

COVID-19 Special Investigation Report: An Equitable, Clean Energy Recovery for New England

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About the Author

Joan Fitzgerald

Professor of Urban and Public Policy, Northeastern University

Joan Fitzgerald is a Professor of Urban and Public Policy at Northeastern University. She focuses on urban climate action and strategies for linking it to equity, economic development, and innovation. In her fourth book, *Greenovation: Urban Leadership on Climate Change* (Oxford Univ. Press, 2020), she argues that the climate strategies of too many cities represent random acts of greenness rather than integrated and aggressive action. She points to leading cities in North America and Europe and offers strategies for lagging cities to accelerate their action. Her ongoing Climate Just Cities Project examines strategies for post-Covid urban climate action to emphasize equity. She blogs on viral inequality and urban climate action on Planetizen.



She previously published *Emerald Cities: Urban Sustainability and Economic Development* (Oxford Univ. Press, 2010), which examined how cities are creating economic development opportunities in several green sectors. Fitzgerald has published in academic journals such as *Environment and Planning C: Government and Policy*, *Local Environment: The International Journal of Justice and Sustainability*, *Economic Development Quarterly*, *Urban Affairs Quarterly*, *Urban Affairs*, *International Journal of Urban and Regional Research* and the political quarterly, *The American Prospect*. Her academic and consulting work has been supported by the Funders Network for Smart Growth and Sustainable Communities, John D. and Catherine T. MacArthur, Annie E. Casey, Rockefeller Brothers, Rockefeller, Surdna, Century, and Robert Wood Johnson Foundations and the Urban Sustainability Directors' Network. She has also conducted research for the U.S. Department of Labor, the Massachusetts Technology Collaborative, the Boston Housing Authority and other government agencies.

Before coming to Northeastern University, Fitzgerald taught urban planning and policy at the New School University, the University of Illinois at Chicago, and Ohio State University.

She is the former director of the Law and Public Policy program at Northeastern University and also served as interim dean of the School of Public Policy and Urban Affairs from 2012 until 2014. Under Joan's leadership, the school established new connections across Northeastern and throughout the Boston community. Through the Smart and Sustainable Cities hiring initiative, Joan transformed the faculty of the Policy School. She fostered and led new programmatic initiatives such as the Urban Informatics master's degree and certificate programs and the development of the Resilient Cities Lab. She expanded SPPUA's Open Classroom series to include topics such as climate change, health policy, and water in an era of climate change.

Executive Summary

The COVID-19 pandemic has created the need for massive federal investment to stimulate a recovery. Government investment will either integrate considerations of climate change and transition to renewable energy or thwart transformation by reinforcing the status quo of fossil fuel-based system. In addition to a green recovery, we need one that ensures that the environmental justice communities most negatively impacted by the COVID pandemic benefit from job creation, incentives for energy efficiency and adopting clean energy, and air quality improvements.

All evidence shows that investing in a renewable future will create a stronger, more equitable and more resilient recovery than one based on fossil fuels.

Before the pandemic, the New England states were among the national leaders in implementing aggressive policies to promote clean energy and reduce reliance on fossil fuels. They were beginning to focus on making this transition equitable. The Covid-19 pandemic has laid bare the need to accelerate and combine these agendas. All evidence shows that investing in a renewable future will create a stronger, more equitable and more resilient recovery than one based on fossil fuels.

The New England states and many of their cities have been promoting more renewable production, more efficient use of energy in buildings, and electrification of transportation. The clean energy sector* has been severely impacted by the COVID-19 pandemic with job losses and a slow-down of clean energy deployment. As the nation faces depression-level unemployment, and the risks of the climate emergency are getting worse, investing in clean energy has huge potential for economic recovery.¹ Targeted federal investment in renewable energy and energy efficiency could reduce unemployment while establishing the nation (and the New England region in particular) as a leader in key clean technologies that address climate change and will drive the world economy for decades to come. The federal government has potential to direct its resources to catalyze a nation-wide green recovery from the COVID-19 pandemic. Specifically, with the right stimulus, New England's interconnected clean energy sectors², particularly renewable energy, energy transmission and storage, energy efficiency, and electric vehicles, could result in job creation and economic prosperity for the region.

The first section of this report explains how New England's clean energy sector has been impacted by COVID-19 and examines the states' policies on clean energy and energy efficiency. Then, multiple federal and state policy considerations are identified. This discussion examines interconnecting issues related to building energy efficiency, renewable energy production, and electrification of transportation, concluding with specific recommendations to accelerate ongoing activity and create economic opportunity. The discussion also examines how policy can create more equitable access to clean and resilient power and housing.

We know that massive federal investment works. As discussed later in the report, the American Recovery and Reinvestment Act (ARRA) of 2009 demonstrates the effectiveness of a federal stimulus on the clean energy sector (see Policy Considerations section below). Of its total investment of \$840 billion, ARRA spent \$92 billion on clean energy technologies, including: clean energy generation; grid modernization; electric

* Defined as renewable or zero-emission electricity generation, transmission, distribution, storage; energy efficiency services and products, and production of low- and zero-emission motor vehicles.

vehicles; transit; energy efficiency; and workforce training to support these industries. There are several “green new deal” proposals, including one by presidential candidate Joe Biden, that could likewise create a green post-Covid-19 recovery. The recommendations focus on federal and state policies to promote specific sectors of the clean energy economy.

- Federal stimulus proposals should fund weatherization and deep energy efficiency activity, including fuel switching.
- The New England states should adopt Passive House or a zero-net carbon stretch code.
- The New England states should adopt incentive programs to promote fuel switching that gets fossil fuels out of buildings.
- Increase Bureau of Ocean Energy Management (BOEM) staff and develop clear procedures to accelerate approval of construction and operation plans (COPs). According to the Business Network for Offshore Wind, seven COPs are currently under review, with another five expected to be filed by the end of 2020.
- Finance infrastructure improvements in regional ports to support the offshore wind industry.
- Conduct a feasibility assessment of creating a shipbuilding industry to support offshore wind.
- Fund workforce training to support the offshore wind industry.
- Extend federal tax credits for wind and solar development.
- The New England states should revise their net metering policies to support the development of more community solar.
- The New England states should assess land use and zoning policies for siting utility solar arrays to establish guidelines to address competing interests (e.g. preserving forest land vs. solar expansion).
- Provide federal support in the form of continuing federal tax credits and research and development, as defined in several of the green new deal proposals for expanding community solar projects.
- Expand existing state efforts to support solar plus battery storage in order to reach regional goal of becoming carbon neutral by 2050.
- Modify an extended renewable-energy investment tax credit to include stand-alone energy storage systems.
- Include energy storage as part of loan guarantees that the Department of Energy provides for clean-energy projects.
- Reauthorize the ARRA Smart Grid Investment Grant program for grid modernization so investments in energy storage and transmission to accommodate more renewable energy can be made now.
- Restore the \$7,500 federal tax credit for electric vehicle purchases and adjust it for income.
- Provide subsidies to cities for converting bus fleets to electric as per green new deal plans.
- The New England states should develop timelines for cities to transition bus fleets to electric.
- New England cities should consider congestion pricing and ultra-low emission zones to complement existing strategies to accelerate electric vehicle sales.

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COVID-19 Special Investigation Report: An Equitable, Clean Energy Recovery for New England

1. Introduction

The United States needs massive federal investment to stimulate a recovery from the Covid-19 pandemic. This investment should focus on transitioning to a green economy that transitions the nation to renewable energy. And it must do so in a way that ensures that the environmental justice communities most negatively impacted by the COVID pandemic benefit from job creation, incentives for energy efficiency and adopting clean energy, and air quality improvements. All evidence shows that investing in a renewable future will create a stronger, more equitable and more resilient recovery than one based on fossil fuels.

Before the pandemic, the New England states were among the national leaders in implementing aggressive policies to promote clean energy and reduce reliance on fossil fuels. They were beginning to focus on making this transition equitable. The Covid-19 pandemic has laid bare the need to accelerate and combine these agendas.

The national and New England clean energy sector* has been severely impacted by the COVID-19 pandemic with job losses and a slow-down of clean energy deployment. As the nation faces depression-level unemployment, and the risks of the climate emergency are getting worse, investing in clean energy has huge potential for economic recovery.³ In addition to reducing unemployment, a focus on a renewable recovery could establish the nation (and the New England region) as a leader in manufacturing key clean technologies that will be the drivers of the world economy for decades to come. With the right stimulus, New England's interconnected clean energy sectors,⁴ particularly renewable energy, energy transmission and storage, energy efficiency, and electric vehicles, could result in job creation and economic prosperity for the region.

This report begins by explaining how New England's clean energy sector has been impacted by COVID-19 and examines the states' policies on clean energy and energy efficiency. The next section identifies multiple federal and state policies that need to be implemented. This discussion examines interconnecting issues related to building energy efficiency, renewable energy production, and electrification of transportation, concluding with specific recommendations to accelerate ongoing activity and create economic opportunity. The discussion also examines how policy can create more equitable access to clean and resilient power and housing.

