Connecticut Fund for the Environment

Save the Sound®

Comments of Connecticut Fund for the Environment

on

Draft 2017 Comprehensive Energy Strategy
Connecticut Department of Energy & Environmental Protection
Bureau of Energy and Technology Policy

Submitted via electronic filing and email to DEEP.EnergyBureau@ct.gov

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Connecticut Fund for the Environment (CFE) is a non-profit environmental organization with over 4,700 members statewide. The mission of CFE, and its bi-state program Save the Sound, is to protect and improve the land, air, and water of Connecticut and Long Island Sound. We use legal and scientific expertise and bring people together to achieve results that benefit our environment for current and future generations.

Executive Summary

The draft 2017 Comprehensive Energy Strategy (the "draft CES") released on July 26th contains important acknowledgements regarding the need to reduce our greenhouse gas (GHG) emissions, and the importance of continued investment in clean energy resources. Importantly, the draft CES confirms the Department of Energy & Environmental Protection's (DEEPs) commitment to a long-term vision of a zero-carbon economy. The draft CES also reflects an important and positive deviation from the 2013 CES's focus on building out natural gas infrastructure, recommends important proposals to: (a) clean up Connecticut's Class I renewable energy classification to phase-out polluting biomass and landfill gas; (b) implement a conservation fee for oil customers to equitably contribute to efficiency programs; and (c) take further steps to modernize Connecticut's electric grid and improve the resilience of Connecticut's electricity infrastructure.

Despite these important recognitions and recommendations, the draft CES overwhelmingly falls short of proposing the specific policies needed in the next three years to sufficiently scale up renewable energy growth and to achieve greater electrification of building thermals (cooling and heating) and the transportation sector.

CFE recommends that the final CES reflect the following critical improvements to strengthen the state's plan to tackle climate change:

1. **The Final CES Should Contain Quantitative GHG-reduction Analysis.** While the draft CES acknowledges that Connecticut energy policy must "put the State on a clear path to meet the Global Warming Solutions Act (GWSA) to reduce GHG emissions 10

percent below 1990 levels by 2020 and 80 percent below 2001 levels by 2050," it does not demonstrate how the CES will ensure the 2020 target will be met. Because the 2020 target is within the three year period of the CES, specific quantitative analysis of GHG emissions data must be incorporated into the final 2017 CES to demonstrate how DEEP's policy recommendations will achieve the needed GHG emission reductions.

2. **The Final CES Should Propose a More Ambitious Annual Increase to the Renewable Portfolio Standard (RPS) to Speed Renewable Energy Deployment**. DEEP should recommend a minimum of a 2.5% annual increase in the RPS, setting a target of 45% renewables by 2030**.** The Synapse Energy Economics ("Synapse") report concludes that over the ten year period, in combination with other regional policies, a 2.5% annual increase would generate an additional 1,400 megawatts (MW) of wind and solar power in New England and create 710 more additional jobs per year than DEEP's proposal of a 1% annual increase. A 2.5% annual increase would also lower emissions by 14% and decrease reliance on imported natural gas by 43%, with only minor impacts on electricity bills. Even an annual RPS increase of 2.5% will not guarantee that Connecticut is on track to meet its legally required reductions without additional electrification of the heating sector.

3. **The Final CES Should Remove the Proposed Cap to Behind the Meter (BTM) Solar**. More BTM solar is vital to help reduce our in-state GHG emissions, create a resilient and affordable electric grid, and strengthen our local economy**.** DEEP's cost assessment of BTM solar is incomplete and short-sighted, and its conclusions regarding cost-shifting are premature without a true and complete value of solar analysis that fairly assesses all of the benefits from distributed energy and BTM resources.

4. **The Final CES Should Recommend the State Adopt a Full-Scale, State-wide Shared Solar Program.** Shared solar provides resiliency benefits to the state, and is an important mechanism to equitably distribute the benefits from solar across Connecticut. The final CES should recommend the establishment of a state program that will advance jobs, renewable energy generation, greenhouse gas reductions, and solar access.

5. **The Final CES Should Propose an Increase in Connecticut's Energy Efficiency Savings Targets**. Connecticut's current investment level of 1.5 percent energy savings does not capture all cost-effective measures. Connecticut's energy efficiency investments should be on par with neighboring states like Massachusetts and Rhode Island, which support over 2.5 percent annual savings reductions. More ambitious energy efficiency savings programs will help Connecticut achieve its mandatory greenhouse gas emissions target for 2020 without overreliance on environmentally outdated sources like nuclear.

6. **The Final CES Should Effectively Promote the Conversion of Fossil-Fuel Based Heating to Efficient Electricity.** The final CES should recommend specific policies to promote renewable thermal technology development and deployment for all customers in all buildings, not just for customers currently using traditional electric resistance heat. The final 2017 CES should incentivize utilities to prioritize heat pump conversions over converting customers to gas heating, including deploying "partial-load" strategies. The

final CES should also recommend establishing coordinated incentives and financing to promote renewable thermal technology development and deployment, as well as an aggressive marketing and education campaign to explain the significant benefits of converting to new renewable thermal technologies.

7. **The Final CES Should Include Specific, Final Policy Proposals to Electrify the Transportation Sector.** The EV Roadmap sets forth important concepts for ramping up Electric Vehicles (EVs), but the urgency of putting EVs on the road cannot be overstated. The final CES should recommend strengthening and institutionalizing the Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR) program, recommend specific programs to build out our state's EV charging infrastructure to make EVs more appealing to Connecticut consumers, and recommend that Connecticut help lead regional efforts to reduce GHG emissions from transportation through a regional cap-and-invest program for transportation fuels modeled after the successful Regional Greenhouse Gas Initiative (RGGI).

CFE recognizes DEEP's hard work in constructing this detailed, analytical draft CES. In order to attain the zero carbon future envisioned by this strategy, the final CES must include more ambitious and detailed policy recommendations, as well as a sustained commitment by Connecticut's citizens, businesses, and government agencies to take the necessary actions to transition Connecticut to a clean, efficient, and healthy renewable energy economy.

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Introduction & Background

Public Act 11-80[1] created the Department of Energy and Environmental Protection (DEEP) and charged it with developing a Comprehensive Energy Strategy (CES) every three years that assessed the energy needs of the State of Connecticut and made detailed recommendations as to how these needs should be met in a manner that furthered the state's economic, environmental and social goals.

The first CES was adopted in 2013. CFE submitted comments, and provided public and written comment at related public meetings in advance of the final strategies publication.[2] The draft 2017 CES was released for public comment on July 26, 2017. CFE has provided comments and questions at the technical sessions held on August 28 and September 13 2017, as well as submitted comments from two coalitions of advocates.[3]

Over the last decades, the state has been a leader on energy issues that impact Connecticut's economy, climate, and health. The 2017 CES presents an important opportunity to build on that history. This is a critical time for action in our state and our country, and

[1] Codified as Sec. 16a-3d., available at https://www.cga.ct.gov/current/pub/chap_295.htm#sec_16a-3d.

[2] Comments of CFE on 2012 Draft Comprehensive Energy Strategy (Dec. 20, 2012).

[3] *See* Draft 2017 CES Comments on docket filed by Coalition of Advocates submitted Sept. 6, 2017, EV Coalition Comments submitted Sept. 19, 2017.

Connecticut's leadership on climate action is more important than ever. CFE urges DEEP to establish a strong climate legacy by strengthening the CES's proposals on electrifying our power, building, and transportation sectors. The final CES should send a clear message to the Connecticut General Assembly that it must act proactively in 2018 to address the urgent need for continued economy-wide decarbonization. The final CES should frame this discussion not in terms of what we can afford to do, but in terms of what we must do to ensure our state remains healthy, economically vibrant, and on a path now that will enable us to transition to a zero-carbon future.

CFE's written comments have four sections. The first section addresses overall climate change goals and is followed by sections that address the goals proposed for each energy sector, corresponding to how the draft CES chapters are organized: Electricity, Buildings and Transportation.

I. Climate Change & Connecticut's Global Warming Solutions Act

Connecticut is feeling the impacts of climate change already. As the EPA concluded,

> Connecticut's climate is changing. The state has warmed two to three degrees (F) in the last century. Throughout the northeastern United States, spring is arriving earlier and bringing more precipitation, heavy rainstorms are more frequent, and summers are hotter and drier. Sea level is rising, and severe storms increasingly cause floods that damage property and infrastructure. In the coming decades, changing the climate is likely to increase flooding, harm ecosystems, disrupt farming, and increase some risks to human health. [4]

In recognition of this reality, state leaders adopted the Global Warming Solutions Act in 2008, which set scientifically-derived targets for needed emission reductions for the years 2020 and 2050.[5] These targets are based on scientific data showing that if we do not reduce emissions at this rate, we will face serious, potentially catastrophic, impacts from climate change.

The GWSA reduction of 10% below 1990 levels is a 4.47 million metric tons (MMT) carbon dioxide reduction of consumption based GHG emissions, from 44.7 MMT in 1990 to 40.23 MMT by 2020.[6] DEEP's most recent GHG inventory analysis (reflecting 2013 data) shows that the state has reduced emissions 4 percent below 1990 levels and 14 percent below 2001 levels, with economy-wide GHG emissions of 43 MMT.[7] Connecticut therefore needs to achieve an additional 6% reduction in GHG emissions, or almost 3 MMTs by 2020.

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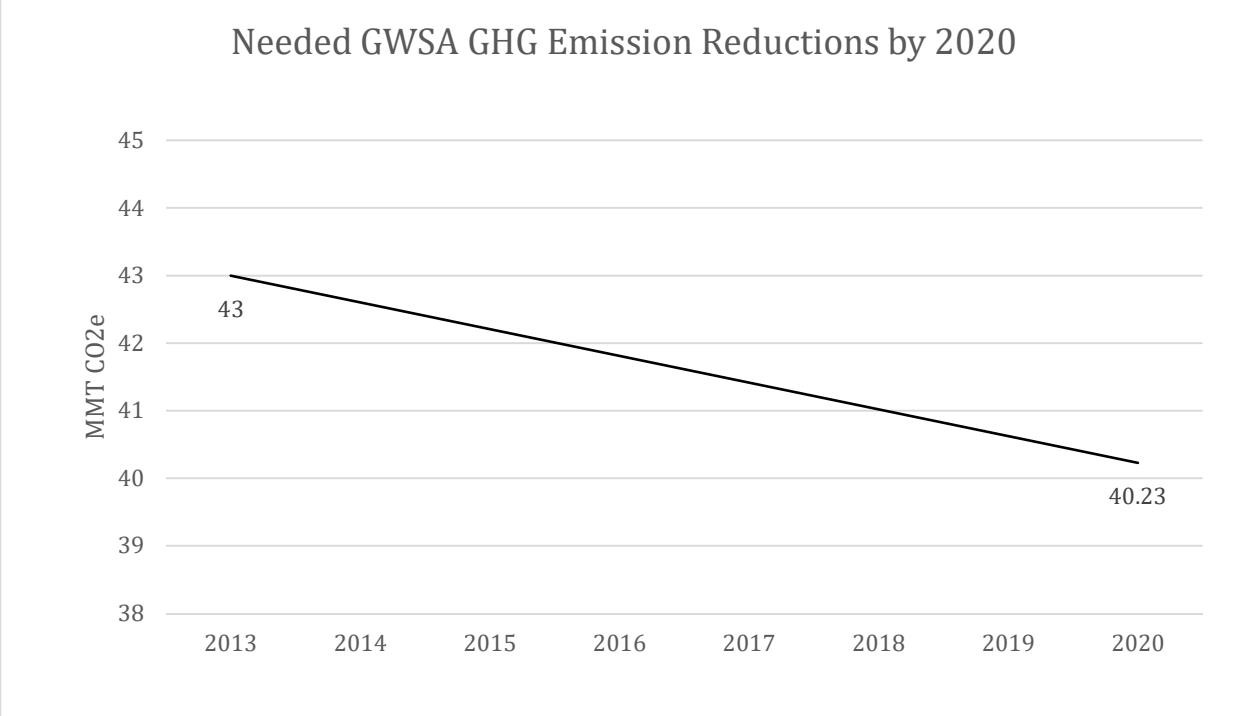
[4] Environmental Protection Agency, *What Climate Change Means for Connecticut* (Aug. 2016), available at https://www3.epa.gov/climatechange/Downloads/impacts-adaptation/climate-change-CT.pdf.

[5] Conn. Gen. Stat. § 22a-200a

[6] *See* CT DEEP, 2013 Connecticut Greenhouse Gas Emissions Inventory (2016), available at http://www.ct.gov/deep/lib/deep/climatechange/2012_ghg_inventory_2015/ct_2013_ghg_inventory.pdf .

[7] CES at xi (citing 2013 Connecticut GHG Emissions Inventory).



The CES should be a comprehensive, in-depth plan for transitioning Connecticut's economy away from fossil fuels and outdated nuclear and towards renewables, modernizing the grid, expanding energy storage and smart grid technologies, reforming utility business models, and meeting the state's GWSA mandates of reducing greenhouse gas emissions at least 10 percent from 1990 levels by 2020 and at least 80 percent from 2001 levels by 2050.

CFE recognizes that the Governor's Council on Climate Change is currently in the process of developing policy recommendations to achieve the state's long-term GWSA goals. However, given that the last GHG inventory showed rising emissions levels from prior years, and the fact that we are just three years away from our first emissions reduction target under the GWSA, it is critical that the final CES map out how policies already in place and specific new policy proposals in the CES will ensure that Connecticut will meet its 2020 GHG-reduction goal. The final CES should include quantitative analysis of current GHG emissions inventories and the amount of emission reductions expected from current and planned policies and initiatives. It should also map out how the policies recommended in the near-term will set up the infrastructure needed to achieve the 2050 reduction targets and establish a zero carbon economy.

Finally, the final CES should provide an update on DEEP's compliance with all of the reporting obligations imposed by the legislature on DEEP pursuant to the GWSA.[8] Time is of the essence if we are to make the necessary emissions cuts needed to meet our GWSA 2050

[8] *See* Conn. Gen. Stat. § 22a-200a(c); § 22a-200(b)(4) (including "a schedule of recommended regulatory actions by relevant agencies, policies and other actions necessary to show reasonable further progress towards reaching the greenhouse gas emission levels required in [the GWSA].")

mandate, and the analysis and reporting contemplated in the GWSA is a critical component of determining what actions we must take to meet these mandates.

