November 8, 2020

Dear Maine Climate Council members,

Please find attached the ***draft final strategies*** of the Maine Climate Action Plan for your review.

Thank you very much to everyone who has provided helpful feedback on the strategies.

We've gotten a few questions about some of the detail being lost from the working group reports and want to clarify that the working group reports will be attached to the plan as appendices so that detail will be available to inform implementation.

We will continue to edit for consistent voice and clarity, but these are the strategies we hope to approve as a council at our meeting next week.

The attached draft also includes updated metrics and outcomes based on the final emissions modeling presented on November 2.

We continue to refine the attached ***draft implementation chart***, working with agencies to identify existing programs that can be leveraged, illustrate areas where there is a need for legislative action, administrative action, funding allocation, local government planning, etc.

Improvements to come include a letter from the Governor, a letter from the co-chairs (which will set forth a vision), an executive summary that will summarize the report, and stories of Maine people, businesses and communities that will help to illustrate the strategies. We also plan to add a bit more detail to the draft about process, public input and anticipated future work of the council – one of our points of discussion at the upcoming Council meeting.

Please review the ***draft final strategies*** and complete this survey by Tuesday COB so we can prepare for important discussions next Thursday.

Here is the survey link: (*link was sent directly to Maine Climate Council members*)

Thank you for all your hard work! We look forward to seeing you on Thursday at 9 am.

-Sarah and the GOPIF team

DRAFT

Maine Climate Council

Four-Year Climate Action Plan

Message from the Governor

(To be filled in)

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(To be filled in)

Executive Summary

(To be filled in)

The Effects of Climate Change on Maine

From increasing land and ocean temperatures, to rising sea levels, more frequent severe storms, shortening winters and disrupted agricultural seasons, and more prevalent public health risks, scientists are identifying the current, and expected, harms of climate change on our state.

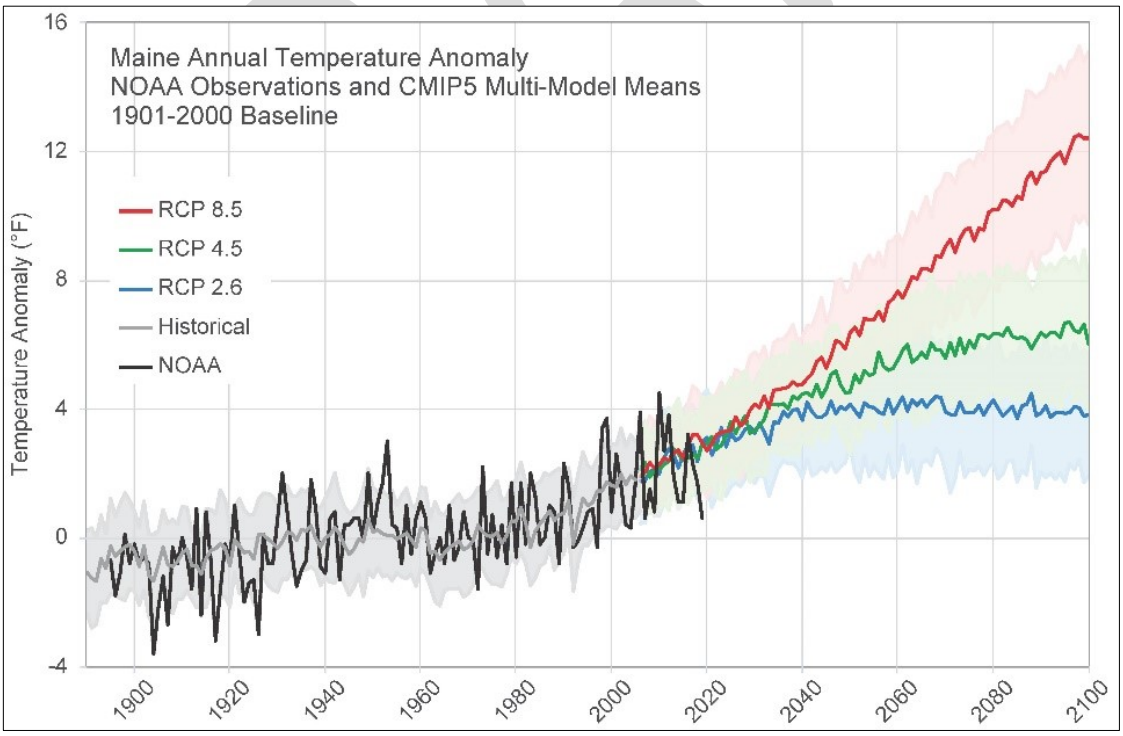
Leading this charge is the Maine Climate Council's expert Scientific and Technical Subcommittee (STS), which identified the impacts on Maine from climate change in its exhaustive report, "Scientific Assessment of Climate Change and its Effects in Maine."

The Assessment, which represents the contributions of nearly 100 leading scientists and other experts, is the most comprehensive analysis of climate change's effect on Maine in more than a decade. Its findings informed the work of the Maine Climate Council as it developed this Climate Action Plan.

The report's conclusion is unequivocal: There is an urgent need for Maine to reduce greenhouse gas emissions and prepare for the impacts of climate change.

Climate models suggest Maine may warm by an additional 2 to 4°F by 2050 and up to 10°F by 2100, depending on the success of curbing greenhouse gas emissions. The warming trends documented in Maine are more prominent than those observed by scientists globally, as greenhouse gas emissions drive dramatic changes in Earth's climate systems.

Figure 1: Historical trends in Maine's temperatures and projections of potential future temperatures.



Observed (black line) and model-projected (gray and colored lines) potential future temperature anomalies for Maine under different socio-economic/emissions scenarios (RCPs – Representative Concentration Pathways). Anomalies are the difference between the temperature in a particular year and the 1901-2000 baseline average. See the Scientific Assessment of Climate Change and its Effects in Maine, Climate chapter for more details.