Massive federal investment works. As discussed later in the report, the American Recovery and Reinvestment Act (ARRA) of 2009 demonstrates the effectiveness of a federal stimulus on the clean energy sector (see Policy Considerations section below). In the past two years, several "green new deal" proposals have been elaborated, one by presidential candidate Joe Biden. Any one of them could put the nation and New England on a pathway to a green recovery.

* Defined as renewable or zero-emission electricity generation, transmission, distribution, storage; energy efficiency services and products, and production of low- and zero-emission motor vehicles.

2. Building Energy Efficiency: The First Step in the Clean Energy Transition

Buildings consume 75 percent of electricity and account for about 40 percent of the nation's carbon emissions.⁵ About 900 billion square feet of building space built or rebuilt over the next two decades, and every foot of it that isn't up to high energy-efficiency levels locks in at least 30 years of wasted energy.

Aggressive action on improving building efficiency not only reduces carbon emissions, but also saves consumers money and creates jobs that can't be exported. Every dollar spent on reducing electricity consumption saves twice as much in increasing electricity supply and lowering distribution costs. On the residential side alone, the untapped market for energy-efficiency investment in the United States is estimated at \$182 billion and, if fully utilized, could reduce national GHG emissions by more than 5 percent.

The surest path to dramatically improving building energy efficiency is through adoption of strict mandatory building and energy codes. Establishing a national code requirement is improbable in the United States, where federalism and the tradition of municipal home rule generate a maze of city and state codes. Most states use the International Energy Conservation Code (IECC), established in 2000 by the International Code Council, as the minimum standard for new residential construction, and either IECC or the roughly equivalent American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) 90.1 for commercial construction. The standards establish criteria for building design and construction, but not all states have adopted them.⁶

The New England states need to adopt more stringent building efficiency standards, such as the passive house building standard. A passive-house building is designed to keep heat in, using super-insulation, triple-pane windows, and similar measures. It consumes about 90 percent less energy for heating and 60 percent less energy overall than a typical building and usually does not require active heating and cooling systems. The buildings also use air exchangers that use the heat produced from lighting, cooking, and other sources to warm incoming cold air.

The New England states need to adopt more stringent building efficiency standards...

Dozens of European cities require the passive-house standard for some new construction—particularly in Germany, where it was developed. The passive-house standard is technologically and economically feasible for both new construction and retrofitting existing buildings, even in cold climates. By definition, passive house construction can be fossil-fuel free if it uses electric heating and appliances.

It's been slow to catch on in the US, but Massachusetts is poised to become a leader—and gearing it to low-income housing. In 2017, the Massachusetts Clean Energy Center, the state economic development agency accelerating the growth of the clean energy sector, launched the Passive House Design Challenge

to demonstrate that the standard can be employed at little extra cost. In 2019, the Clean Energy Center funded eight projects to the tune of \$1.73 million that will build 540 units of affordable passive housing.⁷

The program offered most projects a \$4,000-per-unit incentive. It is funded by the state's 2016 \$15 million Affordable Access to Clean and Efficient Energy Initiative.⁸ The hope is that once developers become familiar with the standard and realize they can do it with low-income housing, it will become the standard for most housing. And once people live in passive housing, they experience lower noise (due to the triple glazed windows), better indoor air quality, and very low utility bills.

The emphasis on low-income housing is doubly important, given the shortage of affordable housing and what we've learned from the pandemic about housing inequities. To that goal, the Clean Energy Center just launched the Triple Decker Design Challenge,⁹ which will award nine prizes for design proposals for all-electric building retrofit approaches: three \$25,000 grand prize winners; four \$15,000 runner-up prizes; and an additional \$10,000 added for the People's Choice prize. And the Massachusetts Department of Housing and Community Development, the agency responsible for distributing federal low-income housing tax credits, is now including bonus points for developers that commit to attempting the passive-house standard.

Massachusetts should adopt a building energy code that moves us closer to this standard. Right now the Board of Building Regulations and Standards, the state body that controls all building code changes, has been directed by the Legislature to produce a net-zero energy stretch code, which means that a building has to produce as much energy as it uses on an annual basis. Passive House advocates are working to make sure that Board of Building Regulations and Standards builds passive house into the new code as the base for net-zero energy. Building electrification will happen with these changes.¹⁰

Connecticut, Maine, New Hampshire, and Vermont have organizations promoting passive house standards and construction, but none have gone as far as Massachusetts advocates in advancing state standards requiring it.

Energy efficiency creates more jobs than all other clean energy sectors.

Energy efficiency creates more jobs than all other clean energy sectors. The American Council for an Energy-Efficient Economy estimates that there were 2.4 million employed in the energy efficiency sector in the United States before the pandemic. But much of this work has been halted. Energy efficiency, which includes construction (including design and installation), manufacturing of EE products and services, wholesale trade, and related business services, has been hit the hardest of the

clean energy sectors by the COVID-19 recession, with a total of 431,762 jobs lost.¹¹ The New England states lost 15,000 jobs in the energy efficiency sector in March alone (Table 1).

Table 1. Job Loss in Energy Efficiency in March 2020 in the New England States

State	Energy Efficiency Employment	Jobs Lost Since COVID-19	Percent Decline
Connecticut	36,000	5,549	15.3
Maine	8,879	1,514	17.0
Massachusetts	88,231	12,568	17.6
New Hampshire	11,913	1,1221	10.2
Rhode Island	13,028	1,728	15.7
Vermont	11,032	1,728	15.7

Source: U.S. Energy & Employment Report. 2020

Due to COVID-19, at least 20 states have stopped retrofits under the federal low-income Weatherization Assistance Program; state and utility programs have come to a standstill as well.¹² There were about 70,000 unemployment claims in energy-efficiency related jobs in March alone.¹³ Post-COVID-19, this work needs to return with a vengeance to bring back these jobs and to help the states meet their greenhouse gas reduction goals.

States can ramp up employment even more by combining weatherization and other building efficiency measures with fuel switching—removing fossil fuels for space and water heating and cooking. Maine is a leader in combining weatherization with fuel switching. Maine passed legislation in 2019 that set a target of installing 100,000 residential heat pumps by 2025, the most ambitious legislation of this type in the country. If achieved, about 20 percent of the state’s homes will be covered. To support the transition, the state’s Efficiency Maine program doubled the rebates it offers for electric heat pumps up to \$1500 on a system that typically costs about \$3750 for a single zone ductless.¹⁴ Illustrating the effectiveness of this program is that Maine has under 1 percent of water heaters in country but 30 percent of water heater sales. Efficiency Maine is a quasi-governmental agency that serves as a one-stop shop for energy efficiency programs in the state. It receives funding from utility energy surcharges, Volkswagen settlement funds, and other sources. The program has stimulated job creation in Maine for construction jobs in weatherization and for heat pump installers. The state is developing training programs to meet this demand.

There is an equity component to combining deep energy retrofitting, fuel switching, and renewable energy as it reduces fuel costs and improves indoor and outdoor pollution in highly polluted neighborhoods.¹⁵ An example of how that works in practice in Oakland, California offers a strategy that New England states and cities can replicate.

West Oakland is one of several local low-income communities of color that are unjustly burdened by hazardous and polluting facilities, resulting in higher rates of asthma, stroke, and congestive heart failure and lower life spans than more affluent communities in Alameda County. West Oakland is a priority community for the city's program to achieve deep carbon reductions in buildings along with fuel switching—replacing natural gas stoves and space and water heating with electric units.

Fuel switching improves indoor air quality and reduces emissions. A new Rocky Mountain Institute report reveals that gas stoves produce significant indoor toxic emissions, with higher risk in low-income households.¹⁶ Citywide, fuel switching alone could reduce greenhouse gas emissions by 18 percent. Making buildings more energy efficient would result in another 12 percent reduction. While fuel switching improves air quality, efficiency measures help to reduce energy burden—a documented disparity in which low-income families spend a higher proportion of household income on electric and natural gas utility bills.¹⁷

But there's more to Oakland's justice-oriented climate action planning. East Bay Community Energy, a community choice aggregation program in Alameda County created in 2018 with a mandate to buy 100 percent clean energy, approved three purchase agreements for solar power and battery storage in 2019 to provide enough power and energy storage to replace a 40-year-old peaker plant in West Oakland. The solar arrays will be placed on the roofs of low-income housing and provide 500 kilowatts of power and 2 megawatt-hours of storage capacity.

In addition to reducing the energy burden and providing cleaner air, the strategy will benefit residents by creating a more resilient power supply. Solar plus storage acts as a virtual power plant that can be drawn upon if the power goes out—accidentally due to storms or deliberately to prevent wildfires as PG&E has done. Oakland used a combination of local bond and state program funding to support this work.¹⁸

The New England states need to replicate similar approaches to linking racial and ethnic justice to their energy efficiency programs and linking them to renewable energy plus storage. Some of this work, as discussed in the next section, is underway. Still, a reexamination of the extent to which low-income populations are prioritized in energy efficiency and renewable adoption is needed.

