

Memo

To: The Next Governor of Connecticut

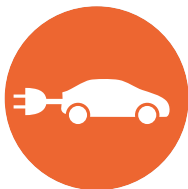
From: Acadia Center

Date: December 2018

Re: Strengthening Connecticut's economy, competitiveness, and overall quality of life.

Message:

The next governor can revitalize Connecticut by modernizing transportation and energy through five reforms that will unlock significant new economic, consumer, and public health benefits for our state.



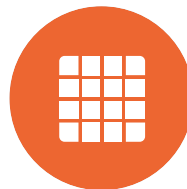
TRANSPORTATION



GENERATION



BUILDINGS



GRID



CHOICE

Building a Stronger Connecticut

Memorandum to the Next Governor - December 2018

Overview: The Next Governor Can Revitalize Connecticut By Modernizing Transportation and Energy

The next governor of Connecticut faces an exciting opportunity: to use proven transportation and energy reforms to revitalize and strengthen Connecticut's economy, competitiveness, and overall quality of life.

The next governor can seize this opportunity by pursuing five reforms.

1. Modernize our transportation infrastructure to improve safety, access, and convenience;
2. Transition power generation to cheaper, cleaner, and more resilient local sources;
3. Improve energy performance in buildings to reduce costly energy use and emissions;
4. Reform energy grid rules to reduce high energy costs and speed energy innovation;
5. Give communities and consumers more control over their energy choices.

These reforms will unlock significant new economic, consumer, and public health benefits for our state. For instance—modernizing transportation only—could produce over \$6.9 billion in new economic benefits, add 14,900 new jobs, and create \$3.7 billion in public health and other benefits.

Remaking the transportation and energy systems must be a core part of Connecticut's new economic strategy. Newly-unleashed investment and innovation will drive economic progress, improved quality of life, and more equitable benefits for all residents and communities. More detail on the five reforms follows.

1. Modernize Connecticut's Outdated Transportation Infrastructure to Improve Safety, Access, and Convenience

The Transportation System and Current Challenges

Connecticut's transportation system—its network of highways, trains, public transit, airports, ports, and walking and biking corridors—is vital to the state's economy. It facilitates the movement of goods and connects people to jobs, shopping, recreation, and other services. However, the system needs critical improvements to address three major challenges and better serve the state's communities and businesses.

Update Transportation Infrastructure: The state's transportation infrastructure and transit options need substantial investment to create a safe, modern, and resilient system. Connecticut's aging and deficient roads and bridges cost drivers about \$6.1 billion annually through increased vehicle

operating costs, congestion delays, and accidents.¹ Approximately four out of every five miles of Connecticut's major roads are in mediocre or poor condition.² More than 300 Connecticut bridges have been rated structurally deficient.³

Improve Transportation Access and Equity: Transportation options must be expanded and improved in communities that remain underserved and overburdened by the current system, delivering more affordable, accessible options and reducing the disproportionate impacts of local air pollution. Traffic congestion continues to worsen in Connecticut's major urban areas, costing approximately \$2.4 billion annually in lost time and wasted fuel.⁴ Despite recent progress, public transportation in Connecticut remains significantly underfunded, resulting in major service cutbacks and inadequate statewide access.⁵ Public bus transportation is either limited or non-existent in 70 Connecticut towns.⁶

Reduce Transportation Emissions: Transportation is the largest source of Connecticut's greenhouse gas ("GHG") emissions, which must be reduced for the state to meet its

climate goals.⁷ Inefficient and outdated transportation infrastructure greatly contributes to public health problems, particularly in congested, often lower-income, neighborhoods. Transportation is the primary cause of nitrogen oxide (“NOx”) pollution in Connecticut—emitting about 67% of this local air pollutant.⁸ NOx leads to ground-level ozone and smog, which can trigger asthma attacks, among other public health harms.⁹

Major Benefits from New Policy Approach to Transportation Emissions

A safe, modern, and clean transportation system would offer transformative benefits to Connecticut’s economy. By capping transportation GHG emissions and auctioning allowances—much like Connecticut already does for GHG emissions in the electric generation sector¹⁰—the state could generate about \$2.45 billion in new revenue between 2019-2030. That revenue could then be reinvested in the transportation system to target certain modern improvements, as demonstrated by the sample portfolio shown in Table 1.

Acadia Center has examined the benefits of transportation reforms in other states¹¹ in order to estimate some of the new economic activity and other monetary benefits that would be generated if Connecticut invested in cost-effective transportation improvements focused on expanding consumer access and reducing emissions. These economy-wide benefits would include:

- Creation of about 14,900 long-term jobs (in other words, not project-related construction jobs);
- Over \$2 billion in new wages,¹² primarily from newly-created jobs;
- \$6.9 billion in new business sales, resulting from project-related spending, spending of new wages in the local economy, and spending of cost-savings generated by lowered transportation expenses;
- Nearly \$3.7 billion in other benefits, including fewer hours spent in traffic and improved health outcomes, as well as \$86 million in savings from avoided costs of GHG emissions.¹³

These benefit estimates flow from a sample portfolio of transportation improvements that focus on clean electric vehicles (“EV” or “EVs”), transit, and other mobility options.

