STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION

REVIEW OF ELECTRIC DISTRIBUTION DESIGN PURSUANT TO R.I. GEN. LAWS § 39-26.6-24	)	Docket No. 4568

PRE-FILED DIRECT TESTIMONY OF ABIGAIL ANTHONY, PH.D.

ON BEHALF OF ACADIA CENTER

I. INTRODUCTION

National Grid has filed, in Docket No. 4568, a "Review of Electric Distribution Rate Design." The opening of the Docket and the filing of the rate design were required in the Renewable Energy Growth Program legislation enacted in 2014. Based on concerns that the rate design proposal is unfair to consumers and contrary to state public policy goals, the proposal is not "reasonable and just" under R.I. Gen. Laws § 39-2-1 and fails to take into account many of the balancing factors under R.I. Gen. Laws § 39-26.6-24(b). Acadia Center recommends that it not be approved.

II. QUALIFICATIONS

Q. Please state your name, title, employer, and business address.

A. Abigail Anthony, Ph.D.; Director, Grid Modernization Initiative & Director, Rhode Island Office; Acadia Center; 144 Westminster Street, Suite 203, Providence, RI 02903.

Q. Please summarize your educational background and work experience.

A. I have been employed by Acadia Center since 2007. In my current position, I direct Acadia Center's Grid Modernization and Utility Reform initiative, focusing on changing regulatory and economic incentives in order to achieve a sustainable and consumer-friendly energy system. My responsibilities include overseeing Acadia Center's efforts to advance grid modernization and the organization's participation in legislative and regulatory proceedings in Massachusetts, New York, Rhode Island, and Connecticut. I participated as an expert on a panel in the grid modernization process in Massachusetts. I was the project leader and primary author of "UtilityVision: Reforming the Energy System to Work for Consumers and the Environment." UtilityVision outlines specific steps needed to modernize the power grid, including reforms to the utility business model, grid planning, and rate-making that will guide infrastructure investments to a consumer-focused and technology-friendly energy system.

I have played a leading role in advancing Rhode Island's energy efficiency procurement policies, particularly through my appointment by Governor Carcieri (and re-appointment by Governor Chafee) to the Rhode Island Energy Efficiency and Resource Management Council.

I received a PhD in Environmental and Natural Resource Economics in 2009 from the University of Rhode Island. My research at the University of Rhode Island examined the effectiveness and cost-effectiveness of residential demand response programs for maintaining grid reliability in increasingly hot weather. I received my MA and BA in economics from the University of Montana.

A copy of my resume is appended to this testimony as Exhibit No. AC-1.

Q. Have you provided expert testimony as part of your professional work?

A. Yes, I provided expert testimony before the Maine Public Utilities Commission in January, 2013. My testimony was in support of the assessment of Maine's "Maximum All Cost-Effective" level of energy efficiency. My testimony demonstrated that states that have policies of investing in all energy efficiency that is cost-effective and lower than the cost of supply have realized large economic and environmental benefits.

Q. Have you previously testified before the Rhode Island Public Utilities Commission?

A. No.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to describe how our energy and electric systems are changing, principles for reform in this new context, and describe my review and conclusions with respect to the tiered fixed customer charge proposals from National Grid in this docket. Testimony regarding the Access Fee proposal will be submitted separately at a later date.

III. BACKGROUND ON THE CHANGING ENERGY SYSTEM AND NECESSARY REFORMS

Q. Please describe emerging trends in the energy system that are relevant to this proceeding.

A. Electric customers increasingly have access to new lower cost technologies that enable clean local generation and customer engagement. Traditional utilities are in the midst of a paradigm shift as demand for these technologies and states' public policy goals require a new utility business model to accelerate the deployment of clean energy resources, including energy efficiency and distributed energy resources. Jurisdictions, for example New York, are exploring how policy and regulatory change – including rate reform – can enable utilities to become full partners and remove barriers to the deployment of clean energy resources and advance consumer choice and control. Such changes will influence the pace at which the energy system inevitably shifts to a more decentralized model with significant levels of local, distributed energy resources.

Q. How will ratepayers, citizens, and states benefit from the changing energy system?

A. In addition to empowering consumers and communities, the transition to a modern, low-carbon energy system will generate significant public health, environmental, and economic benefits. Acadia Center assessed the greenhouse gas (GHG) emissions reduction potential from transitioning to a low-carbon energy system, and the results are presented in "EnergyVision: A Pathway to a Modern, Sustainable, Low Carbon Economic and Environmental Future." I submit this document as Exhibit No. AC-2. The analysis shows that if the Northeast were to electrify all passenger vehicles and homes heated with fossil fuels, GHG emissions from these sources would be cut in half. By maximizing energy efficiency and deploying new technologies and renewable resources, the region can achieve long-term GHG emissions reduction targets of 80% below 1990 levels by 2050.

Investing in clean local energy resources like energy efficiency and distributed solar PV helps avoid expensive distribution, transmission, large-scale generation investments and provides economic benefits, including good local jobs. It is well documented that energy efficiency investments have allowed the region to avoid or defer major transmission upgrades. Similarly, the Tiverton/Little Compton pilot project in RI, the Brooklyn/Queens Demand Management project in NY, and the Boothbay pilot project in ME are real-world examples of local clean energy resources deferring or avoiding upgrades to the distribution grid. The key concept is that customers, and the choices they make, are no longer just cost centers to whom a fair share of system costs must be allocated. Customers, and a whole host of energy resources connected to the distribution grid, are now able to provide major ratepayer and societal benefits, but they need a proper incentive structure in order to do so.

Q. Has Acadia Center explored how to reform utility regulation to realize the benefits of a modern, low-carbon energy system?

A. In February 2015, Acadia Center released "UtilityVision," a framework laying out reforms to utility regulation to move towards a fully integrated, flexible, and low carbon electric grid that puts consumers at the center. I submit this document as Exhibit No. AC-3. The three categories of reforms are: (1) comprehensive, proactive, and coordinated planning for the electric grid; (2) updated roles for regulators, utilities, and stakeholders; and, (3) fair pricing and consumer protection for all.

Q. Does UtilityVision recommend reforming retail electricity rates?

A. UtilityVision makes separate recommendations for 'How Consumers Pay for the Power They Use' and 'How Consumers Get Paid for the Power They Produce.' In the long run, these reforms are tightly linked but they can be considered separately in the shorter term.

Q. How do these recommendations relate to historic principles for retail rate design?

A. Discussions on retail rate design often refer to a long list of general principles laid out by James Bonbright in 1961. These are often summarized or referred to in short hand, but in full they are:

1. The related, "practical" attributes of simplicity, understandability, public acceptability, and feasibility of application.
2. Freedom from controversies as to proper interpretation.
3. Effectiveness in yielding total revenue requirements under the fair-return standard.
4. Revenue stability from year to year.
5. Stability of the rates themselves, with a minimum of unexpected changes seriously adverse to existing customers. (Compare "The best tax is an old tax.")
6. Fairness of the specific rates in the apportionment of total costs of service among the different customers.
7. Avoidance of "undue discrimination" in rate relationships.
8. Efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use:
    a. In the control of the total amounts of service supplied by the company:
    b. In the control of the relative uses of alternative types of service (on-peak versus off-peak electricity, Pullman travel versus coach travel, single-party telephone service versus service from a multi-party line, etc.). (Principles of Public Utility Rates, James C. Bonbright, Columbia University Press 1961, p. 291)

Although these long-standing principles are helpful guideposts on certain questions, they are very general and do not necessarily provide concrete answers to regulators dealing with 21st century issues. In writing UtilityVision, these principles were taken into account but we went beyond them to provide more concrete recommendations.

Q. What are the concrete principles for retail rate reform laid out in UtilityVision?

A. First, regulators should avoid reliance on high fixed charges. Fixed charges limit consumer control and unduly burden low usage consumers that are disproportionately low-income. These charges should be capped at the cost of keeping a customer connected to the grid, such as metering, billing, and the service drop, but public policy considerations can be factored in to keep these charges even lower. Second, other components of electricity rates can be reformed to better align customer incentives with cost drivers and the value they can provide to the system. Third, significant reforms should be phased in. Consumer education is a necessary component of reform, and customers must be given the proper tools to manage their bills and respond to new rate structures.

Q. Why do some argue that fixed charges should be higher?

A. Utilities across the country, and National Grid in this docket, often argue that historical investments are "fixed" and so should be recovered through fixed charges. However, this confuses two concepts. Historical investments are sunk costs but that does not mean that they should be recovered through fixed charges. Rates should be forward-looking and consider the impact of customer choices on future investments. Nationally, the arguments in favor of fixed charges also align with utility interests in increasing revenue stability, and reducing incentives for energy efficiency and distributed generation. In restructured jurisdictions, distribution utilities still have an interest in increased revenue stability in terms of timing the certainty of collections. Also, because companies that invest in transmission lines receive a return on those investments they have an incentive to discourage local energy production.

Q. What downsides do fixed charges present to utilities?

A. In the long run, fixed charges encourage customers to disconnect from the grid entirely. As the costs of distributed generation and storage continue to fall, this may become a viable option for increasing numbers of existing ratepayers.

Q. How do fixed charges relate to broader principles of economic regulation?

A. One key role of public utility regulation is to approximate the incentives of market competition and prevent monopolistic behavior. Utility claims about the necessity of recovering costs through fixed charges are definitively disproven by the numerous competitive industries where large fixed investments are recovered through per-unit purchases by consumers. This includes oil refineries where consumers pay for gasoline by the gallon, and farms where consumers pay for apples by the pound.

Q. How can retail electricity rates be reformed to better align with system costs?

A. Different portions of the electricity bill have different underlying cost structures. System-wide energy supply costs are driven by wholesale energy and capacity markets. Because of the structures of these markets, time-varying rates can provide better economic incentives to reduce overall costs and provide customers with opportunities to save money by taking advantage of low-cost hours. Delivery costs, including distribution and transmission, are driven more so by a few peak hours, and rates for these bill segments can be designed to focus on these peaks. As a result, it is sensible to consider both time-varying rates and smart demand charges for these bill segments. Smart demand charges should be based on local or system peaks and respond to customer behavior in a timely way. Demand charges that are aligned with an individual customer's peak rather than system peaks are not appropriate. Given the complexities of such demand charges, time-varying rates may be the more feasible option for distribution and transmission rates. Innovations in this area should be harmonized to work well together, both for economic reasons and customer comprehension. As technology develops over time, customers may be able to understand and benefit from more complex and granular options.

Q. How would these reforms apply to customers with distributed generation?

A. In the long run, these rate structures could be bi-directional, and customers would be billed for the times when they are taking power in and would be credited for the times when they are exporting power. The bi-directional rates would be designed so that they reasonably approximate the net value going both ways. The general principle is that customers would pay for the products and services they receive and be appropriately compensated for attributes and services they provide.

Q. How should rate reforms be phased in?

A. Customers should be given time to fully understand a new rate system before it goes into effect. Shadow billing, where customers see what their bill would be under different rate structures, and "hold-harmless" periods, where customers can only benefit from new rate structures, are helpful transition tools. Costs, benefits, and consumer impacts should be evaluated throughout phase-in and keeping certain segments on existing rate structures, such as low income, could be justified by both economics and consumer protection principles.

Q. Are time-varying rates or other innovations currently feasible in Rhode Island?

A. For residential customers in National Grid's service territory, the current metering infrastructure and other systems are not capable of implementing these types of reforms. Interval metering is required for more complex options, but other meters may be sufficient for simple time-of-use rates.

Q. Given currently available metering and billing systems, what types of reforms may be desirable?

A. With respect to mass market residential customers, I am not aware of any distribution rate design that is generally superior to a combination of low, flat fixed charges and volumetric per-kWh rates. However, it is possible to make sensible small tweaks to rate design, such as inclining block rates or higher rates in months where local and system peaks are generally set and lower rates in other months.

With respect to customers with distributed generation, adjustments to net metering credit values may be sensible where significant discrepancies between long-run ratepayer value and the retail rate are demonstrated by sound, comprehensive, and publicly scrutinized economic analysis. This economic analysis can be performed on a technology-by-technology basis and is only necessary once significant market penetration by that technology is expected. It is important that net metering credit value should include all relevant ratepayer benefits. Adjusted credit values can also be used to start making our electricity rates smarter. A specially applicable "locational credit" can be designed for distributed generation located in constrained areas and, in the case of solar, a "west-facing solar credit" can be designed to compensate for the additional values provided to the grid.

IV. REVIEW OF RATE DESIGN PROPOSED IN THIS DOCKET

Q. Please describe National Grid's tiered fixed charge proposals for Residential Rate A-16 and Small Commercial & Industrial (C&I) Rate C-60.

A. National Grid has proposed moving from a uniform distribution customer charge to tiered customer charges based on monthly usage (kWh) in the Residential Rate A-16 and Small Commercial & Industrial (C&I) Rate C-60 rate classes. If usage increases a customer may be placed in a higher tier with a higher fixed customer charge. Maximum monthly usage establishes the tier and corresponding fixed customer charge for the next 12 months. If a customer's maximum monthly usage is subsequently reduced, then the customer could move to a lower tier and fixed customer charge. For Residential Rate A-16 customers the fixed customer charge would range from $5.25/month (Tier 1) to $18.00/month (Tier 4) compared to the current fixed customer charge of $5.00/month. For Small C&I Rate C-60 customers the fixed customer charge would range from $10.50/month (Tier 1) to $26.00/month (Tier 4) compared to the current fixed customer charge of $10.00/month. Since this is a revenue neutral proposal, increasing the amount of revenue that is collected through fixed charges leads to a corresponding decrease in the variable distribution rate from $0.03664/kWh to $0.02625/kWh.

Q. How do the above described UtilityVision principles apply in this context?

A. First, in addition to the above issues regarding justification for increased reliance on fixed charges, for mass market customers, National Grid must demonstrate that tiered fixed charges are a better proxy for cost causation than volumetric rates. Second, if not otherwise accounted for, distribution rates for solar and other distributed generation should consider ratepayer value beyond the distribution system for both customers with load and standalone distributed generation. Third, National Grid should provide sufficient education for customers to understand any new aspects of rate design, and must provide sufficient tools for customers to manage their bills under this new rate design.

Q. Does National Grid's proposal address and/or provide sufficient information with respect to the above issues?

No, it does not.

Q. How should the issue of cost causation be considered?

A. The Company asserts that tiered fixed charges based on maximum monthly usage (kWh) is a proxy for demand (kW) and thus the cost that customers impose on the grid; based on a simple regression analysis. However, maximum monthly usage provides no indication as to a customer's demand at the time of local or system peaks. A customer's coincident peak demand is the contribution it makes to the overall size and cost of the distribution system. To date, no evidence has been presented that shows how maximum monthly kWh over a twelve month period relates to local and system coincident peaks, which virtually always occurs in the summer months.

Furthermore, no evidence has been presented about the relative contributions of mass-market customers and customers with distributed generation to local and system peaks. Installing distributed generation has the potential to reduce a customer's coincident peak demand.