Since 1895 in Maine, statewide annual temperatures have risen by 3.2°F (1.8°C), with coastal areas warming more than the interior of the state. Of all the seasons, winters in Maine have warmed the most, which has caused Maine's agricultural growing season to increase by two weeks. Yet increases in extreme precipitation conditions in Maine, such as very dry conditions and large rainstorms, is harming agriculture, shellfisheries, and freshwater and coastal ecosystems susceptible to climate change effects.

This is because nearly two-thirds of Maine's plants and animals, habitats, and at-risk species are either highly or moderately vulnerable to climate change. If warming remains unchecked, our most sensitive plant and animal species on land and sea are expected to shift their ranges further northward in pursuit of their preferred sustaining environmental conditions.

Human and animal health are affected by climate change and will continue to be into the future. Temperature extremes, extreme weather, tick- and mosquito-borne diseases, food- and water-borne infections, and pollen pose some of the highest risks to Mainers' health.

Exposure to climate-related events and disasters, such as extreme storms, flooding, drought, and extreme heat, can cause negative mental as well as physical health effects, and people with existing mental illness are often disproportionately vulnerable to climate-related events.

Warming is also causing Maine to become wetter overall, with statewide annual precipitation (rainfall and snowfall) increasing by 6 inches (152 mm) since 1895. Heavy storms of 2 to 4 inches of precipitation are becoming more frequent, which increases the probability of severe floods that will erode infrastructure and degrade water quality in ponds, lakes, streams, rivers, and coastal areas.

The impact of warming is perhaps most evident in the vibrant subarctic ecosystem of the Gulf of Maine, where surface temperatures have increased at a faster rate than in any other body of water on Earth, a foreboding trend expected to continue through at least 2050.

This continued warming will result in additional warmer-water species and fewer subarctic species in the Gulf of Maine, an ecosystem shift that would have substantial negative impacts on Maine's marine resources and coastal communities, as well as important industries such as commercial fishing and aquaculture.

Warming will also allow dangerous ocean acidification—which has risen at least 30% on average globally—to continue. Ocean and coastal acidification most affect marine organisms that produce calcium carbonate to build shells, such as scallops, clams, mussels, and sea urchins.

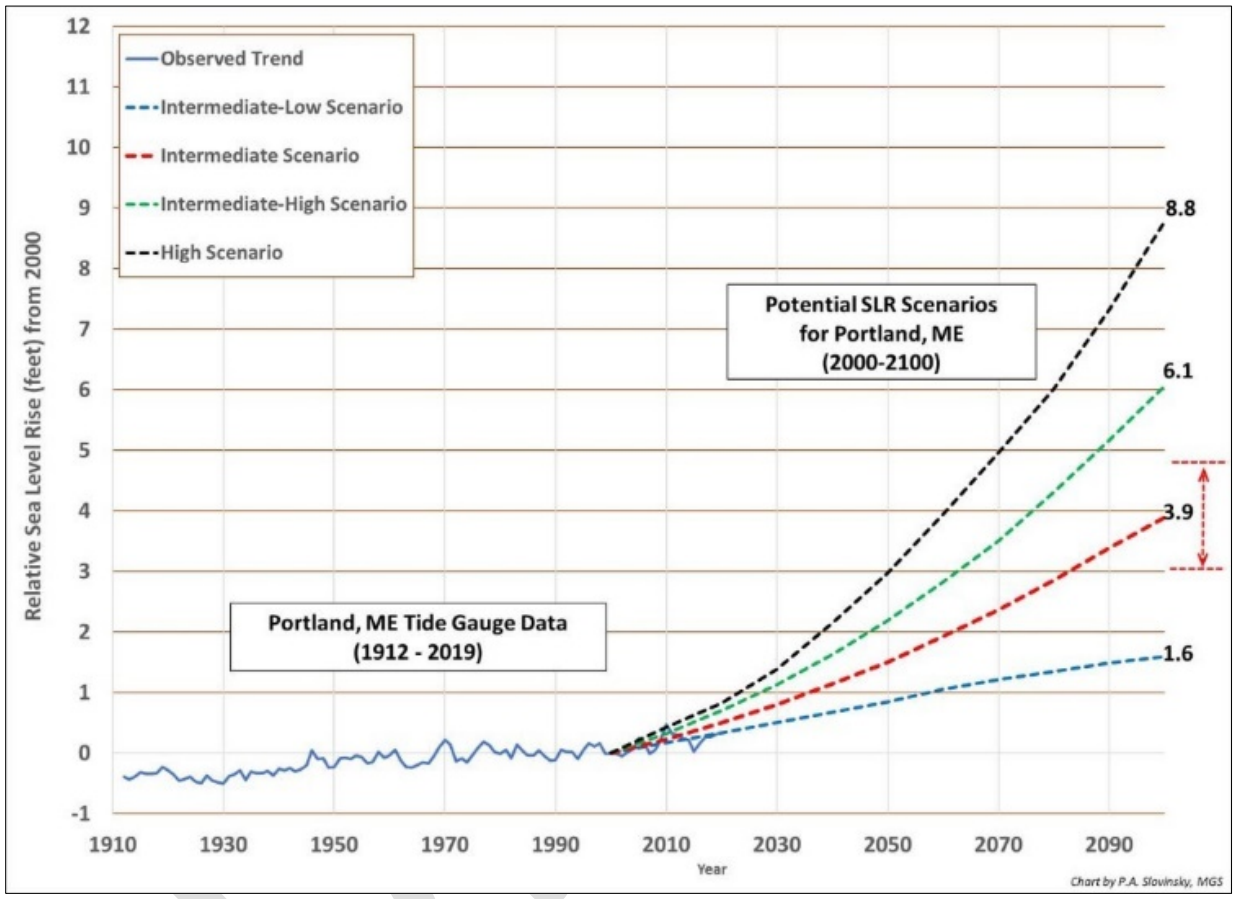
Looking ahead, if greenhouse gas emissions are brought under control, it's possible the southern coast of Maine may warm only 2.7°F (1.5°C) above the 1976-2005 baseline and have an ocean climate akin to Massachusetts or Rhode Island today by the end of the century.