This portfolio has many benefits for Connecticut. For example, electrifying passenger vehicles, buses, and port equipment will improve air quality and reduce operating costs for vehicle owners and taxpayers. Expanding rail, bus transit, and walking and biking will reduce travel in single-occupancy vehicles, improve mobility, and expand

Table 1: Investment Portfolio for Connecticut’s Proceeds from New Emissions Policy¹⁴

Connecticut	Possible Investment Portfolio	2019-2030 Total Revenue (millions)	Average Annual Revenue (millions)
EV & Charging Infrastructure Rebates	56%	\$1,374	\$114
Rapid Transit (Bus & Streetcar)	20%	\$491	\$41
Intercity Rail (Trains & Commuter Rails)	10%	\$245	\$20
Walking & Biking Infrastructure	8%	\$196	\$16
Port Electrification	6%	\$147	\$12
Total	100%	\$2453	\$204

consumer options. By 2030, investment guided by this sample portfolio could result in:

- About 460,000 electric vehicles—17% of the passenger vehicle fleet—as well as associated charging infrastructure, aligned with Acadia Center’s EnergyVision 2030 recommendation for reducing GHG emissions 45% by 2030.¹⁵ This level of annual support would also align with Connecticut meeting its commitment to electrify about 155,000 passenger vehicles by 2025 under the Multi-State Zero-Emission Vehicle Memorandum of Understanding;
- Over 350 electric buses and their charging infrastructure to expand CT DOT’s service and replace aging and polluting diesel vehicles;¹⁶
- Construction of two small streetcar systems, similar in scale to the proposed New Haven Streetcar;¹⁷
- Over 700 miles of new walking and biking trails throughout the state to add new capacity and complete existing gaps in regional trail networks;¹⁸
- Electrification of ports throughout the state, including electric shore power investments and electrification of drayage equipment;¹⁹
- Commuter rail enhancements throughout Connecticut.

Improving Connecticut’s transportation system will require a suite of complementary policies. Valuing carbon emissions from transportation, potentially through a regional cap-and-invest program,²⁰ would complement other policies by generating revenue for reinvestment in significant transportation improvements. These improvements would allow the system to better serve the public while creating new jobs and attracting and retaining businesses.

The next governor should act quickly to put a price on transportation emissions to reap the many benefits and accelerate progress to a more modern, equitable, low-carbon transportation system.

2. Transition Electric Generation to Cheaper, Cleaner, and More Resilient Local Sources

The Electric Generation Sector and Current Challenges

Our modern world depends on electricity to power essential needs—lighting, cooling and heating, motors, and electronics. Connecticut is no different. Electric power is at the core of its economic well-being and quality of life. Improvements to Connecticut’s electric generation sector are necessary, however, due to several pressing challenges.

Strengthen Energy Independence: Electric generation in Connecticut (and the New England region) continues to rely heavily on an imported fossil fuel, natural gas, for power production—roughly 49% of electric generation in 2016.²¹ This makes Connecticut’s economy vulnerable to market conditions largely outside of its control, such as electricity price spikes caused by natural gas supply constraints in the winter.²²

Grow In-State Clean Energy Industries: Connecticut needs to protect and expand its in-state clean energy industries to maximize long-term economic growth and better compete with neighboring states. Offshore wind and rooftop solar are the two most promising clean energy resources for maximizing economic impact in Connecticut, as discussed in more detail below.

Reduce Electric Generation Emissions: The electric generation sector remains a significant source of GHG emissions, despite recent strong progress.²³ To meet its new clean energy and climate commitments, Connecticut will need to deploy more renewables at a faster pace, primarily rooftop solar and offshore wind.²⁴

Accelerate the Electric Generation Sector Transition to Boost the Economy

With clean energy and its zero-emissions performance now competing with fossil fuels on cost,²⁵ the time is right for Connecticut to move faster on local power supply options that are cheaper, cleaner, and more resilient than imported fossil fuels. The economic rewards would be immense. Investing in local clean power—primarily offshore wind and rooftop solar—means prioritizing economic growth and job creation in Connecticut.

Offshore wind and rooftop solar both represent immediate opportunities for strong and sustained positive economic impact in Connecticut. As carbon-free power, offshore wind has incredible potential in Connecticut and the region. Good wind speeds, shallow water and close proximity to population centers make it a nearly ideal grid-scale renewable resource. The federal offshore areas currently available for leasing have an annual generation potential roughly

equal to the amount of electricity consumed annually by Connecticut—almost 29,000 gigawatt hours in 2016—significantly more than even the generation capacity of the state’s lone nuclear power plant.²⁶

Chart 1: Annual Offshore Wind Potential and CT Electricity Consumption



Source: BOEM, EIA

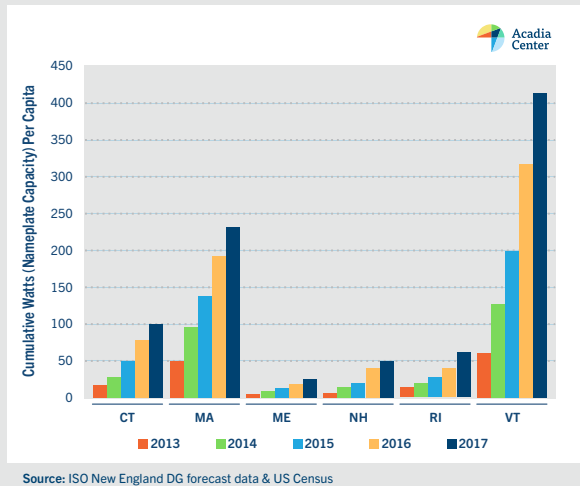
Major Benefits from New Policy Approach to Wind Power