Q. Has National Grid shown that this proposal coincides with cost causation principles or equitable ratemaking principles under R.I. Gen. Laws § 39-26.6-24(b)?

A. No, it has not.

Q. Has National Grid shown that this proposal takes into account the benefits of distributed energy resources under R.I. Gen. Laws § 39-26.6-24(b)?

A. No, it has not. Similarly, the benefits of distributed resources are also relevant to the Least Cost Procurement and System Reliability statute, R.I. Gen. Laws § 39-1-27.7.

Q. Does National Grid propose to provide sufficient education and tools for customers to manage their bills under this proposal?

A. National Grid has provided little information with respect to an outreach and education program or the tools it will offer customers to help them manage their bills; nor have they provided an estimation of the costs associated with such a program and tools. To date, they have failed to identify any reasonable way for customers to know whether they are in danger of hitting a higher tier and being locked into 12 months of higher costs. This is both patently unfair and also runs counter to any claims that tiered fixed charges would provide better incentives to consumers.

Q. Given this, does this proposal take into account simplicity, understandability, and transparency under R.I. Gen. Laws § 39-26.6-24(b)?

A. No, it does not.

Q. Does the "cost shift" argument warrant immediate attention?

A. No, I do not believe immediate attention is required for a number of reasons. Based on the information provided in response to data request CLF 1-16, the magnitude of the costs associated with the REG Program is very small in the near term and modest in the medium term. As mentioned above, National Grid has not quantified the benefits – such as avoided energy, capacity, and transmission and distribution costs – that these resources would provide to the grid and electric ratepayers in Rhode Island. Furthermore, National Grid has not provided information with respect to the cost to implement the billing changes and customer outreach and education efforts. Based on the response to CLF 1-16, the proposal would reduce the cost impact by $110,559 in Year 1 and $846,750 in Year 5, or in other words it would reduce the cost of the REG Program by 10%. I believe the impact of the proposal must be weighed against the benefits that local distributed energy resources provide to ratepayers as well as the costs of implementing the proposal.

Given that the cost of the program is small in the near term and National Grid has the ability to recover this lost revenue through the decoupling mechanism, I believe it is prudent to take a step back and contemplate a rate design and utility business model that empowers all parties to work toward a modern, clean energy system and not settle for quick fixes that may undermine the future sustainability of the electricity system.

Q. What are the practical impacts of National Grid's proposed tiered fixed customer charge?

A. Acadia Center is concerned with five potential impacts associated with implementing National Grid's tiered fixed customer charge proposal. They include the impact on: 1) energy efficiency; 2) local clean energy resources; 3) investments that help consumers and the utility manage load; 4) customer bills and which customers are most affected; and, 5) strategic electrification of buildings and transportation.

Q. What are your concerns with respect to energy efficiency?

A. The proposal could have a negative impact with respect to investing in energy efficiency. Increasing fixed charges and lowering variable rates gives customers less opportunity and incentive to invest in energy savings measures that lower bills, and reduces the value of the energy savings – in this case by 28%. While Acadia Center believes that the implications for energy efficiency may be small under the current proposal, the negative impact could be significant under higher fixed charges scenarios, and National Grid has indicated that this proposal is only a first step. In its pre-filed testimony, National Grid states that "Given this modest shift, transitioning more recovery of revenue requirement through the customer and demand charges would occur over several years." [Page 23, lines 8-10.] In addition, in response to data request CLF 2-5, National Grid states that "The Company contemplates a gradual shift toward recovering 100% of its revenue requirement through customer and demand charges in future proceedings."

Q. What are your concerns with respect to the deployment of clean local energy resources?

A. Reducing the variable distribution rate reduces the value of net metering credits, which has an impact on the value proposition of net-metered projects. This also has the effect of increasing the amount of the REG Program performances incentive that becomes a cash payment as opposed to a bill credit, which has tax implications for the customer. The proposed Access Fee for standalone renewable generators would also have a negative impact on the deployment of local energy resources, but as indicated above, testimony with respect to the Access Fee will be filed separately at a later date.

Q. What are your concerns with respect to helping customers and the utility manage load?

A. The proposal does nothing to support investments that help consumers and the utility manage load and reduce the cost of the electricity system going forward. In response to data request PUC 1-9, National Grid states that "Given this amount of savings, it is likely that most participants in energy efficiency programs will not see a change in tier under the current proposal, unless they are close to tier boundaries." Further, in response to data request Division 1-8, which asked how the proposed rated design encourages customers "to shift load from high use, peak periods into off-peak periods," as discussed on page 20 of the pre-filed testimony, National Grid responded that it was referring to its ideal rate design and that

> "The proposed designs for residential (Rate A-16) and small commercial and industrial customers (Rate C-06) will not necessarily encourage customers to shift load from high use, peak periods into low use, off-peak periods because the proposed design, unlike the ideal design, does not have a direct demand component. Rather, the Company's proposal is intended to encourage customers to reduce, or constrain, overall use during high-use months."

Given these statements and the complex nature of communicating to customers why and how they can reduce maximum monthly usage 12 months out and possibly lower their customer charge, it is very unlikely this proposal will help consumers and the utility manage load and reduce the cost of the electricity system.

Q. What are your concerns with respect to the potential impact on customers' bills?

A. National Grid has stated that "The Company designed the proposed rates so the bill impact on any individual customer will be no more than +/- five percent annually." [Page 12, lines 13-14 of pre-filed testimony.] However, based data and information provided by National Grid in this docket there is the potential that bill impacts will exceed +/- 5%. In response to PUC 1-2, National Grid states that

> "As an example, Attachment PUC 1-2 shows that a residential customer placed in Tier 4 (maximum usage greater than 1,200 kWh per month) using only 250 kWh in a month would see a bill increase of $10.83, or 20.6%." and, "Although it is theoretically possible for a customer to have a maximum monthly usage greater than 1,200 kWh and a monthly usage of 250 kWh, the Company's analysis of the 2014 data did not indicate that there were any customer with this usage pattern."

However, in reviewing the Load Research Data in workbook 'WP NG – 2 Load Research Analyis.xlsx' there are numerous instances where actual customers would realize bill impacts that exceed + 5%. For example, the customer at Premise 72 (tab 'RES Year 1 MERGE') has an average monthly usage of 534 kWh and a maximum monthly usage of 1,460 kWh. This would put the customer in Tier 4, increasing its customer charge from

$5.00 to $18.00 per month. Using 'SCH NG – 13 Rate Re-DesignTypicalBills.xls' to determine the percent change shows a bill increase of 7.4%.

It is important to note that customers that use electricity for space heating may have lower load factors, with larger differences between average monthly usage and maximum monthly usage as electricity needs increase in the winter months.[1] This raises concerns regarding the impact of the proposal on renters and lower income customers. Data from the American Housing Survey shows that, in New England, 70% or 28,675 of the housing units that use electricity as the primary heating source are rental units.[2] Within that sub-set (i.e. renters with electric space heating), 75% fall below the median household income in Rhode Island ($55,902) and 62% are low-income renters (60% of the median household income or $33,541).[3] The number of cost burdened and severely cost burdened households and renters in Rhode Island is high.[4] While some renters and low-income customers will fall under the A-60 rate class, concerns with respect to exacerbating cost burdens for more vulnerable customers in the A-16 rate class must be further explored.

Further, with respect to the National Grid's statement that "The Company designed the proposed rates so the bill impact on any individual customer will be no more than +/- five percent annually." [Page 12, lines 13-14 of pre-filed testimony.], Acadia Center notes that this does not apply to customers with distributed energy resources. In response to CLF 1-4, National Grid clarified that the +/- 5% limit on bill impacts applies to "full requirement customers" and not those participating in net-metering or the REG Program. The illustrative example provided in response to CLF 1-4 shows that, while a REG customer would receive the same level of compensation, there is a shift from a bill credit to a cash payment due to the impact of the proposed rate design on the volumetric charge and thus the bill. In this example, under the proposed rates the customer's monthly bill would go from $11.35 to $14.69 – approximately a 30% increase. No

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[1] In Rhode Island approximately 10% of 40,965 household units use electricity as the primary heating fuel (2014). 2015 Housing Fact Book, Page. 10. Available at: http://www.housingworksri.org/sites/default/files/HWRI_FB15.pdf

[2] American Housing Survey (2013). Available at: http://sasweb.ssd.census.gov/ahs/ahstablecreator.html

[3] Ibid.

[4] 2015 Housing Fact Book, Page. 19. Available at: http://www.housingworksri.org/sites/default/files/HWRI_FB15.pdf

analysis is provided for net metered customers, however this example demonstrates that had the customer been a net metered customer the bill impact would be an increase of approximately 30%.

Q. What are your concerns with respect to the strategic electrification of buildings and transportation?

Acadia Center is concerned that the proposed tiered fixed customer rate design would have a negative impact on strategic efforts to electrify buildings and transportation, which is necessary if Rhode Island and the Northeast is to meet deep GHG emissions reduction targets. Under this proposal, a customer that installs a high-efficiency cold climate heat pump or purchases an electric vehicle would be negatively impacted because their maximum monthly usage would increase along with their customer charge.

VI. CONCLUSION

Q. Do you believe that the proposals of National Grid in this docket are just and reasonable?

A. No, I do not. It is contrary to general rate design principles, Acadia Center's UtilityVision principles, and the public policy goals of Rhode Island.

Q. Do you believe that the proposals of National Grid in this docket should be approved under the balancing factors laid out in R.I. Gen. Laws § 39-26.6-24(b)?

A. No, I do not. This proposal fails to take into account the benefits of distributed energy resources, equitable ratemaking principles, and cost causation principles, and does not provide rates to customers that are simple, understandable, or transparent.

Q. Why is it important that Rhode Island move forward with a more comprehensive rate design and grid modernization proposal?

A. Our changing energy system will require regulatory reforms in the coming years. However, these changes must be based on careful study of the benefits and costs of a clean, local energy future, and the entire energy and utility system should be considered comprehensively. It will require big picture thinking to meet our big picture goals for the economy, the environment and public health, and our society as a whole.

Q. Does this conclude your testimony?

A. Yes, it does.

ABIGAIL W. ANTHONY
Director of Grid Modernization and Utility Reform
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PROFESSIONAL EXPERIENCE

Director, Grid Modernization and Utility Reform, Acadia Center, Providence, RI 2012-Present

- Project leader and primary author of UtilityVision: Refoming the Energy System to Work for Consumers and the Environment. UtilityVision outlines specific steps needed to modernize the grid and create a clean, consumer-friendly and environmentally-friendly energy system.
- Director of Acadia Center's efforts to advance grid modernization and the organization's participation in legislative and regulatory proceedings in Massachusetts, New York, Rhode Island, and Connecticut.
- Responsible for developing and executing Acadia Center's policy priorities for grid modernization. This includes advancing reforms to the utility business model, grid planning, and rate-making that will guide infrastructure investments to a consumer-focused and technology-friendly, decentralized energy system.

Director, Rhode Island, Acadia Center, Providence, RI 2010-Present
Policy Analyst 2007-2010

- Lead, coordinate, and advance Acadia Center's cutting edge efforts to promote and implement energy efficiency and clean energy policy reforms in Rhode Island.
- Advance Acadia Center's regional energy policy initiatives and efforts to reform energy system planning to achieve lower costs and environmental impacts.
- Management and oversight to advance Rhode Island's energy efficiency policies, including representing environmental interests on the Energy Efficiency and Resource Management Council (EERMC) and serving as chair of the System Integration Committee.

Selected significant activities include:

- Co-author of "Escalating New England Transmission Costs and the Need for Policy Reforms," the first analysis and comprehensive assessment of the cost drivers of transmission expenditure in ISO-New England and recommendations for reform. Delivered EnergyVision "Power Talk" at the 2014 Northeast Energy Efficiency Partnership Annual Summit.
- Co-author of "EnergyVision: A Pathway to a Modern, Sustainable, Low Carbon Economic and Environmental Future". EnergyVision sets forth important steps on four parallel tracks to create an energy system that is cleaner, safer, and more affordable.
- Led the EERMC in the development of "Standards for System Reliability Procurement," and resulted in National Grid's adoption of new internal operating procedures in New York, Massachusetts, and Rhode Island for the consideration of non-wires alternatives.
- Developed legislation and successfully advocated for including natural gas in Rhode Island's Least Cost Procurement mandate, enabling RI to lower its energy costs by investing in all natural gas efficiency that is cost-effective and lower cost than supply.
- Developed legislation and successfully advocated for decoupling, which removes the disincentive for utilities to fully partner on delivering excellent energy efficiency programs to Rhode Islanders.
- Led the EERMC in the development, negotiation, and achievement of nation-leading energy savings goals in 2009-2011, 2012-2014 and 2015-2017. As a result, Rhode Island's investments in energy efficiency have delivered $1.99 billion in benefits to consumers, created over 25,000 job-years of employment, and added $2.34 billion to RI Gross State Product.