However, if emissions remain unchecked, even the eastern coast of Maine may feel like Rhode Island, with temperatures rising and exceeding 5.4°F (3°C) above the baseline by the year 2100.

Two effects of warming oceans are melting sea ice and rising sea levels, of which the latter in Maine is accelerating. Sea levels along Maine's coast have risen about 1 foot/century (3 to 4 mm/year) in the last few decades, after rising at 0.6 to 0.7 feet/century (1.8 to 2 mm/year) since the early 1900s. About half of the last century's sea level rise in Maine has occurred since the early 1990s.

As Maine's relative sea level rises, coastal communities and ecosystems will see increased frequency of "nuisance flooding," inundation of coastal lowlands with saltwater, erosion, and loss of dry beaches, sand dunes, and other habitats. A 1.6-foot sea level rise may submerge 67% of Maine's coastal sand dunes and reduce the dry beach area by 43%, which could happen by 2050 or earlier and would have significant impacts on coastal tourism.

Figure 2: Historical trends in Maine's sea levels based on Portland tide gauge data and projections of potential future sea level rise scenarios.



Sea level has risen in Maine over the last century and is expected to continue rising along Maine's coastline well beyond 2100. The Scientific and Technical Subcommittee recommends the State commit to manage for 1.5 feet of relative sea level rise by 2050 and 3.9 feet of relative sea level rise by 2100 (red arrows in the figure), and consider preparing to manage for 8.8 feet of sea level rise by 2100, especially for low risk-tolerant infrastructure. (See the Scientific Assessment of Climate Change and its Effects in Maine, Sea Level Rise and Storm Surge chapter for more details.)

As part of its report, the STS developed sea level rise projections for the Maine's coastal areas. Based on those projections, the Maine Climate Council recommends the state ***commit to managing*** for 1.5 feet of relative sea level rise by 2050, and 3.9 feet by the 2100. The Council also additionally recommends the state ***prepare to manage*** for 3 feet of relative sea level rise by 2050, and 8.8 feet by 2100.

This scientific, scenario-based approach to sea-level rise allows Maine to consider a range of potential outcomes, as well as the risk tolerance of different kinds of infrastructure, and has been adopted by several New England states and municipalities.

Changing climate conditions, particularly more extreme precipitation and declining snowpack from warmer winter seasons, create significant stress in Maine's forests, which cover 89% of the state and supports an important forest industry sector that has $8-10 billion in direct economic impact.

Maine's forests also sequester over 60% of our annual carbon emissions (~75% including forest growth and durable products). Maine also has some of the highest densities of non-native forest pests in the U.S., further stressing tree species.

Climate shifts are also affecting Maine's diverse agriculture sector, which generates over $660 million of direct value into Maine's economy. Warming temperatures and increasingly variable precipitation provide both potential benefits and damages to workers, crops, and livestock.

Climate change will affect all sectors of Maine's economy, from tourism, agriculture and forestry to transportation and trade. Warmer temperatures, more rain, and sea-level rise will increase the incidence of flooding and damage to property and infrastructure.

All told, the scientific assessment of climate change in Maine is clear. Our state must prepare for the harmful impacts from climate change now, while striving to reduce our greenhouse gas emissions to avoid potential worst-case scenarios that may otherwise lay ahead.

Maine's Climate Action Plan Goals

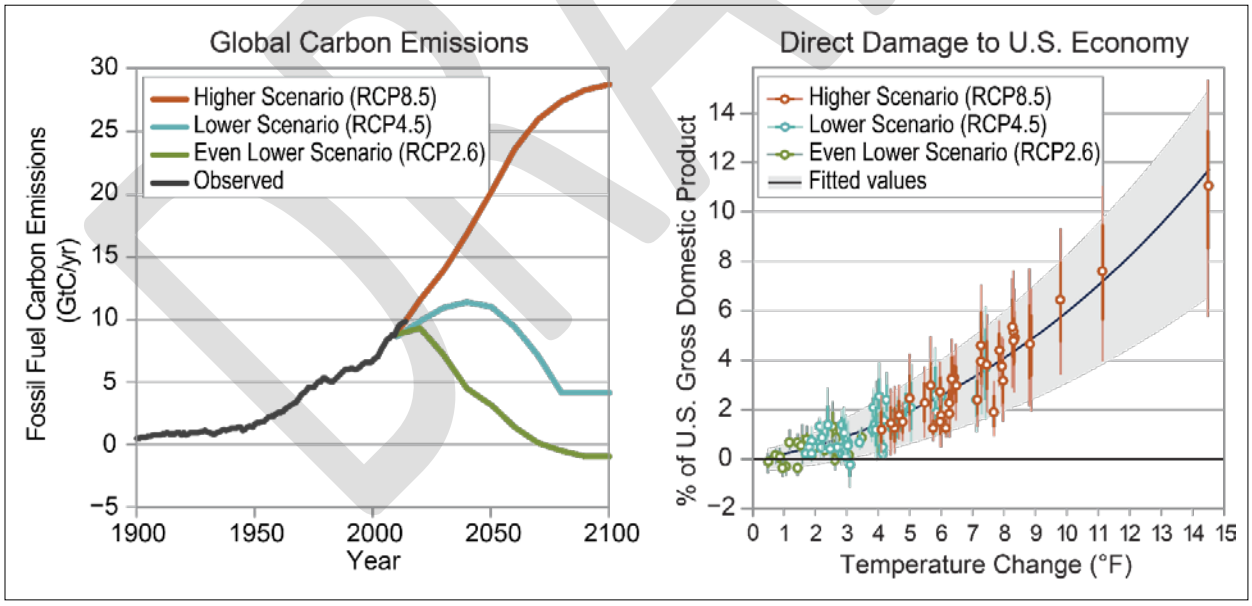
Reduce Maine's Greenhouse Gas Emissions

Over the past decade, the rising consensus of international scientists and the increased challenges of extreme weather activity has highlighted that the world is facing unprecedented challenges associated with climate change as a result of human activities—primarily the combustion of fossil fuels that emits carbon dioxide and other greenhouse gases.