With three deep-water ports and a skilled manufacturing sector, Connecticut is well-positioned to launch its own offshore wind industry. An offshore wind build-out at the scale required to meet Connecticut’s clean energy and climate goals would provide a major boost to Connecticut’s economy and skilled labor market. Acadia Center has estimated that if Connecticut were to pursue a build-out of 2,000 MW of offshore wind by 2030, it would produce the following benefits:

- Over \$3 billion in new economic growth for Connecticut, primarily from construction activities as deployment at this scale would probably take place in phases over the relevant timeframe;²⁷
- At least 4,000 new jobs, primarily focused in the skilled trades and concentrated in Connecticut’s shoreline economy around its deepwater ports, which means more high-paying jobs for New London, Bridgeport, and New Haven;²⁸
- Significant long-term utility bill savings for Connecticut’s electric ratepayers, likely in the range of several hundred million dollars based on a bill savings analysis performed by Massachusetts for its recent offshore wind bid selection.²⁹

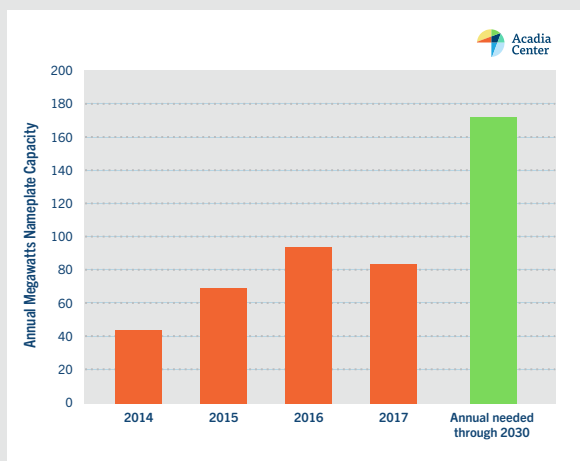
Ramping up the in-state solar industry would also boost Connecticut's economy and job market. Distributed solar, which includes rooftop and other small-scale solar, is a key part of Connecticut's important and growing clean energy economy. The industry currently employs about 2,170 people in Connecticut—11% more than in 2015.³⁰ Distributed solar also gives Connecticut residents and businesses another way to control their energy use and reduce high energy costs.

Chart 2: Solar Deployment Per Capita in New England



Yet Connecticut can do much more to take advantage of distributed solar's economic benefits. Connecticut lags other New England states in its pace of deployment.³¹

Chart 3: CT Annual Distributed Solar Installations Versus 2030 Climate Target



Vermont has installed four times more distributed solar per person than Connecticut, and Massachusetts nearly two times more per person.³² These higher deployment rates in nearby states indicate that Connecticut's in-state solar industry could expand, if supported by effective solar policies.

Connecticut's current deployment rate will not be sufficient for meeting its climate goals, as Acadia Center has modeled through its EnergyVision 2030 project.³³ Connecticut will need to more than double its current annual rate of distributed solar installations to stay on track through 2030.

Major Benefits from New Policy Approach to Solar Power

Doubling the installation work of the existing in-state solar industry would help Connecticut's economy. Acadia Center has estimated that increasing distributed solar installations to about 160 MW annually—an achievable target based on current installation rates in other New England states—would result in:

- Approximately 1,960 new jobs in Connecticut, with that employment level sustained through 2030;³⁴
- Increased personal income of at least \$216 million, which means greater spending power and more in-state economic activity;³⁵
- About \$13.6 million annually in new state tax revenue (personal income and sales taxes) generated by new jobs and economic activity.³⁶

To capture the full economic potential of rooftop solar and offshore wind for Connecticut, existing policies will need to be changed to maximize cost-effective deployment of both resources. New solar laws put in place in 2018 will need to be revisited. Both industries will need clear, sustained policy support through 2030. The next governor of Connecticut should move quickly to prioritize these two in-state clean energy industries by giving them central roles in economic development strategy.

3. Improve Energy Performance in Buildings to Reduce Costly Energy Use and Emissions

The Building Sector and Current Challenges

To advance Connecticut's economic well-being and quality of life, improving energy usage in buildings must play a key role. The poor energy performance of the many aging buildings in Connecticut burdens household budgets, business competitiveness, and public health. Unnecessary energy consumption in our buildings makes our energy system

more expensive and increases pollution emissions. Two major challenges exist for the building sector, and solutions to each are available that will help boost Connecticut's economy.

Increase Commitment to Energy Efficiency: Connecticut needs to give more residents and businesses access to its award-winning, high-quality energy efficiency programs by increasing energy efficiency savings targets to match those in leading states, among other policy reforms. Connecticut invests in cost-effective electric efficiency at roughly half the levels pursued in Massachusetts and Rhode Island (see Chart 4).³⁷ Energy efficiency program funding must also be fully restored and protected by undoing the ongoing legislative fund raid imposed in late 2017. The energy efficiency industry employs more than 34,000 people,³⁸ but those jobs and the health of that industry overall have been imperiled by the severe fund raid.

