Acadia Center

EnergyVision 2030

Transitioning to a Low-Emissions Energy System in the Northeast

Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont

An Achievable Vision of a Clean Energy Future

Clean energy technologies offer an historic opportunity to build an energy future that produces large benefits: modernization of our energy systems, better options for all consumers to control energy costs, advanced economic growth, and dramatically reduced climate pollution. Numerous studies show that by leading on clean energy innovation states can save residents and businesses money, keep more energy dollars in the region, grow the workforce, and secure a healthier future. As a result, Northeast states are making commitments to build a clean energy future, and as they do, questions arise: what impact will current efforts to expand clean energy resources have over time? Where can we do more to advance this future? What amount of clean energy is needed to adequately reduce carbon pollution and meet current emissions targets?

EnergyVision 2030 analyzes these questions by taking a comprehensive look at where efforts to expand clean energy resources can lead, how consumer adoption and market penetration rates can grow, and what increases in clean energy efforts are needed to attain state and regional emissions goals.

EnergyVision 2030 data show that progress is being made and with further strategic action, expanding adoption of modern, market ready technologies can reduce climate pollution emissions 45% by 2030: a target needed to put the region on the path to meet scientifically directed emission reductions of 80% by 2050. This is a goal most of the Northeast states have made a commitment to in some form. By acting now to reform outdated rules and financial incentives that still encourage investments in old and expensive energy choices and taking steps to facilitate consumer adoption and remove barriers, the region can benefit all residents and achieve its climate commitments.

EnergyVision 2030 suggests one pathway to advance adoption of clean energy technologies in four core areas—grid modernization, electric generation, buildings, and transportation—and demonstrates that even relatively modest increases of clean energy technologies can significantly reduce emissions while delivering consumer and economic benefits for all. EnergyVision 2030 further conducted a second scenario to examine the emissions reductions that could be achieved with stronger actions to accelerate growth in clean energy markets; this Accelerated Scenario is presented in an appendix to the report.

The results of the modeling for selected key technologies are summarized below. Some market segments are already growing, and states can redouble efforts beyond current commitments to accelerate consumer benefits and bolster their emerging clean energy economies.

Comparative Market Penetration of Selected Clean Energy Technologies, present to 2030

	Current Market Levels (2015)	2030 Baseline Under Current Trends	EnergyVision 2030 Primary Scenario	EnergyVision 2030 Accelerated Scenario
Electric Vehicles (% of fleet)	<1%	5%	17%	23%
Heat Pumps (% of residential heat)	<1%	3%	13%	16%
Electric Generation (% renewable)	19%	44%	57%	66%
Wind and Solar	3%	24%	35%	45%
Hydro	13%	18%	20%	19%
Other	4%	3%	2%	2%
Electric Efficiency (average % annual savings)	1.4%	1%	2.5%	2.7%
Emissions Reduction from 1990 Levels	18%	30%	45%	50%

Components may not sum due to rounding

> **Summaries of each key area follow. Additional details about the modeling and each of the four key areas are available in separate companion briefs at** 2030.acadiacenter.org**.**

Grid Modernization

Energy Grid

Today's grids—and the policies that govern them—are often out of sync with technological advances and consumer expectations for a clean, reliable energy system. Clean, local energy resources like energy efficiency, distributed renewable generation, and energy storage are tools that can solve grid problems instead of relying only on building expensive infrastructure projects. Sophisticated metering technology can support innovations in how consumers pay and are paid for electricity, rewarding them for optimizing their energy generation and consumption. Updated rules, planning processes, and financial incentives can enable the adoption of technologies critical to meet 2030 and longer term emissions reduction targets.

To take full advantage of opportunities to benefit consumers and advance emissions-reducing technologies, the rules and regulations governing the electric grid need to be comprehensively updated. The present grid was designed at a time when centralized power generators exclusively controlled a one-way flow of electricity to consumers. A modern grid needs to accommodate greater consumer control and two-way flows of power. Building the modern grid will require updating the rules that govern grid plans, energy markets, and financial incentives so that clean energy resources can flourish. Utility revenue can be linked to achieving affordability and climate change goals. Grid modernization will provide the backbone that supports the carbon-cutting changes in all sectors.