An introductory chapter setting forth how the goals and strategies for each sector (electric, buildings, transportation) tie together would also be beneficial. Because grid modernization is impacted by and affects the electrification of all sectors, addressing how we can change utility models and approach grid modernization holistically can help ensure a smooth transition to a zero carbon economy.

II. Electric Power Sector

Connecticut's greatest progress in reducing statewide GHG emissions has occurred in the electric power sector, where emissions decreased 34 percent since 1990.[9] Yet the electric sector still has further reductions to achieve. CFE agrees with DEEP's conclusion in the draft CES that "decarbonization of the electric power sector [is] the cornerstone to the success of achieving a carbon-free economy."[10] The electric sector will play a pivotal early role in achieving our emission reduction goals because it offers cost-effective emission reductions options and has the potential for reducing economy-wide emissions through electrification of the transportation and heating sectors.[11]

CFE understands the desire of DEEP to prioritize the most cost-effective policy options to achieve our GHG-reduction goals. However, any cost-benefit analysis must be based on long-term life-cycle costs and benefits, and take into account both direct and indirect benefits of renewable energy sources. It should also recognize that -- while minimizing the impact to ratepayers is important -- not all price impacts are bad for ratepayers. An energy program that increases energy prices (rates) may not increase energy costs (what a person pays on her utility bills) because of the net benefits of the program.[12] Connecticut's energy efficiency programs are the best example: these programs are funded by a small additional charge on each unit of fuel sold, but result in significant systemic cost-savings that have a net benefit to all ratepayers. In fact, 2016 investments in energy efficiency will save consumers approximately $961.8 million in lifetime bill savings, meaning every $1 invested in energy efficiency will save another $3.89 on

[9] GC3 Exploratory Report, *A Report of the Governor's Council on Climate Change* (2016), available at http://www.ct.gov/deep/lib/deep/climatechange/gc3/gc3_exploratory_report_2016.pdf.

[10] Draft CES at xii.

[11] *See generally*, Union of Concerned Scientists, *The US Power Sector in a Net Zero World* (Nov. 2016), available at http://www.ucsusa.org/sites/default/files/attach/2016/11/UCS-Deep-Decarbonization-working-paper.pdf.

[12] Public Act No. 17-144 (passed in the 2016 legislative session as House Bill No. 7036, available at https://www.cga.ct.gov/2017/ACT/pa/2017PA-00144-R00HB-07036-PA.htm), requires the Office of Fiscal Analysis to prepare a ratepayer impact statement for any bill before the General Assembly that would have a financial impact on electric ratepayers. This new requirement will result in an unfair, one-sided analysis of renewable energy and energy efficiency programs that have net-benefits for ratepayers and economy, and make it harder obtain support for critical renewable energy and energy efficiency investments needed to transition Connecticut to a clean energy economy in the future. Especially because OFA itself acknowledged that "OFA does not currently have expertise identifying ratepayer impacts," DEEP should recommend in the final CES that this provision be repealed in the next legislative session.

utility bills.[13] When considering upfront costs, DEEP must also consider longer-term consumer savings.

Renewable energy programs also have other significant long-term, life-cycle benefits, including: reducing pollution that saves lives and millions in healthcare costs,[14] reducing dependence on the volatile, polluting fossil fuel market,[15] reducing, system line losses, avoiding transmission and distribution capacity improvements, as well as other security, health and environmental costs. Renewable energy will help diversify and stabilize electricity supplies, protect customers from price volatility and supply risks created by over-reliance on natural gas. [16] Renewable energy sources such as wind and solar have zero fuel costs, which allows for competitive long-term pricing that can save consumers money on their energy bills.

A recent study released by Abt Associates on the positive impacts of the Regional Greenhouse Gas Initiative (RGGI) demonstrates how critical carbon reductions are to our health and economy.[17] The study shows that from 2009-2014, the carbon reductions from RGGI resulted in $5.7 billion in saved health care costs in the Northeast,[18] and in Connecticut an estimated 421 asthma attacks were avoided and up to 34 lives spared.[19]

The final comprehensive energy strategy should recognize these longer term, systemic life-cycle savings and net benefits for Connecticut residents.

Finally, the Governor's Council on Climate Change (GC3) data analysis shows that renewables should generate at least 75% of our energy by 2050 to meet our GHG-reduction mandates under the GWSA.[20] The policies DEEP establishes in the next three years related to investments in renewables in Connecticut and the region will have long-lasting impacts, and

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[13] Acadia Center, Proposed Budget Raid Would Cost Connecticut Jobs, Economic Growth and Consumer Trust (May 17, 2017), available at http://acadiacenter.org/proposed-budget-raid-would-cost-connecticut-jobs-economic-growth-and-consumer-trust/.

[14] Abt Associates, *Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014,* (Jan. 2017), http://abtassociates.com/AbtAssociates/files/7e/7e38e795-aba2-4756-ab72-ba7ae7f53f16.pdf (showing the carbon reductions from RGGI resulted in $5.7 billion in saved health care costs in the Northeast).

[15] Synapse Energy Economics, Inc. New England's Shrinking Need for Natural Gas (Feb. 7, 2017), http://www.synapse-energy.com/sites/default/files/New-Englands-Shrinking-Need-for-Natural-Gas-16-109.pdf.

[16] U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, 5 of the Fastest Growing Jobs in Clean Energy, April 24, 2017, https://www.energy.gov/eere/articles/5-fastest-growing-jobs-clean-energy.

[17] Abt Associates, *Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014,* (Jan. 2017), http://abtassociates.com/AbtAssociates/files/7e/7e38e795-aba2-4756-ab72-ba7ae7f53f16.pdf. RGGI states include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont. The RGGI states' recent announcement that they have agreed to increase the annual reduction in the cap from 2.5% annually to 3% will decrease emission from the power sector an additional 30% between 2020 and 2030. The final CES should reflect strong support for those reductions and seek to ensure that the additional auction revenues are used to support efficiency and clean energy programs, and are protected from budget raids.

[18] *Id.*

[19] Abt Associates, *Analysis of the Public Health Impacts of the Regional Greenhouse Gas Initiative, 2009-2014, Appendix E* (Jan. 2017), available at http://abtassociates.com/AbtAssociates/files/d0/d0c73dbb-4921-4cd5-a4d5-b1f587ccb99d.pdf.

[20] See CT DEEP, GC3 meeting slides, September 8, 2016 at www.ct.gov/deep/gc3.

therefore should do more to advance the long-term goal of a zero carbon economy than the measures in the draft CES will accomplish.

A. RPS Increases Not Ambitious Enough and Should be Increased to Reach a Minimum of 45% Renewable Generation by 2030 (E.1.1).

The state's Renewable Portfolio Standard (RPS)—which requires electric utilities to provide an increasing percentage of their electricity from renewable sources—is the foundation for clean energy markets and a proven tool for supporting renewable energy development. By setting targets for renewable energy generation, RPS policies diversify our electric supply, spur local economic development, and save consumers money in the long run.[21] The RPS drives investments in renewables by guaranteeing that there is a market for that energy as well as by helping those renewables become more competitive with fossil fuel-based energy that currently has a market advantage.[22] Because RPS policies create competition amongst renewable technologies, they incentivize cost reductions and technology improvements in renewables. Solar is a prime example of this effect. As numerous policies and programs in Connecticut and elsewhere have driven the deployment of more photovoltaic installations, the cost of solar energy has declined significantly.[23]

The draft CES proposes an extension for the Class I RPS through 2030, but a slowdown in the rate of increase from 1.5% to 1%, reaching a level of only 30% renewable energy by 2030. Connecticut cannot afford to slow down the ramp-up of renewables at this critical stage of renewable technology growth and development. Other states like California and Massachusetts recognize the critical importance of continuing to strengthen renewable requirements. Connecticut also needs the economic and climate benefits that come with fostering in-state and regional renewable growth.

An RPS for Connecticut that increases by 2.5% per year starting in 2021, reaching a level of 45 percent by 2030 will create more renewable energy while simultaneously creating jobs and reducing the negative impacts of climate pollution. As the attached analysis conducted by Synapse demonstrates,[24] the proposal in the draft CES falls short of meeting our minimum-required GWSA reduction path, with carbon pollution exceeding the implied GWSA targets every year from 2026 to 2030. Under DEEP's draft proposal, Connecticut's consumption-based emissions in 2030 fall to 31.8 MMT, which is 5 percent over the reduction target. With a 2.5%

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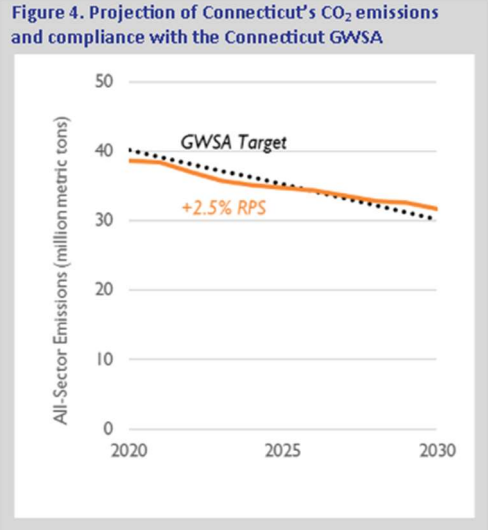
[21] CT DEEP, *Taking Action on Climate Change, 2014 Progress Report*, available at http://www.ct.gov/deep/lib/deep/climatechange/ct_progress_report_2014.pdf.

[22] Union of Concerned Scientists, *How Renewable Electricity Standards Deliver Economic Benefits* (May 2013), http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/Renewable-Electricity-Standards-Deliver-Economic-Benefits.pdf.

[23] Galen Barbose and Naim Darghouth, Lawrence Berkeley National Laboratory, *Tracking the Sun IX, The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States* (Aug. 2017), https://emp.lbl.gov/sites/all/files/tracking_the_sun_ix_report_0.pdf.

[24] Synapse Energy Economics, *Increasing the Connecticut RPS* (Sept. 25, 2017), available at http://www.synapse-energy.com/sites/default/files/Increasing-the-Connecticut-Renewable-Portfolio-Standard-17-070_0.pdf (Attached as Appendix A).

increase in the RPS, consumption-based emissions in 2030 will exceed the target by 3 percent. However, the Synapse RPS also demonstrates that even an annual RPS increase of 2.5% will not guarantee that Connecticut is on track to meet its legally required reductions (as Synapse finds the cap is still exceeded in 2028, 2029 and 2030) without adequate electrification of the heating sector. As figure 1 below demonstrates, the accelerated RPS requirement at least puts Connecticut closer to a trajectory for meeting the 2050 GWSA reduction target with renewable resources.



Synapse Economics, Inc., RPS Analysis 1

The final CES should therefore recommend *a minimum* of 2.5% annual increase to ensure Connecticut stays on track to meet its GHG-reduction mandates and reaps the economic, environmental, and health benefits of a stronger RPS. 50% renewables by 2030 would put Connecticut in a position to largely decarbonize its electric sector and meet its GWSA emissions reduction targets.

i. DEEP Should Not Cultivate Non-Renewable Energy Sources to Meet Carbon Reduction Goals (E.1.5).

DEEP's stated intention to rely on nuclear and large-scale hydropower to meet Connecticut's GWSA goals[25] is not in the best interest of Connecticut residents. Relying on nuclear and hydropower will come at the expense of renewable energy infrastructure growth that will bring more benefits both to Connecticut's economy and our environment.

Our state's economy stands to benefit from the deployment of Connecticut-based renewables. Generating our own renewable energy from solar and wind rather than buying it

[25] *See* Draft CES at 66 ("Over the next thirty-years, Connecticut will need to procure much more clean carbon free power to meet the GWSA goals of reducing emissions by 80 percent by 2050. To do so, Connecticut must consider all reasonable resource options including Class I resources, large-scale hydropower,and nuclear retention, to maximize the potential benefits while minimizing the rate impact to electric customers.")

from neighboring states brings additional benefits to Connecticut, including lower air pollution and more jobs. Making legislative changes to allow for unrestricted development of shared solar and use of virtual net metering would foster growth of in-state renewable energy generation and provide support for more job growth in Connecticut. Installation of renewable energy facilities primarily utilizes local workers, so investment dollars are kept in our communities.[26] A January 2017 report by U.S. Department of Energy and BW Research Partnership estimates that together energy efficiency and solar account for 36,875 jobs in Connecticut.[27] The report also found that with 2,927 jobs, solar makes up the largest segment of Connecticut's electric power generation workforce.[28]

Continued reliance on expensive, outdated nuclear power at the expense of renewable growth is also contrary to the state's best interest.[29] Nuclear technology produces harmful nuclear waste, is expensive, and imposes safety and national security risks to Connecticut residents.[30] CFE recognizes that Millstone is a valuable low carbon-emitting energy resource that for the short-term, Connecticut needs in order to meet our GWSA greenhouse gas (GHG) reduction goals. However, Connecticut should not delay building out its solar and wind infrastructure because it can rely on Millstone for low carbon power. Rather, Connecticut should strengthen its RPS and create an actionable plan to replace Millstone with energy efficiency and renewable resources by the end of its licensure.

Similarly, relying on large Canadian hydro projects would undercut efforts to stimulate additional generation of renewable energy in Connecticut and the New England region. Hydropower imports from Canada should not be relied on over local, in-state renewable generation of solar and regional contracts for off-shore wind, which can better support local grid resiliency. Large-scale hydropower has other adverse environmental impacts (like damming big rivers, negatively impacting food sources for native populations and flooding forests) that detract from overall climate benefits.[31] Given how expensive large-scale hydro transmission lines are

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[26] Union of Concerned Scientists, *How Renewable Electricity Standards Deliver Economic Benefits* (May 2013), available at http://awea.files.cms-plus.com/FileDownloads/pdfs/UCS%20Renewable-Electricity-Standards-Deliver-Economic-Benefits.pdf.