3. Clean Energy Goals in New England and Challenges to Achieving Them

With a growth rate of 10.4 percent since 2015, clean energy was one of the nation’s fastest growing sectors until the COVID-19 pandemic hit. By the end of 2019, the clean energy sector employed 3.4 million nationally, but 600,000 of those jobs have been lost since March 2020.¹⁹ The New England states have also seen a decline in employment. (Table 2).

Table 2. Cumulative Job Loss in the Clean Energy Sector in New England (March, April, May) and Gains in June

State	Cumulative Job Loss Since Pre-COVID	Percent Decline	Job Increase in June
Connecticut	5,664	12.8	887
Maine	11,899	13.8	295
Massachusetts	15,889	14.0	3,750
New Hampshire	1,471	8.5	224
Rhode Island	3,354	20.5	532
Vermont	2,258	12.4	490

Source: BW Research Partnership. 2020

Factors affecting the slowdown include the closing of factories producing solar panels and wind turbines and their hundreds of component parts, shipping delays, paused construction and energy retrofitting, and halted solar rooftop installations. In June, when restrictions were lifted on construction, clean energy jobs started to return.

The clean energy sector includes nuclear energy, but this report focuses only on renewable energy. While nuclear provides 61 percent of New Hampshire’s electricity (the highest percentage in the nation), and 42 percent in Connecticut,²⁰ it is not a focus of energy policy or economic development in the New England states. Likewise, the New England states have not focused policy on onshore wind. Maine has the most onshore wind, with 923 megawatts, the other four states combined have only developed 558 megawatts of the nation’s 107,319 megawatts.²¹ This report includes offshore wind, solar energy, and interconnected sectors: battery storage; transmission; energy efficiency; and electric vehicles. Because each is in different stages of development and has very different employment opportunities, each is discussed separately below.

Renewable energy policy in the United States is almost exclusively the responsibility of states. The main policy instrument is the renewable portfolio standard (RPS), which requires utilities to purchase a set percentage of their power from renewable sources by a set date. Currently, 38 states plus Washington, DC, have an RPS (or similar program).

Spurred by these standards, the New England states have witnessed rapid growth in renewable energy adoption. The move to renewables has already reduced greenhouse gas emissions to 17 percent below 1990 levels.²² Further, four of the New England states have pledged to be 100 percent renewable and legislation in Massachusetts is under consideration (Table 3).

Table 3. New England State Renewable Energy Commitments

State	Renewable Portfolio Standard (amount and target date) ²³	Renewable Energy Goal (year established)
Connecticut	44% by 2030	100% renewables of electricity by 2040 (2019) ²⁴
Maine	80% by 2030; statewide target of 100% renewables by 2050	100% renewables of electricity by 2050 (2019) ²⁵
Massachusetts	Class I:* 35% by 2030 and an additional 1% each year after. Class II:** 6.7% by 2020	Proposed in 2017 and currently under discussion ²⁶
New Hampshire	25.2% by 2025	100% renewables by 2050 (2018) ²⁷
Rhode Island	14.5% by 2019, with increases of 1.5% each year until 38.5% by 2035	100% renewables of electricity by 2030 (2020) ²⁸
Vermont	75% by 2032	75% renewables by 2032 for electric utilities (2015) ²⁹

*Class I is produced in New England

**Class II refers to energy generated by eligible renewable energy resources that began operating before 1998, including waste energy

Much of the renewable expansion has been solar energy (Table 4). Maine has a considerable amount of energy production from wood and waste.³⁰ Offshore wind is under development and has potential to be the leading component of the region's renewable energy supply and job potential.

Table 4: Solar Development in New England States (Through Q1 2020)

State	Renewable Portfolio Standard (amount and target date) ²¹	Renewable Energy Goal (year established)
Connecticut	44% by 2030	100% renewables of electricity by 2040 (2019)
Maine	80% by 2030; statewide target of 100% renewables by 2050	100% renewables of electricity by 2050 (2019)
Massachusetts	Class I:* 35% by 2030 and an additional 1% each year after. Class II:** 6.7% by 2020	Proposed in 2017 and currently under discussion ²⁴

Table 4. Solar Development in New England States (Through Q1 2020) (cont'd.)

New Hampshire	25.2% by 2025	100% renewables by 2050 (2018)
Rhode Island	14.5% by 2019, with increases of 1.5% each year until 38.5% by 2035	100% renewables of electricity by 2030 (2020)
Vermont	75% by 2032	75% renewables by 2032 for electric utilities (2015)

Source: Solar Energy Industries Association. 2020

Each of the states has linked its climate action to job creation and economic development. Connecticut’s initial green jobs analysis focused on energy efficiency and infrastructure supporting electric vehicles.³¹ A 2016 update of this study examined direct and indirect jobs that could be created by expanding solar, wind, and fuel cell development and increasing energy efficiency activity. The study concluded that the number of job years per million invested ranged from 7.1-11.3.³² A third study on the jobs and economic development potential of achieving the goal of reducing emissions by 80 percent by 2050 estimated that it would create about 500,000 per year above business as usual projections through 2050.³³

Maine’s initial analysis identifies wind, biofuels (wood pellets), renewable transportation fuels, and cold climate heat pumps as growth sectors.³⁴ In an interview, Dan Burgess, the Governor’s Director of Energy in Maine, noted that the state can’t keep up with demand for heat pump installers and other energy efficiency jobs.³⁵ In Massachusetts, the MassCEC has completed several reports that demonstrate that state policy on renewable energy and energy efficiency drives employment growth, noting that since 2011 job growth in the clean energy sector has grown eight times faster than overall growth.³⁶ New Hampshire began defining “green” jobs as a growth sector in 2009.³⁷ In 2011 that state surveyed “green employers” to identify how state policy could help them meet their needs for expansion.³⁸ A year later, the state tried to further refine how green jobs were defined in order to promote their expansion.³⁹ Rhode Island first documented the link between renewable energy and energy efficiency policy and job growth in 2016.⁴⁰ The state’s 2020 examination of the clean energy economy documented growth well above other sectors and concluded that continued expansion of renewable energy and energy efficiency would create well-paying jobs, often in low-income communities.⁴¹ After Tropical Storm Irene destroyed Vermont infrastructure in 2011, the state established an economic development strategy built on creating resilience and updates progress periodically.⁴² Starting in 2014, Vermont’s Clean Energy fund began a series of annual estimates of the size and characteristics of the clean energy workforce in order to assess economic opportunities and challenges.⁴³

Clearly, the New England states see clean energy as an essential part of their climate resilience and economic development agendas. We now examine the region’s leading clean energy sectors separately to propose strategies for ensuring that they lead recovery for New England, prioritizing environmental justice and job creation in the communities most severely impacted by the COVID-19 emergency. The five clean energy sectors explored in depth in this report are: offshore wind, solar energy, battery storage and transmission improvements, building energy efficiency, and widespread adoption of including electric cars and buses.

3.1 Offshore Wind as an Economic Driver for New England

The offshore wind capacity on the Eastern Seaboard is enormous. That's because the amount of wind energy that can be captured and used (the capacity factor) for offshore wind is much higher than for onshore. Offshore turbines are higher and bigger, and the winds offshore are steadier, thus they can produce more energy and do so with less intermittence than onshore turbines. The U.S. Department of Energy estimates that wind energy off the Atlantic Coast could supply about 35 percent of the country's electricity. The DOE's National Renewable Energy Lab estimates the United States has about 2,000 gigawatts of offshore wind energy capacity, which is roughly double the nation's current electricity use.⁴⁴

The price of offshore wind is competitive with fossil fuels and more competitive than onshore wind for the eastern seaboard, particularly if paired with energy storage.^{45,46} At \$29–\$56 per megawatt hour (unsubsidized), wind energy costs less than natural gas, at \$41–\$74 per megawatt hour.⁴⁷ Offshore wind is changing the scene even further. The Department of Energy's 2016 National Offshore Wind Strategy report is a road map for achieving its 2015 Wind Vision report goals: that wind power (land-based and offshore) supplies 10 percent of the nation's electrical demand in 2020, 20 percent in 2030, and 35 percent in 2050.

In 2017 wind energy and its supply chain employed 105,500 in the United States.

In 2017 wind energy and its supply chain employed 105,500 in the United States. About 38 percent work in construction, development, and transportation, 25 percent in manufacturing, 19 percent in operations and maintenance, and the rest in other categories.⁴⁸ With all the current projects and pending commitments, the potential is many times that. The DOE estimates high levels of domestic content in the

three largest components of a turbine: more than 85 percent for nacelles (the housing for the gearbox and other generating components), between 70 and 85 percent for towers, and between 50 and 70 percent for blades and hubs.

The American Wind Energy Association estimated that about 25 gigawatts of wind power, 35,000 jobs, and \$35-43 billion in investment are at risk due to the COVID-19 pandemic.⁴⁹ While these figures include both onshore and offshore wind, we focus on offshore in this report, as it has significantly more development potential in the New England states.

