enosburg Falls Middle and High School was designed with efficiency in mind.

Efficiency programs are necessary to overcome these barriers. Well designed efficiency programs take these barriers head on—educating consumers, reducing split incentives, providing subsidies that reduce the up-front costs, and systematically driving the penetration of efficient technologies into the marketplace where they can make the greatest difference. As noted earlier, the potential for increased energy savings is large. However, efficiency programs need policy support and consistent funding to access this potential.

Efficiency Should Play a Central Role in Energy Strategy

Energy efficiency and conservation provide so many benefits for consumers, the environment, the local economy and the competitiveness of our businesses and industry that it should play a central role in the region's energy strategy. State officials, regulators, business associations and others should recognize these benefits, treat energy efficiency as a resource and take a leadership role in making conservation and energy efficiency a centerpiece of any broad-based initiative to promote economic growth and development, improve energy security and reliability, and protect the environment.

Reducing Demand Makes Pollution Cuts Easier and Less Expensive

Efficiency investments can provide the energy needed by a growing population and economy, while reducing pressure to build new power plants or operate older facilities to maintain reliability. Without this pressure, reducing global warming pollution will become easier to achieve.

Energy efficiency can also reduce the cost of cutting global warming pollution. Efficiency measures reduce costs to consumers in several ways. First, those individuals and businesses that implement energy efficiency see direct reductions in their energy costs over time. Second, all electricity consumers benefit from reduced costs to generate and supply power—particularly at peak periods when electricity is at high demand and is most costly to supply. Finally, all consumers benefit from reduced demand for fossil fuels, such as natural gas, which are used in several sectors of the economy.

Moreover, energy efficiency improvements benefit local economies. By reducing energy costs, efficiency measures free up money that consumers can then use on other goods and services. And consumer spending on energy efficient products tends to benefit local merchants and efficiency service providers, as opposed to spending on fossil fuels, which tends to siphon consumer dollars outside of the region—and often outside of the country.

The economic benefits of energy efficiency can offset the cost of a carbon cap, enabling a tighter carbon cap to be set at the same or less cost. Combining energy efficiency with a strong carbon cap would encourage high-polluting coal- and oil-fired power plants to reduce their emissions or give way to low-carbon forms of generation, delivering significant cuts in pollution.

Efficiency Measures Are Cheaper than Generating and Delivering Electricity

Efficiency measures are two-thirds less expensive than generating and delivering electricity.

In 2002, New England's public benefit fund programs produced energy savings at an average cost of 2.4 cents per kWh.[18] Northeast Energy Efficiency Partnerships estimates that capturing all remaining

Potential Efficiency Measures Span All Sectors of the Economy

Potential efficiency measures span all sectors of the economy and practically all uses of electricity. (See Table 1.) Lighting—as one of the major uses of electricity—holds a great deal of efficiency potential. In New England, lighting holds the greatest potential for savings in the commercial and residential sectors.[26] For example, commercial office buildings (without recent lighting upgrades) could reduce lighting expenses by half, producing net savings within one to three years.[27] Heating and cooling air and water hold potential for energy savings nearly as large. In the industrial sector, energy savings can come from more efficient motors, combined heat and power applications and advanced manufacturing technologies.

Table 1: Selected Efficiency Measures and Their Costs

Efficiency Measure	Net Cost (cents per kWh, levelized)
LED Traffic Signals[28]	-6.3
Improved Industrial Pump Efficiency[29]	0.0
Residential Compact Fluorescent Lighting[30]	0.1
Appliance Efficiency Standards[31]	1.0
Improved Building Codes[32]	2.5

achievable energy efficiency potential in New England would cost just 3.1 cents per kWh.[19]

In comparison, projections of the wholesale cost of power in New England range from 4 cents per kWh to over 5 cents per kWh over the next decade.[20] Including the cost of transmission and distribution capacity and transmission line losses, estimates increase to 9.4 cents per kWh.[21]

In 2004, Northeast consumers paid an average of 10.9 cents per kWh for electricity service.[22] However, electricity rates do not include the broader social, economic, environmental or public health impacts of electricity generation.[23] The nuclear industry, for example, has received more than $100 billion in federal subsidies since the end of World War II.[24] Fine particulate air pollution from power plants (largely coal-fired) causes an estimated 30,000 premature deaths each year as well as many illnesses, imposing health care and other costs on the economy.[25] The recent spike in natural gas prices—driven in part by increased demand from electric power plants—has had widespread economic ramifications beyond increases in electric rates. Environmental damage caused by the extraction of fossil fuel resources is extremely costly to remediate. Finally, the potential economic damage that could be caused by global warming is incalculable.