[27] U.S. Department of Energy and BW Research Partnership, *U.S. Energy and Employment Report* (Jan. 2017), https://www.energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

[28] U.S. Department of Energy, *2017 US Energy and Jobs Report, State Charts* at 38, available at https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report%20State%20Charts%202_0.pdf.

[29] As stated in CFE's written comments submitted on Docket No. 17-07-32, CFE supports the ongoing full resource assessment to determine whether Connecticut should take action to financially support the Millstone nuclear power station owned by Dominion Energy ("Millstone"). However, it would be against Connecticut's best interests to continue to invest in Millstone as the solution to meeting our GWSA emissions reduction targets, given all publicly available analysis suggests that Millstone is currently highly profitable and does not need ratepayer support to continue to operate in the near future.

[30] *See e.g.*, Physicians for Social Responsibility, *Nuclear Power Safety* (accessed on Sept. 24, 2017), available at http://www.psr.org/nuclear-power/safety.html?referrer=https://www.google.com/.

[31] Union of Concerned Scientists, *Environmental Impacts of Hydroelectric Power* (accessed on Sept. 24, 2017), http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-hydroelectric-power.html#.WcftfciGOUk.

and the energy losses over those lines,[32] off-shore wind infrastructure costs become more competitive. Offshore wind development also promises more economic benefits to Connecticut and the New England region. Taking part in regional off-shore wind procurements will increase port activity in New London and New Haven, with the potential for more manufacturing and other skilled labor positions opening up, and more revenue for the state.

The Final CES should propose replacing Millstone's energy capacity with offshore wind projects, and should increase the RPS enough to support a level of renewable growth sufficient to provide the zero carbon generation needed by the state.

ii. The Final CES Should Recommend Directing the RPS Alternative Compliance Payments to Support Renewable Energy and Energy Efficiency Programs.

Finally, the CES should recommend an additional change to the RPS that would direct Alternative Compliance Payments (ACP) to support green energy programs at the Connecticut Green Bank. Prior to 2013, the ACP funds were transferred to the state's Clean Energy Fund (now known as the Connecticut Green Bank) for the development of Class I resources. In 2013, the law was amended to rebate these payments to ratepayers instead.[33] The ACP funds would have more impact if they were directed back to support green energy development, which could then be used to leverage greater sums of private investment in clean energy. While the amount each ratepayer individually receives from the ACP refund is very small (CFE estimates under three dollars in 2014), the aggregate value of the ACP funds ($7,860,956 in 2014) invested in green energy investment programs like the Green Bank would leverage this money for greater impact on our renewable economy. Directing the funds to clean energy programs that have a proven track record of creating jobs and growing deployment of renewables while reducing CO2 emissions would be a far smarter investment for Connecticut.

B. DEEP's Proposal to Phase-Down Biomass and Landfill Gas RECs Is Beneficial to Connecticut's Climate and Environmental Goals (E.1.2).

CFE agrees that DEEP's proposal to phasedown biomass and landfill gas renewable energy credits (RECS) will be beneficial to cleaning up the Class I renewable category. Biomass – especially those plants that burn trees – are not clean, and may actually increase carbon pollution compared with fossil fuels. A report by the Partnership for Public Integrity (PFPI), concluded that per megawatt-hour, a biomass power plant employing "best available control technology" (BACT) emits more nitrogen oxides, volatile organic compounds, particulate matter, and carbon monoxide than a modern coal plant of the same size.[34] The combustion of

[32] As DEEP recognizes in the Draft CES at 67, "[t]o bring substantial quantities of incremental large-scale hydropower into New England, it will require new transmission lines and therefore a significant financial commitment by ratepayers. New transmission lines are typically 1,000 MW costing $2 billion or more."

[33] *See* Public Act 13-303.

[34] Mary S. Booth, *Trees, Trash, and Toxics: How Biomass Energy Has Become the New Coal*, The Partnership for Policy Integrity (April 2, 2014), available at http://www.pfpi.net/wp-content/uploads/2014/04/PFPI-Biomass-is-the-New-Coal-April-2-2014.pdf.

biomass in power plants releases harmful air pollutants such as particulates, NOx, and SOx. DEEP's proposal to phase out biomass as a Class I renewable therefore makes sense for the state's climate goals and environmental health. This is especially true given that Connecticut's energy suppliers have satisfied a vast majority of their Class I REC requirement through biomass.[35]

However, the slow phase-out proposal in the draft CES[36] will take many years to have an impact on supporting development of other Class I renewable resources like solar and wind. And, as discussed above, even with this phase-out, a more aggressive increase in the RPS will bring greater economic and environmental benefits to Connecticut.

C. DEEP Should Withdraw its Proposals to Cap Behind-the-Meter Renewables and to Change Structure of Net Metering and Conduct a Value of Solar Analysis (E.1.3/E.1.4).

The draft CES recommends two dramatic changes to the state's renewable energy policies: capping the amount of behind-the-meter (BTM) solar, and changing the net metering structure that BTM solar customers benefit from. Both proposals,[37] which should be deleted from the final CES, are based on flawed conclusions regarding the costs of BTM solar installations and their impact on ratepayers not directly participating in these programs. [38]

First, DEEP fails to quantify the value of distributed generation that may not be reflected in procurement bid prices.[39] The benefits of BTM solar include:

- **Avoided costs.** Electricity is generated onsite or for nearby use, avoiding transmission and distribution costs. This is far more efficient than generating electricity at a central power plant and sending it to customers who live hundreds of miles away.
- **Reliability & resiliency.** Solar can dramatically improve reliability. It can be "islanded" from the grid, allowing it to continue operating even during a power outage (when there are no safety concerns). Solar can also improve resiliency by providing additional sources of power to the grid and reducing the energy base load. Notably, the peak

[35] In 2014 (the most recent year for which DEEP has compliance data for the RPS), Connecticut met 76 percent of Class I RPS requirement with biomass and landfill gas RECS. (*See* Draft CES, Fig. E3).

[36] The draft CES proposal is to reduce the value of Class I biomass and landfill gas RECS after 20 years for new facilities and 15 years for existing facilities, and then cap the amount of generation eligible as a Class 1 resource.

[37] DEEP also declines to recommend lifting the cap on virtual net metering for municipalities, presumably under the same cost-shifting theory. The final CES should recommend that the legislature eliminate the cap on virtual net metering so that municipalities can benefit from the resulting cost-savings, economic development, job creation and energy security.

[38] While it is somewhat helpful that DEEP produced the numbers that make up the cost calculations presented in the draft CES, producing just the numbers themselves does not help the public understand the cost assumptions and calculation methodologies that DEEP employed to come up with the costs of BTM solar. These calculations and methodologies should be explained as well.

[39] The bid prices of the large-scale renewable procurements under [act], many of which have not been placed into service, should not be the exclusive set of data relied on by DEEP to assess cost differentials between grid-scale and behind the meter.

performance time for solar (afternoon) typically coincides with peak demand in summer.

- **Declining cost.** The cost of solar has fallen dramatically in recent years, just like the cost of other technologies, and trends indicate that the cost will continue to fall.
- **Long-term price stability.** Solar is high-value because unlike natural gas and other fossil fuels, it is not subject to price volatility. With solar, you get a clean, reliable source of electricity whose cost will not spike as a result of price fluctuations or new environmental regulations. The same cannot be said of fossil fuels, which are dirty, variably priced, and vulnerable to new environmental regulations.
- **Economic benefits.** Local economies also benefit from solar. A January 2017 report by U.S. Department of Energy found that solar makes up the largest segment of Connecticut's electric power generation workforce, with 2,927 jobs.[40] Solar panels must be installed, and maintained by local workers. These jobs generally pay well and cannot be outsourced.
- **Life-Cycle cost savings.** Over time, solar decreases rates by providing a reliable, clean source of electricity that has already been paid for by the owner. As we get more solar, utilities will save on transmission and distribution costs and the need for new base load generation will be reduced. Unlike natural gas prices, which are subject to volatile price spikes, solar continues to provide clean, reliable electricity to the grid at a set cost.

Second, DEEP's conclusions that net-energy billing results in cost-shifting to customers who don't participate in solar is premature, and cannot be stated conclusively without conducting a true value of solar analysis.

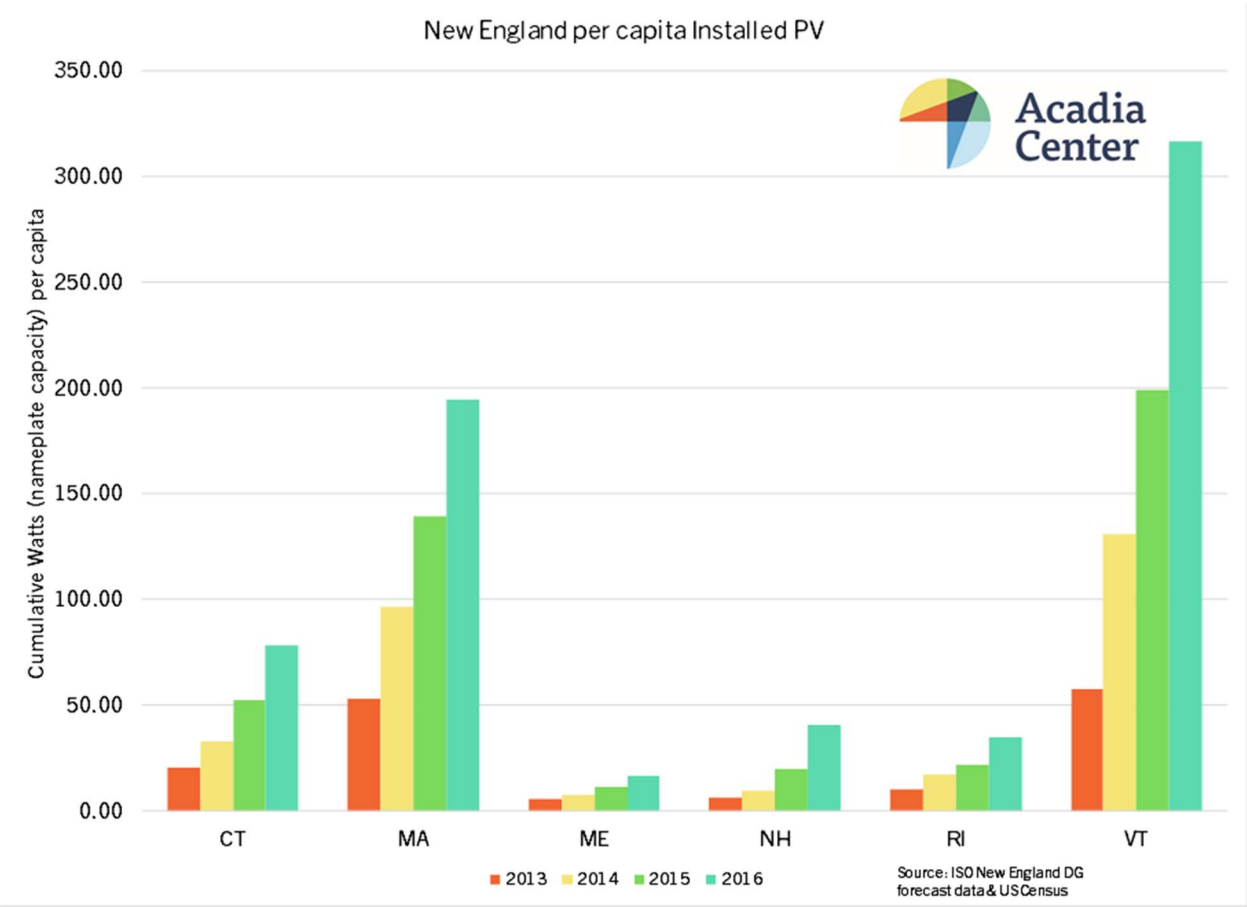
CFE recognizes that debates around cost-shifting and appropriate net metering compensation structures are taking place in various jurisdictions across the country. But there is also extensive evidence that cost-shifting concerns have been overstated, particularly in states like Connecticut with low distributed solar penetration levels. For example, In January 2017, the Lawrence Berkley National Laboratory published a report concluding that "… for the overwhelming majority of utilities, the current PV penetration levels are far too low to result in any discernable effect on retail electricity prices, even under the most pessimistic assumptions about the value of solar and generous assumptions about compensation provided to solar customers (e.g. full [net metering] with volumetric rates)."[41]

Consistent with the Lawrence Berkley Report's findings, when the New Hampshire Public Utilities Commission recently reevaluated its net metering program, it concluded that the utilities' expressed concerns about cost shifting did not warrant significant restructuring of the

[40] U.S. Department of Energy, *2017 US Energy and Jobs Report, State Charts* at 38, available at https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report%20State%20Charts%202_0.pdf.

[41] Barbose G., *Putting the Potential Rate Impacts of Distributed Solar into Context*, January 2017, Lawrence Berkley National Laboratory, at 8, "Much debate has occurred around the existence and size of any cost-shifting from distributed solar, particularly for solar compensated via net energy metering (NEM) with volumetric retail rates." https://emp.lbl.gov/sites/all/files/lbnl-1007060.pdf.

net metering program at this time given the low distributed generation penetration levels in New Hampshire and the absence of any data to support cost shifting claims. It stated: "As the penetration level of DG in the State is quite low in both absolute and relative terms, there is little evidence of significant cost-shifting from DG customers to customers without DG."[42] Acadia Center analysis shows that Connecticut lags behind Massachusetts and Vermont in the amount of installed PV per capita:



The draft CES reports that in 2016, behind the meter solar represented about 1.5% of load, and is expected to increase to between 3.8% and 4.5% of load by 2020.[43] Because Connecticut's BTM solar penetration rate is relatively modest, concerns about cost-shifting are likely overstated.

[42] State of New Hampshire Public Utilities Commission, Order No. 26,029, DE 16-576, *Order Accepting Settlement Provisions, Resolving Settlement Issues, and Adopting a New Alternative Net Metering Tariff*, June 23, 2017 at 72 (herein "New Hampshire PUC Order No. 26,029"). Distributed generation penetration levels in New Hampshire are projected to stay well below 2% by 2030. *See*, Barbose 2017 at 11.