Greenhouse gas emissions are rising at increasing rates in the U.S. and globally. Global average atmospheric carbon dioxide levels reached 409.8 ± 0.1 parts per million in 2019 – a level of carbon dioxide not experienced on Earth for at least 3 million years.

Climate science indicates at least 1.0°C (1.8°F) of global warming has happened since pre-industrial times, and that the Earth will likely warm by 1.5°C between 2030 and 2052 at current rates. The Intergovernmental Panel on Climate Change (IPCC) has determined the risks from climate change to people, species, and natural systems are much higher if global warming reaches 2.0°C, than if warming is limited to 1.5°C or under. To accomplish this, the IPCC has found that we need to globally reach net zero CO_2 emissions and reduce other greenhouse gas emissions by 2050.

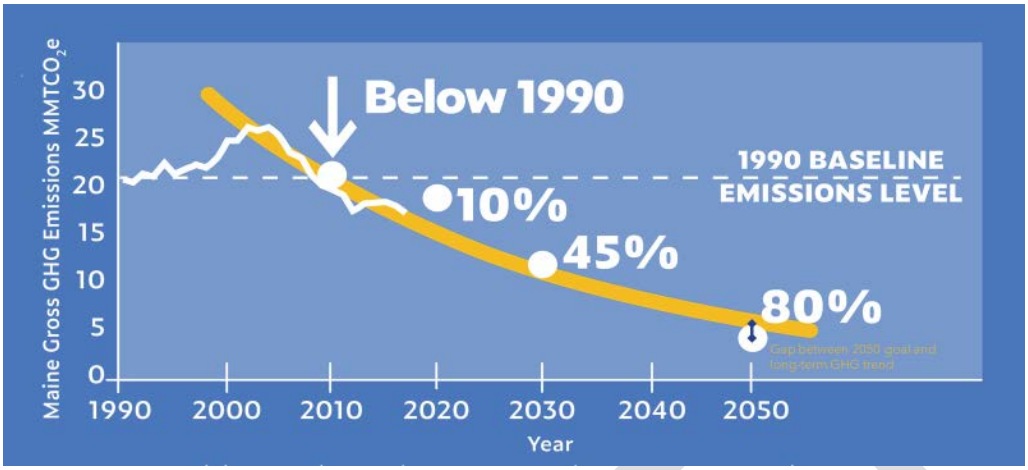
Figure 3: Global Carbon Emissions and Direct Damage to U.S. Economy [We may trade for different chart on impact on US Economy]



Source: nca2018.globalchange.gov/chapter/29/#key-message-2.

To limit warming and reduce the severe impacts of climate change, the world must reduce greenhouse gas emissions as quickly as possible. In 2019, Governor Janet Mills signed legislation to reduce Maine's greenhouse gas emissions 45% by 2030 and 80% by 2050, and to create this Climate Action Plan. In addition to these goals set forth in law, Governor Mills has signed an Executive Order committing Maine to become carbon neutral by 2045..

Figure 4: Maine's Greenhouse Gas Emissions.



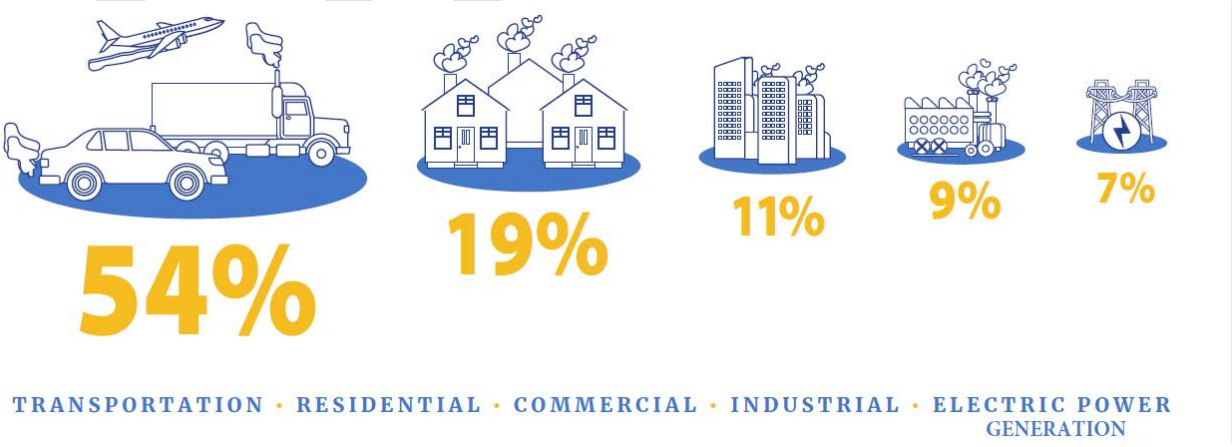
Source: Maine Department of Environmental Protection 8th Report on Progress toward GHG Reduction Goals.

The strategies in this Climate Action Plan offer Maine direction to meaningfully contribute to the international efforts to slow global climate change, in alignment with the scientifically rigorous emissions reductions goals recommended by the IPCC.

While Maine has been a leader in mitigating greenhouse gas emissions in the U.S. so far, reducing our annual emissions from a high of 26.53 million metric tons of carbon dioxide equivalents ($MMTCO_2e$) in 2002 to 17.5 $MMTCO_2e$ in 2017 (a reduction of 34%), significant progress must still be made to meet the state's 2030 and 2050 targets.

In 2017, most of Maine's greenhouse gas emissions came from transportation, followed by residential commercial and industrial sources, then electricity generation. This Climate Action Plan outlines strategies to reduce emissions from all sectors, with an emphasis on the largest emitters.

Figure 5: 2017 Maine Greenhouse Gas Emissions by Sector.



Source: Maine Department of Environmental Protection 8th Report on Progress toward GHG Reduction Goals.