Advanced communication and management systems can unlock the potential of flexible customer demand and managed usage, or load, to efficiently optimize the grid. These improvements will lower consumer energy bills, maximize the value of renewable energy generation, and reduce overall system costs. The modern grid will empower consumers to better control their energy use and costs, if it establishes fair rates for all consumers.

Demand Optimization

Optimizing energy usage allows us to reduce demand on the grid strategically, ultimately reducing the peak level of demand when the grid is most strained and expensive to run. Optimization can supply energy according to user needs and when renewable generation is available.

Optimization can be accomplished through demand response, active load management, and energy storage. Acadia Center analysis shows that **implementation of these approaches together could contribute a total of 8,000 MW of new resources** to facilitate load optimization by 2030.

Demand response (DR) provides the ability to reduce or shift energy consumption during periods of high demand. Traditionally, DR is done through coordination between utilities and large customers. Our forecast shows 4,000 MW of demand response is needed in 2030, twice the level of today, but close to the levels in the market ten years ago.

Active load management (ALM) is similar to DR but automated so that large numbers of smaller customers can participate, often without a discernible change in service. Smart or programmable technologies make ALM possible. For example, automatically preheating a water heater when renewable generation is available helps optimize the grid and reduce the need for fossil fuel sources. Our forecast requires 1,800 MW of ALM by 2030.

Energy storage, such as batteries, can store power and release it later. For instance, storage can bank solar energy produced during midday and release it after sunset. Electric vehicles can contribute to grid optimization through smart coordinated charging and storage. Our forecast shows 4,200 MW of electric storage is needed in 2030, equivalent to the battery capacity of just 26,000 electric vehicles.

These technologies have all been commercially demonstrated and are critical to optimizing use of the existing grid,[1] which will better enable renewable generation to meet demand and reduce customer costs.

EnergyVision 2030: Modeling

EnergyVision 2030 analyzes trends in the region's energy markets using a respected energy system model, the Long-range Energy Alternatives Planning System (LEAP), licensed from Stockholm Environment Institute, to project a detailed forecast of energy consumption and emissions in all sectors. Acadia Center incorporated the U.S. Energy Information Administration's Annual Energy Outlook (AEO) forecast, ISO New England's Capacity, Energy, Loads, and Transmission (CELT) forecast, and other data sources as appropriate. The LEAP model allows simulation of the electric system to determine the generation mix and to ensure that there are sufficient resources to satisfy peak summer and winter demand. More detail is provided in the Technical Appendix of the report.

Electric Generation

Solar and wind power are emerging as cost-effective alternatives to traditional fossil-fueled generation sources. Across the United States, solar prices have dropped dramatically and installed capacity has grown exponentially.[2] New York and New England have vast untapped solar and on- and off-shore wind resources. Harnessing this clean, low-cost generation is critical to meeting the 2030 emissions target.

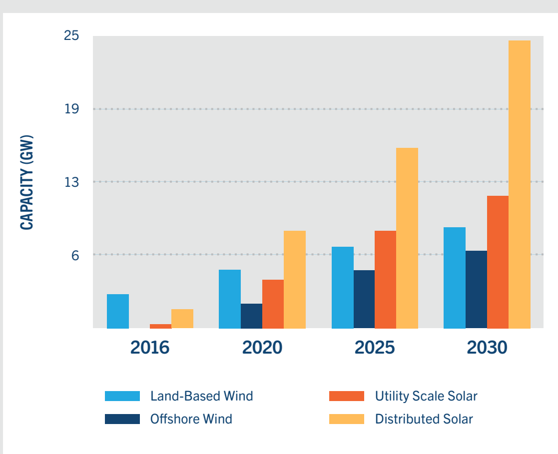
Grid-Scale Generation

The sources of electricity generation in the Northeast region shifted significantly from 2001 to the present. Coal use declined from 16% to 2.5% and natural gas increased from 28% to 45%.[3] The successful Regional Greenhouse Gas Initiative (RGGI) cap-and-trade program and related policies and market changes contributed to this trend by making lower-carbon generation more competitive. Cheaper natural gas has pushed out older, less-efficient coal and oil generation; however, the region's increasing overreliance on natural gas will provide few additional emissions benefits and increases risks of price volatility or supply disruption. Hydraulic fracturing has reduced natural gas prices but raised concerns about impacts on local communities and climate. Expanding renewable generation is a less risky alternative that provides stable costs, mitigates fuel price risk, and reduces emissions.