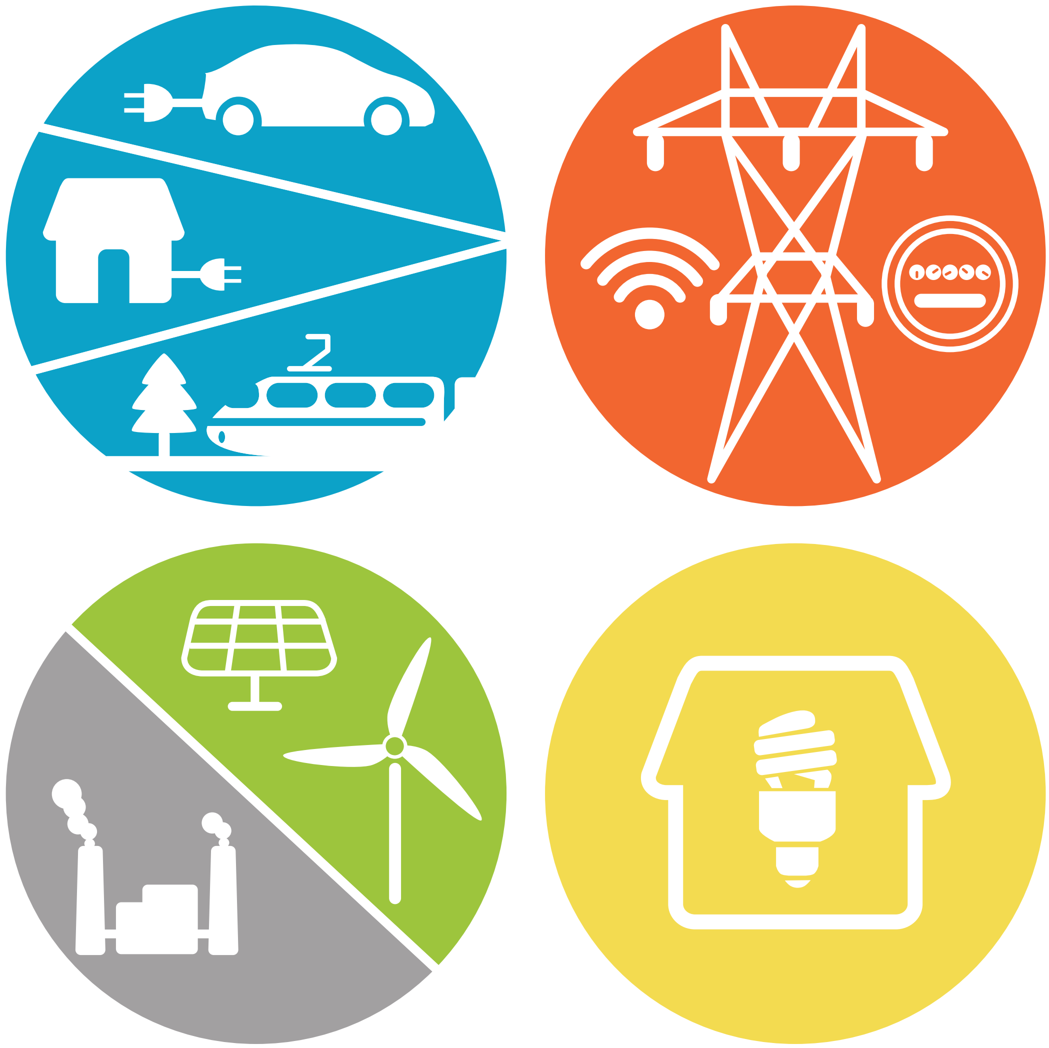
EDUCATION

University of Rhode Island: PhD Environmental and Natural Resource Economics, 2009

- 2012 Greg J. Lessne Award for "excellence in the study of natural resource economics."
- National Science Foundation Coastal Institute IGERT Project Fellow
- Invited participant, Dissertations for the Advancement of Climate Change Research, National Science Foundation

University of Montana: MA Economics, 2004
University of Montana: BA Economics, 2002

Exhibit No. AC-2



EnergyVision

A Pathway to a Modern, Sustainable, Low Carbon Economic and Environmental Future

ENE

Docket 4568 0018-Acadia Center

Dedication to David LeClair

ENE dedicates EnergyVision to David LeClair, who tragically lost his life on June 14, 2013 in a bicycle accident during the Trek Across Maine, a normally joyful 3-day, 180-mile trip that attracts thousands of bicyclists in a fundraiser for the American Lung Association. David was riding with his employer group from athenahealth, a company that provides cloud based services in the health profession. David was known for his energy, enthusiasm and genuine kindness. As his friends and colleagues at athenahealth note, "David has shown us that caring is the greatest thing you can do in life – and he demonstrated what caring means in ways large and small." ENE was deeply moved when David's team at athenahealth selected ENE to receive a generous donation in his memory. We hope that EnergyVision, which sets forth an ambitious, positive pathway to a sustainable future, is a fitting tribute to David's enthusiasm and optimism and his passion for the environment. We are honored to dedicate EnergyVision to David.

About ENE

ENE is a nonprofit organization that researches and advocates innovative policies that tackle environmental challenges while promoting sustainable economies. EnergyVision is part of a series of ENE reports that focus on how states and regions can address the challenge of climate while improving economic and consumer benefits. EnergyVision was produced by ENE staff, led by Jamie Howland, Director, ENE Climate and Energy Analysis Center with primary contributions from Abigail Anthony, Varun Kumar and Daniel Sosland. Thanks to Eleanor Kung for visualization designs and to Headwaters Writing & Design for layout.

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An EnergyVision Pathway to a Modern, Sustainable Low Carbon Economic and Environmental Future

ENE's EnergyVision presents an overarching framework to guide investment choices and reforms needed in our energy system. If fully implemented, the approach outlined here would achieve key goals for our economic and environmental future: more efficient energy use, accelerated economic development, cleaner air, greater control over consumer costs and steep reductions in greenhouse gas emissions. Focusing on four interconnected components of our energy system, centered on the electric power grid, EnergyVision describes a major shift in how we think about energy so as to improve economic productivity, reduce emissions, make the electric system more resilient, empower consumers to have more control over their energy future and take advantage of viable, exciting technologies to replace fossil fuel use in our buildings and cars. **EnergyVision integrates these four components**: (i) utilize market-ready technologies to **electrify buildings and cars**; (ii) **modernize the way we plan, manage and invest in the electric power grid** so that it facilitates new technologies, decentralized energy systems and consumer control; (iii) make continued progress toward a **clean electric supply** through increased investments in local renewable power; and (iv) **maximize investments in energy efficiency** so that energy consumption is as efficient as possible, while improving building comfort and reducing unneeded energy demands that waste consumer dollars and act as a drag on the economy.

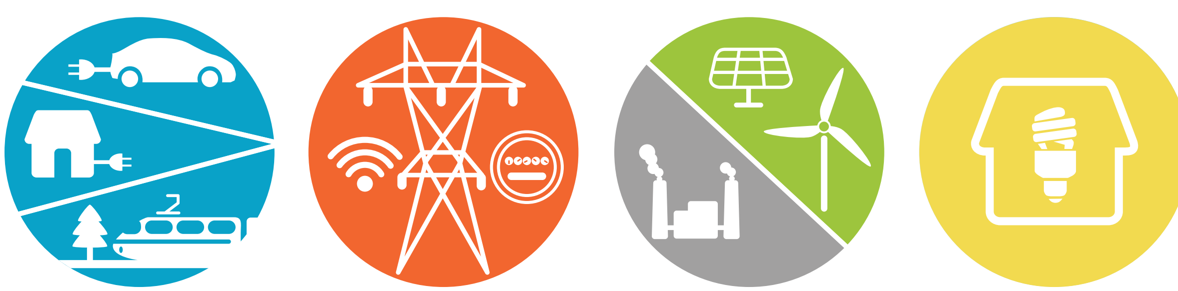
ENE's EnergyVision represents a cultural shift in how we envision our energy infrastructure. No longer will our energy dollars be poured only into massive power stations and miles of wire. The **new grid is at our homes and businesses**, where users control energy use and improve energy efficiency; install smart appliances; generate electricity from solar and distributed energy sources; plug in our cars; connect to community wind, solar, and cogeneration; and earn incentives for using power when the grid is most available. We can begin to think of and manage our homes and businesses as our own "micro-utilities," handling many of the services currently managed by large power companies, and doing so with new, efficient and clean technologies.

Our core climate and energy challenge is to **construct a fully integrated, flexible, and low carbon energy network**. A smart and dynamic electric system, managed with the cooperation of utilities, power grid operators, consumers, and communities will be characterized by widespread clean energy supply and distributed generation, deep energy efficiency in increasingly electrified buildings and vehicles and incorporation of new energy resources, business and consumer incentives and community energy systems. Making the grid and regulations **"Renewable-Ready"** can meet our needs today and build the clean, electrified energy system of tomorrow.

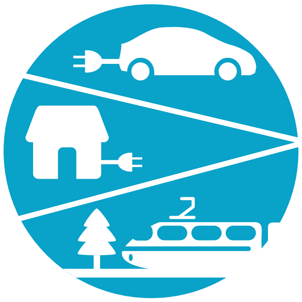
This is **a future that offers deep emissions reductions and widespread consumer benefits**. ENE has done the math, and the emissions savings add up. Consider this hypothetical: **if all gasoline powered vehicles and all buildings using fossil fuel for heat in the Northeast shifted overnight to electricity, GHG emissions from these uses would fall by 50%.** While there are many other steps that would need to occur to fully transition these sectors to electricity, new and emerging technologies are making this pathway more viable than ever before. With increasing investments in clean energy – energy efficiency, renewable power like wind, and distributed energy resources – the carbon profile of electricity will continue to decline. As detailed below, it is reasonable to forecast a scenario in which emissions from vehicles and buildings fall by over 75% by 2050.

EnergyVision: Four Interconnected Areas

This EnergyVision presents a framework for the future that hinges on the replacement of fossil fuels with clean, low carbon emitting electricity to heat our buildings and power our cars. Focusing on the Northeast region, EnergyVision centers on the electrification of our entire energy system through reforms and advances in four interconnected areas: **Electrify Buildings and Transportation**; **Modernize the Grid**; **Clean Electric Supply**; and, **Maximize Energy Efficiency**.



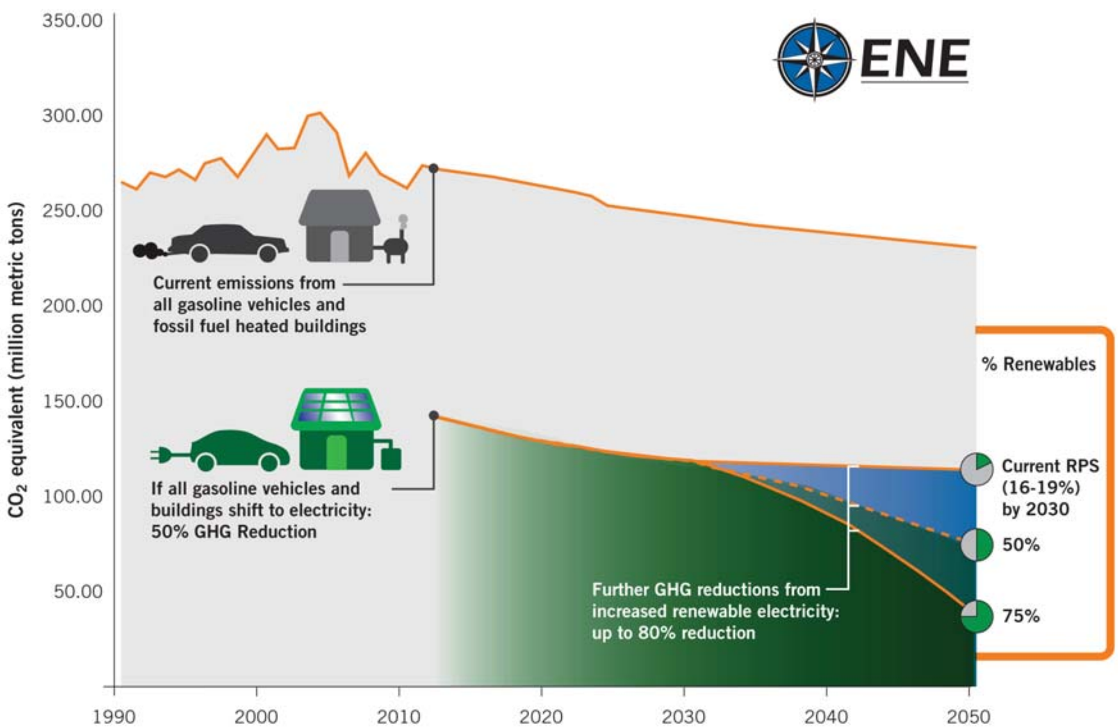
Electrify Buildings and Transportation   Modernize the Grid   Clean Electric Supply   Maximize Energy Efficiency



I. Electrify Buildings and Transportation

Electricity can power many of the things that currently use fossil fuels. While it may challenge conventional wisdom, electrification can deliver lower costs and lower emissions today. The economic and environmental benefits of electrification will grow as the energy system transforms to include more renewables, distributed generation, and energy storage. If all gasoline powered vehicles and buildings using fossil fuels shifted to electricity technologies today, emissions would fall by nearly 50%:

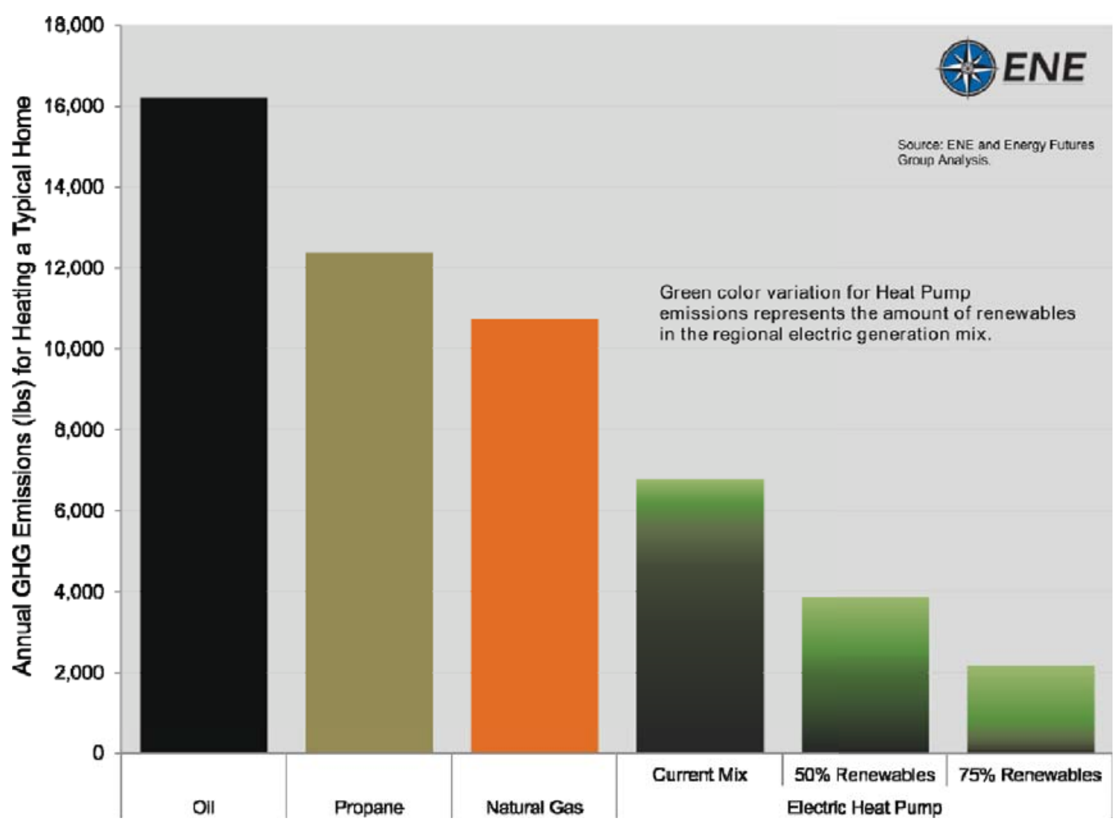
ENE Assessment of GHG Levels with Full Electrification