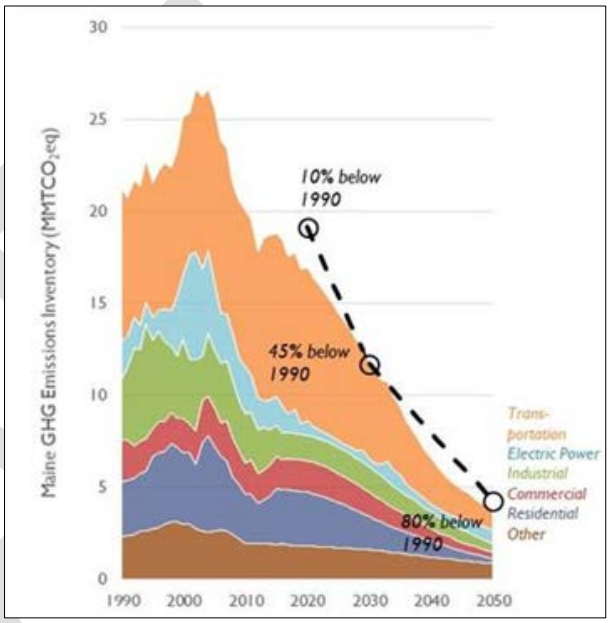
Modeling projections help us understand the different future scenarios for Maine's greenhouse gas emissions. While models are rarely perfect, the projections clarify the actions and timing required to achieve our state's emissions reductions goals.

If Maine continues on a "business as usual" path, our modeling suggests emissions will slowly decline through 2030 and then flatten in later years. Under that scenario, our 2050 emissions will be 13.8 million metric tons, which is 9.6 million metric tons greater than our 2050 target. In this scenario, transportation accounts for 41% of emissions in 2050 and remains Maine's largest emissions source.

Figure 6 demonstrates a potential pathway that utilizes many of the strategies proposed by the Maine Climate Council, including a transition to electrification in Maine's transportation and buildings sectors, combined with emissions reductions in other sectors, allowing for significant greenhouse emissions reductions.

This pathway meets Maine's 2030 and 2050 emission reduction goals. By 2030, total emissions are 11.67 million metric tons, equal to the target of 45% below 1990 levels. Total emissions in 2050 are 3.72 million metric tons, or 82% below 1990 levels.

Figure 6: Maine Emissions by Source, 1990-2050 Modeling.



Source: Synapse Energy Economics.

Table 1: Projected Emissions by Sector, 2017-2050

Sector	2017 GHG Inventory (MMTCO2e)	2030 Projected Emissions	2050 Projected Emissions
Transportation	8.57	5.19	1.10
Electric Power	1.03	0.39	0.70
Industrial	2.46	2.37	0.78
Commercial	1.71	1.31	0.36
Residential	3.00	1.83	0.30
Other	0.74	0.59	0.49
Total	**17.51**	**11.68**	**3.73**

Source: Synapse Energy Economics

Even as we reduce our greenhouse gas emissions to meet our reduction goals, Maine's carbon neutrality goal of net-zero emissions by 2045 will require our natural and working lands – such as forests, farms, and coastal environs -- to store carbon for decades to come. Enhancing these systems for greater carbon storage capacity, while continuing to provide critical economic, recreation, and habitat benefits and drinking water protection, will help Maine reach our goals and support healthy forests, farmland, and natural and coastal areas.

Curbing emissions also benefits economic activity. Research shows that 41 states, including Maine, have reduced energy-related carbon dioxide emissions while increasing gross domestic product (GDP). Maine cut gross emissions by 32% from 2005 to 2017 while the state's GDP grew 4.8%.

Figure 7: Greenhouse Gas Emissions and Gross Domestic Product (GDP).

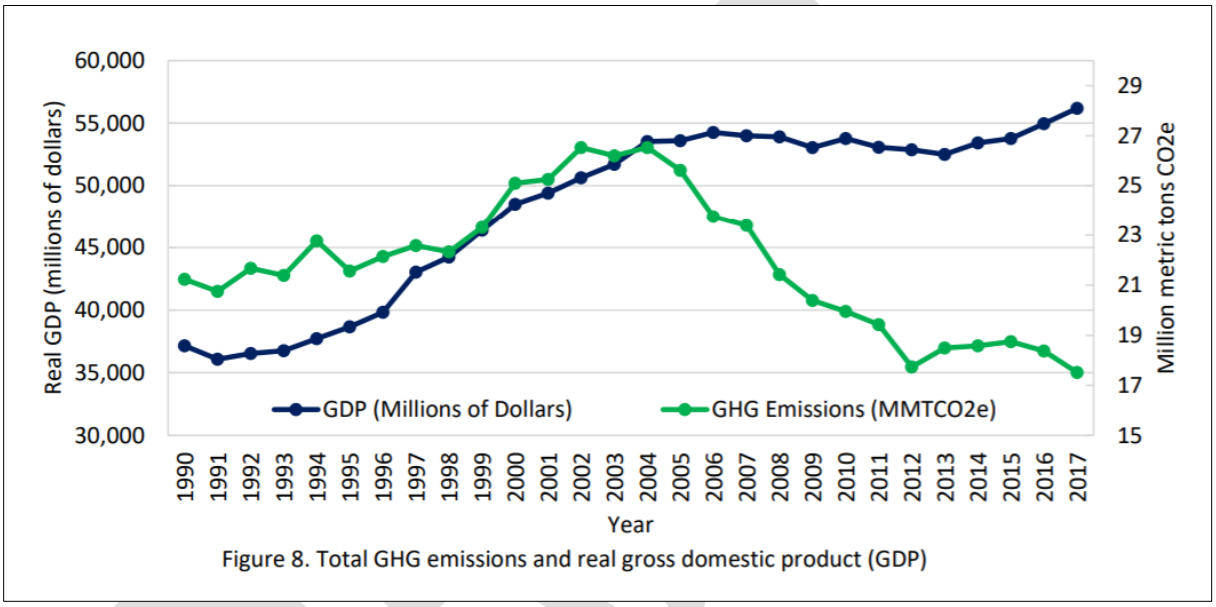


Figure 8. Total GHG emissions and real gross domestic product (GDP)

Source: Maine Department of Environmental Protection 8th Report on Progress toward GHG Reduction Goals.