[43] Draft CES at 13.

Similarly, the Brookings Institute reviewed several solar valuation studies by regulators in over 10 states, and concluded that many show that net metering benefits all utility customers,[44] in contradiction to cost-shifting arguments pushed forward by utilities. Thus, as the Brookings report cautioned, "[n]et metering --- frequently benefits all ratepayers when all costs and benefits are accounted for, which is a finding state public utility commissions, or PUCs, need to take seriously as the fight over net metering rages in states."

Thus, prior to drawing conclusions about the value of BTM solar or proposing changes to our net metering structure, DEEP and PURA need to engage in "data-driven decision-making" process similar to that undertaken by other states.[45] This process should involve all stakeholders in an open, transparent evaluation that includes all the cost and benefits of BTM renewables.[46] As the Brookings Institute Report recommends, DEEP should recommend that PURA "[a]dopt a rigorous and transparent methodology for identifying, assessing, and quantifying the full range of benefits and costs of distributed generation technologies." A scoping docket should be established to consider best practices for solar valuation, and ensure that the valuation methodology PURA chooses for distributed technologies fairly and comprehensively assesses the benefits and costs.[47]

Only after an evidence-based, public proceeding evaluating the full value distributed generation brings to Connecticut's grid can DEEP fairly evaluate the cost effectiveness of BTM solar relative to utility scale or procured solar, and what reforms (if any) to net metering structures and rate design would best advance the state's goals.[48] Thus, the final CES should delete both the recommendation to replace the net metering structure with a feed-in-tariff, and the proposed 20 MW per year cap on the installation of BTM solar (approximately 1/5th of the

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[44] M. Muro and D. Saba, Rooftop Solar: *Net metering is a Net Benefit*, Brookings Institute (May 23, 2016), https://www.brookings.edu/research/rooftop-solar-net-metering-is-a-net-benefit/.

[45] North Carolina Clean Energy Technology Center, *The 50 State of Solar: Q2 2017 Quarterly Report*, July 2017, https://nccleantech.ncsu.edu/the-50-states-of-solar-report-q2-2017-updates-released/ (reporting that in the second quarter of 2017, Maine, Montana, Nevada, and New Hampshire each took legislative or regulatory action toward conducting distributed generation valuation or net metering cost-benefit studies, while stakeholders in Arkansas and Utah recommended completion of studies prior to adopting significant changes within ongoing net metering dockets.

[46] Keyes J., and Rabago K., *A Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation, Interstate Renewable Energy Council, Inc*. (Oct. 2013), available at http://www.irecusa.org/wp-content/uploads/2013/10/IREC_Rabago_Regulators-Guidebook-to-Assessing-Benefits-and-Costs-of-DSG.pdf. *See al*so Rhodium Group, What is it Worth? The State of the Art in Valuing Distributed Energy Resources (Jan. 2017), https://energy.gov/sites/prod/files/2017/01/f34/What%20Is%20It%20Worth--The%20State%20of%20the%20Art%20in%20Valuing%20Distributed%20Energy%20Resources.pdf.

[47] The docket should first establish best practices for valuing distributed generation technologies, including how unmonetized values such as environmental benefits, financial risks, and social values are quantified.

[48] CFE agrees with Acadia Center's position that certain net metering reforms could better account for costs and benefits of distributed generation in Connecticut, (*See* Acadia Center, Distributed Solar in the Draft CT Comprehensive Energy Strategy (Aug. 3, 2017) http://acadiacenter.org/wp-content/uploads/2017/08/Acadia-Center-Distributed-Solar-in-Draft-CT-CES.pdf). But comprehensive net metering and rate design reforms can only fairly be evaluated by incorporating analysis on the true assessment of avoided costs and values of distributed generation. Moreover, solar rate design and compensation mechanisms should support continued investment in solar in Connecticut. *See e.g.* Solar Energy Industries Association, *Principles for the Evolution of Net Energy metering and Rate Design* (June 7, 2017), available at https://www.seia.org/sites/default/files/NEM%20Future%20Principles_Final_6-7-17.pdf.

2016 BTM solar market). If adopted, these policies would result in shrinking Connecticut's solar industry and in-state solar development, and the loss of all the accompanying environmental and economic benefits.[49]

D. DEEP MUST ENDORSE A STATEWIDE SHARED/COMMUNITY SOLAR PROGRAM (E.1.6).

The draft CES's treatment of shared solar is extremely disappointing to CFE. Rather than using the opportunity to map out a strategy to transition from the 6 megawatt pilot program to a full-scale, statewide program, the draft CES focuses on its concerns that it has with shared solar and recommends that if "any" state-wide shared solar program is considered, it should be subject to certain policies, including the proposal to require up-front investments by subscribers. Such a policy may hinder participation in shared solar should it be adopted.[50] The final CES should instead make recommendations about the design of a statewide shared solar program that addresses their concerns.

Recognizing the myriad benefits of shared solar programs, at least twenty five states have at least one community solar project in operation, and twelve states and the District of Columbia have specifically adopted shared solar policies and programs.[51] Clean energy investors are putting their money into these states while Connecticut falls behind. Establishing a full-scale shared solar program will also be good for Connecticut's overall economy. Vote Solar recently issued a report showing that a 200-megawatt shared solar program would deliver more than 2,500 new jobs, $370 million in local economic benefits and $80 million in property taxes in Connecticut.[52] Increasing in-state development of renewables through shared solar will mean more high-quality jobs and economic growth in Connecticut

A statewide shared solar program would provide many benefits to Connecticut, including the overarching climate benefit of more in-state renewable generation, helping Connecticut meet its commitment under the GWSA to reduce emissions at least eighty percent from 2001 levels by 2050. An independent panel of experts from the Connecticut Academy of Science and Engineering (CASE) already recommended that Connecticut move forward with establishing a statewide, shared solar program.[53] Despite CASE's well-supported recommendation, the Connecticut General Assembly (CGA) only authorized a two-year pilot

[49] The zero emission and low emission renewable energy credit program ("ZREC/LREC") and the residential solar incentive program ("RSIP") and solar home renewable energy credit program ("SHREC") programs have brought significant economic and environmental benefits to the state, including bringing down the price of renewables (allowing customers to get more at a lower costs). These programs are still needed to support BTM renewable growth in Connecticut.

[50] *See* Draft CES at 78.

[51] Solar Energy Industries Association, *Distributed Solar: Shared Renewables/Community Solar, http://www.seia.org/policy/distributed-solar/shared-renewablescommunity-solar* (last viewed July 19, 2017).

[52] Vote Solar, Community Solar: Ready to Work for Connecticut, Jobs & Economic Benefits Report (June 2017), available at https://votesolar.org/files/2514/9754/9863/CT_JEDI_Report_June_2017.pdf.

[53] *Id.* at 44.

program limited to a total of 6 megawatts of shared solar projects.[54] The CES is a critical opportunity for DEEP to endorse moving forward with a full-scale program.

A statewide shared solar program would provide many benefits to the state above and beyond those that grid-scale and current rooftop solar provide.

First, shared solar programs expand community access to solar power for renters, those with shaded roofs,[55] and those who choose not to install a residential system on their home for financial or other reasons. All ratepayers and tax payers fund solar incentive programs. Accordingly, as a matter of equity, solar energy programs should be designed in a manner that allows all contributors to participate. A statewide shared solar program would therefore help close the solar equity gap across the state.

By providing access to renewable energy to renters and residents of multi-family unit dwellings, a full-scale statewide shared solar program will especially benefit low and moderate income communities. Because low-income families spend a disproportionate amount of their income on utility bills, they receive a proportionally greater economic benefit from solar power. Allowing renters to access solar through shared solar will provide financial relief to families struggling with unpredictable energy costs.[56] Relatedly, restricting access to shared solar to only those able and willing to pay upfront costs or establish ownership of the solar panel would detract from this central purpose of shared solar: providing increased access to renewables to low and moderate income residents. For low income participants, third party ownership without up-front investments, at least in the initial several years, is often the only feasible way they can participate in solar because they do not have sufficient savings or credit worthiness. DEEP provides no evidence that these third party ownership models are necessarily any more expensive to ratepayers than direct ownership models, since the utility pays the same net metering rate regardless of the ownership structure.[57] Thus, the draft CES's recommendation to require upfront investment from shared solar subscribers should be removed.

Second, shared solar provides a more meaningful engagement than market clean energy products provide. As noted in Coalition Community Solar Access's comments to which CFE co-

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[54] Public Act 15-113, *An Act Establishing a Shared Clean Energy Facility Pilot Program*, as amended by Public Act 16-116, *An Act Concerning the Shared Clean Energy Facility Pilot Program*.

[55] A 2008 study by the National Renewable Energy Laboratory (NREL) found that only 22 to 27% of residential rooftop area is suitable for hosting an on-site photovoltaic (PV) system. About eighty percent of Connecticut state residents cannot install rooftop solar panels because they are renters, because their rooftops are too shady or otherwise unsuitable, or for other reasons.

[56] Vote Solar, Low Income Solar Policy Guide (accessed on Sept. 25, 2017), available at http://www.lowincomesolar.org/toolbox/community-shared-solar/.

[57] For an overview of various shared solar business models, *see* American Council on Renewable Energy, *Community Solar Power: A Look at Business Models Behind Shared Solar* (June 6, 2016), http://www.acore.org/acore-blog/item/4249-community-solar-power-a-look-at-the-business-models-behind-shared-solar (last viewed July 27, 2017). *See also* Coughlin et. al., *A Guide to Community Shared Solar: Utility, Private, and Non-Profit Project Development*, National Renewable Energy Laboratory (May, 2012), http://www.nrel.gov/docs/fy12osti/54570.pdf (last viewed July 31, 2017)("Usually, the utility or some identified third party owns the solar system itself").

signed, there is demonstrated demand for shared solar that allows a customer to directly participate in, and receive economic benefits from, a specific solar energy project. Shared solar allows a community to come together to create a specific project, typically located in the same utility service territory or area where customers are located, so they can engage directly with the project. Shared solar also reduces up-front costs for participants through improved economies of scale. Shared solar projects that retain the RECs generated and retire them locally bring additional carbon reduction benefits to the state that current clean energy products do not provide. These benefits do not exist with voluntary renewable energy products.

Third, shared solar also will make the state's energy infrastructure more resilient by addressing energy demand and with the potential to operate as a backup in times of need.[58] As we saw during hurricane Sandy, centralized grids are prone to risks of service disruptions and power outages. Distributed solar PV systems like shared solar can be combined with energy storage and/or a microgrid to avoid electricity outages resulting from larger-scale grid disruption.[59] Similarly, shared solar can also help support the grid as the continued increase in electrification of both the heating and transportation sectors increases load on the grid. Shared solar projects could be located in areas of the grid where expanded distributed energy resources (DER) can either defer or avoid grid investments, and be cost-effectively integrated into the distribution grid. The benefits to the state from such a program will be improved when guided by the mapping and load forecasting information gathered by PURA in the Distribute Energy Resources docket (as discussed below in Section H).

Thus, establishing a full-scale shared solar program, like so many other states already benefit from, would promote equal access to clean energy, promote resiliency, and spur local, private investment in the state. The final CES should specifically recommend instituting a full-scale, statewide shared solar program within the three year period covered by this energy strategy.

E. The Voluntary Renewable Product Verification in the Competitive Electric Supply Market Should be Strengthened, but Not In Lieu of a Shared Solar Program (E.1.7).

CFE strongly supports the Clean Energy Options Program and has advocated for the continuation of a similar program under PURA Docket No. 16-08-23. CFE also agrees with the recommendation in the draft CES that PURA's new regulations for voluntary renewable energy products require competitive renewable product offerings to meet the supplier standards of the CCEO program. However, as discussed above, clean energy options product offerings should not

[58] *See e.g.* Shared Renewables HQ, *Community Energy Projects*, http://www.sharedrenewables.org/community-energy-projects/ (last viewed July 20, 2017) (New York's CSS policy, "PSC Order Establishing a Community DG program", started the project in multiple phases, with the first phase concentrating on two specific guiding objectives of (1) providing the greatest locational benefits to the larger power grid and (2) ensuring at least 20 percent of the participants are low- and moderate-income customers).

[59] ICLEI USA, Solar Energy & Resilient Communities, *How Does Solar Energy Contribute to Building Resilient Communities*? (accessed on Sept. 22, 2017), http://icleiusa.org/wp-content/uploads/2016/02/Solar-and-Resiliency-Fact-Sheet.pdf.

be seen as a replacement or alternative for shared solar, which provides additional benefits to residents and the state above and beyond a clean energy product offered through the competitive electric supply market. Whereas a voluntary renewable product requires a customer to pay an additional fee or a premium to purchase RECs from a renewable resources already on the grid, shared solar brings a new renewable source to market and allows subscribers to obtain economic and environmental benefits from that source. Further, if the RECs are retired in-state and contribute to Connecticut's carbon reduction over and above our RPS mandate, there is far more value to the state's environmental goals than from market purchases.

F. The Working Group to Implement Best Practices to Optimize Siting of Renewable Facilities Should Support the Continued Deployment of Grid Scale Solar in Connecticut (E.1.8).

CFE appreciates DEEPs continued efforts to strike the right balance between protecting core forests and farmlands while continuing to support the deployment of grid-scale solar in Connecticut. CFE is very concerned that Public Act (P.A.) 17-218 will have negative impacts on the growth of renewables in Connecticut, and agrees that further clarification is needed regarding the meaning of what type of project would "materially affect" the status of the land as a core forest or prime agricultural soil. The Act's language is vague and has the potential to be interpreted in an overly-restrictive manner, which could adversely impact solar development opportunities in Connecticut. Given that the draft CES embraces grid-scale solar as the most cost-effective method of deploying solar in the state, it is particularly critical that DEEP help ensure that the language adopted in P.A. 17-218 is interpreted reasonably or amended so that it does not make it significantly harder to deploy these large-scale solar developments.