Buildings and Electrification: Space and Water Heating

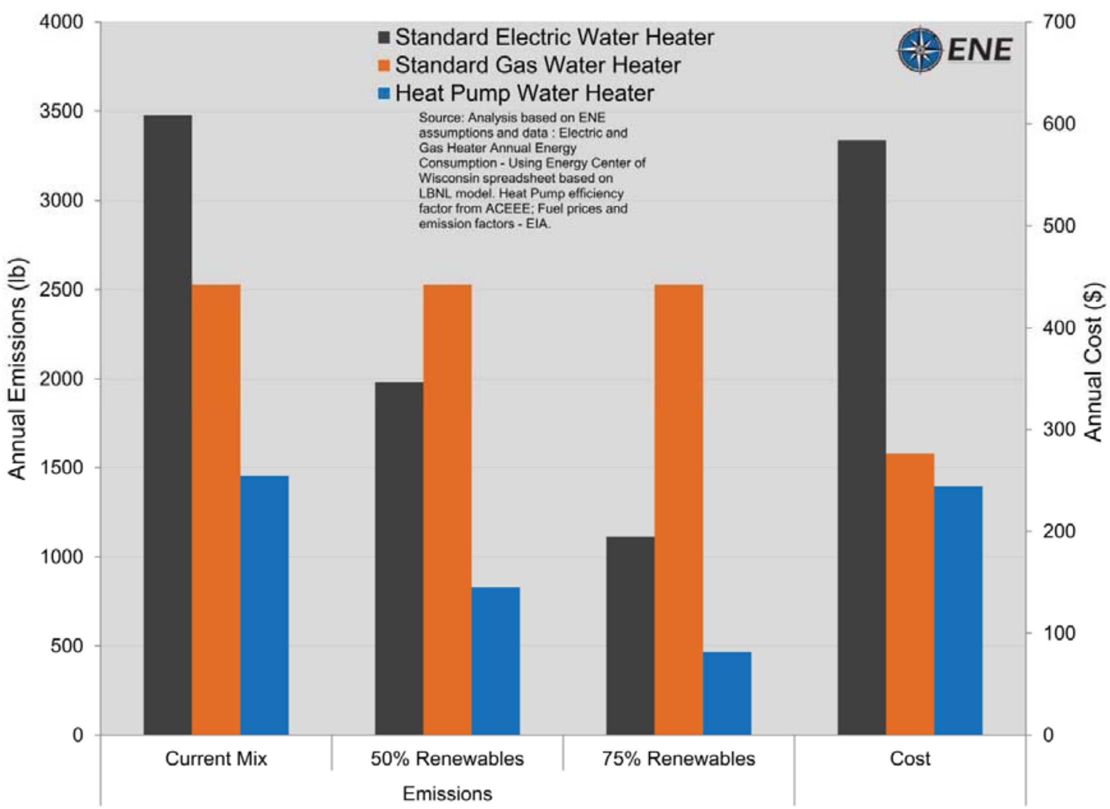
Recent technological advances have made **Efficient Electric Heating a compelling alternative to natural gas and oil for heating homes and businesses**. Although electric resistance heaters are widely recognized as one of the least efficient ways to provide space heating, electric heat pumps – a different technology – have been rapidly improving to the point where they deliver space heating about three times more efficiently than resistance heat. In addition, heat pumps can use the existing electric power grid infrastructure to heat homes and businesses at lower cost and with reduced greenhouse gas emissions compared to oil or natural gas. This means that heat pumps deliver immediate environmental benefits without locking the region into the added expense of over investing in natural gas distribution system expansions. As a greater proportion of our electricity comes from renewable resources, the environmental and climate benefits of heat pumps will increase; they will heat buildings with even lower emissions and reliance on fossil fuels. As the illustration below shows, switching building heating to high efficiency electric heat pumps offers clear economic and emissions benefits:

Emissions of Heating Technologies Compared



Similar advances in technology will allow electricity to be substituted for fossil fuels in other building energy end-uses. There are several other common uses for natural gas and heating oil in homes and businesses, which are a major source of emissions from buildings. Emerging and recently commercialized products can electrify these activities, providing benefits today and greater future emissions reductions as more renewable electricity comes online. Electric heat pump hot water heaters (HPHWs) can dramatically reduce cost and emissions compared to natural gas, oil, or traditional electric hot water heaters. Commercial deployment of HPHWs has begun. Dehumidifying clothes dryers, which are currently available in Europe, dry clothes without the excessive waste heat of traditional gas or electric dryers. This advanced technology can cut emissions from drying clothes by 50% today, and further reductions would increase as clean power is added to the grid. The figure below compares the cost and emissions of efficient electrification options for water heating.

Cost and Emissions Savings from Heat Pump Water Heaters



Nearly 35% of homes in the Northeast rely on heating oil or propane. The **high-cost and market volatility of these fuel imports makes this region an ideal candidate for widespread adoption of efficient electric space and water heating**. Increasing investments in high-efficiency electric heat also avoid the risk of over-reliance on natural gas and costly investments in added pipeline capacity.

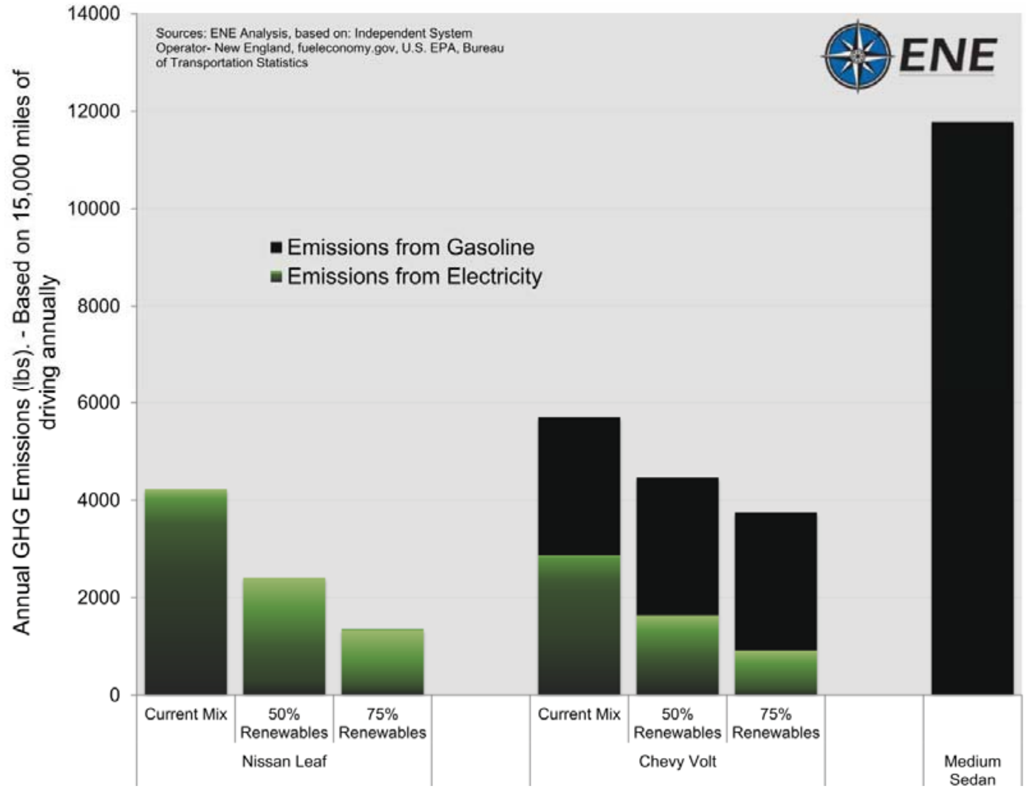
Natural gas may be viewed by some as an interim step for reducing emissions from heating oil use (provided fracking concerns over fugitive methane emissions and impacts to groundwater are addressed). However, there is no viable way to further reduce the GHG emissions from natural gas, and building extensive gas delivery infrastructure will not support or facilitate further deployment of renewable resources like wind and solar. Some states are proposing extensive and expensive incentives to expand natural gas infrastructure and switch building heating to natural gas. This approach risks overinvestment in natural gas and must urgently be reconsidered so that any support for fuel switching is better aligned with the future energy and environmental needs of the region. **States and consumers can either pay for natural gas infrastructure now and then again for a replacement system or start investing in the right combination of solutions now**.

Many state efficiency programs in the region recognize the value of cold weather heat pumps by offering incentives to replace inefficient electric resistance equipment with high-efficiency heat pumps for both space and water heating. These efficiency programs offer an ideal vehicle to encourage the broader adoption of heat pump technologies for greater market penetration needed to achieve widespread building electrification. Most efficiency programs and state policies need to be expanded in order to offer the right incentives to consumers to guide them to the product choices, in this case efficient electric heat pumps, that benefit the consumer and put the region on a path to a sustainable energy system.

Transportation and Electrification

As advances in electric vehicle technology continue, the benefits of a fully electrified passenger transportation system are becoming clear. Shifting our transportation system to electricity is critical. Electric vehicles can currently reduce transportation emissions by over 60% when compared to a traditional internal combustion engine (using the current New England power pool mix). Operating costs are approximately 64% lower: about 5 cents/mile for an electric vehicle in the Northeast compared to 14 cents/mile for a conventional medium sedan. As the carbon intensity of the regional energy mix decreases, the environmental and climate benefits of electric vehicles increase. The figure on the opposite page compares the emissions of an electric vehicle to gasoline-powered options.

Annual Vehicle Emissions From Electricity Compared to Gasoline



Electric vehicles have tremendous potential to reduce consumers' expenditures on imported gasoline and diesel and advance state clean energy and climate goals. **The twenty-first century electric grid needs to be prepared for large-scale electric vehicle adoption in a manner that enhances system reliability, minimizes costs, and protects consumers**. For example, time-varying rates can encourage off-peak charging and minimize costly distribution system investments. **Two-way power flow will also enable electric vehicle batteries to store electricity** and send it back to the grid during peak demand hours, providing grid stability resources through energy storage. Transportation and energy are inseparably linked, yet the policies surrounding each are often created in a vacuum. Policymakers in the region must pursue an integrated approach that appropriately values long-term benefits and will offer the right mix of incentives to consumers, utilities, investors, and market participants to ensure clean, flexible and affordable vehicle charging and a range of attractive vehicle choices.

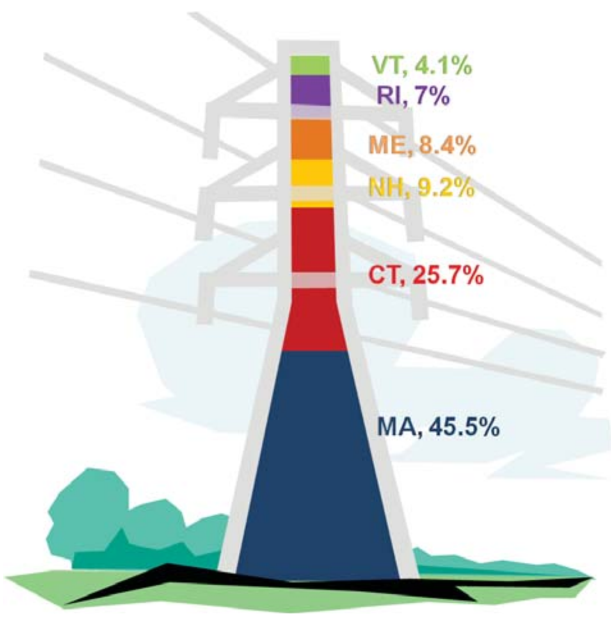
Most modern mass transit systems are increasingly powered by electricity. **Increasing the availability of electric buses, light rail, commuter rail and high-speed rail in the region will lead to additional emissions reductions in the transportation sector. Updated approaches to town planning, zoning and permitting are needed** to facilitate more transportation options, improve the livability of towns and help control energy and transportation costs. Building codes must also be updated to incorporate charging infrastructure.

II. Modernize the Power Grid

To achieve our climate and energy goals, we must reform the region's transmission and distribution (T&D) grid to create a Renewable-Ready Energy Delivery System.

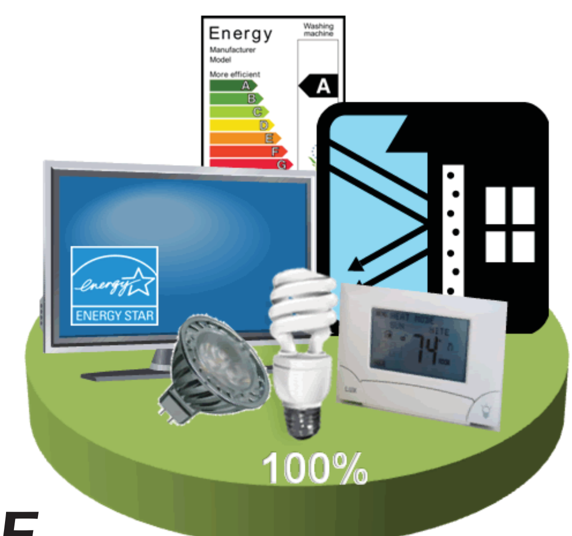
The planning and investment policies that govern our power grid were developed in an earlier era, when large fossil-fueled power plants were constructed to energize population centers. Longstanding policies skew decisions in favor of legacy power grid investments over newer, often less expensive and more advanced solutions. For example, the costs of paying for transmission projects are "socialized" in many regions of the country. This approach spreads the cost of transmission projects to ratepayers in all states in the power pool, while lower cost local options are rarely considered and are not eligible for this type of socialized cost recovery. These rules need to change so that viable, often lower-cost alternatives to large-scale transmission projects – such as energy efficiency, clean distributed generation, energy storage, and demand response – are not excluded when considering investments to maintain and improve power reliability. Such alternatives can replace or defer the need to construct more grid infrastructure, immediately delivering economic and environmental benefits.

Transmission Costs Paid Proportionately by Consumers in All Six States in the ISO-NE Grid

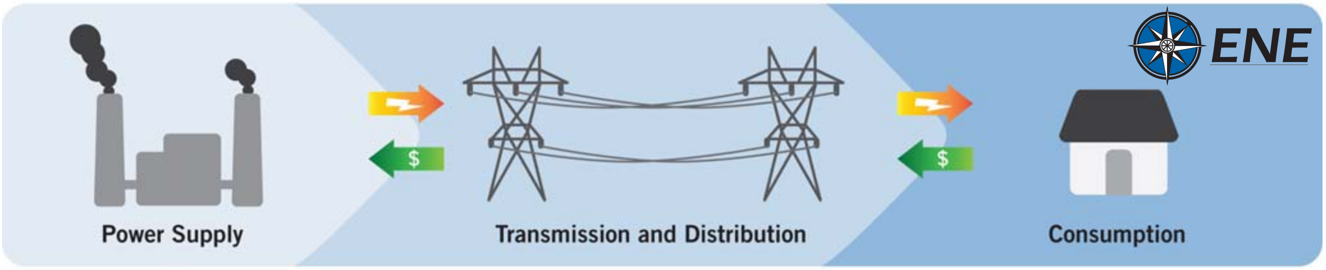


VS.