Economic benefits are also expected through advancements in technological innovation, particularly in the transportation, energy and industrial sectors, which are forecast to support rapid decreases in emissions through 2050. In addition, aggressive renewable energy transition targets now enshrined in Maine law – 80% renewable sources by 2030 and 100% by 2050 -- are strong incentives for emission reductions and concurrent, sustained economic growth.

Avoid the Impacts and Costs of Inaction

Maine must take action to ensure that our people, environment, economy, and society are more resilient to the impacts of climate change that are now occurring. While mitigating the causes of climate change and better preparing Maine for its impacts will require significant public and private investment, inaction will cost Maine substantially more and those costs will accelerate over time.

As part of the research to inform this Climate Action Plan, a detailed report evaluated the **costs of doing nothing more** about climate change in Maine. This analysis found choosing to do nothing more would inflict significant consequences and costs on Maine people, businesses and communities. In many cases, these costs are orders of magnitude greater than the cost of prevention, adaptation or mitigation.

The health consequences from climate change are significant. Vector-borne diseases like Lyme disease and eastern equine encephalitis (EEE) are debilitating, expensive to treat, and carry long-term health effects. Cases of both are expected to increase in Maine as a warming climate expands the range of disease-carrying ticks and mosquitoes.

In 2018, Lyme disease treatments cost $11.5 million cumulatively for 1,400 new cases in Maine, not including ongoing medical costs for people suffering from chronic Lyme symptoms. Direct medical costs for EEE during an outbreak in Massachusetts were in excess of $40,000 per patient, and because EEE can cause complications for years, lifetime costs may reach $5.7 million per patient.

Of the multiple threats Maine faces from climate change, flooding carries the largest financial risk. For coastal communities, unaddressed sea level rise and repeated storm surge flooding could cost Maine $17.5 billion in building damage from 2020 to 2050. In inland communities, the value of buildings threatened by flooding from intense storms between 2020 and 2050 is estimated at $1.8 billion.

For coastal communities, modeling showed 21,000 jobs may be lost due to the cumulative impact of coastal storms and sea level rise between 2020 and 2050. Similarly, flood risk to inland communities could put nearly 3,300 forestry, agriculture, and tourism jobs at risk.

Vulnerability mapping of Maine also shows that at least six wastewater treatment plants will be at risk of permanent inundation from sea level rise by 2050, unless action is taken. The replacement costs for these six facilities will be $31 million to $93 million.

Coastal beaches and dunes also draw more than 13 million visitors each year, which in turn supports many coastal tourism economies. Coastal visitors spent $1.7 billion in 2018 – an average of $125 per person. By 2050, sea level rise and erosion may shrink Maine's total dry beach area by 42%, decreasing visits by more than one million people and lowering annual tourism spending by $136 million.

If Maine's coastal dunes, saltmarshes, and eelgrasses are lost to erosion and sea level rise, valuable ecosystems will be wiped out. Coastal dunes protect buildings, infrastructure, and sensitive wildlife habitat from pounding waves and flooding, an ecosystem service valued at $72 million annually. Saltmarshes and submerged eelgrasses protect coastlines from erosion and provide critical fish spawning habitat that supports Maine's commercial fisheries, which are cumulatively worth between $34 million and $260 million.

Some $600 million in annual revenue from fisheries and aquaculture are also at risk from warming and acidifying ocean waters. Maine's lobster fishery alone had landings worth $485 million in 2019. Southern New England's precipitous drop in lobster landings coincided with warming waters, offering a clear warning to Maine. As lobster populations move northward with their preferred cooler habitats, some projections suggest lobster abundance in the Gulf of Maine could decline 45% by 2050. If this occurs, Maine's cumulative GDP would fall by approximately $800 million over thirty years and reduce the state's economic output by $1.3 billion.

Maine's forests, saltmarshes, and coastal eelgrasses provide many economic benefits and ecosystem services, but their ability to absorb and store large amounts of carbon at low cost is reason alone to conserve these areas. This Climate Action Plan estimates 10,000 acres of forest are being lost to development each year and may accelerate to 15,000 acres per year by 2030.

Based on the high, but avoidable, costs of doing nothing more, the strategies outlined by this Climate Action Plan include providing support and technical assistance to Maine communities, businesses and citizens who will be most impacted by climate change to withstand its impacts.

Without additional climate mitigation or adaptation, Maine's vulnerabilities could be further exposed. Through October 2020, the U.S. had experienced 16 weather/climate disasters with damages of $1 billion. (NOAA, 2020). Preparing for action now to mitigate and adapt to climate change will ensure a stronger future for Maine.

Economic Impacts and Opportunities

Even before the downturn as a result of the COVID-19 pandemic, Maine faced an economic crossroads. While the state's 10-year Economic Development Strategy highlighted opportunities through innovation in new and heritage industries, and clear intersections between global trends and Maine's assets, long-standing demographic challenges and an aging workforce remain obstacles to growth.

Today, as Maine charts the course for economic recovery, many of the proposed solutions in this Climate Action Plan can leverage Maine's strengths and mitigate workforce trends by supporting good paying jobs, growing the economy, protecting key economic sectors most at risk from climate change, and fostering innovation in new sectors arising to combat it.

The public and private investment required for climate change mitigation and adaption represents a significant economic and workforce development opportunity for Maine, everywhere from existing fields such as engineering and the construction trades, to emerging fields in energy efficiency, renewable energy, broadband deployment and more.

Maine has identified "shovel-ready" infrastructure projects for working waterfronts, roads and bridges, wastewater and water systems, and deploying broadband that will create jobs, support local communities and economies, and increase Maine's resilience to the impacts of climate change.

Maine is also poised to expand its clean energy economy through continued development of renewable energy and energy efficiency, as detailed in a report prepared for the Maine Climate Council by the Governor's Energy Office (GEO). The report, *Strengthening Maine's Clean Energy Economy,* outlines

near-term opportunities in clean energy to support Maine's economic recovery from COVID-19, and the long-term career prospects in the emerging clean energy and cleantech sectors.