Move to Clean Heating Technologies: Connecticut's building sector relies heavily on fossil fuels for its heating needs—for instance, 35% of Connecticut households use natural gas and 45% use fuel oil or propane.³⁹ This overreliance on imported fossil fuels ends up costing Connecticut consumers roughly \$1.2 billion annually.⁴⁰ Converting the building sector to more affordable clean heating technologies is now possible with recent advances in performance and cost reductions. Heat pumps are the most promising of these newer technologies—offering highly efficient performance, consumer savings, and zero on-site emissions.

High Building Energy Performance Unlocks Significant Benefits

Energy efficiency is at a critical moment in Connecticut. Despite good progress made over the last two decades through Connecticut's energy efficiency programs—officially named the Conservation and Load Management

("C&LM") programs—Connecticut now risks falling behind nearly all other states in New England on efficiency.

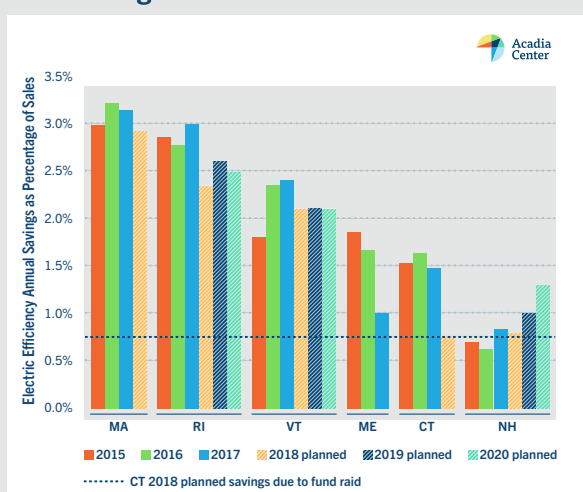
Two factors have driven this concerning reality. First, most states in the region have committed to, and implemented, more ambitious energy savings targets than Connecticut. Second, the two-year legislative diversion of approximately \$117 million in ratepayer funding for electric efficiency will decrease energy savings substantially in our state.⁴¹ Chart 4 illustrates these two points.

Massachusetts, Rhode Island, and Vermont have been obtaining significantly more electric efficiency savings than Connecticut for several years now. Due to the current fund raid, 2018 will see a major drop in Connecticut's electric efficiency performance—a drop sufficient to place our state at, or close to, the bottom of the New England region.

This drastic loss of efficiency savings has serious repercussions for Connecticut's consumers, economy, and environment. It makes power more expensive. Connecticut residents, businesses, and municipalities will pay approximately \$275 million in higher utility bills if the full two years of the fund raid are not undone.⁴² The economy will also lose ground. Because the efficiency programs produce \$7 in economic growth for every \$1 they spend on cost-effective energy efficiency, Connecticut will sacrifice an economic boost of approximately \$889 million—again, if the fund raid remains in place.⁴³ Connecticut communities will also suffer increased local air pollution, as an additional 1.6 million gallons of oil will be burned annually.⁴⁴

The next governor of Connecticut must help restore efficiency as a core economic and energy strategy by moving to undo the current fund raid in early 2019. Combined with setting higher efficiency savings targets, this could unlock immediate economic, consumer, and public health benefits for our state. For example, Acadia Center has estimated that just one year of full investment in electric efficiency would give the following boost to Connecticut's economy:

Chart 4: Electric Efficiency Savings Levels in New England



Major Benefits from New Policy Approach to Energy Efficiency

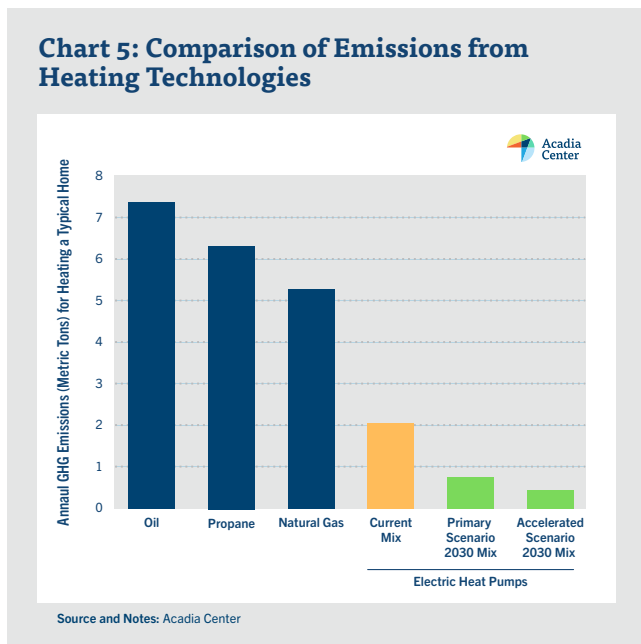
- \$1.8 billion in economic growth from increased efficiency services, upgrades, renovations, or retrofits provided to thousands of residents and businesses;
- Over \$ 1.1 billion in important consumer and energy system benefits, such as customer bill savings, water savings, less strain on the energy grid, and reduced pollution compliance costs;
- Approximately 13,000 jobs, primarily in Connecticut's building performance industry, but also jobs created by new household and business spending.