Non-Transmission Alternatives Costs Borne Entirely by Consumers in One State

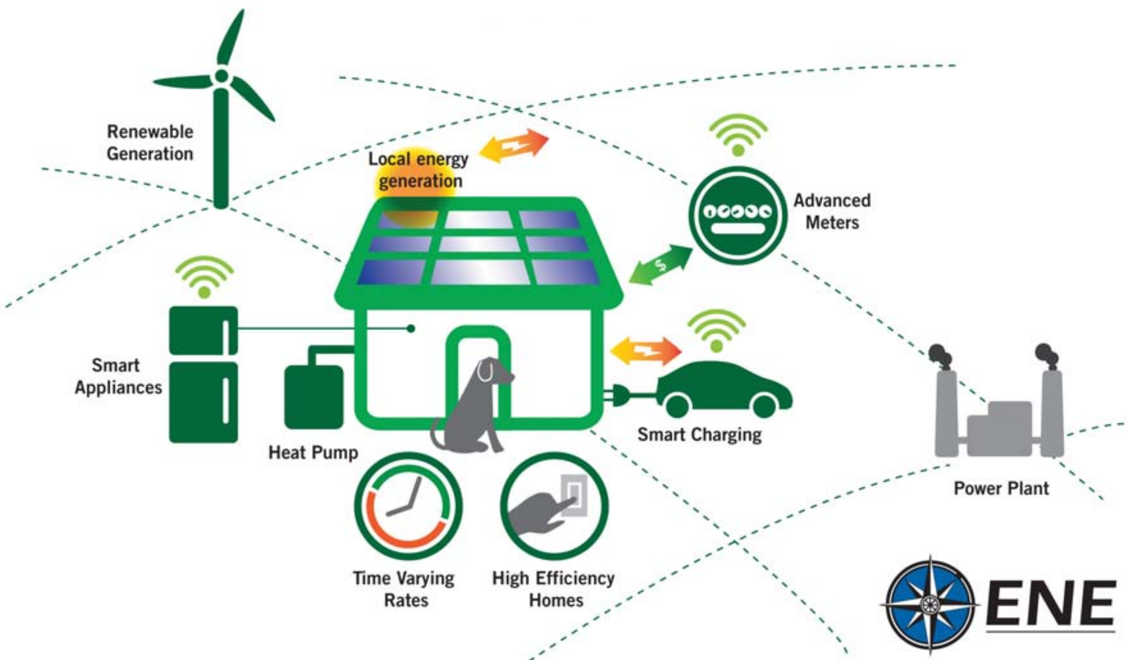


Old Power Grid System



To maximize consumer and economic benefits, improve system resiliency to storms and other disruptions, and reduce GHG emissions, **we need to reshape the vision of our power delivery system. The "Old System" is a one-way route from power plants to homes and businesses. The Modern Grid System is a multi-directional path using an array of technologies to meet our energy needs**:

Modern Grid System

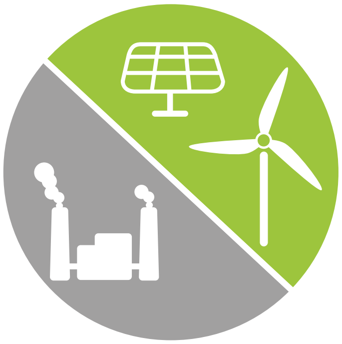


In the Modern Grid System, the home and business become the centerpieces of the energy system. Consumers will have greater control over energy use within and around the buildings they occupy through technologies such as rooftop solar water heating and photovoltaic systems, advanced meters that help consumers control and monitor power usage, and technologies such as smart appliances and heat pumps. Community energy systems – local windpower, solar arrays, and combined heat and power – will also play an important role in a decentralized power grid. Energy efficiency, already a "first fuel" that increases consumer savings and reduces energy consumption, becomes a "first resource" through targeted deployment that offers a cost-effective alternative to building more poles and wires to supply additional power.

Electric power grid planning and financing has not kept pace with changes in energy technologies and environmental and consumer goals to Integrate Clean Energy Resources. Demand side energy resources like energy efficiency; energy storage; small scale, distributed renewable generation; and on-site combined heat and power systems do not rely on power being transmitted but rather on using energy more efficiently and generating more power on-site. The new system must facilitate development of new clean power sources and energy efficiency – whether these resources are located at a wind farm, inside the steam pipes of a paper company, or as an energy management app on a consumer's phone. To achieve these goals, outdated regulations governing energy resource ownership must be revised, new rate structures must be considered, and clear rules need to be adopted that reflect the appropriate role of the utility in an increasingly decentralized system.

New technologies are dramatically increasing the ability to Optimize Energy Consumption in the electric system. Traditionally, the solutions to problems such as overloaded facilities, low voltage, stability response, contingencies, loss of load, and system losses have been T&D capital projects: new circuits, new substations, or larger conductors. As technologies improve, the range of alternative solutions has grown: demand response, direct load control, advanced metering, time-varying electricity rates and automated appliances, and electric vehicles that can also serve as energy storage are all cost-effective tools for reducing peak demand and optimizing grid performance. Deploying these cost-effective resources to reduce peak demand and optimize grid performance can potentially defer or avoid grid investments and provide significant consumer savings.

The existing regulatory policies that guide utility planning and investment decisions limit new technology and risk perpetuating the status quo. The traditional rate-making methodology that guides distribution utilities' decision-making focuses on certainty: allowing a utility to recover its investment plus a rate of return set by regulators. This practice was established decades ago and premised on investments in a largely stable and proven infrastructure of power plants, substations, poles and wires. Currently, there is a lack of clarity as to how new technologies and grid modernization strategies, which do not fit neatly into the old rate of return model, will be treated by utility and grid regulators. This uncertainty can discourage utilities from deploying advancements like time varying rates, load control, or voltage regulation and limits utility approaches to smarter grid options. New technologies can deliver substantial benefits, including increased reliability and efficiency, lower costs and bills, increased consumer control and choices, and lower greenhouse gas emissions. **Reformed regulatory models are needed to remove current uncertainties and align utilities' financial incentives with the states' clean energy, carbon reduction, and economic goals**. Because major new market opportunities exist for electricity, it is critical that utilities' interests are aligned with the steps needed to modernize the grid.

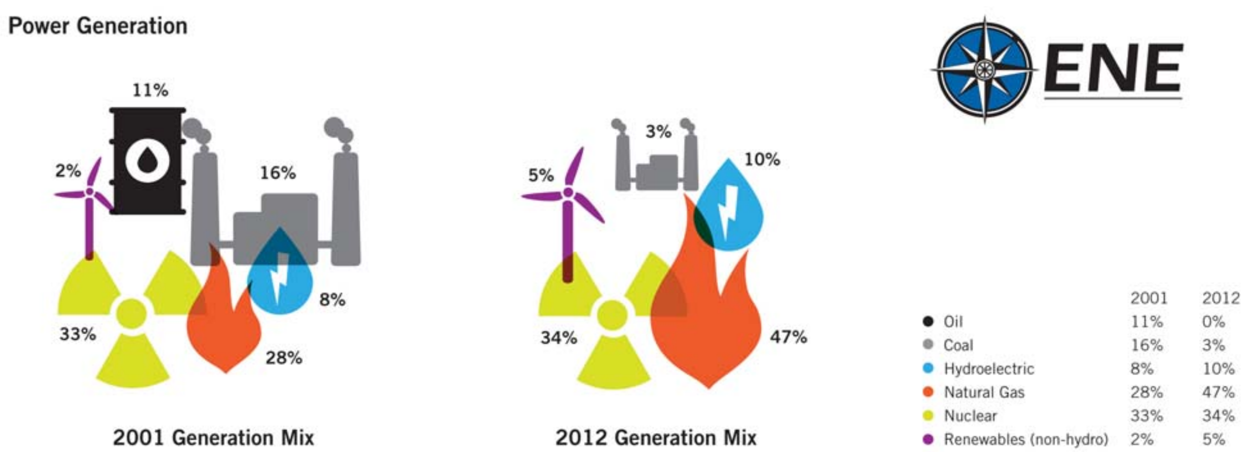


III. Clean Electric Supply

In the past five years, large shifts to natural gas for generating electricity have led to dramatic reductions in emissions as coal and oil plants have been idled or closed. As coal and oil plants decline, the opportunity for additional emissions reductions from fuel switching also declines (and there remain concerns regarding the lifecycle emissions of natural gas supplies). Deployment of more grid-scale renewable power can provide the next phase of emissions reductions in the region.

As the following figures show, **there has been a dramatic evolution in the sources of energy used to generate electricity in the Northeast**. From 2001 to 2012, the share of electricity generated by oil and coal generating plants has fallen from 27% of all electric generation to less than 3%:

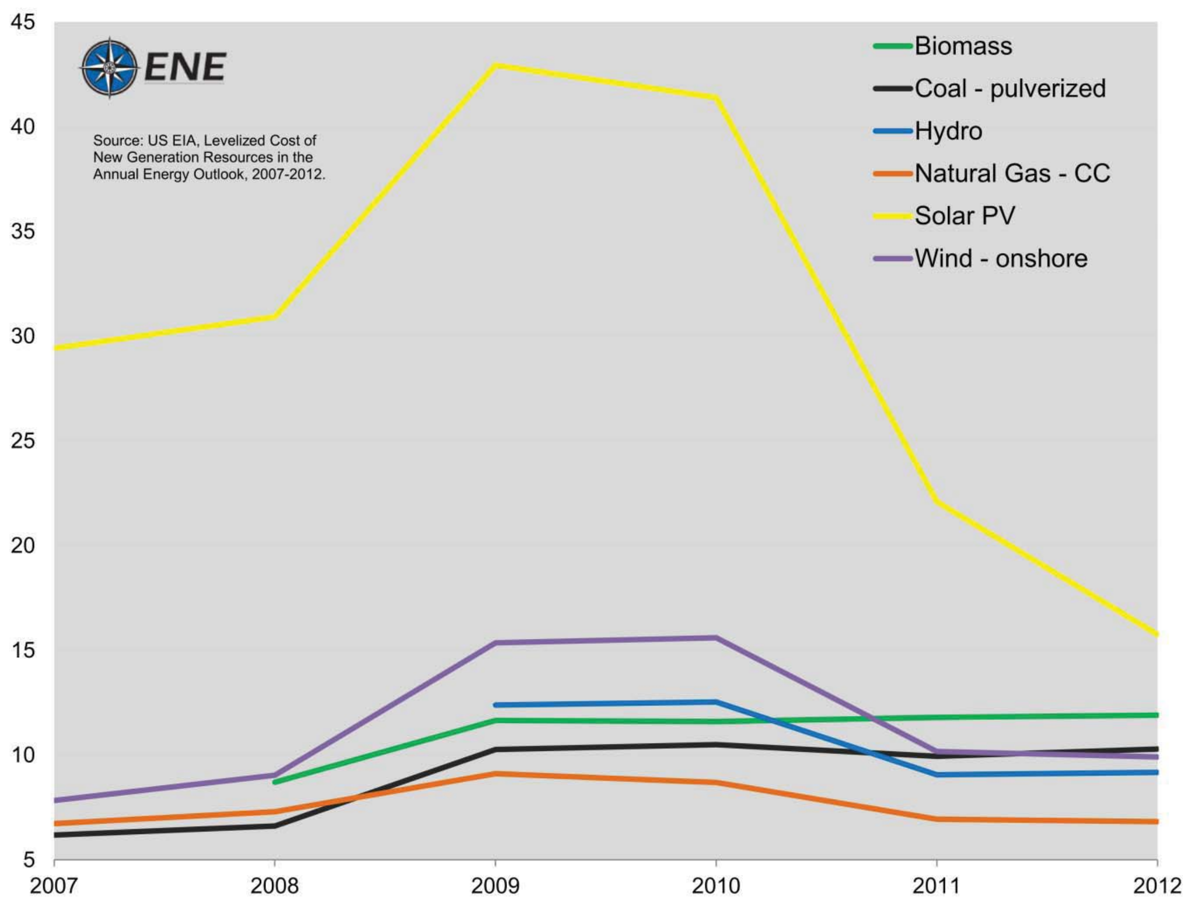
Transition of Electric Generation Fuels from 2001 to 2012



Increasing the region's use of wind, solar, and other renewable resources will reduce power sector emissions and provide significant economic benefits. Advances in technology, declining costs, and market-based strategies have helped increase the number and variety of clean energy resources in the region. Use of clean energy in the region has increased by about 25% since 1990. To meet our economic and climate challenges, it is critical that we build on this progress with sustained commitments to clean power. Policies that encourage the growth of renewable energy and require fossil fuel-based energy sources to reflect the cost of pollution tackle this problem head on.

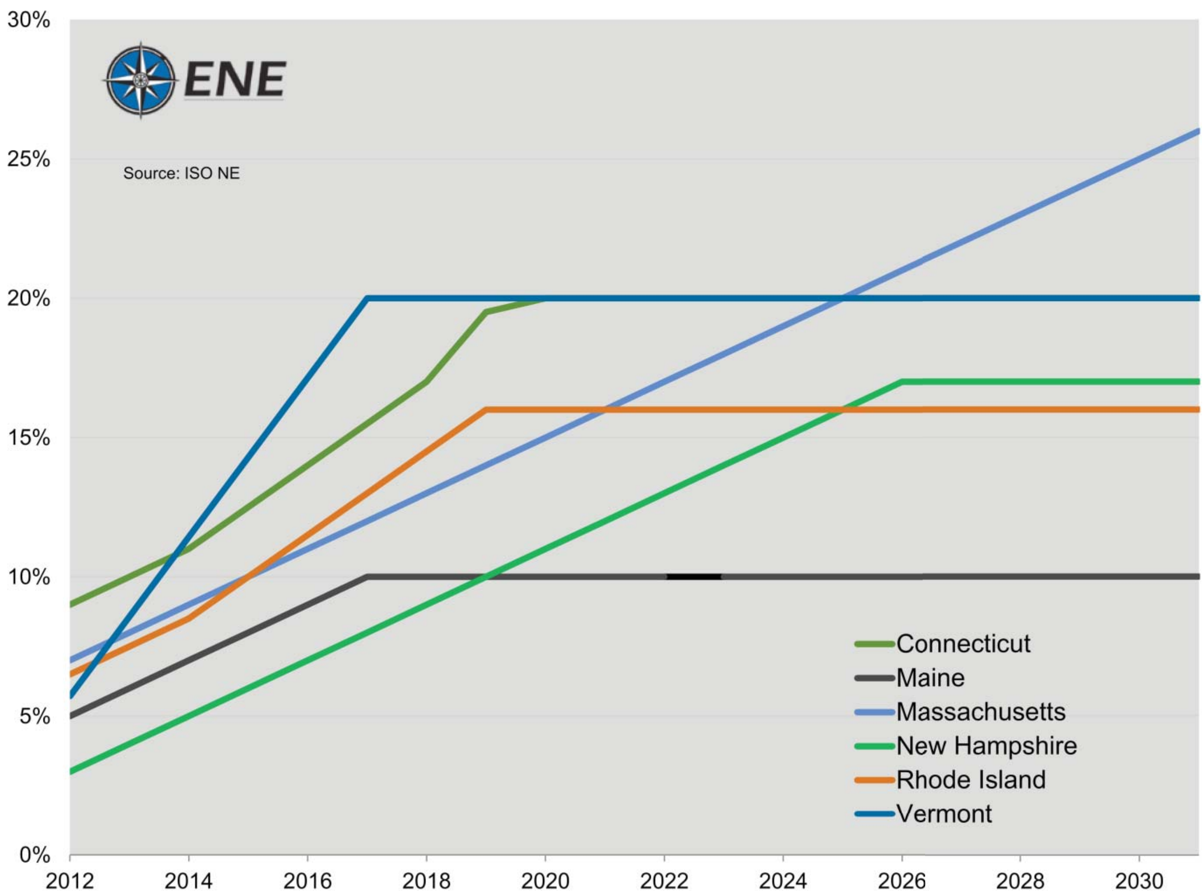
The cost of many renewable technologies has declined in recent years, making renewables more cost-competitive with conventional resources **highlighting the need to support and continued Clean Power Incentives to promote commercialization, innovation and market structures**. The following chart depicts the levelized cost of energy (LCOE), which reflects the "all-in" cost of generating electricity over the life of the plant (cents/kWh), taking into account costs for capital, operations and maintenance, and fuel.