Solar energy can be used to support agriculture in a number of ways: saving money, increasing self-reliance, and reducing pollution. Therefore, a viable farming community and strong solar industry are not at odds with each other. For example, dairy operations using "long day" lighting to increase production can save money with skylights and other sun-lighting options.[60] Vermont is demonstrating the cost-savings effects of cattle grazing with solar installations.[61] Planting pollinator gardens between solar arrays is also common in Europe and several US states. The European Union distributes best practices for combining solar and agriculture.[62] The legislature should not restrict solar development on prime agricultural land if the solar supports the agricultural use on that land in part or whole.

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[60] Union of Concerned Scientists, *Up with the Sun: Solar Energy and Agriculture* (2003), available at http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/agfs_solar_2003.pdf.

[61] Green Alliance, *Solar Arrays and the Future of the New England Farm* (June 2015), available at http://www.greenalliance.biz/blog/archives/201506/solar-arrays-and-future-new-england-farm.

[62] Rob Davis, *Minnesota Leads on Solar for Pollinators and Crops*, Jan. 31, 2017, https://fresh-energy.org/2017/01/31/19302/. *See also* BRE (2014) *Agricultural Good Practice Guidance for Solar Farms*. Ed J Scurlock, available at http://www.appg-agscience.org.uk/linkedfiles/Solar%20Farms%20-%20Good%20Practice%20Guidance.pdf.

Moreover, the reality is that much of Connecticut's farmland is already zoned for industrial use. [63] Unlike industrial, commercial or residential development on farmland, solar is a temporary use of land. Once solar projects are decommissioned after their useful life, the property can be restored to previously existing conditions and agricultural activities may resume. Yet Public Act 17-218 currently subjects grid-scale solar projects on prime forest or farmland to more scrutiny than siting a big box store like a Walmart or Dollar Store. DEEP's proposed working group should ensure that P.A. 17-218 does not hold solar and wind projects to a higher standard than other forms of development.

G. The CES Should Address Capacity Concerns Through Increased Reliance on Renewable Energy (Rec. E.2.1).

CFE commends DEEP for declining to recommend the immediate installation of new natural gas infrastructure in the 2017 draft CES. This represents an important shift from the 2013 CES. However, CFE is still concerned that despite flattening electricity sales, the draft CES still attributes grid reliability concerns in the winter months to pipeline capacity constraints, implying that new natural gas infrastructure may be needed. The case for further expansion of natural gas infrastructure to address potential winter peak issues is problematic on many fronts.

Expanded natural gas infrastructure is incompatible with the state's short and long-term GHG reduction goals. Leaks associated with natural gas production and distribution release large amounts of methane, a pollutant that is 87-times more potent than carbon dioxide at trapping heat in the Earth's atmosphere over a 20-year span.[64] According to a study published by the National Academy of Sciences, methane leakage can have as much as double the climate effect of natural gas.[65]

New interstate gas pipelines would cost consumers billions of dollars to build, operate and maintain, bring no proven net benefits and carry a very high risk of creating substantial future stranded costs as renewable technologies come to dominate generation. As a recent Synapse report found, the Access Northeast Pipeline alone could cost as much as $6.6 billion - more than double the $3.2 billion proponent's claim - because of anticipated cost overruns, operational and maintenance costs, depreciation and return on equity investment. The Synapse report found that state energy efficiency programs, renewable portfolio standards, and greenhouse gas emission reduction targets throughout the New England states will soon result in current pipelines running under capacity. Since current pipeline capacity is sufficient to meet

[63] Gregory Hladky, *Foreign Competition, Labor Costs Push Connecticut Shade Tobacco Farmers to the Edge*, The Hartford Courant, http://www.courant.com/news/connecticut/hc-ct-tobacco-troubles-20170613-story.html.

[64] Sierra Club, *The Gas Rush: Locking America Into Another Fossil Fuel for Decades*, file:///S:/STAFF/Claire/Claire%20Legal/CES/1466-Gas-Rush-Report_04_web%20(2).pdf.

[65] Dana Caulton et al., *"Toward a Better Understanding and Quantification of Methane Emissions from Shale Gas Development,"* Proceedings of the National Academy of Sciences 111(17): 6237-6242, (April 2014), http://www.pnas.org/content/111/17/6237.abstract.

both Connecticut's and the region's needs, there is no justification for imposing billions of dollars of transmission fees on ratepayers.[66]

CFE understands the desire to allow ISO-New England (the independent system operator of New England) to take the lead in determining whether there are regional natural gas generation reliability issues. However, climate mandates and public health implications are not part of the ISO's energy-planning and decision-making process.[67] DEEP therefore needs to continue to support these broader goals as it engages with ISO-New England. The final CES should explicitly embrace alternative strategies – including aggressive energy-efficiency measures, removal of barriers to scaling up renewables and deployment of targeted distributed energy resources – as superior options to investing in new gas pipelines.

H. The Final CES Should Embrace Integrated Distribution Planning and New Utility Business Models that will Support a Modernized, Zero-Carbon Grid (E.2.2/2.4).

The draft CES appropriately acknowledges the critical role that grid modernization will play in supporting a smooth transition to a zero carbon economy.[68] Significantly increasing the percentage of grid scale and BTM renewables in Connecticut's generation mix, which is essential to achieving the state's climate goals, will require adoption of a more dynamic regulatory framework to ensure a fair and affordable allocation of the costs and benefits of cleaner, more efficient and resilient energy system. Further analysis of the relative costs and benefits of distributed generation (including the value of solar study requested above), should be integrated into the design and development of new utility business models so that they better serve the state's long term energy, environmental and economic goals.[69]

These new business models need to reward the integration of higher levels of distributed energy resources, provide reasonable cost recovery for business plans and the technologies needed to implement such, and empower third parties and customers to become active participants in the creation and use of that new energy system. [70] While Connecticut should certainly study the work being done in New York, Massachusetts and other jurisdictions, as the

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[66] Synapse Energy Economics, Inc., *New England's Shrinking Need for Natural Gas* (Feb. 7, 2017) available at http://www.synapse-energy.com/sites/default/files/New-Englands-Shrinking-Need-for-Natural-Gas-16-109.pdf. (finding that New England's use of natural gas will decrease by 41 percent from 2015 levels by 2030 due to state requirements for energy efficiency, renewable energy and emissions caps.)

[67] *See* Andy Savitz, New England's Power Grid Operator is Biased (Sept. 10, 2017), https://commonwealthmagazine.org/energy/new-englands-power-grid-operator-biased/.

[68] *See* CES Draft Executive Summary at XV ("It will need to integrate distributed generation, and expand energy storage and demand response at the lowest cost for electric ratepayers.")

[69] *See* Mike O'Boyle, *Harnessing The Power of the People Through "Value of Solar"… And Beyond* (Feb. 2, 2017), https://www.forbes.com/sites/energyinnovation/2017/02/02/harnessing-the-power-of-the-people-through-the-value-of-solar-and-beyond/#27b698a86c80.

[70] *See* generally, Advanced Energy Perspectives, *Major Steps Toward a 21st Century Electricity System in New York, California* (Mar. 25, 2015), https://blog.aee.net/major-steps-toward-a-21st-century-electricity-system-in-new-york-california?hsFormKey=4c39ae1d2a10af432298c108a9b42659&submissionGuid=c2c52a8c-2223-458f-bfa2-ddf97fc1c64c#blog_subscription.

draft CES proposes, DEEP and PURA should act now to undertake some specific modifications to how our utilities are compensated in order to better align that compensation with state policy goals.

CFE also agrees with DEEP that PURA should initiate "a generic proceeding on grid modernization and adaptation of the utility business models to reflect the modern grid."[71] As part of this grid modernization docket, PURA should undertake integrated distribution planning to better understand where DERs can be deployed in Connecticut to avoid new infrastructure needs. The DEEP docket on Grid-Side System Enhancements to Integrate Distributed Energy Resources (DER) pursuant to P.A. 15-5[72] was a good first step. The pilot programs that DEEP approved in February, 2017 create an opportunity to begin to target distributed generation (including shared solar projects) to areas of the grid where expanded DER can either defer or avoid grid investments, or at a minimum be cost-effectively integrated into the distribution grid.[73] As noted in its approval of Eversource's DER Customer Portal Management System proposal, DEEP believes it "will provide a valuable tool for developers to better understand where to locate projects and maximize value to all ratepayers."

Following this pilot, DEEP and PURA should now require that United Illuminating and Eversource develop an integrated systems-wide mapping tool to identify optimal locations for the deployment of distributed renewable resources (include renewables, energy storage, EVs, and demand response technologies).[74] This mapping tool should be made available to developers and citizens to guide the build out of DER resources in the state. As DEEP has noted, to help ensure the best siting decisions, this statewide map should also integrate GIS information that the Connecticut Center for Land Use Education and Research (CLEAR) provides that shows the topographic, environmental and other land use characteristics.

Additionally, rather than DEEP encouraging electric distribution companies' (EDC's) to submit revised energy storage proposals to DEEP and/or PURA, DEEP should *require* the EDC's to submit revised energy storage proposals consistent with Section 16-244w of the General Statutes.

III. The Building Sector

The Synapse RPS report demonstrates the critical need for reducing GHG emissions from the building sector. Ramping up renewables in the electric sector and transitioning to electric vehicles will not be enough, on their own, to meet our states long-term climate goals under the

[71] Draft CES at 83.

[72] Connecticut General Assembly, June Special Session, Public Act 15-5, https://www.cga.ct.gov/2015/act/pa/pdf/2015PA-00005-R00SB-01502SS1-PA.pdf

[73] Similarly, microgrids play an important role in advancing resiliency in the state, particularly for critical infrastructure such as wastewater treatment plants. Investments needed to protect vulnerable substations continue to be a top priority and the state should recognize that while some of these costs may be borne regionally others will fall on Connecticut ratepayers.

[74] California's regulatory agency requires similar information. *See* Public Utilities Code Section 706, available http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PUC&sectionNum=769; https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB327.

GWSA. The final CES should therefore adopt ambitious goals and recommendations to both improve energy efficiency in building systems and transition building heating from outdated fossil fuels to cleaner, thermal renewable options.

A. The Final CES Should Set More Aggressive Energy Efficiency Targets.

It is widely recognized that energy efficiency (EE) is the most cost-effective option for reducing GHG emissions, [75] and it also creates jobs, boosts the economy, and saves consumers money.[76] "There are also substantial additional benefits to homeowners and businesses (e.g., gas savings, water savings, and improvements to comfort, health and safety, building durability, and business productivity) as well as environmental, public health, low income energy affordability, local economic development, and other societal benefits."[77]

CFE fully supports DEEP's continued commitment to energy efficiency, as well as the draft CES's recognition of the ongoing importance of energy savings as both a financial and energy resource for the state. However, the incremental policy recommendations included in this section should be more ambitious. More ambitious energy efficiency savings programs will help Connecticut achieve its mandatory greenhouse gas emissions target for 2020.

The draft CES's assumption that Connecticut's level of savings for its current energy efficiency programs is sufficient should be revisited, and revised to increase the annual amount.[78] Connecticut's current investment level of 1.5 percent energy savings does not capture all cost-effective measures, and falls far short of the investments being made by other states like

[75] Lucy Johnston and Rachel Wilson, The Regulatory Assistance Project (RAP) & Synapse Energy Economics, Inc., *Strategies for Decarbonizing the Electric Power Supply*, Nov. 2012, available at http://www.raponline.org/wp-content/uploads/2016/05/rap-gpbp-decarbonizingpowersupply-2012-nov-16.pdf.

[76] *See e.g* Bracken Hendricks, Bill Campbell and Pen Goodale, Efficiency Works, Creating Good Jobs and New Markets Through Energy Efficiency (Sept. 2010), *Center for American Progress, https://grist.files.wordpress.com/2010/09/good_jobs_new_markets.pdf;* Connecticut Energy Efficiency Fund, Energy Efficiency Board, 2016 Programs and Operations report (March 1, 2016), https://www.energizect.com/sites/default/files/FINAL-ALR-2106-R2-WEB-3-24-17.pdf. *See also*, Taren O'Connor & Bill Dornbos, *Why Raiding Connecticut's Energy Efficiency Fund is a Bad Idea*, https://ctviewpoints.org/2017/06/28/why-raiding-connecticuts-energy-efficiency-fund-is-a-bad-idea/ (June 28, 2017)(noting Since 2010, Connecticut's energy efficiency programs have generated about 27 billion kilowatt hours in lifetime energy savings—more than the annual generation of the Millstone nuclear power plant. These energy savings equal over $5.5 billion in savings on customers' energy bills).

[77] *See* Neme, C., & Grevatt, J. (2016, February). *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years.* The Regulatory Assistance Project: Montpelier, VT. Available at: http://www.raponline.org/document/download/id/7944 (citing Lazar, J., & Colburn, K. (2013). *Recognizing the Full Value of Energy Efficiency.* Montpelier, VT: The Regulatory Assistance Project.)

[78] *See* Neme, C., & Grevatt, J. (2016, February). *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years.* The Regulatory Assistance Project: Montpelier, VT. Available at: http://www.raponline.org/document/download/id/7944.

Massachusetts and Rhode Island, which support between 2 and 3 percent reductions.[79] The final CES should include specific proposals for DEEP to work with the Energy Efficiency Board to achieve all cost-effective energy efficiency, including proposed legislative changes that would require energy efficiency funding to follow higher established savings levels. DEEP should lead efforts to increase efficiency investments and, as called for in the draft CES, work with PURA to ensure that cost effectiveness testing reflects all resource costs and benefits.

Additionally, while DEEP has made considerable progress with the state's Lead By Example (LBE) program (enacted by the General Assembly in 2011 as Public Act 11-80[80]), from the limited data available on savings achieved, it seems reasonable to conclude that we have fallen short of the Act's call for a 10% reduction in its energy use by January 1, 2013 and an additional 10% by July 1, 2018.[81] CFE applauds the recent progress DEEP has made in developing systems to account for energy use and for efficiency upgrades it has made at State facilities. Hopefully this new analysis will allow DEEP's future reports to the legislature to indicate total usage and savings achieved in relation to the statutory benchmarks. To ensure progress is made on this effort, the LBE Chart on Page 113 of the Draft CES should be amended to include specific time frames for each of the steps described to reduce Connecticut's state building costs, and should include installation of renewables in the benchmarks. DEEP and OPM should also work together to maximize the use of Guaranteed Energy Savings Performance Contracts, that do not require large upfront funding, to ensure that efficiency investments in State owned buildings proceed at a much faster pace than has been the case over the last few years.