Once the recovery is set in motion, offshore wind could become a major employment engine for New England—with Delaware, New York, and New Jersey included, the states have collectively committed to developing 23.2 gigawatts of offshore wind (Table 4). Job creation estimates range from 19,000 to 45,000 by 2025, depending on investment, with the potential to nearly double again by 2030.⁵⁰ A March 2020 report by the American Wind Energy Association estimates that the projects in the pipeline for the Eastern Seaboard that will be operational by 2030 would produce \$28 to \$57 billion in investment.⁵¹

...offshore wind could become a major employment engine for New England...

The six New England states have committed to developing offshore wind to meet their climate goals and renewable performance standards (Table 5). Throughout New England, there is bi-partisan support for offshore wind development.

Massachusetts is among the first states to commit to offshore wind (New Jersey was the first in 2010). A 16-year-long battle to get approval for Cape Wind, a proposed 468-megawatt wind farm in Nantucket Sound failed in 2017, but in 2016 the legislature passed a bill to develop 1,600 megawatts of offshore wind

by 2027. At the time, this was the largest mandate in the country. In 2018, the Democratic legislature and Republican governor Charlie Baker called for another 1,600 megawatts by 2035.

New York quickly moved beyond Massachusetts. In January 2017 Governor Cuomo committed to developing 2,400 MW of offshore wind by 2030 and two years later increased the amount to 9,000 megawatts by 2035. Maine is the late comer—but after years of political opposition, the state now has bi-partisan support for developing offshore wind. At the direction of the legislature in 2019, the state public utilities commission approved Maine Aqua Ventus, which is the nation’s first floating offshore wind demonstration.⁵² The project will build two turbines 12 miles off the coast. The U.S. Department of Energy has provided about \$40 million to test the floating turbines, which were designed and developed by the University of Maine’s Advanced Structures and Composites Center.⁵³ The significance of this demonstration is that it would open up development to sites in deeper waters that can’t support the foundations typically needed for offshore wind. Floating technology is considered the next generation in offshore wind development.^{54,55}

Table 5. Offshore Wind Commitments of eastern Seaboard States

State	Offshore Wind Commitment (megawatts)	Projects with Developers ⁵⁶
Connecticut ⁵⁷	2000 by 2030	Constitution Wind; Revolution Wind; Park City Wind
Delaware ⁵⁸	Under discussion	
Maine ⁵⁹	8000 by 2030	Maine Aqua Ventus
Maryland ⁶⁰	1200 by 2030	MarWind; Skipjack
Massachusetts ⁶¹	3200 by 2035	Vineyard Wind; Baystate Wind; Mayflower Wind
New Jersey ⁶²	7500 by 2035	Ocean Wind
New York ⁶³	2400 by 2030	South Fork; Empire Wind; Sunrise Wind
Rhode Island ⁶⁴	400	Revolution Wind
Total Offshore	24,700	

Maine, New Hampshire, and Massachusetts are partners with the Bureau of Ocean Energy Management in the Gulf of Maine Intergovernmental Regional Task Force on offshore wind, led by the federal government. The Task Force is identifying renewable energy leasing and development opportunities on the Outer Continental Shelf in the Gulf of Maine.⁶⁵

According to the U.S. Department of Energy’s National Renewable Energy Laboratory, 20.7 direct jobs are created per megawatt of offshore wind developed. Depending on the multiplier, two-to-four times as many indirect jobs could be created. The New England states are eager to capture these jobs and related economic development. Liz Burdock, president and CEO of the Business Network for Offshore Wind, estimates that most of the permanent jobs will be in project development and management, supply and installation of electrical substations and underwater cable, and operations and maintenance. She and

officials in Massachusetts and other states are optimistic that the amount being developed will attract manufacturing and shipbuilding jobs as well.⁶⁶

Officials in Massachusetts, New York, and elsewhere are in conversations with turbine manufacturers with the goal of landing a turbine production facility, which would have very specific location requirements—in particular a harbor with no bridges or overhead obstructions that would prevent the blades from passing. Kirsten Holland, a program manager for offshore wind at the Massachusetts Clean Energy Council reports that Massachusetts is coordinating with Rhode Island and Connecticut in meetings with developers on creating opportunities in the production supply chain.⁶⁷ The idea is to identify strengths of each state so as not to compete unnecessarily.

To support supply chain development, the Massachusetts Clean Energy Center (MassCEC) maintains an online directory of businesses in the state with specializations related to offshore turbine construction, including engineering, electrical, and marine services; welding; concrete and steel fabrication and supply; underwater construction; and heavy-lift crane operations.⁶⁸ Currently, more than 400 businesses are listed. During the summer of 2020, MassCEC is completing an assessment of the capacity and needs of the regional supply chain to support the industry.

A key need will be specialized port facilities that can handle the huge vessels needed to get the 100-meter turbines to the wind farms. Massachusetts invested in configuring New Bedford's Marine Commerce Terminal to build, assemble, and deploy offshore wind farms. In 2016, Massachusetts signed an agreement to lease the facility to Ørsted (formerly DONG Energy), Deepwater Wind, and OffshoreMW. The port is committed to Vineyard Wind for staging its turbines for 18 months starting December 2020. It is likely to be occupied fully for years to come as the existing contracts go into effect. Further, Massachusetts is decommissioning the Brayton Point coal plant and transforming it into an offshore wind port and manufacturing center with up to \$650 million in investment. Demolition of the site was completed in June 2020.⁶⁹ It is now being graded to meet offshore wind requirements for a deep-water port and manufacturing and storage of offshore wind components.

Connecticut has invested \$25 million in upgrading port facilities in New London and added another \$157 million in February 2020 to meet the capacity requirements for dispatching components manufactured in the city for Ørsted and Eversource, which have committed \$79.5 and \$77.5 million, respectively.⁷⁰ Their 10-year leases with the port will bring in \$2 million a year in revenue. The Connecticut Port Authority has approved a \$157 million plan to redevelop a 100-year old site in Hartford into a construction and manufacturing hub.⁷¹

In Maine, Governor Mills established the Maine Offshore Wind Initiative to develop strategies for capturing jobs and economic development. An assessment is ongoing to determine what capital improvements would be needed to transform three ports—Portland, Eastport, and Searsport—to service offshore wind. Findings are expected by the end of 2020, according to Dan Burgess, Director of the Governor's Energy Office.⁷²

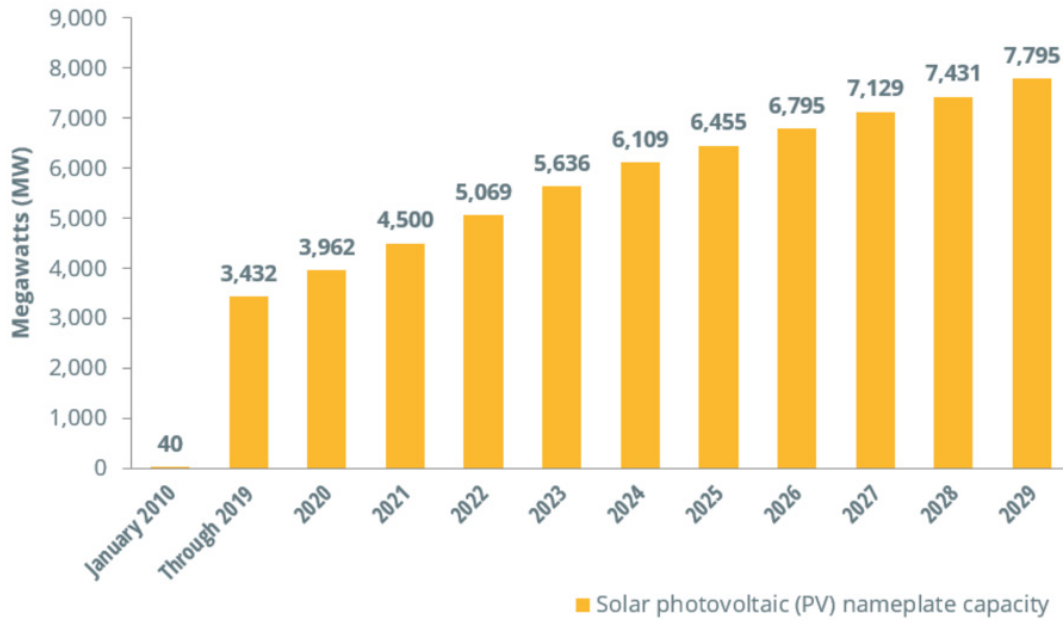
The federal government has a role to play in supporting this industry and the jobs and energy it can deliver. Most measures are relatively low cost. The Trump administration has delayed project approvals of committed east coast offshore wind projects and eliminated tax credits that motivated projects (the federal tax credits for renewable energy will expire at the end of 2020). The federal government could put these projects back on track at little expense and create a lot of jobs in the New England region.