Other states in the region have moved to seize these valuable benefits to improve their economies and competitiveness. Connecticut needs to do the same.

Clean Heating and Cooling for Buildings – Electric Heat Pumps

Thanks to advances in technology and significant cost reductions, electric heat pumps have become a new tool for heating and cooling buildings more efficiently while reducing emissions.⁴⁵ Heat pumps extract heat from either outside air or the ground and move it into a building to heat it. An air conditioner is a type of heat pump that moves heat from inside a building to the outside to cool it; heat pumps simply reverse this process during the heating season and can now efficiently function even in cold Northeastern winters.

Heat pumps are also far more efficient than traditional electric resistance heating and, with today's electric generation mix, provide immediate GHG emissions reductions. Currently, heat pumps reduce emissions about 70% compared to oil heat and about 60% compared to natural gas.⁴⁶



As generation grows cleaner, emissions from heat pumps will continue to decline. Installing heat pumps today creates a “renewable-ready” infrastructure that will take advantage of a cleaner energy grid as renewables continue to come on line at a faster rate.

An immediate opportunity for accelerating heat pump deployment in Connecticut is in the residential new construction market. In the four more urbanized states in the Northeast—Connecticut, Massachusetts, New York, and Rhode Island—83% of residential new construction over the last five years was heated by gas or propane.⁴⁷ The homes built in 2017 alone will emit about 2 million metric

tons of CO₂ over the fifteen-year life of their heating equipment, more than half of which could have been avoided if heat pumps were installed instead.⁴⁸ In Connecticut alone, 1,343 new homes were built with natural gas heating.⁴⁹ The cost to ratepayers of connecting these new homes to gas distribution infrastructure was about \$23 million. Almost all of this new cost could have been avoided with heat pumps.⁵⁰

Speeding the switch to clean heating technologies will require strong policy support from the next governor. Working in combination, several reforms will help expand the heat pump market in Connecticut: increased consumer awareness and education, improved market and customer strategies for manufacturers, distributors, and installers, advancements in heat pump controls and other related innovations, and specialized incentives and financing to increase consumer uptake. Helping residents and businesses switch to clean heating technologies could also be a focus of Connecticut's energy efficiency programs, if changes are made to the rules governing those programs.

4. Reform Connecticut's Energy Grid Rules to Reduce High Energy Costs and Speed Energy Innovation

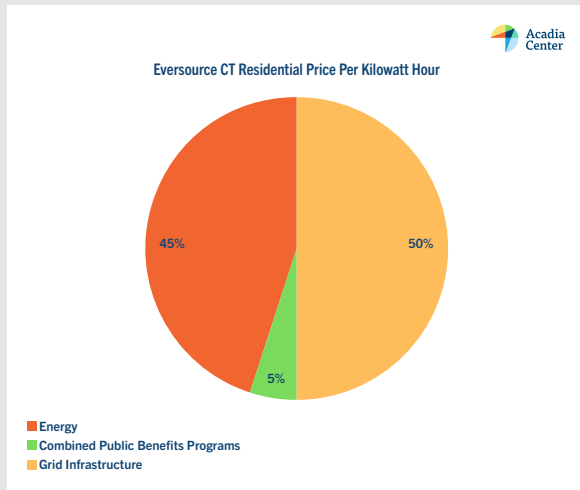
The Energy Grid and Current Challenges

The rules and regulations that drive the decision making for Connecticut's energy grid are out of sync with technological advances and consumer expectations for a clean, reliable energy system. Local energy resources like energy efficiency, rooftop solar, and energy storage are superior tools that can solve grid problems—instead of relying only on building expensive, traditional infrastructure projects. Sophisticated metering technology can support innovations in how consumers pay and are paid for electricity, rewarding them for optimizing their energy generation and consumption. Updated rules, planning processes, and financial incentives can enable the adoption of technologies critical to meet 2030 and longer-term emissions reduction targets.

High grid costs in Connecticut also need to be addressed. Residents, businesses, and municipalities pay not only for the electricity they consume, but also for the energy grid infrastructure that delivers it—basically, the poles and wires of the electric system. For residential customers in Connecticut, this grid cost dominates the retail price of electricity. Half of the price of one kilowatt hour of electricity goes to paying for the grid infrastructure that delivers that electricity to the customer.

These high grid infrastructure costs are a burden on Connecticut's consumers and communities. Any effort to reduce energy costs in Connecticut must include serious examination of all major cost components of the retail price of electricity, not just energy supply.

Chart 6: Major Components of Retail Electricity Price in CT



Source and Notes: Eversource CT Residential Rate 1. Monthly customer service charge not included.

Reforming Grid Rules Results in Real Benefits to Consumers

Creating a more affordable, customer-centric electricity grid of the future for Connecticut will require wide-ranging reforms.⁵² Consumers need to be protected and given more opportunities to participate in clean energy. Energy grid planning and stakeholder processes need dramatic improvement. The utility business model and incentives must change to be better aligned with policy goals. And consumers need more granular price signals for both energy consumption and generation.