DEEP could also augment the utility ratepayer supported programs by additional use of its competitive RFP authority under PA 15-107 to solicit additional energy efficiency. Given the continued challenge of reaching rental and low-income customers, the state should consider issuing a RFP aimed at these markets. In addition the CES should again recommend the mandatory release of energy use data to prospective renters, which would incentivize private developers and residential and commercial building owners to maximize energy efficiency investments.

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[79] *See* Massachusetts Department of Energy and Environmental Affairs, Massachusetts' Nation-Leading Three-Year Energy Efficiency Plan Approved (Jan. 29, 2016), *http://www.mass.gov/eea/pr-2016/massachusetts-3-year-energy-efficiency-plan-approved.html* (noting The energy savings goals in the 2016-2018 Plans once again set nation-leading savings levels for both electricity (2.93% of retail sales). *See also* DSIRE database, Energy Efficiency Resource Standard, Rhode Island (accessed Sept. 22, 2017, Laws updated March 20, 2015), http://programs.dsireusa.org/system/program/detail/4507.

[80] See Conn. Gen. Stat. § 16a-37u; see also Public Act 11-80, An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future, §§ 118 and 123.

[81] Acadia Center recently concluded that "there is insufficient information available to conclude that the LBE program is currently fulfilling its statutory charge. The scattered information that is available strongly suggests that the program is not making necessary progress." Acadia Center's *Policy Progress Report: Status of Connecticut's 'Lead by Example' Energy Efficiency Program for State Buildings* (October 14, 2016), http://acadiacenter.org/wp-content/uploads/2016/10/Acadia-Center-CT-Lead-by-Example-Progress-Report-UPDATED-10.14.2016.pdf.

B. **The Final CES Should Create a Specific Plan to Convert Fossil-Fuel Based Heating to Efficient Electricity**.

Over 60 percent of the energy used in residential and commercial buildings is for space heating and cooling.[82] As recognized by the GC3, electrifying heating through deployment of efficient and renewable thermal technologies like heat pumps is a critical component to meeting our GHG-reduction targets. Yet other states in the region are far ahead of Connecticut in the electrification of heating. The final CES should include specific strategies to catch Connecticut up.

For example, the draft CES recommends focusing only on switching customers currently using traditional electric resistance heat to heat pumps due to current market conditions (low fuel prices). The final CES should go further and recommend specific policies to promote renewable thermal technology deployment in all buildings, and encourage the Energy Conservation Management Board to work with the utilities to prioritize heat pump conversions over converting customers to gas heating. This should include education around "partial-load" strategies, which would allow consumers to use heat pumps to cover a significant portion of heating and cooling needs, while maintaining existing oil or gas equipment. The final CES should also recommend establishing coordinated incentives and financing to promote renewable thermal technology development and deployment, as well as an aggressive marketing and education campaign to explain the benefits of heat pump conversion.

Diversification within heating oil businesses is both necessary and beneficial, and if fuel oil dealers are trained in installing heat pumps, this can be a win-win for both our economy and environment. In fact, the numerous fuel oil dealers that now install heat pumps are benefiting from the incentives that have led many oil and propane heat customers to adopt this efficient heating technology. DEEP should work with the oil industry to ensure that accurate information is communicated to fuel oil and propane customers about the ability of new heat pumps to function well as the primary heat source in our cold weather climate.

Further expansion of the natural gas distribution system hinders rather than helps the state achieve its climate goals. Conversion to, or the addition of supplemental renewable and cleaner, more efficient thermal technologies, should be supported by both the utility efficiency programs and the Green Bank. EnergizeCT, in combination with the utilities and other stakeholders, should undertake informative campaigns to help customers understand the capabilities of new cold weather heat pumps.

Finally, since the economics of conversion from oil or gas is very dependent on price of fossil fuel, the CES should recommend new price signals for carbon, as a catalyst for market transformation in support of GHG reduction efforts. Historically, the cost of fossil fuels has not taken into account their negative health impacts and harm to our environment and climate. Attaching a price to carbon to account for these social costs will encourage the transition to zero and low carbon thermal sources. Accordingly, carbon pricing will make conversions to thermal

[82] 2013 Comprehensive Energy Strategy.

heating more economical for Connecticut residents. Importantly, CFE supports carbon pricing as *one* tool in the toolbox for fighting climate change.[83] Carbon pricing alone will not solve climate change, but in combination with proactive legislation, and regulations that include incentives to transition to renewables and improve energy efficiency provide a strong framework for achieving a low carbon future.[84]

C. DEEP Should Pursue its Proposal to Assess a Conservation Charge for Heating Oil and Propane Customers in the final CES

Connecticut's energy efficiency programs have been very successful in reducing customers' energy use and bills and must continue to play an even more important role going forward. As discussed earlier, Connecticut lags behind its neighbors and California in the level of energy savings it supports. The bulk of existing funding for these efficiency programs comes from a small surcharge on every kilowatt hour of electricity and a corollary charge on natural gas. Although the efficiency programs have been made available to homes heated by oil and propane, these customers do not contribute to the energy efficiency fund.

CFE agrees with DEEP's recommendation in the draft CES that to provide equitable distribution of efficiency programs and investments for homes using oil and other deliverable fuels, an additional energy efficiency program contribution plan for these consumers should be implemented. As demonstrated by DEEP and the September 13th Technical meeting, the benefits that would accrue to oil and propane heat customers from the availability of expanded energy efficiency programs would far outweigh the small fuel surcharge they would see. The estimated cost for the proposed fee per household is $35-45/year, and the estimated efficiency gains are estimated at $51.7 million. Given we need all cost-effective fossil fuel consumption reductions possible to meet Connecticut's climate goals, the proposed conservation charge is a low cost tool to improve investments in oil efficiency measures that will help meet our climate goals.

CFE agrees that use of biofuels seem to be a positive development over use of traditional oil for those residents that have furnaces and are unable to transition to heat pumps. Some biofuels can reduce particulate matter and have lower nitrogen oxide and greenhouse gas emissions.[85] However, the blends of biodiesel vary, as do levels of carbon dioxide, sulfur, and particulate emissions, so more information is needed to assess the environmental performance and emissions of biofuels by Connecticut's biodiesel retailers. If DEEP is able to confirm through data and analysis that biodiesel's used by Connecticut's retailers has significant environmental benefits, DEEP could consider applying a lower heating oil efficiency charge to biodiesel fuels than to conventional heating oil to help offset their increased cost and further

[83] Connecticut also needs to continue to support the successful Regional Greenhouse Gas Initiative (RGGI), which has reduced power plant GHG emissions 40%, and generated at least $2.9 billion in net economic benefits. CFE also supports instituting a regional cap and invest program modelled off of RGGI to address transportation carbon emissions, as detailed in Part IV of these comments.

[84] *See generally*, David Doniger, Natural Resources Defense Council, *Carbon Price, Yes. Clean Air Act Rollbacks, No.* (Feb. 8, 2017), https://www.nrdc.org/experts/david-doniger/carbon-price-yes-clean-air-act-rollbacks-no.

[85] Environmental Defense Fund, *The Fuel Effect: What is Being Burned Matters*, https://www.edf.org/sites/default/files/10071_EDF_BottomBarrel_Ch3.pdf

incentivize their purchase by customers still using oil. As an initial step, the draft CES should recommend a reporting mechanism for assessing the emissions and pollution data for biofuels.

IV. Transportation Sector

CFE appreciates DEEP's recognition in the draft CES that given that the transportation sector is the major contributor to air pollution and GHG emissions in Connecticut, electrification strategies must be deployed. Indeed, addressing the negative health and environmental impacts of our transportation sector must be a top priority. Non-diesel light duty vehicles make up nearly 45% of mobile NOx emissions in the state.[86] NOx emissions react with other pollutants to form ground level ozone, which has been demonstrated to impair lung function and produce many respiratory illness symptoms. Connecticut's eight counties all received failing grades for high ozone days from the American Lung Association in 2016.[87]

Connecticut needs bold and swift action to meet its GHG-reduction targets, which, as the draft CES notes, requires, among other things, the deployment of over two million zero emission vehicles (ZEVS) in Connecticut by 2050.[88] Connecticut must also meet its commitment under the State Zero Emission Vehicle Programs Memorandum of Understanding (ZEV MOU) to put approximately155,000 EVs on the road by 2025.[89]

Meeting these EV goals will bring the state significant health and economic benefits. A recent report by the American Lung Association showed that the ten states that have adopted ZEV sales programs will experience wide-scale health benefits and related cost-savings as a result of drops in passenger vehicle fleet pollution. Specifically, the report estimates that these pollution-related health and climate change costs will drop from $37 billion annually to $15.7 billion by 2050; representing a $21 billion drop in annual costs. The ALA also estimated that annual pollution-related impacts drop by over 85%, due to fewer lost work days caused by pollution-related illnesses, fewer asthma attacks and fewer premature deaths.[90] In Connecticut

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[86] Connecticut Department of Energy & Environmental Protection, *Proposed State of Connecticut Mitigation Plan under the Volkswagen 2.0L Partial Consent Decree, Appendix D*, page 6, available at http://www.ct.gov/deep/lib/deep/air/mobile/vw/CT_VW_Proposed_State_Mitigation_Plan_-_PREPROPOSAL.pdf.

[87] American Lung Association, *State of the Air 2016*, page 64, http://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2016-full.pdf.

[88] Draft CES at 188 (citing Connecticut Department of Energy and Environmental Protection, "Meeting of the Governor's Council on Climate Change (GC3) - September 8, 2016," http://www.ct.gov/deep/lib/deep/climatechange/gc3/gc3_mitigationwedges_09_08_2016.pdf.)

[89]Conservation Law Foundation, Sierra Club, Acadia Center, *Charging Up: The Role of States, Utilities, and the Auto Industry in Dramatically Accelerating Electric Vehicle Adoption in Northeast and Mid-Atlantic States* (Oct. 2015), https://www.sierraclub.org/sites/www.sierraclub.org/files/uploads-wysiwig/ChargingUp_DIGITAL_ElectricVehicleReport_Oct2015_0.pdf.

[90] American Lung Association, *Clean Air Future: Health and Climate Benefits of Zero Emission Vehicles* (Oct. 2016), available at http://www.lung.org/local-content/california/documents/2016zeroemissions.pdf. *See also* http://www.lung.org/local-content/california/documents/national-clean-air-future-report.pdf.

alone, the combined health savings and climate benefits will be $1.3 billion.[91] These benefits will be realized, of course, only if Connecticut meets its targets.

Mass transit investments are also critical to making public transit more accessible and to encouraging transit-oriented development that ultimately reduce driving and related pollutions.

A. EV Roadmap has Promising Concepts, but the Final CES Should Recommend Specific Policies for Immediate Implementation (T.2.1)

As summarized in the Connecticut Electric Vehicle Coalition submission dated September 22, 2017, CFE agrees with the principles outlined and the priorities identified in the proposed Electric Vehicle Roadmap cited in the draft CES, but urges DEEP to adopt more specific recommendations in the final CES to ensure that transportation electrification in Connecticut moves forward at a more rapid rate. CFE recognizes the resource constraints DEEP faces, but if the proposed EV Roadmap is to have any chance of helping Connecticut meet its commitment under the ZEV MOU to have 150,000 EVs on its roads by 2025, faster action is required. In mid-2015, Connecticut had sold approximately 2,957 electric vehicles.[92] To go from a few thousand, to almost two million EVs on the road by 2050, Connecticut needs to adopt an all-hands-on deck approach to increasing EV sales. CFE therefore urges DEEP incorporate the specific proposals included in the Connecticut EV Coalition submission dated September 19, 2017, rather than waiting for the development of the EV Roadmap.

First, DEEP should extend and expand the CHEAPR program to help consumers overcome the initial sales price hurdles that deters many consumers from choosing EVs despite their long-term cost savings. DEEP's EVConnecticut website indicates that current CHEAPR funding is diminishing rapidly.[93] This is particularly troubling given that the travel provision under the California ZEV Program[94] that has motivated automakers to more aggressively market sales in the Northeast is expiring at the end of the year. Connecticut could miss out on this opportunity to sell more EVs if its rebate funding sources are low and automakers steer their marketing efforts to states with stronger rebate programs. Through funding mechanism discussed below, DEEP should institutionalize the rebate program to assure buyers that funding will be available when choosing their next vehicle.

CHEAPR should also be expanded by designing specific incentives that would increase environmental justice and equity. Low-income communities suffer disproportionately from

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[91] *Id*.

[92] Conservation Law Foundation, Sierra Club, Acadia Center, *Charging Up: The Role of States, Utilities, and the Auto Industry in Dramatically Accelerating Electric Vehicle Adoption in Northeast and Mid-Atlantic States* (Oct. 2015), https://www.sierraclub.org/sites/www.sierraclub.org/files/uploads-wysiwig/ChargingUp_DIGITAL_ElectricVehicleReport_Oct2015_0.pdf. *See generally* http://drivingzev.com/sales; http://drivingzev.com/zev-state/connecticut.

[93] On August 1, 2017, $521, 250 was remaining. On September 22, 2017, only $102,750 remained. *See* http://www.ct.gov/deep/cwp/view.asp?a=2684&q=564768&deepNav_GID=2183 for current available funding.

[94] The travel provision lets auto manufacturers earn ZEV credits in every state for a zero-emission vehicle that's sold in any ZEV-Program state. See Section 1962.1(d)(5)(E), available at https://www.arb.ca.gov/msprog/zevprog/zevregs/1962.1_Clean.pdf.

health impacts related to air pollution from conventional cars, and would benefit most from electrification of our transportation sector.[95] Rebate programs need to be designed to address this equity gap. For example, California's original rebate program includes an increased rebate amount for consumers with household incomes less than or equal to 300 percent of the federal poverty level.[96] Through California's newly enacted Enhanced Fleet Modernization Program, low-income drivers who trade in a gas guzzler for an electric vehicle can qualify for a rebate of up to $14,000. The final CES should recommend Connecticut establish a similar income eligible EV incentives program that offers bigger rebates and rebates for used cars to customers in a lower income bracket.