3.2 Moving Beyond Rooftop Solar with Community Solar Energy

Solar energy adoption has been growing rapidly in the New England states and is projected to grow almost 8,000 megawatts by the end of the decade (Figure 1). Most are small-scale residential systems, but still are

having an impact on reducing overall demand for ISO New England.⁷³ Solar and all renewables will have to expand significantly more than current policy supports to meet the region’s goal of reducing greenhouse gas emissions 80 percent by 2050.

Figure 1. Projected Cumulative Growth in New England Solar Power. Source: ISO New England 2020.



Notes: Amounts include PV connected "behind the meter," as well as PV participating in the wholesale electricity marketplace. Megawatt values are AC nameplate.

Table 6. Solar Development in New England States (Through Q1 2020)

State	Solar Installed in Megawatts	Number of Installations	Solar Jobs	Percentage of State's Electricity from Solar
Connecticut	759.14	45,263	2,234	1.96
Maine	91.81	2,224	639	1.09
Massachusetts	2,852.25	104,528	10,400	15.39
New Hampshire	119.75	8,521	1,031	0.77
Rhode Island	284.62	6,228	1,009	3.52
Vermont	356.19	8,608	1,186	14.36

Source: Solar Energy Industries Association. 2020

Among the New England states, Massachusetts and Vermont are leaders in the percentage of their electricity sourced from solar (Table 6). Given the relatively small size of the New England states, the ability of expanding utility-scale solar projects may be limited.⁷⁴ As noted, Maine has size, but limited solar capacity. That is why solar plus storage (discussed below) is so important to renewable expansion in New England.

The Solar Energy Industries Association is warning that half of the 250,000 people employed in solar could lose their jobs in the COVID-19 recession, rather than the expected increase to 302,000. Rooftop solar slowed by more than 40% in states such as California that moved quickly to implement shelter-in-place orders.⁷⁵ Now installations are virtually stopped everywhere. While solar is part of the portfolio standards of the New England states, it only employed about 1,000 in New Hampshire, Rhode Island, and Vermont and about double that in Connecticut before the COVID-19 recession. Maine has the lowest number employed, at 639.⁷⁶ These figures reveal that while solar is essential to the renewable energy goals of the New England states, it is less of a driver for job creation.

With policy in place, solar should be back on track in the recovery.

Policy matters in solar deployment and employment. The key mechanism states use to advance solar adoption are subsidies for purchase and net metering, which allows home or business owners with solar PV arrays to sell excess power back to the utilities, often at attractive rates. Massachusetts lost close to 30 percent of its solar jobs (about 4,200) between 2015 and 2018 and only gained a little more than 100 in 2019 due to inconsistent policy. Still,

it employed 10,400 before the COVID-19 pandemic. To stimulate the state's economy, the Massachusetts Department of Energy Resources revised the Solar Massachusetts Renewable Target Program (SMART), the state's primary solar incentive program in April 2020.⁷⁷ The changes doubled the program's capacity to 3.2 gigawatts and earmarked 1,600 megawatts for installations in low-income and environmental justice communities. The new regulation also requires energy storage with all projects 500 kilowatts or larger. With policy in place, solar should be back on track in the recovery.

Although Maine ranks only 31st in the nation in solar capacity, its Clean Energy Authority estimates that solar installations are still justified.⁷⁸ Connecticut has wavered in its renewable goals, particularly when it comes to solar. There seemed to be momentum behind Green New Economy legislation that included a 100 percent renewable energy by 2050 goal, investment in renewable energy-related workforce training and, like Massachusetts, more emphasis on energy efficiency for low-income households. In January 2020, Governor Ned Lamont signed an executive order calling for 100 percent renewable energy by 2040.

A key sticking point in the Connecticut legislative debate that resulted in much weaker legislation being passed was net metering that paid retail rate for PV customers selling power back to the grid. Utilities typically oppose net metering expansion, ostensibly because it subsidizes wealthier customers who can afford to purchase solar panels and that they don't pay their fair share for transmission.

A discussion of net metering policy is beyond the scope of this paper, but the debate does reveal a key challenge for solar expansion—equalizing who has access to solar. Today, more than two million rooftop systems have been installed in the United States. While this is a laudable achievement, the main beneficiaries of rooftop solar are white and relatively well-off residents who own their own homes and can make the upfront investment.⁷⁹ That's why community solar has emerged a way for customers who rent, live in multi-family buildings not amenable to solar arrays, or cannot afford the upfront costs to “subscribe” to or own the energy from a solar installation in their community. Community solar (sometimes called shared solar) allows multiple parties to share the output (and benefits) of a large solar project. Some

operate on a pay-as-you-go basis with no upfront costs, while others pay upfront.⁸⁰ These projects are usually established and operated by a third party, typically a solar developer.

The National Renewable Energy Lab estimates that community solar could become as much as 49 percent of the distributed solar market in 2020.⁸¹ Shared solar arrays can be hosted and administered by a variety of entities, including utilities, solar developers, residential or commercial landlords, community and nonprofit organizations, or a combination thereof.

Community solar needs to be a focus of expansion in the New England states to create an equitable transition to renewable energy. Increasing community solar can create tensions when it is developed on undeveloped forested land. This tension is coming to a head in Massachusetts, playing solar developers against conservationists. A February 2020 report by the Massachusetts Audubon Society estimates that about one-fourth of natural lands that were developed between 2012 and 2017 were for utility-scale solar projects.⁸² As Massachusetts seeks to limit where solar farms can be developed, developers and the industry association argue that state solar goals cannot be met if further restrictions apply.⁸³

Community solar needs to be a focus of expansion in the New England states to create an equitable transition to renewable energy.

As the New England states expand their commitments to solar development, they will have to solve several policy issues related to net metering and expanding community solar. These include net metering caps and other subsidies, creating equitable access, and siting. These policies will also create needed new jobs post-COVID-19.

3.3 Battery Storage and Transmission to Support Renewable Expansion

The COVID-19 pandemic reveals that electricity has to be reliable. Power outages could be deadly to those reliant on medical equipment at home. It could stop home-based learning and working. And it could mean extreme discomfort during heatwaves. Prior to COVID-19, increasingly frequent and severe storms that left many parts of New England vulnerable to power outages exposed the fragility of our electric grid. In August 2020, Hurricane Isaias has left large swaths of Connecticut without power for days. So, the transition to more renewable, and thus intermittent,

The COVID-19 pandemic reveals that electricity has to be reliable.

sources of electricity means we need sufficient battery storage and reliable transmission.

In 2018, the nation almost doubled the amount of grid-connected storage to 777 megawatts. Driven by renewable energy growth, Wood Mackenzie Power & Renewables estimates the U.S. total by 2024 will be 5.4 gigawatts, with a market value of \$5.1 billion. growth is an increased focus on adding renewable energy sources to the nation's grid.⁸⁴

In 2016 Massachusetts established a mandate to generate 600 megawatts of energy storage by 2025 and estimated it would create \$800 million in system benefits to ratepayers. A 2019 initiatives increases the goal to 1,000 megawatt hours. Further, in 2019 Massachusetts became the first state in the nation to make battery storage eligible for funding as an energy efficiency measure.⁸⁵ MassCEC has several programs that support advances in battery storage technology.⁸⁶

Connecticut's Green Bank also supports battery storage research and deployment.⁸⁷ Connecticut is also moving on renewables plus storage. The Mountain Ash Solar Farm with 30 Tesla batteries, opened in 2016.

4.7-megawatt Mountain Ash Solar Farm includes more than 15,000 solar panels on a 15-acre site and is expected to produce enough solar energy over the next two decades to power more than 8,400 homes for a year.

The Connecticut Public Utilities Regulatory Authority (PURA) adopted an Equitable Modern Grid Framework in October 2019. It aims to: enable a cost-effective transition to renewable energy; build a resilient, reliable, and secure electric supply to residents, address energy affordability in underserved communities; and support the growth of Connecticut's green economy.⁸⁸ The framework has four pathways: reducing the state's high energy prices; expanding advanced metering infrastructure; expanding energy storage; increasing the number of electric vehicles to stabilize the grid.

New Hampshire planned for a large storage project when Liberty Utilities' announced that it would install up to 800 Tesla batteries along with residential solar systems in December 2017. The idea is to use distributed storage to reduce peak demand across the entire service area. The project didn't get off the ground, nor did a \$7 million battery storage project proposed by Eversource as a pilot. Until recently, battery storage in New Hampshire is the project of wealthy individuals who want to be free of the grid rather than state policy.⁸⁹

Eversource is planning a battery storage project in rural Westmoreland, New Hampshire, which has been prone to power outages. The utility proposes to own and operate a 1.7-megawatt/7.1-megawatt-hour battery, which can supply power to the town for five hours. As part of the project, Eversource will offer building energy efficiency retrofits. Further, Eversource is offering residential plans that compensate customers for allowing Eversource to use batteries, thermostats and electric vehicle chargers when power demand peaks.⁹⁰ In addition, Eversource has battery storage projects under development in Massachusetts in Provincetown and on Martha's Vineyard.⁹¹

Likewise, Vermont's investor-owned utility, Green Mountain Power, started investing in residential solar with battery storage in 2017 and expanded the program in 2019.⁹² In January 2020, the utility got approval for what will be among the nation's first (and largest) residential battery storage programs.⁹³

These programs provide a secure power supply for customers but also save money for all customers because the utilities can draw on customer's battery during peak demand times rather than using peaker plants, which are often the dirtiest plants from which a utility gets power.