After considering these substantial costs, energy efficiency becomes even more attractive.

Reduced Energy Demand Leads to Lower Energy Prices

In addition to saving consumers money directly, reduced energy demand leads to lower energy prices.

This effect is explained by the economic principle of supply and demand. For example, energy efficiency reduces demand for natural gas and slows the upward pressure on natural gas prices. This is especially true because natural gas is often used for generation at the marginal (or peak) periods of demand, where efficiency has the greatest effect. (This is also particularly true when demand and supply are in tight balance—as they currently are for natural gas.) With efficient electricity use, people and industries that depend on natural gas have slightly smaller bills than without. These savings can then be reinvested in other parts of the economy, rather than spent on high-priced fuel imported from outside the region. This additional spending creates positive impacts throughout the economy.

Researchers at the Lawrence Berkeley National Laboratory estimate that for every 1 percent reduction in national natural gas demand, natural gas prices fall by 0.8 percent to 2 percent below forecast levels.[33] Reduced demand for electricity would have a similar effect on electricity prices.

In a recent analysis, the American Council for an Energy-Efficient Economy found that by 2008, the continental U.S. could reduce electricity consumption by 3.2 percent and natural gas consumption by 4.1 percent, while more than doubling renewable energy generation. These efforts would reduce natural gas prices 22 percent below projected levels.[34] In the Northeast region, a program of investment in efficiency and renewable energy could cut natural gas usage by 5 percent in five years, cutting natural gas prices by 6 percent.[35]

We estimate that deploying identified cost-effective energy efficiency measures in the Northeast electricity sector over the next decade would reduce electricity demand by 11 percent and utility natural gas demand by 11 percent versus projections in 2015. As a result, the average price of electricity would fall by 0.4 cents per kWh and the average wellhead price of natural gas would decline by 2.6 cents per thousand cubic feet. (See Methodology on page 26 for modeling details.)

Under this scenario, Northeast consumers would save a net of $13 billion from 2006 to 2020 (before factoring in the cost of a carbon cap). On average, a typical residential consumer would spend $1.56 less per month on energy bills over this period. A $51 billion investment in efficiency measures over the next decade would in 2020 yield direct savings of $47 billion from reduced electricity purchases, supplemented by $17 billion in savings through lower energy prices. These savings would rapidly grow in magnitude beyond 2020. Significant additional savings would stem from the social, environmental and public health benefits of efficiency investments.

Efficiency Measures Help to Avoid Reliability Payments

At the same time, efficiency measures will help to avoid reliability payments that New England's Independent System Operator (ISO-NE) is proposing to pay to generators in transmission-constrained areas.

Currently, ISO-NE makes payments to generators who have requested to shut down their plants when it determines that those plants are critical for reliability. Called "reliability must-run" contracts, ISO-NE considers these payments as evidence that the New England capacity market is broken. Salem Harbor in Massachusetts is one such plant under must-run contract.

ISO-NE has proposed an alternative market plan, called "Locational Installed Capacity" (or LICAP), in which payments will be made to generators based on the need for supply in a given geographic area.

The proposal of LICAP is a tacit admission that deregulation has not worked as promised. The assumption entering into deregulation was that market forces would ensure adequate capacity installations in the right places at the right times to ensure the continued function and reliability of the electric system. However, the proposal for LICAP shows that market forces have not succeeded in creating the most reliable configuration for the electric system.

A coalition of New England members of Congress predicts that regional electricity customers could pay up to $13.5 billion over the next five years, with no guarantee that generators would build new capacity to meet reliability concerns.[36] The plan has been officially protested by the governors and public utility commissions in all six New England states.[37]

However, to the extent that advanced efficiency programs relieve pressure in transmission-constrained areas by reducing demand, energy efficiency can reduce the need for LICAP—and for reliability must-run contracts. The improved reliability effects of efficiency measures could thus save consumers even more money.

Energy Efficiency Can Stimulate the Local Economy

Money saved by consumers through efficiency programs can then be spent for other goods and services, creating jobs and stimulating the local economy—in addition to reducing pollution.