Relatedly, CFE strongly supports the recommendation in the draft CES that the state should pursue a pilot-program to evaluate group EV purchase and EV-solar purchase programs.[97] The Connecticut Green Bank has already employed this concept with its partnership with Nissan to offer a limited incentive on purchases of the 2017 LEAF.[98] DEEP and the Green Bank should continue to work with other EV manufacturers to establish other group purchase programs to significantly lower the cost of EVs to individuals and companies. Finally, CFE applauds DEEP for highlighting innovative EV car-sharing models like those established in Indianapolis and Los Angeles. Electric car sharing services are another important way to provide clean transportation options to people who do not need, or cannot afford, to own cars. DEEP should include recommendations in the draft CES to pursue similar electric car sharing service pilots in New Haven, Bridgeport and Hartford.

Second, as the draft CES recognizes, increasing access to charging infrastructure will be critical to deployment of EVs, and the draft CES should propose specific actions to move the state in that right direction. Specifically, the final CES should direct the Public Utilities Regulatory Authority (PURA) to open a docket to establish an appropriate role for our electric utilities to support the efficient and equitable deployment of EV charging that incorporates consideration of load management and the grid benefits of EVs while also maintaining innovation, competition, and customer choice in Connecticut's EV charging market. The final CES should also direct the Connecticut Building Inspector to adopt and enforce EV-Ready building codes that require sufficient electrical infrastructure to support chargers in garages in new residential constructions.[99]

Third, the final CES should require the Public Utilities Regulatory Authority (PURA) to work with the utilities to ensure that new EV electric load is incorporated in a safe, reliable, and efficient manner, supported by scaled-up solar photovoltaics, as well as other critical steps

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[95] *See* Conservation Law Foundation, Sierra Club, Acadia Center, "Charging Up: The Role of States, Utilities, and the Auto Industry in Dramatically Accelerating Electric Vehicle Adoption in Northeast and Mid-Atlantic States,", available at https://www.sierraclub.org/sites/www.sierraclub.org/files/uploads-wysiwig/ChargingUp_DIGITAL_ElectricVehicleReport_Oct2015_0.pdf

[96] California, Clean Vehicle Rebate Project, https://cleanvehiclerebate.org/eng/income-eligibility

[97] See Draft CES at 203.

[98] *See* Connecticut Green Bank, http://www.ctgreenbank.com/wp-content/uploads/2017/05/Energy-Savings-in-Motion-Group-Buy-Flyer.pdf, (accessed on Sept. 1, 2017).

[99] Per requirements set forth in Public Act 13-298, the Connecticut Building Inspector was supposed to adopt EV-ready residential codes in their 2016 revisions, but did not.

needed to modernize the electric system and enable smart EV integration. Modernizing the electric system to enable smart EV integration will facilitate a more cost-effective transition to electric transportation and will benefit all ratepayers by putting downward pressure on rates.[100] Grid modernization proceedings are already underway in other states; Connecticut should engage its utilities to support strategic electrification in our state.[101]

The EV Roadmap proposal in the draft CES includes the evaluation of "appropriate time-of-use rate structures that support the adoption of EVs." However, despite recognizing that time of day ("ToD") rates incentivize EV customers to charge during off-peak hours, PURA determined (through Docket 16-07-21) that an EV-specific ToD rate pilot was not necessary. CFE disagrees with this conclusion, and urges DEEP to recommend legislation that would require PURA to swiftly institute an EV time of use rate that provides overnight charging at a very low cost. At a minimum, DEEP should recommend time of use rates that encourage people to charge their EVs during off-peak hours or during peak solar or wind generation, helping to better take advantage of these variable renewable energy sources.

CFE also likes DEEP's suggestion to build on the state's current LBE program by developing a multi-agency strategy to accelerate the adoption of EVs for the State fleet. As part of this initiative, the Department of Administrative Services should collaborate with DEEP to conduct and publish an up to date inventory of the composition of state owned vehicles as required in Sec 4a-67d of Chapter 58 the general statutes (which mandates that all state non-special use vehicles be alternative fuels, hybrid electric or plug in electric),[102] and take steps to enforce full compliance with this statute.

B. The Final CES Should Recommend a Market Based Program to Reduce Transportation Emissions and Generate Funding for Electrification and Sustainable Transit (T.3.2).

CFE appreciates DEEP's active participation in regional partnerships and initiatives to advance a clean and efficient regional transportation network. The final CES should advance Connecticut's leadership role in the Northeast by recommending the adoption of regional, market-based program to reduce transportation carbon emissions and generate funding for sustainable public transportation and electrification.

CFE is glad to see that DEEP recommends that sustainable transportation funding options like electronic congestion pricing should be considered.[103] Traffic congestion is a persistent and growing problem in metropolitan regions across the Unit States, including in Connecticut, which imposes significant economic, environmental and health costs on residents and taxpayers. Congestion pricing is a smart strategy for improving transportation system performance,

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[100] The Citizens Utility Board, *the ABCs of EVs: A Guide for Policy Makers and Consumer Advocates* (April. 2017) https://citizensutilityboard.org/wp-content/uploads/2017/04/2017_The-ABCs-of-EVs-Report.pdf.

[101] *See* Luke Tonachel, *Electric Vehicles Can Benefit All Utility Customers*, Natural Resources Defense Council (Feb. 14, 2017), https://www.nrdc.org/experts/luke-tonachel/electric-vehicles-can-benefit-all-utility-customers.

[102] CGA Ch. 58, Sec, 41-67dvailable online at https://www.cga.ct.gov/current/pub/chap_058.htm#sec_4a-67d.

[103] Draft CES at 199.

including reductions in delays and idling, generating revenue for funding transportation, and reducing Connecticut's GHG emissions and pollution. The U.S. Department of Transportation has noted the benefits obtained by U.S. cities that have employed congestion pricing. For example, on the State Route 91 priced lanes in Orange County, California, traffic during rush hours moves at over 60 mph, while the traffic in adjacent lanes crawls at average speeds of 15 mph or less. Commuters on the priced express lanes thus save as much as half an hour each way – and the fuel they would have otherwise burned – on the 10-mile trip, or as much as an hour a day.[104] Employing similar strategies in Connecticut would save billions and reduce GHG emissions significantly.

However, the most effective market-based mechanism for generating revenue for transportation improvements, while encouraging transition to a clean fleet of cars would be a market based cap-and invest program akin to a RGGI for transportation emissions. As recommended by the EV Coalition, the final CES should recommend that the state employ (or at minimum conduct a study to evaluate) a cap on transportation carbon emissions to generate millions of dollars in annual revenue for the state to reinvest in clean transportation options and to create a modern transportation system. Earlier in September, California finalized a plan to invest over $2 billion over the next year on initiatives designed to reduce use of oil from transportation. Ontario and Quebec have a similar international carbon market limiting emissions, and are projected to spend about $2 billion each on clean transportation programs by 2020.[105] The Northeast states should create similar programs to raise money for clean transportation initiatives in the Northeast, including funding Connecticut's transit-oriented-development programs, Complete Streets policies, electric vehicle charging infrastructure, public transit and shared mobility services, all of which are appropriately highlighted in the draft CES as critical to advancing a clean and efficient transportation system in Connecticut. The final CES represents on opportunity for DEEP to establish Connecticut as a leader in driving an innovative, market-based solution to our aging and highly polluting transportation system.

C. The Final CES Should Continue to Advocate for the Implementation of Federal Vehicle Fuel Economy Standards and Maintaining LEV, ZEV, and GHG Programs (T.2.2)

CFE agrees with DEEP that the federal fuel and vehicle standards previously adopted by the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) are critical to reducing our dependence on polluting fossil fuels for transportation, and bring myriad benefits to the country. By 2025, these standards are expected to nearly double fuel efficiency and save individual consumers $1,460 to $1,620 in fuel costs. These standards are working, and they're saving Connecticut families money at the pump, while reducing carbon pollution and making the air cleaner and safer for our kids to breathe. Automakers are meeting the standards faster and more affordably than anticipated, and

[104] U.S. Department of Transportation, Federal Highway Transportation, the Benefits of Congestion Pricing, last modified Feb. 1, 2017, https://ops.fhwa.dot.gov/publications/congestionpricing/sec3.htm.

[105] Daniel Gatti, *What the Northeast Could Build With a Transportation Cap and Invest Program*, Union of Concerned Scientists (Sept. 15, 2017), http://blog.ucsusa.org/daniel-gatti/what-the-northeast-could-build-with-a-transportation-cap-and-invest-program.

consumers are reaping the benefits. If the standards are rolled back, the action could kill as many as 50,000 additional manufacturing jobs by 2030. In 2030, the standards are expected to create an estimated 650,000 jobs (full-time equivalent) throughout the U.S. economy, including 50,000 in light-duty vehicle manufacturing (parts and vehicle assembly).[106] Weakening standards to cut tailpipe carbon pollution will also further contribute to climate change, which can worsen asthma symptoms for the 24 million Americans – including 6.3 million children – who suffer from asthma. [107]

CFE applauds DEEP for its stated commitment to continue to advocate for aggressive national vehicle efficiency standards while maintaining its commitment to implement the California Low Emission Vehicle (LEV), ZEV and GHG programs. These actions will result in cleaner, more efficient vehicles being deployed in the state.

D. VW Settlement Environmental Mitigation Trust Fund Should be Used to Effectively and Equitably Electrify Connecticut's Transportation System (T.2.1).

The Volkswagen (VW) settlement funds provide a way to make an important difference in increasing EV use in Connecticut through the National ZEV Investment Plan. CFE applauds the proactive steps taken to develop a draft mitigation plan for public input even before the Trust Effective Date is established. CFE jointly submitted comments to DEEP's draft, which highlighted our priorities for spending these funds. These priorities, many of which were already contained in DEEP's draft mitigation plan include:

- Prioritizing investment in urban areas that have suffered from poorest air quality and where emissions reduction will have greatest health impact.
- Using 15% of funds (the maximum allowed) for EV charging infrastructure for light-duty vehicles, including deployment of DC Fast charging infrastructure along Connecticut corridors per FHWA guidelines (I-91, I-95, I-84, and I-395); prioritizing development of public charging sites such as city and town centers, schools, state office buildings, and other workplaces; and investing in pilot projects that address multi-unit dwellings and workplaces without onsite parking.
- Prioritizing zero-emissions technology over hybrids, CNG or propane.
- Prioritizing zero-emissions buses, particularly transit buses.[108]

CFE is glad to see that the draft CES recommends identifying opportunities to invest the allowable fifteen percent of VW Appendix D funds in EV infrastructure. CFE also agrees with

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[106] Union of Concerned Scientists, *Fuel Economy and Emissions Standards for Cars and Trucks, Model Years 2017 to 2025*, June 2016, http://www.ucsusa.org/sites/default/files/attach/2016/06/Fuel-Economy-Standards-2017-2025-summary.pdf.

[107] Centers for Disease Control and Prevention, *National Center for Health Statistics, Asthma*, accessed on Sept. 22, 2017, https://www.cdc.gov/nchs/fastats/asthma.htm.

[108] March 6, 2017 Letter to Bureau of Air Management, Department of Energy and Environmental Protection from Coalition, available at http://docs.wixstatic.com/ugd/842761_505763e2798c4e40be5c775b833bed44.pdf.

the suggestion in the draft CES that the state should work on a regional proposal to advance EV infrastructure development. The final CES should emphasize the importance of using the VW Settlement Funds to advance zero-emissions technology over alternative fuel technologies.

Conclusion

The next three years are a critical time for strategic, innovative energy policy and climate action in Connecticut. We urge DEEP to incorporate more aggressive and concrete recommendations that can be implemented in the short term, both to ensure meeting the 10% reduction in GHGs by 2020 as mandated by the GWSA and to lay the policy and regulatory foundations essential to achieving our longer term climate goals.

Thank you for your time and consideration of these written comments.

Respectfully submitted,

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APPENDIX A

to

Comments of Connecticut Fund for the Environment

on

Draft 2017 Comprehensive Energy Strategy

* * *

Increasing the Connecticut Renewable Portfolio Standard

Creating Economic and Environmental Benefits for Connecticut

Synapse Energy Economics: Pat Knight, Ariel Horowitz PhD, and Avi Allison
Sustainable Energy Advantage: Po-Yu Yuen and Jason Gifford

September 25, 2017

Increasing the Connecticut Renewable Portfolio Standard

Creating Economic and Environmental Benefits for Connecticut

Synapse Energy Economics: Pat Knight, Ariel Horowitz PhD, and Avi Allison
Sustainable Energy Advantage: Po-Yu Yuen and Jason Gifford

Overview

Connecticut has historically demonstrated leadership in creating clean, renewable energy economic development opportunities, enhancing energy security, and reducing emissions of greenhouse gases. The state's Renewable Portfolio Standard (RPS)—which requires electric utilities to provide an increasing percentage of their electricity from renewable sources as part of their basic electric service—is a critical component of Connecticut's leadership. RPS policies around the country are the foundation for clean, renewable energy markets and are a proven tool for supporting cost-effective renewable energy development.