Electric Generation Cost Trends



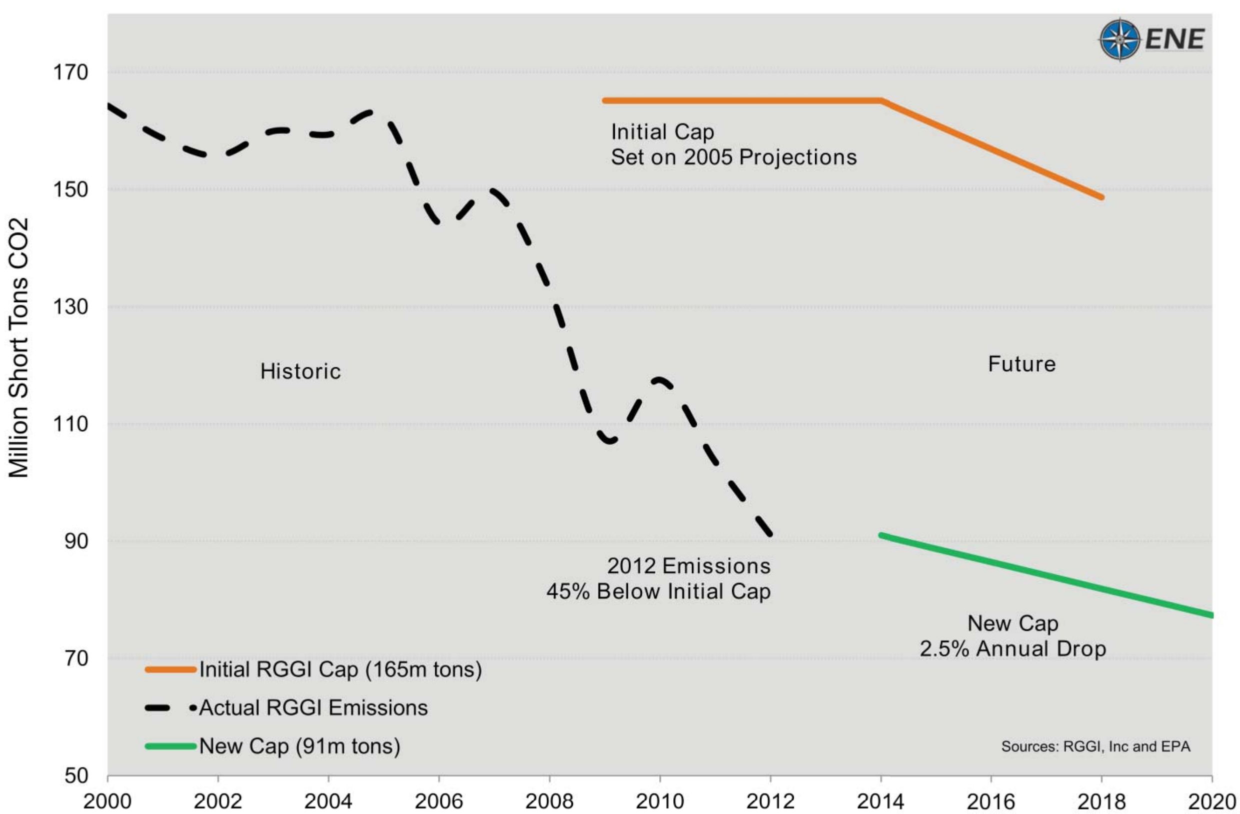
Renewable Portfolio Standards are a catalyst to spur increased generation of renewable power. Eight Northeast states have established Renewable Portfolio Standards (RPSs) or equivalent policies that support increasing amounts of clean power. Requiring utilities to steadily increase purchases of renewable energy provides key financial support for emerging renewable technologies such as wind and solar, which are competing against incumbent generation from fossil fuels that have long benefitted from public subsidies and emit harmful greenhouse gases with minimal cost or penalty. While the current levels of RPS standards shown in the figure below are an impressive start, higher levels of renewable generation will be needed in the clean energy system of the future.

Class I RPS standards in the New England States



The Regional Greenhouse Gas Initiative (RGGI) should lock in lower emissions and deliver further reductions. In order to secure significant progress reducing emissions, states participating in the RGGI – the region's power sector cap and trade program – recently **agreed to reduce the emissions cap by 45% and deliver continuing reductions through 2020**, as shown in the figure below. States must build on this progress by extending RGGI targets beyond 2020. Long range goals are needed to send clear market signals that will deliver the investment needed to further reduce greenhouse gas emissions from our electric system. States should also establish carbon controls for other sectors of their economies – such as industry, transportation, liquid fuels, and natural gas – in order to drive cost-effective emissions reductions across the regional economy, and raise funding for complementary clean energy programs that boost in-region economic growth.

Emissions Trends and Cap: RGGI

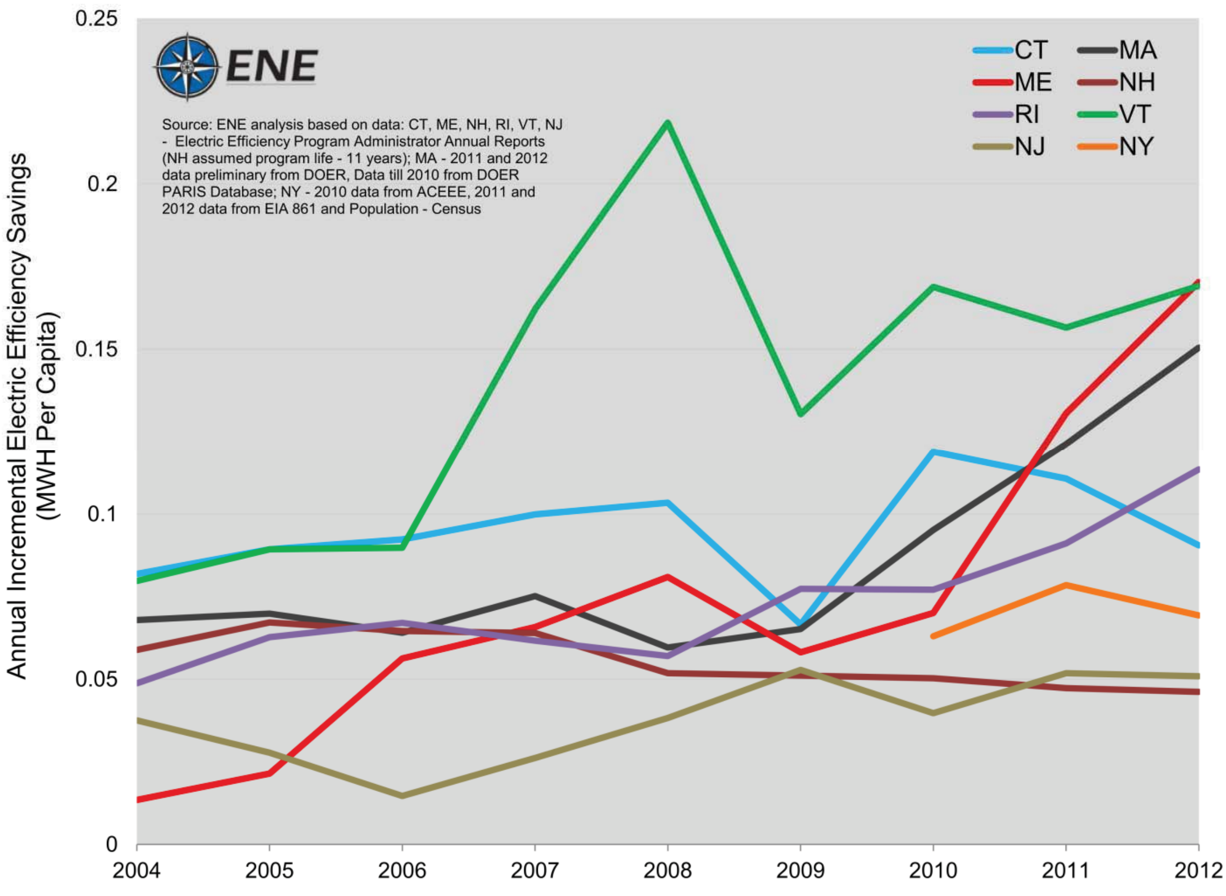


IV. Maximize Energy Efficiency

Energy efficiency is the cornerstone policy to reduce emissions and complements energy system transition strategies by reducing energy needs. Projects can also target specific infrastructure needs, such as providing an alternative to a transmission or distribution line upgrade, all while removing wasteful energy consumption and emissions.

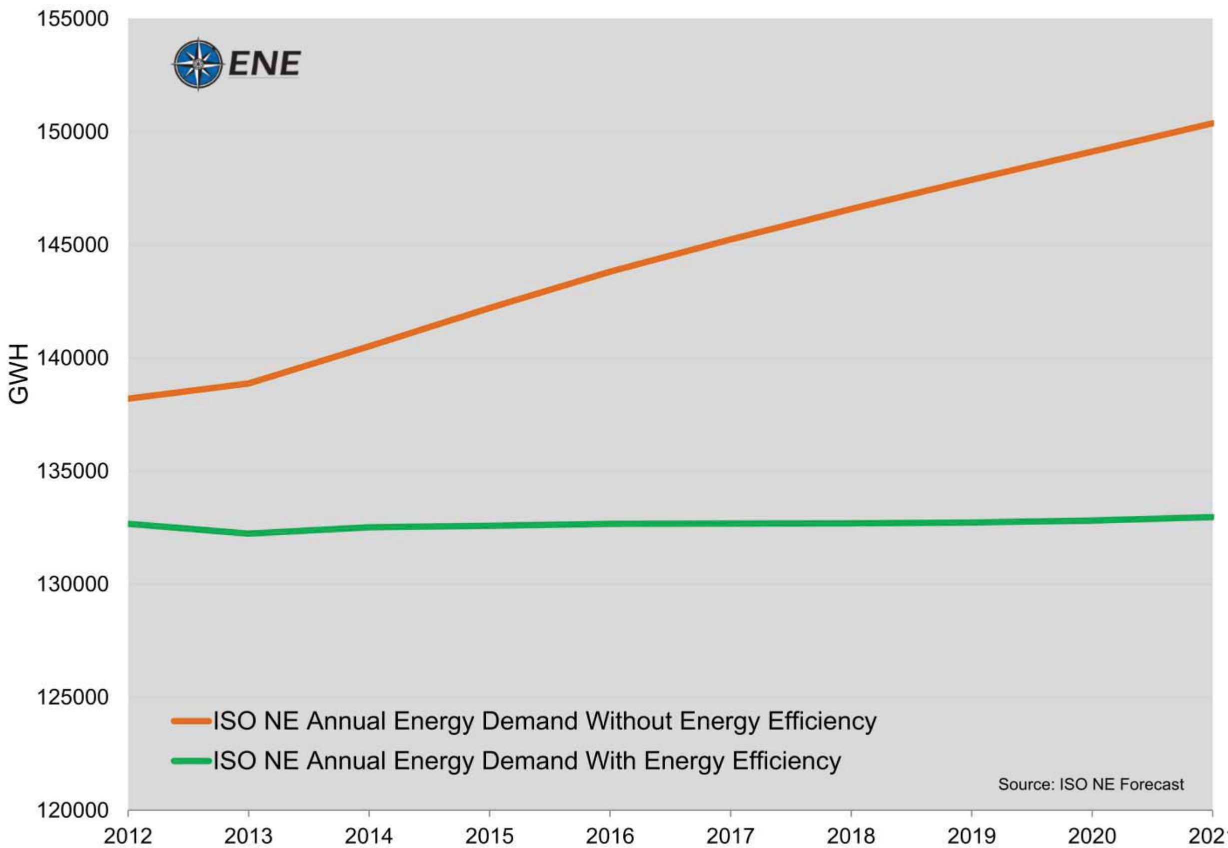
Energy Efficiency is the cheapest and cleanest "fuel," and states must support capturing All Cost-Effective Efficiency that is less expensive than supply. By adopting laws and regulations that prioritize energy efficiency, states are dramatically reducing consumption of fossil fuels, keeping more energy dollars at home, and driving economic growth. For example, the six New England states have invested over $3.3 Billion in energy efficiency that will save over 124,000 GWh. These energy savings will deliver $19.5 billion dollars in economic benefits and 51.3 million metric tons of avoided greenhouse gas emissions. Current and planned levels of efficiency investment in leading states are shown below.

Efficiency Savings Levels of Northeast States



In 2011, ISO-New England recognized the potential for states' investments in energy efficiency to defer and potentially avoid costly investments in the regional transmission system. As a result of the states' investments in energy efficiency, at least $416 million in planned transmission investments have been deferred and potentially avoided. This dramatic impact of efficiency on the energy needs of the region is illustrated in the figure below.