Pursuing these reforms will be worth it, however, because they can result in real benefits on many fronts, but especially for consumers and the broader economy. Examples from Acadia Center’s grid reform efforts include:

Major Examples of New Policy Approach to Grid Rules

- Decreasing high fixed monthly charges for over 1 million residential electric utility customers in Connecticut, which will encourage efficient consumption of electricity and help alleviate energy cost burdens for low-income customers;
- Helping create a new regulatory framework through the Rhode Island Power Sector Transformation Initiative and rate case settlement that will lead to a more efficient grid, a cleaner and cheaper energy system, and a utility business model that helps advance the public interest;
- Winning the reversal of an anti-solar fee, or demand charge, in Massachusetts that would have unfairly penalized households that chose to install rooftop solar.

The next governor should pursue a package of energy grid and utility reforms that will modernize the grid, provide better options for consumers to control their energy costs, advance grid and utility innovation, and significantly reduce pollution emissions. These reforms would help bring down Connecticut’s high grid costs, alleviating a significant financial burden on Connecticut’s residents, businesses, and communities.

5. Give Communities and Consumers More Control Over Their Energy Choices

The Current Challenges for Connecticut Communities

Any effort to revitalize Connecticut must focus on its communities—where we live, work, and play. Energy system reforms have an important role here too. Communities want more control over their energy options because they are on the front lines of creating a sustainable, low-carbon economic future. Unfortunately, state policies and outdated rules often prevent community action on energy. Current barriers in Connecticut include:

Community Energy Codes Not Allowed: A community energy code, or stretch code, allows a community to adopt more stringent energy conservation provisions than those required by the base state building energy code. No stretch code exists in Connecticut and communities are not allowed to adopt policies more stringent than the state code.⁵³

New Construction Requirements Lacking: Connecticut building code does not require that new homes be “EV-Ready” or “Solar-Ready”, meaning that they are built to allow these technologies to be added later more easily, if desired by future homeowners. This effectively blocks communities from preparing their new housing stock for the cleanest transportation and energy technologies.⁵⁴

Community Choice Aggregation Not Available: Community Choice Aggregation (“CCA”) allows communities to pool residential, business, and municipal electricity load and then purchase and/or develop clean electricity on behalf of customers participating in the CCA program. State law does not currently authorize CCA in Connecticut.⁵⁵

Empowering Communities Will Help Revitalize Connecticut

The next governor needs to empower Connecticut’s communities to lead the way on energy innovation. Rooted in their immediate surroundings and championed by respected neighbors, local energy initiatives have great capacity to change behavior, establish new norms, and advance local clean energy options. The fixed scope of local projects often translates into lower hurdles for implementation and a more straightforward evaluation process. Community-based action that successfully demonstrates innovations in energy efficiency, distributed generation, and smart energy management can be scaled up to the state level and provide a crucial backstop to federal rollbacks. Connecticut communities need to be at the center of any state energy planning and reforms.

Conclusion: Transportation and Energy Reforms Build a Stronger Connecticut

The five transportation and energy reforms described in this memorandum can open a new, bold future for Connecticut—one that is prosperous and innovative, economically vibrant, and healthier for Connecticut's people and communities. Over and over, the facts show that the opportunity to transform Connecticut is real—billions of dollars in economic growth and thousands of new jobs are within reach. By putting key transportation and energy policies in place, the next governor can help our state revitalize its economy, compete for businesses and talent, attract the next generation to its towns and cities, and attain a high quality of life for its residents. Acadia Center is eager to begin this crucial work with the next governor.

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References

1 See TRIP, *Connecticut Transportation By The Numbers: Meeting the State's Need for Safe and Efficient Mobility* (May 2017) (http://www.tripnet.org/docs/CT_Transportation_by_the_Numbers_TRIP_Report_May_2017.pdf), p. 1 (summary of key transportation facts).

2 See id.

3 See TRIP, *Preserving Connecticut's Bridges: The Conditions and Funding Needs of Connecticut's Aging Bridge System* (September 2018) (http://www.tripnet.org/docs/CT_Preserving_Connecticut_Bridges_TRIP_Report_September_2018.pdf), at p. 1 (executive summary).

4 See *Connecticut Transportation By The Numbers*, supra, at p. 6.

5 See Connecticut Association for Community Transportation, *The Reality of Failing to Fund Transportation* (2018) (<http://www.cact.info/documents/FINAL2018TheRealityofFailingtoFundTransportation.pdf>), at p. 2.

6 See Connecticut Association for Community Transportation, *Connecticut's Connections: Shaping the Economy Through Transportation* (February 2016) (http://www.cact.info/documents/FINALLegislativePaper_Feb.2320162.20.16.pdf), at p. 3.

7 For GHG emissions data by sector for Connecticut, see U.S. EIA data available online: <https://www.eia.gov/environment/emissions/state/>. Connecticut must reduce GHG emissions to levels set in law; targets exist for 2020, 2030, and 2050. See Conn. Gen. Stat. §22a-200a.

8 See CT Department of Energy & Environmental Protection, *State of Connecticut Mitigation Plan under Volkswagen 2.0L and 3.0L Vehicle Partial Consent Decrees*, Appendix D (April 2018) (https://www.ct.gov/deep/lib/deep/air/mobile/vw/CT_VW_Final_Mitigation_Plan.pdf), at p. 4.