A unique approach to using battery storage is being piloted in the New England states through state energy efficiency programs. Connected Solutions is a battery storage incentive program that essentially provides community storage. Customers agree to allow the utility to draw from their batteries during peak times. One of the first units was installed at a 14-unit affordable housing project in rural Vermont.⁹⁴ The idea is to reduce financial barriers to household and business battery storage units for a wide range of utility customers.

In addition, the nation needs to upgrade our World War II-era power grid so it can better integrate renewable sources, particularly land-based and offshore wind. Elliott Nagin points out in *Catalyst*, the magazine of the Union of Concerned Scientists, that we need considerable government investment in research and development for energy storage on the grid, if the United States is not to fall further behind China, Japan, and South Korea.⁹⁵ The US Department of Energy notes that the cost of integrating wind energy into the grid varies from below \$5 per megawatt hour to almost \$20 per megawatt hour if wind is to support at least 40 percent of the system's peak load where wind power is delivered.

If the New England states are to achieve the regional goal of reducing greenhouse gas emissions by 80 percent by 2050, renewable adoption will need to accelerate. The Brattle Group estimates that meeting this goal will require developing between 4 and 7 gigawatts of additional clean energy capacity annually, much more than is currently planned.⁹⁶

3.4 Racial Equity in the Renewable Transition

Across New England and the US, evidence is accumulating that Black and Latino communities are disproportionately concentrated in neighborhoods that are highly polluted because of proximity to polluting power plants, waste treatment plants, industrial facilities, and freeways. Pollution has led to higher rates of asthma and related conditions among residents of these communities, resulting in increased vulnerability to the Covid-19 virus.⁹⁷ To remedy this past discrimination, it is even more essential and urgent that policy makers prioritize replacing fossil fuels with resilient renewable energy and storage systems, as noted above.

Further, the clean energy sector has little racial diversity. Solar Industry Foundation figures for 2019 reveal that the solar industry workforce was only 7.7 percent black, although blacks are 13 percent of the nation's labor force.⁹⁸ Depending on the specific occupation, racial and ethnic minorities are underrepresented in the wind industry as well. Employers are having difficulty in finding qualified applicants in many wind-related occupations.⁹⁹ These findings suggest that states need to prioritize these groups in their workforce training programs.

3.5 Moving Toward Renewable-Based Transportation

Transportation accounts for 28 percent of the nation's greenhouse gas emissions—the largest single source and the largest sector relying on fossil fuels.¹⁰⁰ A more renewable-based transportation future requires replacing internal combustion vehicles with electric vehicles and more non-car options including biking, walking and public transportation.

Due to Covid-19 travel restrictions, how we travel has shifted dramatically since March 2020. Airplane travel has plummeted.¹⁰¹ Public transit use also has declined dramatically.¹⁰² And so has driving.¹⁰³ European Space Agency satellite images published in *The New York Times* on March 24 show dramatic reductions in air pollution in several large U.S. cities due to so many vehicles being off the road as people shelter in place. These images show us how much more livable and healthier our cities would be if we used public transportation and electrified cars, buses, delivery trucks, and taxis in our cities.

Despite this vision of less polluted cities, it isn't clear how policies to reduce transportation emissions will fare post-COVID. Will people forsake public transit for cars? Will street closures continue, creating more permanent space for walking, biking, and outdoor restaurants? Will work-from-home continue to be the norm, cutting down on commuting hours—and emissions—in the process? It is likely that, except in a few large cities in which public transit is essential, it may take some time for the public to use it at pre-Covid-19 rates.

What we do know is that we are a car-centric society and most of our cities are built for cars. And for most cities, buses are the only form of public transportation. Therefore, this discussion focuses on electrification of cars, taxis, and buses.

3.6 Electric Vehicles

California accounts for more than half of the nation's EV sales. EVs have not caught on in most New England states, but Massachusetts illustrates that policy can turn that around quickly (Table 7). Still, all of the New England states have a long way to go in adopting electric vehicles.

Table 7. Electric Vehicle Sales and Market share in New England States, 2018

State	EV Sales in 2017	EV Sales in 2018	Percent Increase	In-State Mkt. Share 2018 (%)
Total U.S.	187,985	328,118	74.5	1.9
Connecticut	759.14	45,263	2,234	1.96
Maine	91.81	2,224	639	1.09
Massachusetts	2,852.25	104,528	10,400	15.39
New Hampshire	119.75	8,521	1,031	0.77
Rhode Island	284.62	6,228	1,009	3.52
Vermont	356.19	8,608	1,186	14.36

Source: EV Adoption.¹⁰⁴

Global electric vehicle (EV) sales are expected to drop by 43 percent by the end of 2020—from 2.2 million in 2019 to 1.3 million.¹⁰⁵ The U.S. was harder hit, with sales down 55 percent.¹⁰⁶ In addition to the COVID-19 recession, a cause of the decline is that city and state budgets have plummeted, leaving few dollars for fleet purchases. Further, gas prices are very low, making the purchases hard to justify. In response, General Motors is offering a \$10,000 rebate on Chevy Bolt purchases, but several manufacturers have slowed their projected rollouts of new electric models. Still, long-term prospects for EVs remain strong according to Bloomberg NEF analysis that predicts they will comprise 58 percent of new passenger car sales globally by 2040 and 67 percent of all municipal buses.

So what do we do in the meantime? Other than the tax credits, we don't have a national policy to promote electric vehicle sales. Experience from world leaders in electrifying transportation, in countries such as Norway, Great Britain, and the Netherlands, tells us that it takes three things: subsidies for purchasing electric vehicles, creation of an extensive charging infrastructure, and to truly reduce emissions, we need to connect vehicle electrification to renewable energy and an upgraded grid that can handle the increased demand.

The New England states have established goals for electric vehicle adoption and expansion of charging infrastructure (Table 7). In 2020, Connecticut produced an Electric Vehicle Roadmap that takes an integrated approach to dramatically increasing uptake for public and private fleets and medium- and heavy-duty trucks. Strategies include charging, changing building codes and permitting requirements to support adoption, and promoting equitable adoption.

Table 8. Electric Vehicle Goals and Sales and Charging Infrastructure Development in the New England States

State	Electric Vehicle Goal	Charging Infrastructure
Connecticut	125,000-150,000 electric vehicles registered by 2025. 11,667 electric vehicles registered as of December 31, 2019. ¹⁰⁷	Deployed 277 EV charging stations since 2013. As of early 2020 there are 376 publicly available EV charging stations for a total of 966 charging connectors in the state. Of these, 50 are fast chargers with 212 charging connectors. ¹⁰⁸
Maine	No numerical goal for electric vehicles until charging infrastructure more developed. 748 plug-in electric vehicles registered as of January 2015 (latest available). ¹⁰⁹	In 2019, 20 “fast chargers” publicly chargers installed. Efficiency Maine has awarded incentives to qualified bidders to install and operate new public charging stations, which will be installed through 2020. ¹¹⁰
Massachusetts	300,000 zero emissions vehicles registered by 2025 ¹¹¹ 22,000 electric vehicles registered as of July 2019. ¹¹² It has been recommended that a goal is established that all new cars, light duty trucks, and buses sold in Massachusetts are electric by 2020. ¹¹³	As of December 4th, 2018, there were 495 publicly available level II charge and 48 DC Fast Charge stations installed. ¹¹⁴ Incentives and programs for expanding the charging infrastructure are under discussion. ¹¹⁵
New Hampshire	No goals for vehicles registered. 836 plug-in electric vehicles registered in New Hampshire as of January 2015 (latest available). ¹¹⁶	113 public charging stations available in New Hampshire as of May 2019. ¹¹⁷ The Electric Vehicle Charging Stations Infrastructure Commission recommended expanding charging infrastructure in its 2019 report. ¹¹⁸
Rhode Island	43,000 zero emission vehicles registered by 2025. 421 plug-in electric vehicles registered as of January 2015 (latest available). ¹¹⁹	As of December 4th, 2018 there were a 75 level II charge and 7 DC Fast Charge stations publicly available. ¹²⁰ The state is presently incentivizing installing new EV charging stations. ¹²¹
Vermont	Goal of increasing the share of renewable energy in the transportation sector to 10% by 2025 and 80% by 2050, which is about 50,000 plug-in electric vehicles registered by 2025. ¹²² As of December 16, 2019, there were 3,300 plug-in vehicles registered. ¹²³	In July 2019, 30 new charging stations were planned to join the existing 217 charging stations across the state. ¹²⁴

Massachusetts has the most ambitious goals, which would require decarbonizing all modes of transportation. As charging infrastructure is developed, states need to commit to electrifying all transit and school bus fleets, as recommended by several organizations.¹²⁵ The remaining states are less ambitious in their policy.