The Regulatory Assistance Project estimates that from 2000 to 2010, existing energy efficiency programs in New England will reduce carbon dioxide pollution by 2 million tons per year—while creating $2 billion in economic output, over 1,000 jobs annually, and nearly $700 million in wages.[38]

A 2004 study by Synapse Energy Economics found that making greater use of energy efficiency and renewable energy nationwide would reduce carbon dioxide pollution almost 50 percent below business as usual by 2025—and generate $36 billion annually in savings.[39]

A 2003 study by the Tellus Institute for the World Wildlife Fund found that a suite of national-level clean energy policies would reduce electricity demand by 25 percent below projections and carbon dioxide pollution by 60 percent below 2000 levels—while producing net energy savings of $100 billion annually by 2020.

Efficiency programs can create productivity benefits as well, especially in the industrial sector. Investments that increase industrial energy efficiency can improve product quality, lower capital and operating costs, increase employee productivity, or help capture specialized product markets.[40] By increasing reliability and preventing power outages, efficiency programs can also create value for the economy. One recent study estimated the cost of power outages to U.S. businesses alone at between $104 billion and $164 billion per year.[41]

Energy efficiency is the key to reducing carbon dioxide pollution at the least cost—providing a net overall economic stimulus in response to investment in energy saving technologies. This can offset the effect of the carbon cap or stand on its own, making energy efficiency a "win-win" alternative for the Northeast.

Efficiency Programs Improve the Effectiveness of a Carbon Cap

The economic benefits of efficiency investments can enable a tighter carbon cap to be set without additional sacrifices by ratepayers, delivering more bang for the buck.

Efficiency savings would offset any increases in electricity cost caused by the carbon cap, enabling a stronger cap to be set at the same or less cost.

A carbon cap, by limiting the amount of carbon dioxide generators are allowed to emit and establishing a trading mechanism for carbon allowances (or permits to emit global warming pollution), would create additional costs for generators that would then be passed on to consumers. Energy efficiency (when explicitly included as a part of the cap-and-trade policy) can offset the increased price of electricity, because it saves consumers money directly on electricity bills, reduces the price of energy and reduces the need for reliability payments.

More importantly, however, with energy efficiency, policy makers could set a tighter carbon cap without additional sacrifices by ratepayers, delivering greater progress faster and a less cost. Setting a strong carbon cap would give high-polluting coal- and oil-fired power plants a strong incentive to reduce their emissions or give way to low-carbon forms of generation, delivering significant cuts in pollution. Since the owners of the plants would have to pay a fee for the right to emit each ton of pollution, power from those plants would become more expensive relative to power from cleaner, low-carbon power plants, thus tilting the market toward cleaner resources.

Halting growth in electricity demand will reduce pressure to continue operating the region's older, carbon-inefficient plants to maintain the reliability of the electric system. Efficiency programs do not need transmission lines in order to have an effect in transmission-congested areas, unlike central station power plants. Efficiency programs can reduce demand in these areas and thus help to increase the reliability of service—and reduce the extent to which older power plants are necessary to ensure that available capacity can meet demand. As a result, replacing these older plants will be more technically feasible.

A weak cap with no energy efficiency will force changes in technologies used to meet new demand for electricity. However, the old sources will face little incentive to reduce their emissions and may, in fact, face increasing pressure to continue operating to serve growing demand. A strong cap with energy efficiency, by contrast, will force changes in existing generation and its replacement with cleaner renewable technologies—delivering greater progress faster and for less cost.

Efficiency programs will have the additional benefit of reducing the pressure to import cheaper electricity from outside the region, resulting in leakage outside of the cap. If regulators fail to prevent this problem by regulating electricity imports as part of the cap-and-trade system, energy efficiency can mitigate the price differential that would result between the Northeast and neighboring regions with cheap (and often carbon-intensive) electricity. While efficiency measures on their own would likely not be enough to prevent leakage altogether, it would reduce the pressure to shift demand from Northeast generators to unregulated sources outside the region.

Energy Efficiency Won't Happen On Its Own

Because cap-and-trade programs are market-based mechanisms, many stakeholders expect that the market will automatically pick the least expensive route to comply—and if that route involves energy efficiency, price signals will be enough to drive the process.

However, markets tend to substantially under-value energy efficiency, preventing it from competing with supply-side measures on equal footing. Fundamental aspects of cap-and-trade policy design can also impede full consideration of energy efficiency opportunities.[42] For example:

- Substantial market barriers exist between sensible technologies and marketplace penetration, including:

- o Consumer awareness of energy saving measures;
- o The up-front capital cost of efficient technologies (balanced by long-term savings); and
- o Split incentives between builders and buyers or landlords and tenants. (For example, builders typically do not have an incentive to spend extra time and effort designing and building the most efficient building possible, and emphasize lower design and construction costs over reduced energy bills—making new buildings typically less efficient than they could be.)