To realize the benefits of renewables and meet the 2030 emissions target, **42% of New England's generation needs to be Class I renewable (i.e. primarily wind and solar) in 2030—nearly double the requirements** under current state renewable portfolio standards (RPSs). **New York will need to achieve or surpass 50% renewable energy and hydroelectricity, as currently promised in its Clean Energy Standard.** To achieve this scale of renewable energy generation, New England can increase solar 12-fold and on-shore wind six-fold; New York can increase solar generation 20-fold and triple on-shore wind generation. In New York and New England there is 8,200 MW of potential offshore wind in areas already leased for development alone.[4]

These targets require rapid growth rates, but other regions have demonstrated that rapid market expansion is possible. Texas increased its onshore wind capacity by 7,300 MW in five years: more than New York and New England would need to add by 2030.[5] California increased its utility-scale solar capacity by 3,500 MW in two years—nearly the growth needed in New England over the next 14 years.[6] For off-shore wind, Europe exceeded the growth rate needed in the Northeast, increasing capacity 16-fold from 2005 to 2015.[7]

Forecasted Renewable Energy Growth in New England & New York



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Pipelines

Building clean generation and implementing energy efficiency measures will decrease natural gas demand in the region. Through 2030 and beyond, Acadia Center analysis shows that the current and planned pipeline capacity in New England will be sufficient to meet both building and electric generator needs. Adding new pipeline capacity to the region would cost ratepayers billions of dollars and would lock the region into higher-emission gas generation for decades.

Distributed Generation

Distributed generation (DG) such as rooftop solar[8] provides emissions-free renewable energy that advances energy independence and can reduce the need for utilities to build new transmission and distribution infrastructure. Like utility-scale solar, costs for rooftop solar panels have declined significantly. To reach the 2030 emissions target, **8.5 GW of residential and community solar—equivalent to approximately 1.1 million residential rooftop installations**—will need to be added. **Commercial solar, including municipal and government solar, would contribute 16 GW of capacity, and grid-scale solar would provide the remaining 11 GW** needed across New York and New England.

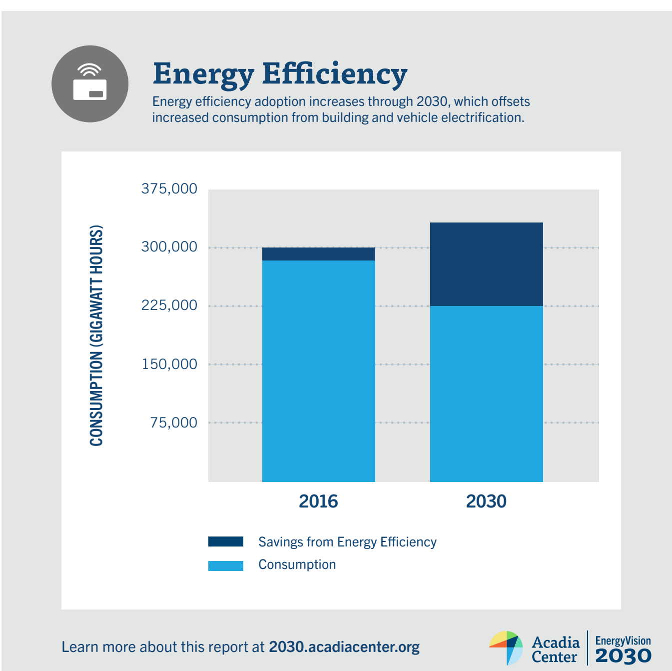
Vermont has shown that rapid deployment of distributed solar is possible.[9] Rooftop solar capacity in Vermont grew by nearly 100% annually between 2013 and 2015, exceeding the 20% annual growth rate needed to meet the 2030 emissions goal in the Northeast. To ensure widespread and equitable adoption of distributed energy resources, the region must reform how regulators assign monetary value to local, distributed solar. States must also develop appropriate compensation models and planning processes that put solar in reach of all customers.