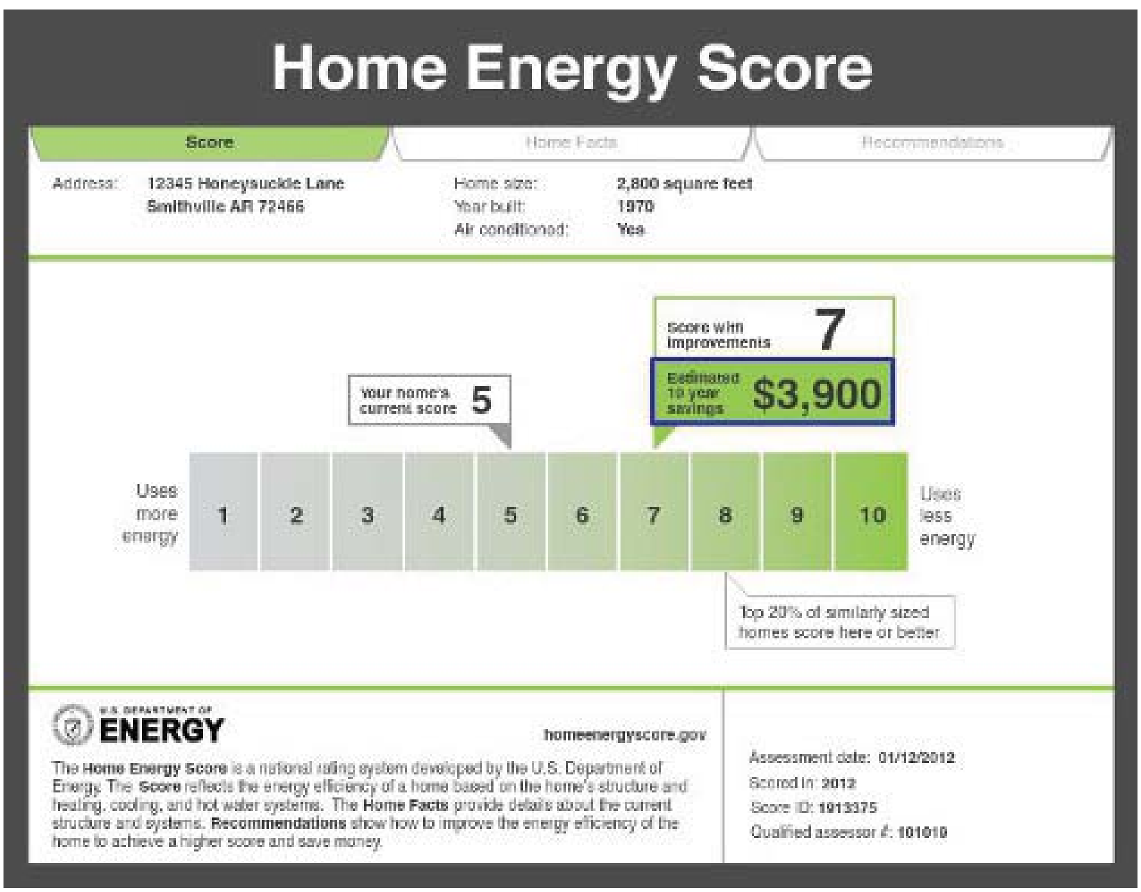
New England Energy Demand Forecast



Energy Efficiency Investment Programs will need to evolve to meet the changing needs of the energy system of the future. While these programs will continue to provide the incentives and education needed to ensure consumers and businesses invest in the most efficient products, new areas are emerging that will also play an important role. The more flexible electric grid of the future will provide more control to customers and allow them to become "micro utilities" with their own distributed generation, storage through electric vehicles, and demand control through intelligent appliances and building systems. Energy efficiency programs will need to play a key role in the adoption and diffusion of new demand side technologies and products. Expanding Zero Net Energy building programs established in many of the northeastern states will educate both industry and the housing market on how energy efficiency can be maximized and deployed.

As policymakers, homeowners and others continue to struggle with the inefficiency of the existing building stock, an increasing focus must be placed on Building Weatherization. Efficiency programs need to continue to evolve to address this difficult segment of the market through improved program design, continued education of the building trades, and access to affordable financing. Providing the information businesses and consumers need to appropriately value energy efficiency through Building Energy Labeling can enhance energy efficiency efforts. Several states have begun to take steps towards uniform building rating and labeling systems. Labels (see example below) that are provided as part of a real estate listing service can provide potential buyers or lessees with the information they need to more fully understand the energy costs of a building. This information will drive participation in weatherization programs by helping to ensure that investments in energy efficiency by a property owner can be recouped in the future, which in turn will expand the amount of efficiency that is captured.

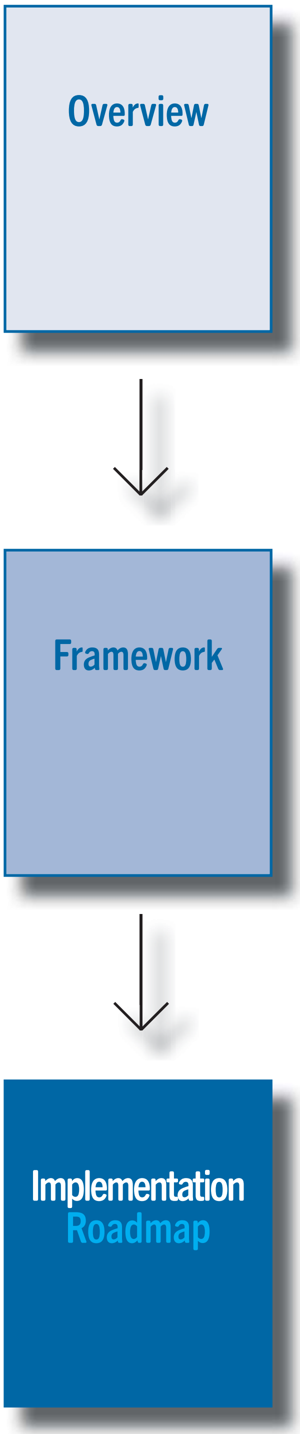
Example Building Energy Label



For new construction, major renovations, and many building systems, Building Codes and Product Standards can be the most effective way to improve energy efficiency. States need to constantly improve their baseline building energy codes to ensure new buildings are as efficient as possible. These codes will need to evolve to meet the needs of a modernized grid and energy system by ensuring new buildings either require or can be easily upgraded to support two-way vehicle charging, rooftop PV, and other components of the future energy system. While some improved federal product standards have been promulgated in recent years, there remains tremendous opportunity to adopt stringent efficiency standards for products not subject to federal preemption. In cases where there is a clear need for regional standards that are more stringent than federal standards, states should coordinate and seek joint exemptions to federal preemption.

Development patterns and land use decisions must evolve to recognize and support Locational Efficiency in order to reduce transportation energy needs in the future. The physical layout of the built environment has a dramatic and long-lasting impact on transportation energy needs and the amount of carbon sequestration provided by forests and soil. Planning and zoning regulations must fully account for these impacts and encourage new and infill development that creates communities that require less driving through better access to public transit, shorter commuting distances, and increased opportunities for walking and biking. This type of development will create more livable communities that will complement a local and community centered energy system.

Making the Vision Real: EnergyVision Implementation RoadMap



ENE's EnergyVision portrays a system that looks very different from the one we have today – one that would guide energy infrastructure investments and policies to a more consumer and technology friendly, decentralized system that can put us on the path to achieving deep reductions in greenhouse gas emissions.

The EnergyVision Framework sets forth a coherent path that ties energy supply, generation, and use together – offering clear goals for stakeholders and policymakers to work towards as they make policy and investment decisions related to our energy infrastructure, regulations and markets. The solutions we are looking to are viable. The technology is available and will continue to improve rapidly in the years to come.

While there is action occurring at the state and regional levels in many of the areas that the EnergyVision addresses, making the new energy system a reality will be a challenge. States, regional power systems and federal agencies incentives will need to adopt new policies, market incentives and regulatory reforms; change outdated approaches; uproot old technologies; and apply new ways of thinking about energy options.

ENE is dedicated to moving these changes forward through specific policy recommendations, advocacy action, and supporting economic and emissions analysis.

As an organization deeply engaged in state, regional and targeted national arenas to advance these goals, ENE sees significant interest among key stakeholders in addressing these issues. On-the-ground experience, networks and access provides important insights and buy-in to shape recommendations, expand research, and put plans into action. For these reasons, ENE will be working with stakeholders to develop an Implementation Roadmap that specifically outlines the research areas and policy reforms needed as next steps to advance the promise described in this EnergyVision.

Notes

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UtilityVision

UtilityVision is a collection of resources for decision-makers and stakeholders, designed to outline the specific steps we can take to create an energy system that meets our energy needs and supports a fair, healthy economy and environment.

Acadia Center's EnergyVision (2014) presents an overarching framework to guide investment choices and reforms needed in our energy system. EnergyVision sets forth important steps on four parallel tracks to create an energy system that is safer, cleaner and more affordable, and offers the promise of deep reductions in greenhouse gas emissions: (i) utilize market-ready technologies to electrify buildings and transportation (ii) modernize the way we plan, manage, and invest in the power grid to facilitate consumer control and new technologies; (iii) make continued progress toward a clean electric supply; and (iv) maximize investments in energy efficiency to reduce unneeded energy demand that waste consumer dollars and act as a drag on the economy.

UtilityVision confronts a core part of this climate and energy future: how to construct a fully integrated, flexible, and low carbon energy and grid network. UtilityVision is a framework for how reforms in five interdependent categories can be aligned to put the consumer—our homes and business—at the center of a modern energy system and move us on the path to attain our climate, economic, and consumer goals. The interests of consumers and a sustainable energy system have merged more than ever before. UtilityVision offers a comprehensive pathway to a smart and dynamic electric system focused on giving consumers and communities greater freedom and control over their energy costs, managed with the cooperation of utilities, governed by updated regulations that honor energy technology change, supported by flourishing but well-regulated markets and providing a fair and safe system to protect consumers. **www.acadiacenter.org/document/utilityvision/**


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Center

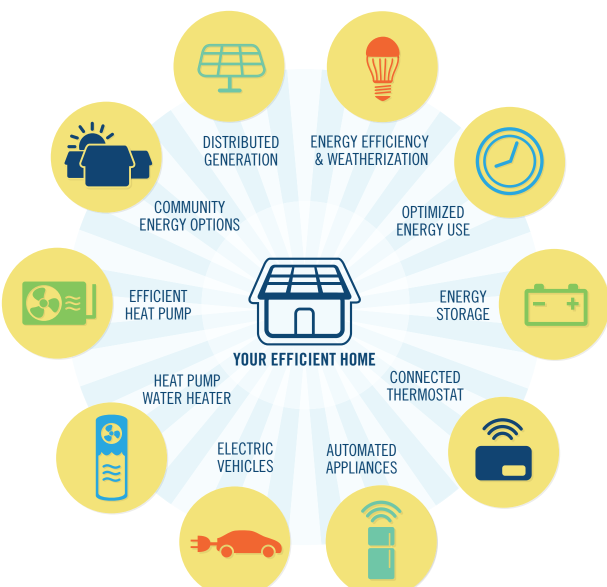
Empowering the Modern Energy Consumer

Today's electric grid is built around technologies that date back to the time of Thomas Edison. The grid—and the policies that govern it— are increasingly out-of-step with new technological advances and consumer expectations for a clean, affordable, resilient, and reliable energy system.

It is time for a cultural shift in how we think about the energy system. No longer should energy dollars be poured only into massive power stations and miles of wire. The energy system should empower people and connect communities in ways that maximize participation and minimize our energy burden and harmful environmental impacts. The old way of constructing the power grid is limited to traditional engineering approaches and is short on authentic consumer engagement that has the potential to deliver a cleaner, lower cost energy system and stronger communities.

In the new UtilityVision approach, more than poles and wires connect neighbors. The new energy system will bring energy efficiency into more homes, businesses and communities, creating local jobs that can't be outsourced and lowering energy bills. New energy technologies will be allowed to flourish so neighbors can connect through community solar arrays or district heating and cooling systems.

An advanced energy future isn't only about Teslas and Nest thermostats, either. Local energy projects can affordably meet the needs of municipalities, freeing up resources for education, public safety, and other critical services. We can reduce the impact of infrastructure in our neighborhoods by deploying customer-side energy resources like demand response and roof-top solar. Electric cars and city buses will reduce noise and diesel pollution in our streets, and the twenty-first century electric grid will embrace electric transportation in a manner that boosts system reliability, minimizes costs, and protects consumers. Renters will have the power to make energy choices for their homes and compare energy costs before they sign a lease. Communities can set and enforce a reasonable standard of efficiency to protect tenants from bearing the cost of overly expensive energy systems.



The modern energy system should benefit and empower all of us to control our energy use and costs, enable consumer-friendly, clean energy technologies to flourish, establish fair and non-burdensome rates, and ensure that consumers—especially the most vulnerable—are treated fairly in the new energy system. While UtilityVision describes a major shift in consumers' role in the energy system, the changes should be implemented strategically so that consumers have the information and understanding to make beneficial decisions.

UtilityVision's updated approach to energy regulation is based on overarching principles:

- *Coordinated planning for the future*: Grid planning will be comprehensive and proactive, merging traditional engineering and infrastructure solutions with customer-side, clean energy technologies.
- *Consumer protection and fair pricing for all*: The modern energy system will empower all consumers by allowing customer-side resources to flourish, establishing fair and non-burdensome rates and revenue structures, and providing a full safety net of necessary protections.
- *Updated roles for regulators, utilities and stakeholders*: Regulators will have a stronger role in strategic grid planning, aligning utility incentives with consumer and environmental goals, and ensuring that the consumer is at the center of the modern grid.

Strategic Planning for a Consumer-Focused Power Grid

Challenge:

Traditionally, utilities and regional grid planners focused on maintaining the power grid for one-way power flow from fossil-fuel power stations over miles of power lines to homes and businesses. Utilities used infrastructure and engineering tools like new circuits, new substations, new power lines, or larger conductors to support growing energy demand and maintain reliable service. Increasingly, cleaner and more cost-effective customer-side tools like energy efficiency, load control, distributed generation, and demand response can be used instead of—or in combination with—traditional infrastructure projects. But the old way of planning and paying for the grid effectively locks out consideration of these newer consumer- and environmentally-friendly solutions.

Recommendations:

Local Distribution Grid

- **New utility planning for a consumer-focused distribution grid:** Long-range grid planning must be comprehensive, merging the traditional world of "poles and wires" with new technologies and modern strategies. Comprehensive, multi-year Strategic Grid Plans should be required, and must:
    - Start with proactive planning to streamline consumer adoption of new energy technologies. Utilities should forecast adoption of customer-side energy resources and proactively plan more efficient and cost-effective upgrades at the local circuit level.
    - Compare a wide array of "grid-side tools" and "customer-side tools" to optimize the grid. The range of solutions considered should be broad and comprehensive: ranging from traditional "poles and wires" to new grid technologies like voltage management to customer energy efficiency, storage, and distributed generation.
    - Evaluate a range of options and scenarios on the basis of standard and level criteria, such as cost, benefits, risks, and public policy goals.
    - Pursue technological synergies.
    - Position the utility well for addressing emerging challenges, embracing new technologies, and continued innovation.
    - Identify an action plan to implement the plan over a multi-year period, implemented with on-going, independent evaluation and annual reporting to stakeholder advisory council and regulators.
- **Update cost-benefit calculations to reflect the public interest:** Decisions about the grid should be based on a calculation of cost-effectiveness that is aligned with state's consumer, energy, and environmental goals. Cost-benefit frameworks should be designed or expanded to fully reflect priorities such as reducing energy bills and reducing consumers' energy burden, addressing climate change, enhancing consumer control and choice, and system-wide efficiency.

Regional Transmission System

- Customer-side resources and energy policies that reduce demand must be included in forecasts of energy consumption and peak demand.
- System needs should be identified, quantified, and described early enough to allow customer-side energy solutions to be proposed and evaluated.
- Customer-side energy resources should be eligible for the same payment treatment as traditional infrastructure solutions for reliability needs.
- Utility incentives should be reformed so that customer-side energy resources are seen as opportunities, and not competition for large, capital-intensive transmission projects.
- State regulators should require that customer-side energy resources are evaluated as part of any economic justification for new transmission system projects. Proposed transmission projects should demonstrate how the project will maintain safe and reliable service, support clean energy goals, and provide the most cost-effective option compared to competing alternatives.