The report highlights the present economic momentum of renewable energy projects across the state, as well as the burgeoning, homegrown innovations in sustainable forest products, biofuels, and offshore wind technology that offer growth opportunities for Maine, particularly in rural areas.

Coupled with aggressive targets and growth in energy efficiency projects, such as the state's goal of installing at least 100,000 more high efficiency heat pumps by 2025, the clean energy economy is now creating jobs, reducing energy consumption and providing energy cost savings to Maine consumers.

These are critical co-benefits to the potential reductions in greenhouse gas emissions through reducing the usage of, and dependence on, fossil fuels for heating Maine homes and buildings.

While climate change is an imperative for developing a clean energy economy, Maine's projected employment decline over the coming decade—due to demographic trends that see a large swath of the workforce enter retirement age—the clean energy economy offers a long-term opportunity for attracting, retaining and growing a skilled, younger Maine workforce.

By committing to a set of targeted investments, policies, and workforce strategies that match the state's ambitious clean energy generation goals, and following through on the Climate Action Plan strategies to address climate change, Maine will experience immediate and long-term benefits for the people, the businesses, and the communities that already, and will in the future, call Maine home.

Advance Equity through Maine's Climate Response

> *"Like COVID-19, climate change has its worst effects on people who already have low health equity to begin with. Those who, for a number of reasons, don't have adequate opportunities to be healthier. Indeed, it's these health inequities themselves that contribute to placing individuals and communities at risk for the deleterious effects of climate change."*
>
> *Dr. Nirav Shah,*
> *Maine Center for Disease Control*
> *Maine Climate Council*

Like other dislocations and disruptions to society, from recessions to pandemics, climate change represents the greatest challenge to marginalized communities most vulnerable to its effects.

The highest costs of Maine's inaction on climate change will also be acutely borne by its most vulnerable, lower-income communities, which are most unable to recover from a disruption.

Floods affect more than buildings and infrastructure, they have devastating impacts on communities, businesses, and local economies, and public health. Low-resource and low-capacity communities will struggle to rebuild their livelihoods and economies if the infrastructure they depend on is not made resilient to sea level rise and storm activity to mitigate flooding risk.

At the same time, high heat days and nights are a health risk for Maine people, especially older and lower-income residents. Exposure to extreme heat is linked to a range of negative health outcomes, including heatstroke, exacerbation of existing respiratory and diabetes-related conditions, and effects on fetal health.

The cost to treat high heat risk is also expected to escalate. With treatment costs at $224,000 for two hundred cases of heat illness in 2019, and healthcare costs forecast to be nine to 14 times higher in 2050, heat-related illnesses could costing $1.9 million to $3.2 million annually, if hospital visits remain proportional to the number of days in Maine with a heat index over 90°F.

These are just two examples of climate change's unequal effects, and how Maine must calibrate its response to identify and promote solutions to help its most vulnerable populations. Deeply considering those impacts and maintaining an ongoing focus on issues of equity is therefore essential in Maine's response to climate change.

Throughout implementation of this Climate Action Plan, proactive engagement with diverse groups of Maine people and communities, especially those most impacted, is required for the development of effective programs and policies.

In addition, the establishment of a new **Equity Subcommittee** of the Maine Climate Council will support ongoing planning and implementation across Maine's climate strategies to ensure shared benefits across diverse populations of Maine people, including setting additional equity outcomes for proposed actions, and monitoring progress to ensure that programs and strategies reach intended populations and communities.

This effort is a direct response to the Equity Assessment of Maine's Climate Goals, which was conducted by the University of Maine's Mitchell Center for Sustainability at the request of the Maine Climate Council and the Governor's Office of Policy Innovation and the Future.

Where the Assessment offered specific considerations to address equity, these are highlighted throughout the Climate Action Plan. Where the Equity Assessment called for further analysis of equity impacts, the Equity Subcommittee's ongoing engagement with diverse communities will inform this work and ensure equity is a foremost consideration in development of climate policy and programs.

The Equity Assessment from the Mitchell Center states,

> "Maine is not only leading by example but it is also creating policies that will reduce emissions as well as enhance the lives and livelihoods of Maine people. This is laudable, and it is our hope that Maine can be a leader in both equitable emissions reductions, and adaptive capacity building.
>
> The creation of Maine's Climate Action Plan offers an opportunity for transformational change. Many of the strategies put forth by the Climate Council Working Groups would involve significant alterations, which are necessary both to reduce our state's greenhouse gas emissions and adapt to a changing climate.
>
> These strategies can also help alleviate inequality across the state if they target the needs of vulnerable citizens first. A more resilient Maine can also be a more equitable Maine, but climate action is not inherently just. With thoughtful analysis and deliberate action, the Maine Climate Council can recognize inequality, find the root causes, and seek to solve them using the strategies in the Maine Climate Action Plan."

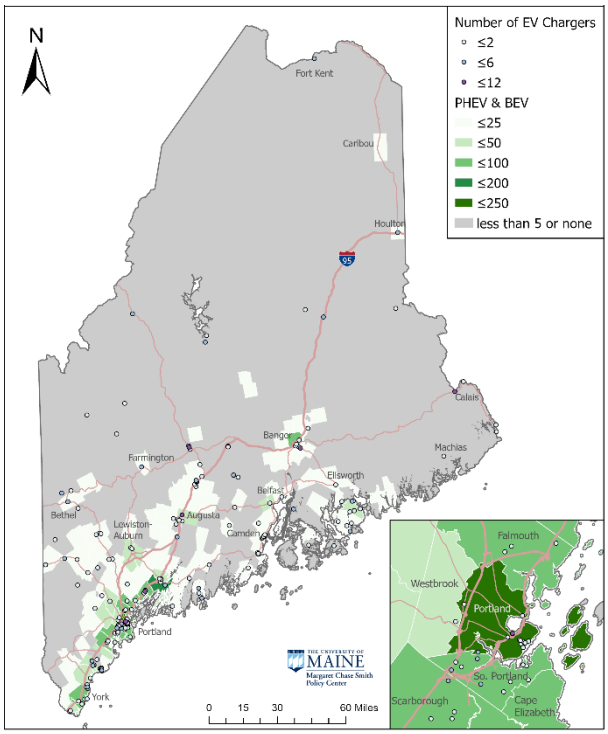
Strategy A: Embrace the Future of Transportation in Maine

Transportation is responsible for 54 percent of Maine's greenhouse gas emissions. To meet our emissions reductions goals by 2030 and 2050, our state must pivot to the future, by pursuing aggressive transition strategies and innovative solutions within this important sector.