Buildings

Buildings offer significant energy efficiency investment opportunities that can be combined with clean heating technologies to provide deep emissions reductions. Efficiency improvements—like home insulation and LED lighting—significantly reduce energy use, complement the adoption of advanced technologies, and make buildings more comfortable and affordable to heat and cool.

Energy Efficiency

The Northeast is a national leader in investing in energy efficiency. Not only is efficiency the lowest cost and cleanest energy choice, it provides enormous economic gains, creates jobs, and saves consumers money. Increasing investments in efficiency have made nearly $500 million of expensive transmission line upgrades no longer necessary in New England. Efficiency investments have reduced the cost of doing business, lowered consumer energy bills by billions of dollars, and provided healthier, more comfortable spaces to live and work in. Energy efficiency works hand in hand with coordinated improvements in the energy system: by reducing overall demand for energy, energy efficiency allows renewable energy resources to ramp up and offsets increased electricity demand from electric vehicles and heat pumps. Many, but not all, Northeast states have strong efficiency plans in place, and states must continue to show a sustained commitment to electric efficiency in order to reduce energy consumption and minimize costs. Leading states like Massachusetts and Rhode Island have achieved the highest electric savings rates in the country—approaching 3% annually—demonstrating the large market potential that exists for cost-effective efficiency investments. Acadia Center modeling shows that if on average all Northeast states achieved at least **2.5% annual efficiency goals,** efficiency would reduce emissions from electricity generation and offset additional demand from new technologies. Some states in the region are meeting—and even exceeding— this level of efficiency cost-effectively, but all states need to make longer-term commitments to ensure this trend continues through 2030.

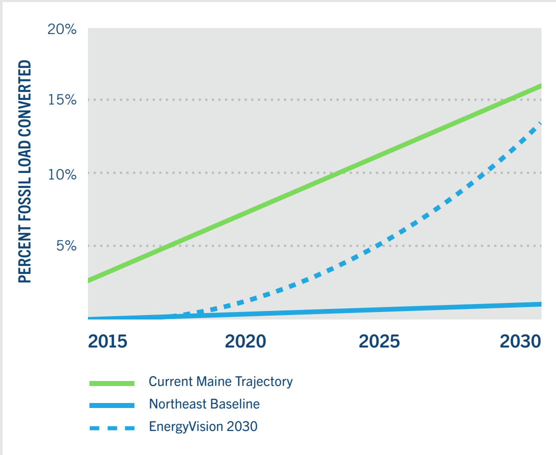


Efficiency opportunities are also plentiful for non-electric energy use. Weatherizing buildings, replacing outdated equipment, and improving industrial processes reduce the amount of fossil fuels consumed in buildings. Acadia Center analysis finds that **natural gas and delivered fuel (fuel oil and propane) efficiency savings must increase to 1.4% and 1.2% per year, respectively,** to help achieve the region's emissions goals. Again, leading states are already showing the way, with Massachusetts achieving over 1.25% natural gas savings per year. To achieve these targets, lagging states need to capture all cost-effective efficiency and leading states need to sustain and even improve their current efforts.

Heat Pumps

Heat pumps are a form of efficient electric heating for residential and commercial buildings. They use air to air exchangers or ground source loops to transfer heat between the inside and outside of a building. An air conditioner is a type of heat pump that moves heat from inside a building to cool it; heat pumps reverse this process. Even in the coldest weather, a heat pump is far more efficient than traditional electric baseboard heating and can displace heating from oil and gas at very low temperatures. Acadia Center modeling shows that **13% of oil, gas, and propane heating in homes and 5% in businesses need to be converted to heat pumps by 2030** to put the region on track to meet its emissions goals. Maine, the coldest state in the region, has already shown this conversion rate is possible, converting 3% of its residential heating stock to heat pumps in just nearly three years.[10] To capture this potential, heat pumps must be promoted through incentive programs, consumer education, workforce training, and electric rate design.