Consumer Voices Critical to Energy System Planning:

Consumers do not only have to be the pocketbook of the grid; they are increasingly the focus of new energy innovations. Improving the consumer voice in energy grid decisions is critically important. A consumer stakeholder advisory council can provide meaningful input into utilities' long-term grid plans and ensure that consumer and environmental benefits are maximized. Structured stakeholder participation in the development and review of long-term grid plans can benefit grid modernization efforts in several ways:

- *Address the imbalance in resources and information* that can lead to utilities' disproportionate ability to influence regulatory decisions and result in the public perception of unfairness.
- *Achieve greater buy-in by all affected parties*, which can reduce the total time of making and implementing decisions. This reduces the regulatory burden and the potential for litigation or appeals of regulatory decisions.
- *Bringing together diverse interests to identify*, discuss, and address complex issues and provide recommendations. This helps overcome information gaps and assist regulators' evaluation of plans and policies.
- *Building a foundation of common knowledge* will lead to greater public acceptance. Actively engaging consumer, business, and environmental interests will ensure more balanced and stable outcomes—a process that has worked well in several states to advance energy efficiency investments and could be adopted and expanded.

- **Regulators have a stronger role in strategic grid planning:** Regulators must play an important role in ensuring that grid planning and utility investment decisions advance a modern, clean, and consumer-friendly energy system by connecting and aligning the utility business model, grid planning, and stakeholder participation.
- **Regulators have a critical role in ensuring consumer protection:** The current regulatory system provides numerous safeguards for consumers. These should be maintained and adequate protections extended to new or expanded retail markets for energy services and equipment so that market players operate in a fair, responsible, and consumer-friendly manner. Protections ranging from winter shut-off restrictions to licensing and code of conduct for companies that approach consumers are among the wide range of consumer protections needed.

Aligning Utility Incentives with Consumer and Environmental Goals

Challenge:

A common way for utilities to earn revenue is by making capital investments on which the utility earns a specified rate of return that is set by the regulators. This system gives utilities incentives to build or upgrade traditional infrastructure projects. This model is increasingly at odds with new technologies that can optimize the energy system and with public policy goals to increase energy efficiency and consumer adoption of distributed energy technologies. Utilities are reluctant to make proactive investments in the grid—such as upgrading circuits to connect more roof-top solar—or to deploy advanced metering or communication systems, because it is unclear whether these investments fit the criteria that determine whether the utility can recover its costs and return.

Recommendations:

The regulatory model needs to evolve to provide utilities with the appropriate financial incentives to encourage full and timely implementation of states' consumer and environmental goals. Instead of earning revenue primarily for building more infrastructure, utilities should also be rewarded for achieving energy efficiency and clean energy goals, minimizing the cost of the grid, and providing choices, opportunities, and control to consumers.

- **Implement Revenue Decoupling:** Revenue decoupling is a well-established rate-making mechanism that severs the link between a utility's sales and its profits. This reduces a utility's financial disincentive to invest in energy efficiency, distributed generation, or any initiative to reduce consumption. States should implement full revenue decoupling, and should not implement high fixed charges or straight-fixed variable rates that are erroneously considered as alternatives to decoupling.

- **Use Grid Planning to Set Rates:** The Strategic Grid Plans should be used to inform the amount of future revenues a utility is allowed to earn, which would then be used to set electricity rates. The Strategic Grid Plans should also be used to inform performance incentive mechanisms.

- **Adopt Performance Incentive Mechanisms and Standards:** Performance incentives mechanisms for utilities have been used for many years, and these can be refined to include emerging performance areas such as system efficiency, grid enhancements, energy efficiency, distributed generation and environmental goals. By increasing the portion of revenue requirements recovered through performance incentives, while reducing the portion of revenue requirements that a utility recovers from the rate base, performance incentive mechanisms help to shift the financial incentive away from capital investments and towards achieving performance goals. In the long run, states and regulators should consider transitioning away from reliance on rate base revenue and give consideration to using transition charges as the energy system moves and resizes to a distributed model.

    - States should establish performance standards to ensure that utility management is aligned with state energy policy, such as capturing all cost-effective energy efficiency and demand response resources. Cost-effectiveness standards should be defined broadly to include all relevant benefits.

- **Provide Regulatory Certainty:** Regulators and stakeholders should use the Strategic Grid Plans to provide the utility with up-front guidance with regard to future resources, grid enhancements, and major capital expenditures. This guidance should provide utilities with greater flexibility and incentive to adopt emerging and innovative technologies and practices.

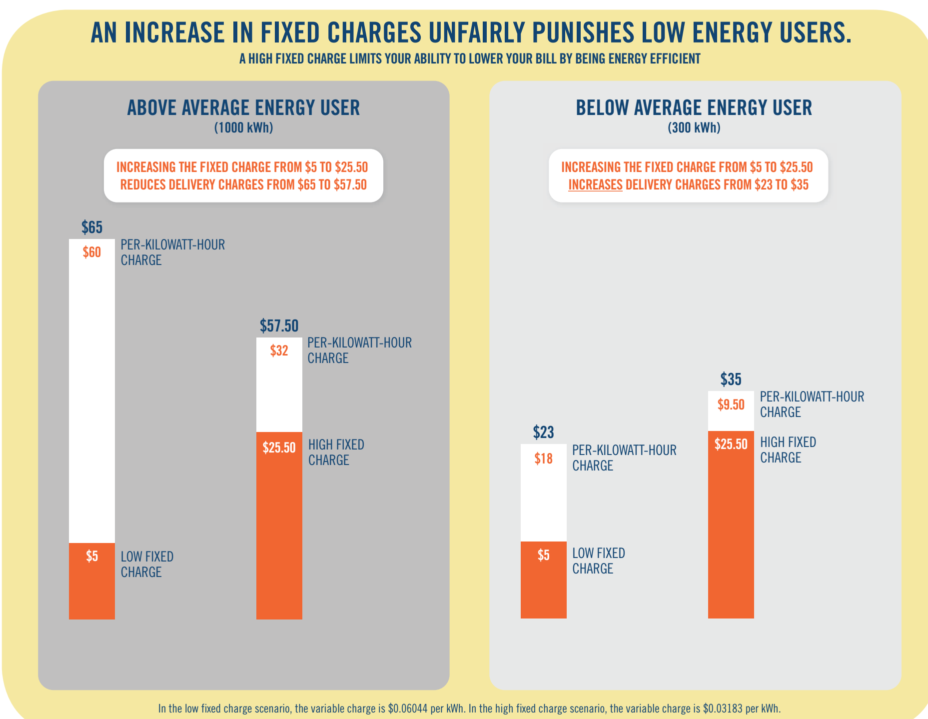
How Consumers Pay for the Power They Use

Challenge:

Despite the progress in clean and innovative energy options for consumers, current rate structures are outdated and do not allow sufficient freedom for new consumer choices. Most residential prices for electricity are flat: the same price per kilowatt hour any time of day or season. However, different portions of the electricity bill have different underlying cost structures. Energy supply costs are primarily influenced by the amount of electricity consumed and its timing because higher cost electricity generators operate when demand is high. In contrast, energy delivery costs, including transmission and distribution, are driven by infrastructure sizing for peak kW demand, often at a single hour during the year, at the regional and local levels. Our electricity bills should be designed to empower consumers to make smart energy and economic decisions, and preserve the consumer incentive to use electricity wisely.

Recommendations:

- **Avoid reliance on fixed charges, which limit consumer options:** High flat monthly charges make it harder to reduce electric bills by using less power or self-generating electricity. Fixed charges should be limited to the cost of keeping a customer connected to the grid, such as metering, billing, and data processing costs. The impacts of public policy considerations should be factored in, as well.



- **Move towards widespread time-varying rates for energy supply:** Time-varying rates provide better economic incentives to reduce overall generation costs and create opportunities for consumers to save money by taking advantage of low-cost hours. Time-varying rates come in a variety of forms, and as technology develops, consumers may be able to understand and benefit from more complex and granular options.

- **Align rates for energy delivery with real costs:** Both demand charges and time-varying rates are good options to consider to align rates for transmission and distribution with underlying system costs, while still creating opportunities for consumers to lower their energy bills through energy efficiency and other customer-side resources.

  Demand Charges: Charges based on the actual costs to maintain the grid to deliver power when needed can reflect the cost a customer imposes on the grid during peak demand periods. Consumers with low energy use will generally pay a lower demand charge than bigger energy consumers. Well-designed demand charges, based on local or system peaks, can respond to customers' behavior in a timely way to reflect the benefits of efficiency, demand response, or other actions to reduce energy use.

  Time-Varying Rates: Time-varying rates for energy delivery can be designed to approximate the incentives of well-designed demand charges. Customers would pay more for energy delivery at peak times when the system is constrained and less at times when the system has excess capacity.

Recommendations (continued...)

- **Align cross-subsidies with public policy objectives:** Market-based mechanisms can often be used to support consumer and environmental goals and reduce cross-subsidization (having one rate class support another). Some cross-subsidies exist to create a value that would otherwise be missed by pure markets, such as lower-cost power to low income customers. Regulators should ensure that beneficial cross-subsidies are aligned with state policy goals, while using market-mechanisms when possible to encourage economic decisions.

- **Phase-in rate innovations:** Significant rate innovations should be implemented on a phased and strategic schedule to ensure maximum consumer benefit and adoption. Consumers should be given time to fully understand the new rate system before it goes into effect. For example, time-varying rates may start as opt-in, transition to opt-out, before finally becoming mandatory. Clear information and education should be provided to allow consumers to understand their electricity bill and what actions they can take to reduce it.

- **Advanced metering infrastructure (AMI)**: AMI should be deployed when and where it is cost-effective. For example, AMI may be geographically targeted based on grid needs; rolled out based on customer size; or installed whenever old meters are retired. New residential rate classes can be created for customers with AMI, or for those who have high energy consumption. All customers could also be allowed to opt-into AMI and new rate structures.

  Costs, benefits, and consumer impacts must be evaluated throughout the phase-in. Keeping certain consumer segments, such as low income, on existing rate structures could be justified by both economics and consumer protection principles.

How Consumers Get Paid for the Power They Produce

Challenge:

In many states, consumers with solar panels, wind turbines, or other power generation systems receive credits for excess electricity they provide to the grid when they generate more power than they need. In some cases, the customer pays the utility the retail rate for her net electricity consumption and gets credited at the retail rate for the power she sends back to the grid. The value of solar power—or wind power, or power stored in a battery or electric vehicle—however, is not necessarily the same as the retail price. It may be higher or lower depending on location, time of day and/or many other factors. Customers with distributed generation should pay the amount that reflects the costs of staying connected to the grid and get credited for the benefits they provide.

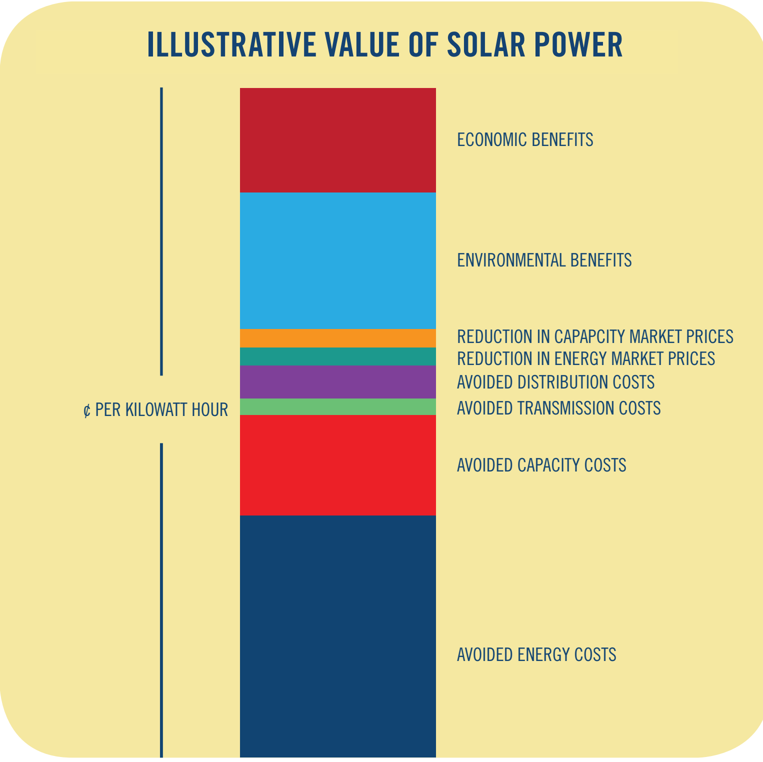
Recommendations:

In the long term, advanced metering and time-varying rate structures will make it possible to accurately charge and credit consumers for the grid services they use and provide. Until these innovations are widespread, regulators can set tariffs based on the calculated value of the benefits customer-side resources provide to the grid.

- **Short-Term–Use the right value for distributed generation:** Net output from distributed generation should be credited at a price that fully reflects its grid-wide costs and benefits, including environmental benefits and the value of avoided energy, capacity, transmission, and distribution costs, along with location value and other components where appropriate. Some jurisdictions are exploring or implementing, “value-of-solar” approaches and this methodology should be applied—and the right value calculated—for other distributed resources too.

Exhibit No. AC-3

Recommendations (continued...)



- **Long-Term- Align "how consumers pay" and "how consumers get paid:"** When the retail rates that we pay for energy supply reflect its time-and location- specific value, it will make economic sense to compensate distributed generation at the same rates. For example, it will cost more to use power on hot summer afternoons, and roof-top solar power will get compensated more for power it sends back to the grid because it is more valuable during those peak hours. Similar concepts apply to long-term reforms of energy delivery rates.
- **Meters that measure power flow in both directions:** Under a "bi-directional rates" approach, a distributed generation customer could receive a bill with the following components: 1) fixed charge (for metering and billing); 2) charge for power consumed on a time-varying basis; 3) credit for power exported on a time-varying basis; 4) charge for using the grid to consume power reflecting costs to the systems; and 5) charge for using the grid to export power reflecting benefits as well.

UtilityVision portrays a system that looks very different from the one we have today—one that would guide energy infrastructure investments and policies to a more consumer and technology—friendly, decentralized system that can put us on the path to achieving deep reductions in greenhouse gas emissions. UtilityVision sets forth a coherent path that ties the utility business model, rate-making, and customer-side energy resources together—offering a clear framework for stakeholders and regulators seeking to modernize the way we plan, manage, and invest in the power grid to empower consumers to have more control over their energy future.

Acadia Center is a non-profit, research and advocacy organization committed to advancing the clean energy future. Acadia Center is at the forefront of efforts to build clean, low-carbon, and consumer-friendly economies. Acadia Center's approach is characterized by reliable information, comprehensive advocacy and problem-solving through innovation and collaboration. UtilityVision was produced by Acadia Center staff, led by Abigail Anthony, Director, Grid Modernization and Utility Reform with primary contributions from Mark LeBel, Jamie Howland, and Daniel Sosland. Thanks to Synapse Energy Economics for their expertise and Public Displays of Affection for visualizations and design.

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