9 See id., at p. 5.

10 See Acadia Center, *Outpacing the Nation: RGGI's Environmental and Economic Success* (September 2017) (https://acadiacenter.org/wp-content/uploads/2017/09/Acadia-Center_RGGI-Report_Outpacing-the-Nation.pdf). Since its launch in 2009, the Regional Greenhouse Gas Initiative, also known as RGGI, has reduced electric generation emissions by 40%. During that same timeframe, RGGI member states have experienced 4.3% more economic growth than non-RGGI states.

11 See economic analysis reports for: the New Haven Rail Line Expansion in CT; the MA South Station High Speed Intercity Rail Expansion; the

NH Capital Corridor Rail Expansion; the RI South County Commuter Rail Expansion; the Cincinnati Modern Streetcar; the Downtown Los Angeles Streetcar; Bus Rapid Transit in Madison, WI; Rural and Small Urban Transit Systems in ND; Bus Expansion for Greenville Transit Authority in SC; Biking and Pedestrian Trails in NC; and NREL's National Economic Value Assessment of Plug-In Electric Vehicles. Further detail available upon request.

12 Note that new wages are a subset of new business sales.

13 See U.S. EPA's social cost of carbon methodology.

14 Benefits will vary based on the final investment portfolio developed with stakeholder input; this analysis is intended to show the scale of the opportunity for Connecticut.

15 See <http://2030.acadiacenter.org>. This number of electric vehicle rebates assumes CHEAPR program levels of \$3,000 for long-range battery EVs and \$2,500 for shorter range battery electric vehicles and plug-in hybrid EVs. It also assumes a \$2,000 incentive for L2 EV chargers and \$20,000 for DC fast chargers. The National Renewable Energy Lab estimates that 338,200 workplace and public L2 and L1 chargers will be needed per million EVs; this analysis considers 80% of these chargers will be L2. NREL also estimates the need for 470 DCFCs per million EVs. See <https://www.nrel.gov/docs/fy17osti/66980.pdf>.

16 Assuming a cost of \$750,000 per bus, \$350,000 per 6-port fast-charger, and \$250,000 per charger installation. See <http://fortune.com/2017/09/19/electric-cars-buses-proterra/> and https://cafcg.org/sites/default/files/5_CARB-ACT-Cost-Model-Discussions_CaFCG-Bus-Team-Meeting-Aug2016.pdf.

17 The proposed New Haven Streetcar is a 3.6-mile loop with an estimated cost of \$30 million. See https://www.lightrailnow.org/news/n_newslog2010q1.htm#NH_20100225.

18 Assuming a cost of \$280,000 per mile, based on: <https://www.ncdot.gov/bikeped/walkbikenc/pictures/EconomyImpact-Analysis.pdf>.

19 See <http://www.cleanairactionplan.org/documents/preliminary-cost-estimates-select-caap-strategies.pdf> and <http://www.dem.ri.gov/mobile/pdf/story6.pdf> for cost estimates for electric port technologies.

20 For more information on this regional collaboration, often called the Transportation & Climate Initiative, see <https://www.transportationandclimate.org/>.