Transitioning transit and school buses to electric would dramatically reduce the amount of nitrogen oxide and particulate matter that creates a health threat to urban dwellers, particularly in low-income neighborhoods that often rely on bus service. New England cities and states could be more ambitious in transitioning bus fleets to electric. Other cities and states offer approaches to replicate.

Los Angeles began phasing out diesel buses in 2011, and in July 2017, the Metropolitan Transportation Agency committed to moving its entire bus fleet to zero-tailpipe emissions by 2030. There's been a lot of trial and error, but Mayor Eric Garcetti, the city council, and MTA leaders agree that it's important for L.A. to serve as a test bed to perfect the technology. Starting in 2019, the MTA is purchasing about 19 electric buses a year and is investing in the charging stations to support them.

In September 2019, New York's Metropolitan Transit Agency approved a budget for purchasing 500 new zero-emission, all-electric buses. King County's Metro, which serves the Seattle metropolitan areas, also has been testing electric buses, and in January it committed to purchasing 120 battery-electric buses by 2021.

The transition will not be cheap. At \$1.3 million each, these buses cost about \$200,000 more than the diesel hybrids currently in use, but the hope is that lower fuel and operating costs will cancel out the higher price over time. Some cities report savings in fuel as high as 80 percent. Studies suggest that electric buses save \$125,000 in avoided maintenance over their lifetime and that the combined fuel and maintenance costs are about \$50,000 less per year than for diesel buses.¹²⁶

4. Policy Considerations & Interconnecting Issues

There is much potential for economic gains if federal and state policy focuses on investments that create a more green and equitable future. The New England states have been establishing aggressive policies to promote clean energy and to reduce reliance on fossil fuels, to varying degrees. They were beginning to focus on making this transition equitable. The COVID-19 pandemic has laid bare the need to accelerate and combine these agendas. All evidence shows that the renewable path will create a strong and more resilient recovery than one based on fossil fuels.

All evidence shows that the renewable path will create a strong and more resilient recovery than one based on fossil fuels.

All of the New England states are part of the Regional Greenhouse Gas Initiative (RGGI), the nation's first regional cap and trade system. Delaware, Maryland, New Jersey and New York are also members and Virginia is expected to join in 2020.¹²⁷ It was established in 2005 and auctioned its first carbon allowances in 2008. The program works by establishing a regional cap on the amount of carbon power plants can emit, then each state issues tradable allowances for emitting carbon. Most of the revenue from the auctions is channeled into energy efficiency programs and smaller amounts to community solar. The National Resources Development Council estimates that over ten years RGGI created 30,000 job years of employment (one year of full-time work), saved consumers \$618 million in energy bills, generated \$2.9 billion in economic growth, and resulted in \$5.7 billion in health benefits.¹²⁸

As of 2020, RGGI is credited with contributing to reducing the region's carbon emissions by 45 percent from 2005 levels.¹²⁹ But critics point out that rather than RGGI being responsible for carbon emission reductions, they were, like in the rest of the country, the result of switching from coal to natural gas. It is beyond the scope of this paper to examine the role of RGGI, but it is clear that if more aggressive in its goals, it could contribute to continued reductions in carbon emissions.

It is also worth noting the RGGI states plus Pennsylvania and the District of Columbia formed the Transportation and Climate Initiative to reduce carbon emissions from the transportation sector. It will operate in the same way as RGGI—the states are to set overall pollution limits proposed to be at about 254 million metric tons per year in 2022. Transportation fuel distributors would then purchase allowances in auctions run by the states. As with RGGI, the number of allowances would decrease each year to reduce emissions.¹³⁰

Adjustments have been made in the timeline due to the COVID-19 pandemic, with a new timeline expected in fall 2020. The group is examining which complementary policies will result in reducing pollution, improving public health, creating jobs, and stimulating economic recovery.¹³¹

Independently, Massachusetts is ramping up the Massachusetts Offers Rebates for Electric Vehicles program (MOR-EV) program. MOR-EV has had a rocky history since it was launched in 2014. There were

few takers of the \$2,500 rebates for purchasing a new electric vehicle. Just as demand began to increase, the rebated was reduced to \$1,500 due to budget constraints in early 2019 and then suspended in Month. By December the program was replenished with a boost of \$27 million a year for at least two years. It's the classic chicken and egg problem—even with rebates, “range anxiety” will prevent more people from buying EVs.

Despite previous rounds of policy leadership, the bottom line is that states will be facing staggering deficits due to the pandemic.¹³² Rhode Island alone is anticipating an \$800 million deficit for the 2020 and 2021 fiscal years.¹³³ Federal relief is essential for state and local governments.

Despite previous rounds of policy leadership, the bottom line is that states will be facing staggering deficits due to the pandemic.

To date, the two COVID-19 stimulus packages have not included support for the energy sector.¹³⁴ The American Recovery and Reinvestment Act (ARRA) of 2009 demonstrates the effectiveness of a stimulus on the energy sector. Of its total investment of \$840 billion, ARRA spent \$92 billion on clean energy technologies, including: clean energy generation; grid modernization; electric vehicles; transit; energy efficiency; and workforce training to support these industries.¹³⁵

To jumpstart projects, the \$25.7 billion invested for clean energy generation paid developers 30 percent of their project costs in cash rather than as a tax credit between 2009 and 2015.¹³⁶ Another \$4.6 billion was provided for guaranteed loans to companies investing in renewable energy. Although Solyndra became the poster child for those arguing that government can't pick winners, total interest payments to the government from the loans exceeded losses from loans by \$30 million.¹³⁷ The program invested in 183 projects, which leveraged private investment of nearly \$ 5.4 billion.¹³⁸

Of the 183 clean-energy projects, 58 went to solar equipment manufacturers, totaling \$1.1 billion. By the end of 2011, 470 wind turbine manufacturing facilities were located in the U.S., more than 10 times the number of such factories in 2004. Before the stimulus wind and solar each provided less than one percent of the nation's electricity. As a result of the stimulus, wind grew from to 7.3 percent of our electric production, while solar expanded less than 1.8 percent, substantially higher than what the U.S. Energy Information Agency predicted before the stimulus.¹³⁹ The stimulus also provided about \$5 billion on a weatherization program that targeted low-income households.

There has not been federal support for renewable energy development since ARRA. The most recent attempt, a bill calling for a national renewable electricity standard requiring half of the nation's energy to come from renewable sources by 2035 and another calling for 77 percent clean energy by 2035, haven't made it out of the Energy and Natural Resources Committee. But these bills set standards and not stimulus funding for the energy sector.¹⁴⁰ New federal investment could give the clean energy and related sectors a much-needed boost to recover from the recession and support states in achieving their climate action goals to reduce greenhouse gas emissions.

There are several variations of a green new deal—a massive federal investment in transitioning to a fossil-free economy that provides living-wages and much improved access for racial and ethnic minorities left out of the green economy. The Center for Climate and Energy Solutions Getting to Zero: A U.S. Climate Agenda, makes proposals by sector¹⁴¹ Washington Governor Jay Inslee's Evergreen Economy for America plan calls for research and investment in manufacturing to create good jobs for more Americans.¹⁴² The Center for American Progress 100 Percent Clean Future also lays out a plan focused on jobs and justice.¹⁴³ Presidential candidate Joe Biden lays out a \$2T investment in a Plan to Secure

Environmental Justice and Equitable Economic Opportunity in a Clean Energy Future. Proposals not focused specifically on climate, such as the recently introduced Environmental Justice for All Act, seeks systemic solutions to economic, environmental, neighborhood, and educational disparities.¹⁴⁴ The proposals address environmental and economic justice to varying degrees. Any one of them would place the entire country on an inclusive path to sustainable economic prosperity.

5. Recommendations¹⁴⁵

The New England states have positioned themselves well to meet their ambitious goals for renewable energy adoption and to create much-needed jobs. Still, they could adopt more ambitious legislation in some areas of the clean energy economy. The following recommended actions for the states and the federal government can revitalize the building energy efficiency sector, accelerate renewable energy expansion, and spur development in related sectors in New England and across the nation.

5.1 Building Energy Efficiency

Federal stimulus proposals should fund weatherization and deep energy efficiency activity, including fuel switching.

Several green new deal proposals were identified above. Each of them specifies specific amounts for energy efficiency.

- The New England states should adopt Passive House or a zero-net carbon stretch code.

The zero-net carbon stretch code, which lays the groundwork for Passive House, is currently under consideration by the Massachusetts legislature. It should become the standard for all states. The states should support pilot projects that demonstrate to the development community how to apply the standards in a cost-effective way. The MassCEC approach, described above, could be replicated in all the states.

- The New England states should adopt incentive programs to promote fuel switching that gets fossil fuels out of buildings.

Maine is the nation's leader on installing heat pumps in residential and commercial properties, which often eliminate the need for fossil fuels. States should explore how to combine renewable energy with heat pumps as well.