Heat Pump Adoption In New England



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Water Heating

Homes and commercial facilities in the Northeast rely on electricity, oil, propane, or gas to generate heat for hot water. Just as with building heating, heat pumps can now replace these existing systems, simultaneously decreasing emissions and lowering annual costs. Conventional water heaters can also be replaced by solar thermal water heater systems that use energy from the sun to heat water, which is then stored until needed. **Northeast states need to replace 11% of fossil-fueled water heaters with heat pumps and 1% with solar thermal systems.**

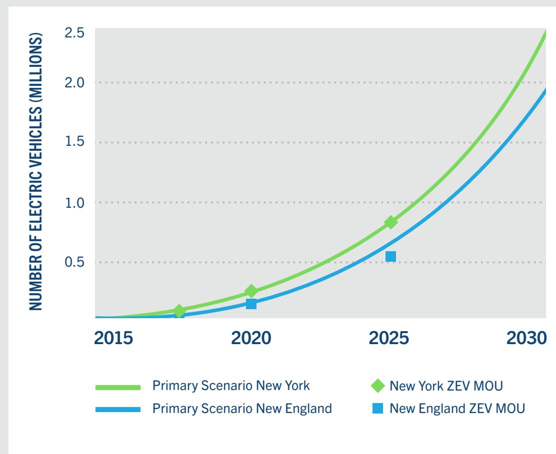
Transportation

Transportation is the largest source of emissions in the Northeast and traditionally the most difficult emissions sector to address, but rapidly evolving technology offers deep reduction potential. Electric vehicles (EVs) and innovations in mobility options can help improve transportation efficiency and reduce emissions.

Electric Vehicles

Electrifying cars and light trucks will deliver significant emissions reductions by 2030. An EV emits less than half the CO2 of a conventional vehicle. EVs will produce even fewer emissions as technology improves and more electricity is generated by renewables.[11] EVs are a practical, commercially available technology that can save consumers money, even at today's low gas prices. Massachusetts, Connecticut, Rhode Island, Vermont, and New York have already committed through a memorandum of understanding (MOU) to put nearly 1.4 million zero emissions vehicles (ZEVs) on the road by 2025.[12] **These commitments can be expanded to include all states in the region and strengthened through ambitious yet achievable deployment targets for 2030: 17% of cars and light trucks and 2.5% of medium-duty trucks electrified.** California has demonstrated that rapid deployment of EVs is possible, achieving 3.6% of sales in 2016. Deployment will require smarter electric rates that make EVs more attractive to drivers. Consumer incentives to facilitate EV purchases are also needed to grow markets but would decline over time. Pricing emissions from transportation fuels will accelerate EV adoption while raising funds for rebates, electric vehicle charging infrastructure, transit, and other transportation sector investments.