- 21** See ISO-New England, *2017 Regional System Plan* (November 2017) (<https://www.iso-ne.com/system-planning/system-plans-studies/rsp/>), at p. 97. Connecticut has no oil or natural gas reserves.
- 22** See *id.*, at pp. 102-103.
- 23** See Acadia Center, *Greenhouse Gas Emissions and Fuel Consumption in New England: Fact Sheet on Key Regional Statistics and Trends* (May 2018) (<https://acadiacenter.org/wp-content/uploads/2018/05/Acadia-Center-Regional-Emissions-and-Fuel-Consumption-in-New-England-May-2018-.pdf>).
- 24** See Acadia Center, *Connecticut: Pathway to 2030* (<http://2030.acadiacenter.org/full-reports/>).
- 25** For example, the 800 MW offshore wind project recently selected by Massachusetts will have a leveled price below wholesale market prices for energy and renewable energy credits, saving Massachusetts ratepayers approximately \$1.4 billion over the twenty years of the long-term contract. See Letter to MA Department of Public Utilities from MA Department of Energy Resources dated August 1, 2018 (<https://eeaonline.eea.state.ma.us/EEA/FileService/FileService.Api/file/FileRoom/9676906>), at pp. 3-4.
- 26** See Acadia Center, *The Offshore Wind Opportunity in Connecticut: Policy Action Needed to Ensure In-State Jobs and Economic Growth* (September 2017) (https://acadiacenter.org/wp-content/uploads/2017/09/Acadia-Center-CT-Offshore-Wind-Opportunity_9_20_2017.pdf). Offshore wind's generation potential will only grow in the New England region; more federal lease areas are expected to be made available for offshore wind development in coming years.
- 27** Acadia Center estimate based on data in E2's recent offshore wind report, *Offshore Wind: Generating Economic Benefits on the East Coast* (August 2018) (https://www.e2.org/wp-content/uploads/2018/08/E2-OCS-Report-Final-8_30_18.pdf), combined with project pricing from the Vineyard Wind 800 MW project selected by Massachusetts, see Letter to MA Department of Public Utilities from MA Department of Energy Resources dated August 1, 2018 (<https://eeaonline.eea.state.ma.us/EEA/FileService/FileService.Api/file/FileRoom/9676906>), at pp. 3-4.
- 28** Acadia Center estimate based on recent New England offshore wind bids and report entitled, *U.S. Job Creation in Offshore Wind: A Report for the Roadmap Project for Multi-State Cooperation on Offshore Wind* (October 2017) (<https://cesa.org/assets/Uploads/US-job-creation-in-offshore-wind.pdf>).
- 29** See Letter to MA Department of Public Utilities from MA Department of Energy Resources dated August 1, 2018 (<https://eeaonline.eea.state.ma.us/EEA/FileService/FileService.Api/file/FileRoom/9676906>), at p. 4.
- 30** See <http://www.thesolarfoundation.org/wp-content/uploads/2018/02/Solar-Jobs-By-State-1.pdf>.
- 31** See Acadia Center, *Connecticut: Pathway to 2030* (<http://2030.acadiacenter.org/full-reports/>).
- 32** See *id.* Acadia Center analysis based on ISO-New England distributed generation forecast data and U.S. Census data.
- 33** See *id.*
- 34** Acadia Center analysis using 2015 economic impact study by the Connecticut Center for Economic Analysis that evaluated Connecticut's existing rooftop solar deployment program.
- 35** Acadia Center analysis using same study.
- 36** Same.
- 37** See also Acadia Center, *Connecticut: Pathway to 2030* (<http://2030.acadiacenter.org/full-reports/>).
- 38** See U.S. DOE, U.S. Energy and Employment Report (January 2017), CT State Chart.
- 39** See U.S. EIA <https://www.eia.gov/state/?sid=CT>.
- 40** Acadia Center analysis of SEDS data for Connecticut for 2016.
- 41** The original diversion of energy efficiency ratepayer funding was for \$127 million over two fiscal years (FY18 and FY19). The General Assembly restored \$10 million of the diverted funds through the budget passed in the 2018 legislative session. The total amount of the funding diversion for the C&LM programs now stands at \$117 million. The first payment to the State of \$63.5 million in diverted ratepayer funds has already occurred. The second payment is due in June 2019. This discussion does not include the legislative diversions that also exist for Connecticut's Regional Greenhouse Gas Initiative auction proceeds and for the Connecticut Green Bank. Any restoration of energy efficiency and clean energy funding should involve those revenue sources as well.
- 42** See Connecticut Energy Efficiency Board, *2017 Annual Legislative Report, Executive Summary* (available online: <https://www.energizect.com/sites/default/files/Final-2017-Annual-Legislative-Report-WEB-2-20-18.pdf>). Acadia Center currently serves as the elected Chair of the Energy Efficiency Board, a stakeholder advisory body that helps oversee Connecticut's energy efficiency programs.
- 43** See *id.*
- 44** See *id.*
- 45** See Acadia Center, *EnergyVision 2030: Buildings Companion Brief* (2017), at pp. 3-4.
- 46** See *id.*
- 47** Acadia Center analysis of data from NYSERDA, *Residential Statewide Baseline Study Volume 1*, and Reed, Faesy, Howland, "Accelerating the Pace to Fossil-Free Residential New Construction," *2018 Summer Study Paper for ACEEE*.
- 48** See Acadia Center, *EnergyVision 2030: Buildings Companion Brief*; NYSERDA, *Residential Statewide Baseline Study Volume 1*; and Reed, Faesy, Howland, "Accelerating the Pace to Fossil-Free Residential New Construction," *2018 Summer Study Paper for ACEEE*.
- 49** Acadia Center analysis of data from Reed, Faesy, Howland, "Accelerating the Pace to Fossil-Free Residential New Construction," *2018 Summer Study Paper for ACEEE*.
- 50** Acadia Center analysis using methodology from *Incentives for Change* (2017).
- 51** The Energy component covers the costs of generating and supplying electricity. The Grid Infrastructure component includes the costs of electricity delivery, mainly transmission and distribution infrastructure costs. The Combined Public Benefits Programs component includes costs for several public benefits programs, such as funding for the energy efficiency programs (the Conservation and Load Management programs mentioned earlier) and for the Connecticut Green Bank. The monthly customer service charge, also known as the residential fixed charge, was not included. Currently, the residential fixed charge for Eversource customers is \$9.21 per month and for United Illuminating customers is \$10.04 per month. The amount of the residential fixed charge should also be a consideration when examining energy grid costs.
- 52** See Acadia Center, *Grid Modernization and Utility Reform Policy Options: A Menu for the Northeast* (July 2018) (<https://acadiacenter.org/wp-content/uploads/2018/07/Acadia-Center-Grid-Modernization-and-Utility-Reform-Policy-Menu-July-2018.pdf>).
- 53** See Acadia Center, *Community|EnergyVision Action Guide for Connecticut* (2017), at p. 8 (<https://acadiacenter.org/wp-content/uploads/2017/11/Acadia-Center-Community-EnergyVision-Action-Guide-CT.pdf>).
- 54** See *id.*
- 55** See *id.*, at p. 10.