- Each state should assess the needs of low-income residents for deep energy retrofits combined with fuel switching to lower energy costs and improve indoor air quality and develop programs and incentives to prioritize these residents.
- Each state should assess its workforce training in energy-efficiency occupations and develop a strategy for targeting these programs to low-income residents.

5.2 Offshore Wind Recommendations

- Increase Bureau of Ocean Energy Management (BOEM) staff and develop clear procedures to accelerate approval of construction and operation plans (COPs). According to the Business Network for Offshore Wind, seven COPs are currently under review, with another five expected to be filed by the end of 2020.

The environmental impact statement for Vineyard Winds, an 800-megawatt project in Massachusetts scheduled to begin operation at the end of 2022, was expected to be released in August 2019. Instead,

BOEMA announced that it would extend the review through the end of 2020, ostensibly to further analyze the cumulative effect of offshore wind development on the fishing industry.¹⁴⁶ Because the delay caused the project to miss a deadline for a 24 percent tax credit, the cost of the energy will likely increase.

Steady and predictable approvals are needed to attract manufacturers, who say they would consider local production once 6 gigawatts are developed. Manufacturers then would want to see an average of one gigawatt a year in the pipeline.

Meanwhile, Germany and China are accelerating offshore wind development to help meet their climate goals and to create jobs.^{147,148} An administration committed to expediting environmental reviews should have approved Vineyard Winds already.¹⁴⁹ If a speedy and predictable approval process is not in place, the U.S. will cede leadership in another key industry of the future.

- Consider “de-risking” sites before they are auctioned off.

The staffing and procedural changes mentioned above could shave months off the approval process, but that’s not enough to create a long-term pipeline of wind lease sales. If BOEM (and perhaps DOE and NOAA) worked with the states in conducting geo-physical studies before auctioning sites, developers would be eager to purchase and pay the government for this work since it would allow them to move faster. The Danes have found that de-risking sites reduces the risk for investors. For more details on this option, see the Danish Energy Agency’s 2018 report.¹⁵⁰

- Reauthorize and expand the Advanced Manufacturing Tax Credit of the 2009 American Recovery and Reinvestment Act.¹⁵¹

This credit provided a 30 percent investment tax credit to clean energy manufacturers, with a value of \$2.3 billion. These credits are essential to manufacturers in the wind supply chain as well as building a shipbuilding industry for the various types of vessels vehicles that will be needed.¹⁵² The Business Network for Offshore Wind recommends doubling this amount.

- Finance infrastructure improvements in regional ports to support the offshore wind industry.

The capital improvements needed to ready the region’s ports to support offshore wind development are considerable and beyond the capacity of the states, particularly after losing revenue due to the COVID-19 pandemic. The U.S. Department of Transportation’s BUILD Program could appropriate additional funds for port/water transportation. The \$1 billion appropriated for Fiscal Year 2020 only includes surface transportation.¹⁵³

- Conduct a feasibility assessment of creating a shipbuilding industry to support offshore wind.

A port infrastructure and shipbuilding program could be a huge economic development catalyst. The Jones Act prohibits prohibit foreign-owned, registered, or crewed vessels from transporting merchandise between two points within the United States.¹⁵⁴ Although the law has been loosened to allow foreign lift and construction vessels to operate if American barges transport components, there is still considerable potential for building many of the vessels needed domestically.¹⁵⁵ Either BOEM or DOE needs to conduct an analysis of the need and potential, including reconfiguring barges and fishing vessels to serve the industry.

- Fund workforce training to support the offshore wind industry.

The training the New England states have in place focuses on jobs in construction, installation, and maintenance. Each state has unique ecosystem of schools and training institutions in place. Federal programs should build on what the states are already implementing in workforce training to support the industry. Some officials suggested to me that they would like to see a federal block grant-type program that gives them flexibility to build on programs as they see fit for the particular aspects of the industry that

have the most potential or greatest need for quick training. There is opportunity for workers in the fishing industry to augment their incomes by working as pilots and crew members of the industry's maritime vessels that may require some transitional training.

- Extend the federal investment tax credits.

An extension of these tax credits was included in the proposed spending bill in December 2019 but was taken out at the request of the White House.¹⁵⁶ Because of longer timelines for developing and building offshore facilities, the credits are essential. Both the American Wind Energy Association and the Solar Energy Industries Association support these credits.¹⁵⁷ We have already established that the credits create billions in private investment.

5.3 Solar Energy Recommendations

- The New England states should revise their net metering policies to support the development of more community solar.
- The New England states should assess land use and zoning policies for siting utility solar arrays to establish guidelines to address competing interests (e.g. preserving forest land vs. solar expansion).
- Provide federal support in the form of continuing federal tax credits and research and development, as defined in several of the green new deal proposals for expanding community solar projects.

Community solar could expand dramatically with renewed federal support. In September 2019, the Department of Energy revived the Obama-era National Community Solar Partnership to make shared solar accessible and affordable to every US household and will provide technical assistance, peer learning opportunities, and resources for doing so, particularly in low- and moderate-income areas.¹⁵⁸ The partnership seeks to enable state and local governments, utilities, businesses, nonprofits, and affordable-housing providers to develop community solar projects.

5.4 Battery Storage and Transmission Recommendations

- Expand existing state efforts to support solar plus battery storage in order to reach regional goal of becoming carbon neutral by 2050.
- Modify an extended renewable-energy investment tax credit to include stand-alone energy storage systems.
- Include energy storage as part of loan guarantees that the Department of Energy provides for clean-energy projects.
- Reauthorize the ARRA Smart Grid Investment Grant program for grid modernization so investments in energy storage and transmission to accommodate more renewable energy can be made now.

5.5 Transportation Recommendations

- Restore the \$7,500 federal tax credit for electric vehicle purchase and adjust it for income.

Critics of the subsidy point out that 78 percent of the federal tax credits for EV purchases went to those with adjusted gross incomes of at least \$100,000 and 7 percent to those earning a million or more.¹⁵⁹ California reveals that this problem is easily solved by establishing an income limit on rebate eligibility. California's limit started in 2016 and was lowered again at the end of 2019.¹⁶⁰ Further, those with incomes

less than or equal to 300 percent of the federal poverty level receive an additional \$2,000 rebate.¹⁶¹ Oregon has a similar low-income program. Getting the rebates right is easy and should be part of a restoration of the federal credit.

- Provide subsidies to cities for converting bus fleets to electric as per green new deal plans.
- The New England states should develop timelines for cities to transition bus fleets to electric.
- New England cities should consider congestion pricing and ultra-low emission zones to complement existing strategies to accelerate electric vehicle sales.

In 2003, London instituted the world's first congestion pricing zone, which charges vehicles a fee—which is higher during peak traffic hours—to enter much of the central city. Since 2009, EV owners have been exempted from the congestion charge. In 2014, then-mayor Boris Johnson laid the groundwork for an Ultra-Low Emission Zone (ULEZ) coinciding with the congestion pricing zone, in which higher-polluting vehicles are banned or required to pay a substantial fee to enter. The ULEZ was started by Mayor Sadiq Khan in April 2019. It requires all vehicles entering the zone to comply with stringent EU standards or pay a daily charge of £12.50 for smaller vehicles and £100 for heavy vehicles.

These zones are being used by at least 200 cities throughout Europe. New York City has also discussed congestion pricing, and there are ways to implement these zones that lessen the burden for low-income drivers.¹⁶²

- New England states and cities should incentive electric vehicle sharing.

Los Angeles is using car sharing to make EVs available to those who can't afford to purchase cars. In June 2017, Mayor Garcetti announced that a new carsharing program called BlueLA would begin by serving four low-income communities in Central Los Angeles. Blue LA, which is funded with \$1.7 million from cap-and-trade proceeds and the California Air Resources Board, started with a demonstration station that offers community education, outreach, and test-drive events. The goal is to provide 100 EVs and 200 public charging stations to serve about 7,000 people in the area. Several community organizations are helping provide the education and outreach services. Cars can be rented from Blue LA for as little as \$10 a month or 15 cents a minute. Low-income users get discounts ranging from 25 to 80 percent. The Regional Greenhouse Gas Initiative could fund similar programs in New England cities.

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Based at Northeastern University in Boston, MA, the Global Resilience Institute's (GRI) research and educational mission is to develop and deploy practical and innovative tools, applications, and skills that drive social and technical changes, which strengthen the capacity of individuals, communities, systems, and networks to adapt to an increasingly turbulent world. Launched in 2017, GRI is the world's first university-wide institute to respond to the resilience imperative. Today, GRI undertakes multi-disciplinary resilience research and education efforts that draw on the latest findings from network science, health sciences, coastal and urban sustainability, engineering, cybersecurity and privacy, social and behavioral sciences, public policy, urban affairs, business, law, game design, architecture, and geospatial analysis. GRI works in close partnership with industry, government, communities, and non-governmental organizations, as well as engages in external outreach to inform, empower, and scale bottom-up efforts that contribute to individual and collective resilience.

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