- Because the proposed cap-and-trade program caps global warming pollution and not energy use, an electricity generator would not be able to take direct credit for reducing customer energy use. Financial incentives in the electricity market also promote greater electricity sales. Additional sales bring revenue to power generators and utility companies, while efficiency measures directly reduce retail revenue and lower wholesale market prices.
- Incorporating energy efficiency into a cap-and-trade program through an offset-mechanism poses challenges with the potential for double-counting and determining "additionality," or to what degree those investments would have happened anyway under business as usual conditions.[43]

Despite the advantages of energy efficiency—low cost, reduced pollution, economic stimulus—cap-and-trade programs don't necessarily promote energy efficiency automatically. Explicit policy support for efficiency measures is required to overcome the many barriers to a level playing field.

Policy Recommendations

The forthcoming carbon cap-and-trade policy under negotiation in the Northeast should explicitly include support of energy efficiency programs in order to produce the most effective results. States in the region should also pursue a comprehensive set of energy efficiency policies outside of, and parallel to, the cap-and-trade program.

Northeastern States Should Make Energy Efficiency a Central Part of Their Plan of Attack on Global Warming

Emissions allowances should be sold at market price and the proceeds should be dedicated to fund energy efficiency and other public benefit programs.

- To ensure the fairness of the cap-and-trade program, emission allowances (that is, permits that allow a facility to emit carbon dioxide) should not be given to generators for free. Emissions allowances have monetary value. Giving them away for free would effectively create billions of dollars in "windfall" profit for polluters.
- Instead, facilities that emit pollution should be required to purchase allowances, creating a "polluter pays" mechanism. The proceeds should be directed toward energy efficiency and other public benefit programs, reducing the overall cost of the policy, accelerating the transition of the electric system toward less carbon-intensive fuels and enabling the Northeast to meet meaningful pollution reduction targets.

The cap should reduce global warming pollution to 25 percent below current levels by 2020, growing tighter over time.

- In order for the cap to be effective in producing benefits for the environment and public health, the cap must first be set at an achievable but ambitious level that forces the development and deployment of new technologies. In the case of a carbon cap, the cap must be set low enough to promote curtailment, efficiency improvements, and fuel switching at the most polluting power plants. Tightening the cap over time can continue momentum toward the desired region-wide shifts in the electricity system. If the cap is set at a weak level, it will fail to drive significant technology changes.

Reductions must be achieved first and foremost from a mandatory cap on carbon dioxide emitted from fossil-fueled power plants in the Northeast, including electricity imports.

- To maximize the benefit of a cap-and-trade program, the scope of the program needs to be clearly defined. The cap must include regulations on electricity imports to prevent leakage. Otherwise, generators outside the Northeast could sell cheap and carbon-intensive power into the region, undermining the effect of the cap.
- Some cap-and-trade programs allow offsets, or pollution-reducing actions from outside the industry to which the cap applies. However, it is difficult or impossible to guarantee that offsets deliver equivalent emissions reductions. Offsets also have the potential to eliminate the ancillary benefits of direct and local actions. For example, allowing an offset for an energy efficiency program in India would not create jobs and economic growth in the Northeast, or help to reduce health-damaging pollution from local power plants. Offsets should not be considered at all until a cap-and-trade program has matured and been proven effective. If offsets are eventually considered, they should meet conservative and rigorous criteria to ensure that they enhance the benefit of the cap-and-trade program.[44]

Northeastern states should pursue a comprehensive set of energy efficiency policies outside of and in parallel to the cap-and-trade program, including but not limited to:

- Establishing dedicated efficiency programs that are independent of electricity and gas service providers (like Efficiency Vermont), and ensuring enough funding to tap achievable efficiency potential;
- Improving residential and commercial building codes;
- Setting minimum appliance efficiency standards;
- Stimulating the deployment of combined heat and power technologies; and
- Educating consumers about energy efficiency opportunities.

Energy-saving compact fluorescent lightbulbs

Methodology

In this report, we model the investment required to develop achievable efficiency savings in the Northeast, the direct savings consumers would receive, and the effects energy efficiency would have on overall electricity and natural gas prices—compared to a business-as-usual case derived from Energy Information Administration forecasts.