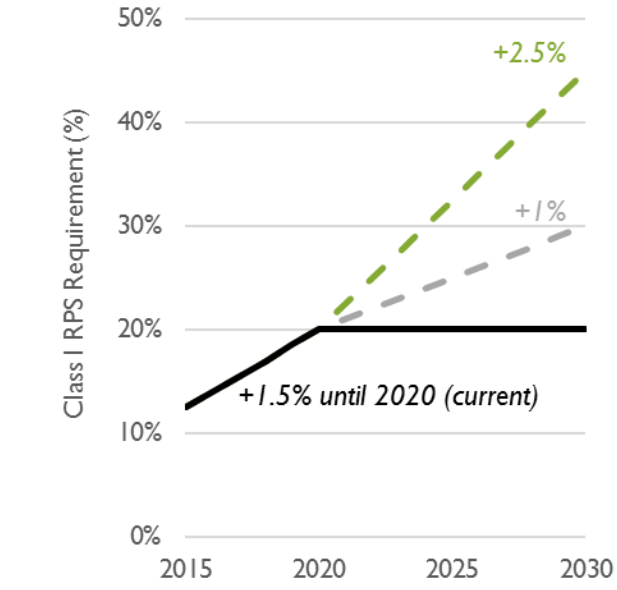
Connecticut's Class I RPS policy currently requires the state's major utilities to provide consumers with 15.5% of their electricity from qualified renewable sources. This increases by 1.5% each year until 20% is reached in 2020. Like many states, Connecticut is updating its RPS . In July 2017, the Connecticut Department of Energy and Environmental Protection (DEEP) released a draft Comprehensive Energy Strategy (CES), which proposed an extension for the Class I RPS through 2030, but with a slowdown in the rate of increase from 1.5% to 1%, reaching a level of 30% renewable energy by 2030.

Other states, including California and Hawaii, have enacted more ambitious RPS programs requiring renewable levels of 40 to 50% by 2030, setting even more ambitious requirements for years after that. In New England, Massachusetts is conducting legislative hearings on an RPS that would boost its annual increase to 2% or 3% per year.

We examined what happens under an RPS that increases by 2.5% per year starting in 2021, reaching a level of 45% by 2030. Our cost-benefit analysis shows that Connecticut will benefit from adopting a more ambitious RPS than DEEP has proposed through the creation of jobs and reducing the negative impacts of climate pollution.

This accelerated approach would put Connecticut solidly on track to reach the pollution reduction requirements of its Global Warming Solutions Act (GWSA). By 2030, this approach would create an additional 1,400 megawatts (MW) of wind and solar power in New England, create 7,100 new jobs, lower emissions by 14%, and decrease reliance on imported natural gas by 43%, with only minor impacts on electricity bills.

Figure 1. Current and alternate RPS requirements in Connecticut



Our Findings

Renew-ables

Increasing the RPS grows New England renewables by 1,400 MW

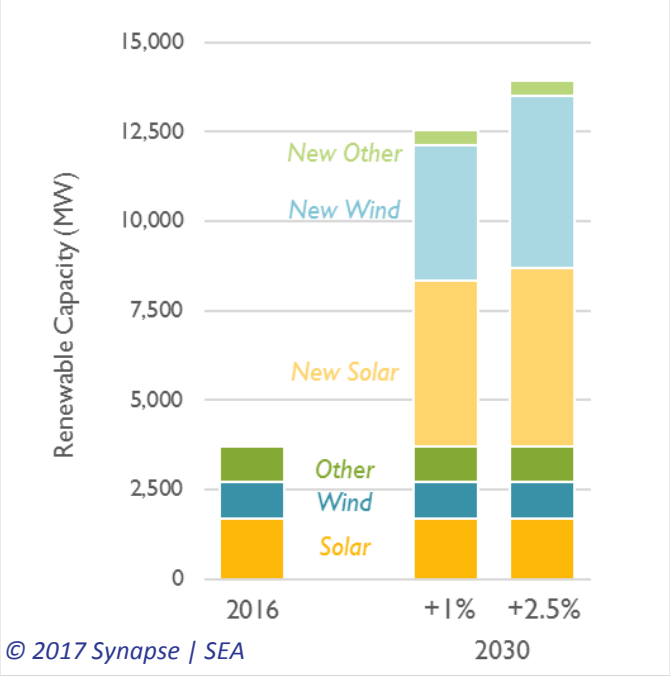
Combined with other regional policies, DEEP's proposal is estimated to contribute to 9,200 megawatts of new renewables in New England by 2030. Of these, an estimated 18% would be located in Connecticut, while the rest would be built in the other New England States. An increase in the Connecticut RPS of 2.5% per year through 2030 would create an additional 1,400 MW of renewable energy in New England.

Jobs

Increasing the RPS adds jobs for Connecticut and New England

Increasing the Connecticut RPS to 2.5% per year would add an estimated 7,100 additional jobs to New England between 2021 and 2030, or about 710 jobs per year. These jobs are driven by a clean energy future of new solar, wind, storage, and transmission. This estimate accounts for changes in jobs related to decreasing the use of natural gas and coal to provide electricity and minor increases in monthly electric bills.

Figure 2. New and incremental renewable additions in the New England electricity system



Natural Gas

Increasing the RPS reduces Connecticut's dependence on natural gas

Under DEEP's proposed 1% annual increase, the electric sector's reliance on natural gas is expected to decrease by 37% by 2030, compared to 2015 levels. Increasing Connecticut's RPS to 2.5% per year will push electricity generation from natural gas to fall 43% by 2030.

Renewables are not the only cause of this reduction; energy efficiency, increased hydroelectric imports, and more stringent carbon pollution reduction programs—put forth under the Regional Greenhouse Gas Initiative (RGGI) program and by the Massachusetts Department of Environmental Protection—are all expected to significantly curtail future need for natural gas in the electric sector. In addition to decreasing emissions, reducing the use of natural gas can help avoid volatile spikes in winter electricity prices.

Emis-sions

More renewables help Connecticut meet its greenhouse gas reduction requirements

Increasing the amount of renewable energy in Connecticut and the rest of New England reduces climate pollution. DEEP's proposal to slow the RPS to 1% per year lowers in-state electric-sector emissions from the 7.0 million metric tons (MMT) that were emitted in 2016 to levels of 5.4 MMT in 2030. Increasing the RPS to 2.5% reduces 2030 in-state emissions to 4.8 MMT.

Under the GWSA, Connecticut is required to reduce carbon pollution by 10% in 2020 (relative to 1990 levels) and by 80% in 2050 (relative to 2001 levels). A line drawn between these targets implies a consumption-based, all-sector carbon pollution cap of 30.2 MMT by 2030.

We estimate that DEEP's proposal falls short of meeting this straight line GWSA reduction path, with carbon pollution exceeding the implied GWSA targets every year from 2026 to 2030. Under DEEP's proposal, Connecticut's consumption-based emissions in 2030 fall to 31.8 MMT, exceeding the target by 5%. With a 2.5%

increase in the RPS, consumption-based emissions in 2030 exceed the target by 3%. While even an annual increase of 2.5% will not guarantee that Connecticut will meet its legally required reductions (as we find the cap is still exceeded in 2028, 2029, and 2030), the accelerated RPS trajectory puts Connecticut closer to its required reductions.

A 2.5% annual increase in renewable energy requirements, combined with more action in other sectors (such as the deployment of heat pumps, water heating, and expanded vehicle electrification), will allow Connecticut to meet its GWSA goals. Reducing carbon emissions in the electric sector by expanding the RPS, though, is a necessary first step to ensure that as levels of electrification increase, total emissions go down, not up.

Bills

Increasing the amount of renewables results in minor changes to bills

A cleaner, healthier, more efficient and reliable energy future comes at a relatively small up-front cost, with significant long-term benefits. Increasing Connecticut's RPS from 1% to 2.5% will increase monthly electric bills for Connecticut ratepayers by about $2.66 per month through 2030, a relative increase of 2.0% compared to recent average bills. Similar increases will occur in the commercial and industrial sectors. When factoring in the social cost of reducing carbon emissions (e.g., health impacts, costs to agricultural productivity, and property damages), the residential bill impact is reduced to $2.30 per month. Renewable energy sources such as offshore wind and solar have zero fuel costs, which allows for competitive pricing that can save consumers money on their energy bills in the long-term.

What scenarios were modeled?

In this analysis, we evaluated two scenarios:

- The **DEEP Proposal**, under which Connecticut implements the RPS proposal in the draft 2017 Comprehensive Energy Strategy (CES). In this case, the Connecticut Class I RPS increases by 1% per year beginning in 2021, reaching a level of 30% renewables by 2030.
- The **Accelerated RPS Proposal**, under which Connecticut accelerates RPS growth to 2.5% in 2021, reaching 45% by 2030.

Figure 3. Generation from natural gas power plants in New England with an Expanded RPS, relative to 2015

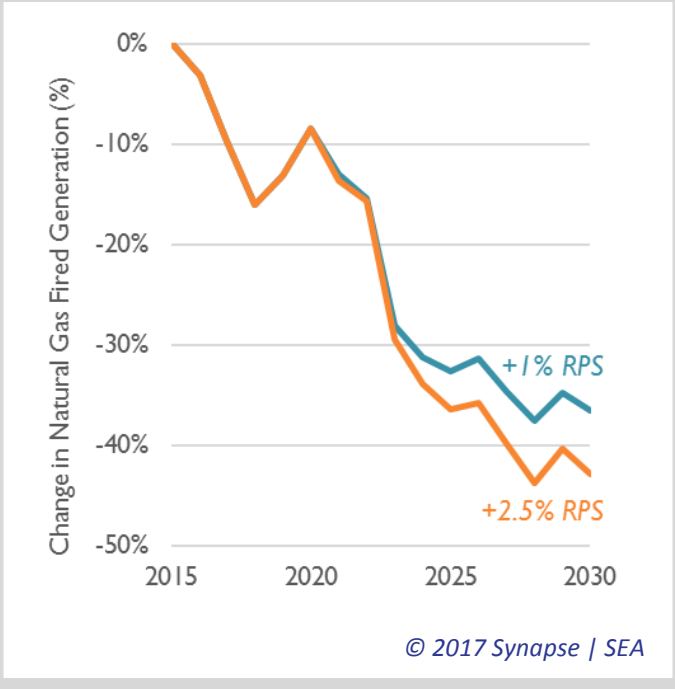


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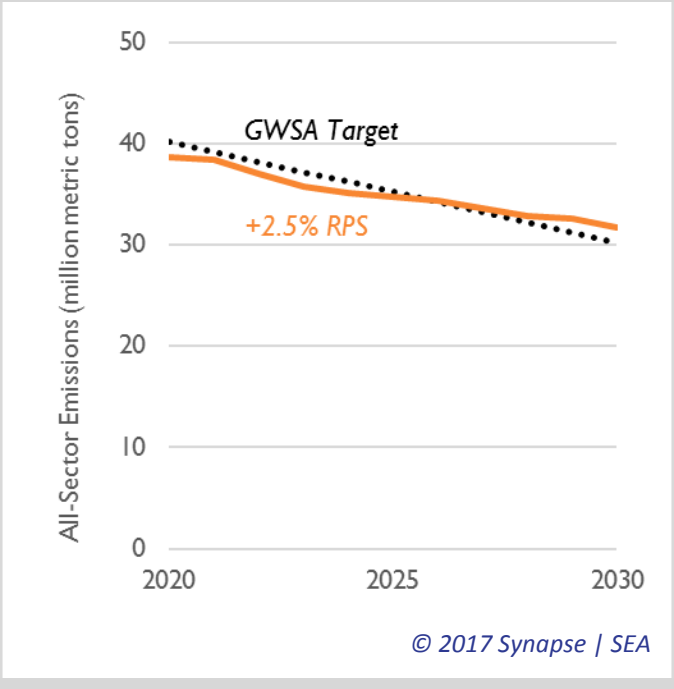
Figure 4. Projection of Connecticut's CO_2 emissions and compliance with the Connecticut GWSA



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Methodology

Synapse Energy Economics and Sustainable Energy Advantage employed a suite of models for this analysis:

- Sustainable Energy Advantage's **Renewable Energy Market Outlook (REMO)**, which is used to develop defined forecasts for both near-term and long-term renewable project buildout and renewable energy certificate pricing.
- Anchor Power Solution's **EnCompass** model, a long-term optimization model that integrates data from REMO and other unit-specific inputs to estimate unit-specific scheduling and dispatch, long-term capital project optimization, market price forecasting for energy and capacity, and estimations of greenhouse gas emissions throughout New England.
- IMPLAN LLC's **IMPLAN** model, an industry-standard job impact model. IMPLAN produces net direct, indirect, and induced job impacts for all six New England states.
- Synapse's **Multi-Sector Emissions Model (M-SEM)**, for projecting future energy use and emission changes associated with non-electric energy use, including the impact of electric vehicle deployment.
- Synapse's **Bill Impact Model**, which estimates bill impacts for ratepayers across a variety of customer classes. This model integrates wholesale market price data and spot market REC price data to estimate the annual, relative change in monthly retail bills between two scenarios.

Modeling assumptions: Both scenarios assume that the DEEP's proposal under the draft CES to phase out biomass eligibility from Connecticut's Class I RPS is enacted. In addition, both scenarios assume that Massachusetts updates its RPS to increase by 2% per year and that Connecticut meets a goal of having 161,000 EVs on the road by 2025, as established in a 2013 MOU signed by Governor Malloy. Both scenarios assume that other currently-enacted legislation in the New England states is implemented as written (including requirements in Massachusetts to procure energy from offshore wind and imported hydroelectricity, requirements to procure cost-effective energy efficiency, updates to the RGGI program, updates to distributed generation policies, and the implementation of greenhouse gas regulations by the Massachusetts Department of Environmental Protection). In both scenarios, more intra-regional transmission is required to facilitate movement of high capacity factor, cost-effective renewable energy in northern New England to load regions in the south. In the CES Case, we add a 600 MW HVDC line; in the Expanded RPS Case, we add a 1,200 MW HVDC line.

For more information on the modeling input development and methodology, please see a recent, related report by this analysis' authors, *An Analysis of the Massachusetts Renewable Portfolio Standard*, available at http://bit.ly/2xW1GzZ

This analysis was prepared for Connecticut Fund for the Environment, Consumers for Sensible Energy, RENEW Northeast, and the Sierra Club. For more information, please contact Claire Coleman at ccoleman@ctenvironment.org.

About Synapse

Synapse Energy Economics, Inc. is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power sector for public interest and governmental clients.

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About Sustainable Energy Advantage

Since 1998, Sustainable Energy Advantage, LLC has helped private, public and non-profit organizations develop opportunities for clean, renewable sources of energy, including wind, solar, hydroelectric, biomass and geothermal power, in competitive wholesale and retail electricity markets.

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