Projected Electric Vehicle Adoption Rate



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Increasing Mobility Options

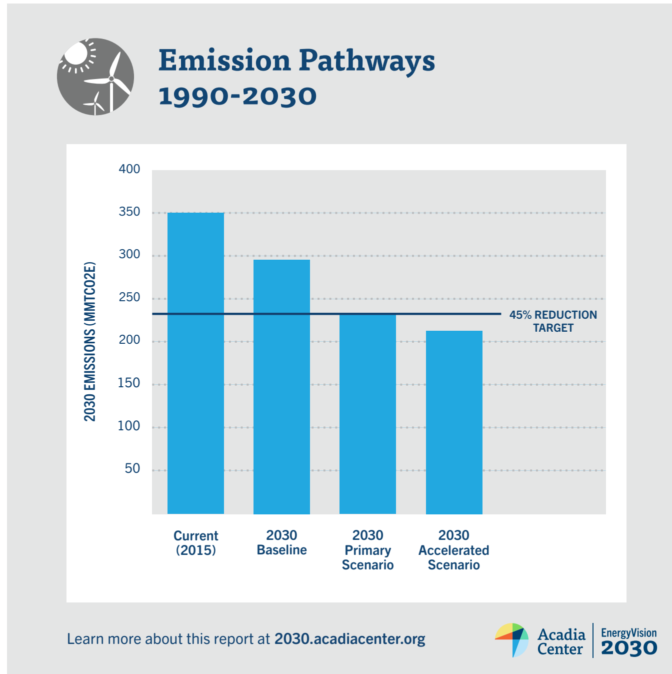
In both rural and more congested areas, improving the availability of alternatives such as public transit, walking, biking, carpooling, and ride-hailing services can reduce the number of vehicle miles traveled (VMT) and related emissions. To meet emissions targets by 2030, the region can **slow projected VMT growth from 8% under current policies to 3%, a VMT reduction of 5% over the 15-year period.** To put this in perspective, VMT in the Northeast dropped 5% in the period of 2007 to 2011, an equivalent reduction in only 4 years. States can reach this target in a number of ways: transit programs can expand in more urbanized areas with below average numbers of public transportation commuters such as in Connecticut and Rhode Island. Rural areas can expand bus and on-demand ride services to improve connectedness. States can improve zoning regulations to help create vibrant, walkable communities, improve connectedness, and preserve open space.

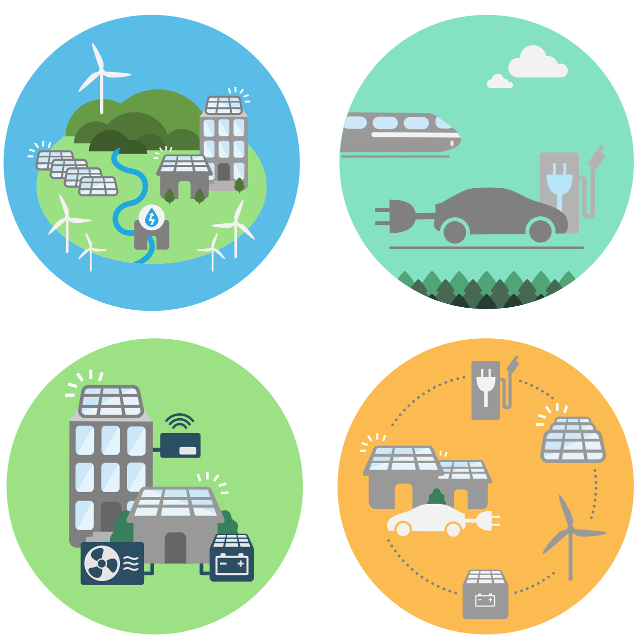
A Clean Energy Pathway in the Northeast

By expanding clean energy, Northeast states will reduce emissions in 2030 by 45% from 1990 levels and be on a path to meet an 80% reduction by 2050. This 80% reduction reflects the scientific consensus for reductions needed to avoid the worst impacts of climate change and is a target many states in the region are legally mandated to achieve.

New York and New England have long reaped the benefits of investing in technological advancement. Over the next 15 years, state and regional policies and consumer demand will shift the energy system towards more efficient, cleaner electric generation. The question is how fast can states move to help expand this transition?

A perfect storm of progress is forming as clean energy technologies advance and costs decline. Building a cleaner, low-emissions energy system will increase consumer choices, improve local economies and public health, create jobs, and produce a more resilient and flexible energy system. EnergyVision 2030 shows one “can-do” path forward that states can pursue to lead this transition to a low-emissions energy system. Northeast states can assert their leadership and, by acting now, accelerate the arrival of the clean energy future.





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Acadia Center is a non-profit, research and advocacy organization committed to advancing the clean energy future. Its approach is characterized by reliable information, comprehensive advocacy, and problem solving through innovation and collaboration. EnergyVision 2030 is a product of Acadia's Climate and Energy Analysis (CLEAN) Center and produced by Acadia Center staff. Thanks to Public Displays of Affection for visualizations and design.

acadiacenter.org • info@acadiacenter.org

Boston, MA 617-742-0054 • **Hartford, CT** 860-246-7121 • **New York, NY** 212-256-1535
Providence, RI 401-276-0600 • **Rockport, ME** 207-236-6470

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