Establishing the Default Path

To allow for a comparison with the benefits of energy efficiency, we first established a baseline forecast for energy demand in the Northeast from 2005 to 2020. In general, the baseline forecast was established using the most recent statistics from the U.S. Energy Information Administration (EIA) for the Northeast's electricity sector, forecast to 2020 using the trajectory set in the regional tables of EIA's *Annual Energy Outlook 2005*.[45]

Annual Energy Outlook tables are divided by region. Region 7 includes all of New England; Region 6 represents New York; and New Jersey and Delaware are part of Region 3 along with other Mid-Atlantic states. For New Jersey and Delaware, we started with energy demand in 2002 from EIA's State Electricity Profiles, then extrapolated to 2020 using the growth rate in the *Annual Energy Outlook*. Estimates for New England, New York, and New Jersey and Delaware were added together to represent the 9-state Northeast region.

We made similar forecasts for electricity prices, natural gas consumption (total and utility-only) and coal consumption, based on EIA data. We also looked up projected national demand for coal and natural gas for use in calculating the price effects of regional energy efficiency programs.

Creating an Energy Efficiency Scenario

Based on estimates of achievable energy efficiency potential compiled from four studies, listed below, we concluded that the Northeast region as a whole could reasonably reduce forecast energy demand by 1.3 percent per year through 2015.

1) New England, by Optimal Energy, Inc. for Northeast Energy Efficiency Partnerships
2) New York, by Optimal Energy, Inc. et al. for the New York State Energy Research and Development Authority,

3) New Jersey, by KEMA Associates for the New Jersey Board of Public Utilities and Rutgers University, and

4) Delaware, using a compilation of national studies by the American Council for an Energy Efficient Economy as a proxy.

Modeling Consumer Savings and Price Dynamics

We developed a Northeast-specific energy and economic model to project the specific energy price impacts of deploying identified energy efficiency measures from 2006 to 2015.

To model consumer savings, we calculated:

- Consumer investment necessary to achieve the efficiency scenario;
- Direct avoided electricity costs due to reduced energy demand;
- Consumer savings on non-utility natural gas purchases, caused by natural gas price dynamics;
- Consumer savings on electricity due to electricity price dynamics;
- Annual net savings; and
- Cumulative net savings.

All dollar values are used and reported in terms of 2002 equivalent.

Consumer Investment

To yield the required level of energy savings, we estimated that a ten year energy efficiency program would be required, with spending levels of $3.2 billion per year from 2006 to 2015, divided into the following categories:

- 15 percent for administrative expenses;
- Of the remainder, 38 percent for residential efficiency programs, 45 percent for commercial, and 17 percent for industrial.

We assumed energy savings of 3.14 GWh/yr for every million dollars of investment and a 15-year benefit period, based on an analysis of public benefit fund expenditures in New England by the Regulatory Assistance Project.[46] Additionally, we assumed a declining rate of investment effectiveness of two percent per year, assuming that the most effective investments would be made first.

Consumer Savings and Price Dynamics

Consumer savings estimates consisted of avoided electricity purchases—simply the amount that would have been spent to purchase electricity in the absence of efficiency savings—and the effect of reduced energy demand on energy prices.

We assumed that efficiency programs would have the effect of reducing upward pressure on the price of electricity, natural gas and coal, which are set by a regional and national market. Based on estimates of how much natural gas and electricity would be saved compared to the base case forecast, we predicted change in national demand. In turn, the change in national demand was translated into an estimate of the effect on electricity and natural gas prices in the Northeast.

Natural gas prices were calculated using the following coefficients:[47]

Intercept	Year	Quantity	Deflator
0.0052	-0.1485	2.0817	1.0101

And Equation 1 below.

Equation 1:

$$\frac{[\text{Intercept}] \times (\text{Number of years since 2003})^{[\text{Year}]} \times [\text{National Demand}]^{[\text{Quantity}]}}{[\text{Deflator}]}$$

Electricity price impacts were calculated by estimating displaced utility related investment and operating/maintenance costs in the efficiency scenario compared to the base case.

Annual and Net Consumer Savings

We examined the effect of the ten-year efficiency program on consumer spending for energy during the period 2006-2020. To obtain final estimates for annual and net consumer savings, we added all consumer outlays for efficiency programs and subtracted savings from avoided electricity purchases and reduced energy prices. Net savings were obtained by adding annual savings from 2006 to 2020.

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