When emissions are analyzed by vehicle type, 59 percent of Maine's transportation-related emissions are from light-duty passenger cars and trucks; 27 percent are from medium and heavy-duty trucks, and the remaining 14 percent come from rail, marine, aviation, and utility equipment vehicles.

We see the most significant reductions of greenhouse gas emissions in Maine's transportation sector emerging through large-scale electrification of our transportation system to support a growing number of electric vehicles, combined with strategies to reduce the number of miles Mainers drive, expand options and funding for public transportation, support development in pedestrian-friendly downtowns and village areas, and increase the efficiency of gas- and diesel-powered vehicles.

Figure 8: Plug-in Hybrids and Battery Electric Vehicles registered in Maine as of December 2019.



In addition to reduced carbon dioxide emissions to achieve Maine's emission reduction goals, there are also major health benefits associated with cleaner air from reduced transportation emissions, including reduced nitrogen oxides, sulfur dioxide, and particulate matter.

Maine's rural character and relatively low emissions from other sectors—like electricity generation—make our transportation emissions disproportionately high compared to other states. The average Maine vehicle travels approximately 12,000 miles per year. An analysis of vehicle miles traveled (VMT) in Maine has found that 65 percent of our driving occurs on rural roads, with 35 percent in urban and suburban areas. Most of these total miles are driven in the southern half of the Maine.

Maine's transportation emissions also include emissions resulting from visitors to Maine, of which there were an estimated 37.4 million in 2019 according to the Maine Office of Tourism. We should consider options to export emission reductions onto these millions of visitors, who generate emissions when they arrive and travel through Maine by road, air or rail each year, in order to help Maine meet its climate change goals and preserve the state for years to come.

The Equity Assessment prepared for the Maine Climate Council identified several considerations for transportation strategies, with an emphasis on ensuring affordability and access to emerging transportation options for low-to-moderate income Mainers.

These considerations included targeted emissions reduction incentives for low- to moderate income drivers, such as for purchasing new or used electric vehicles (EVs) or plug-in hybrid electric vehicles (PHEVs). Public and shared transit was noted for its importance to aging Mainers and Maine people without other transportation options, particularly in rural areas.

In addition, the Assessment highlighted how expanding broadband and online services serves a critical equity-creating role by bringing virtual educational, health and workforce opportunities to more people, while reducing the need for driving and therefore emissions to meet climate objectives.

1. Accelerate Maine's transition to electric vehicles (EVs)

- **To achieve emission reduction goals, there will be 41,000 EVs on the road in Maine by 2025, and 219,000 by 2030.**
- **By 2022, Maine will develop a statewide EV Roadmap to identify necessary policies, programs and regulatory changes needed to meet the state's EV and transportation emission reduction goals; including strategic planning, incentive programs, charging infrastructure, consumer engagement, as well as transition and equity considerations.**
- **By 2022, Maine will develop policies, incentives and pilot programs to encourage the adoption of electric, hybrid and alternative fuel medium- and heavy-duty vehicles, public transportation, school buses, and ferries.**

While battery electric vehicles (EVs) emit significantly less greenhouse gas emissions per mile compared to gas or diesel vehicles, EVs account for less than 0.5 percent of registered vehicles in Maine. However, the market for, and supply of, electric vehicles is expected to increase in coming years, due to advancements in technology, reductions in cost, and growth in consumer demand.

As technology advances and demand increases, barriers to broad EV adoption in Maine—such as vehicle range and cost—are being resolved, as EVs become more available and affordable. Already, the annual costs for charging an EV are lower than the annual costs for fueling a gasoline vehicle, and maintenance costs are significantly lower, often leading to lower lifetime costs overall for EVs.

Plug-in hybrid electric vehicles (PHEVs) can also be part of a potential transition to increased electric driving, with more and more vehicles on the market getting 20 – 100+ miles from their electric range.

EVs and other zero emission vehicles in the heavy-duty market are also a key target for emissions reductions, with early examples coming to Maine in late 2020 and early 2021. The heavy-duty market is important to long-term emissions reductions with evolving technology innovation with new electric and hydrogen technologies emerging in both national and international markets.

To outline a specific plan to accelerate the widespread adoption of EVs and other clean car technologies in Maine, an "EV Roadmap" will be completed by late 2021. This Roadmap will recommend incentive programs, regulatory changes, additional planning, and continued deployment of charging infrastructure to advance the state's EV goals and clean transportation transition.

Equitable access to EVs and PHEVs vehicles and charging is also key – ensuring all Maine people have access to these new, lower-emission transportation options that can save families money in operations and maintenance over time.

While federal tax incentives for many vehicles are attractive (at $7,500 for many EV models), additional purchase incentives and targeted program design, including enhanced rebates, supportive charging infrastructure, used clean vehicle options, and potential financing support, should be part of the roadmap planning, to ensure access, regardless of income and location.

The Future of Electric Vehicles

The electric vehicle (EV) market has witnessed rapid evolution in recent years, with improvements such as increased vehicle range, cheaper batteries, and wider availability of charging infrastructure. The rapidly evolving EV technology will be enhanced as automakers continue to commit to electrification, including U.S. car makers like General Motors investing $20 billion, $11.5 billion from Ford, and $35 billion from German automaker Volkswagen. EV adoption will be further enhanced through adoption targets established in a growing number of states; California is striving to reach 100% zero emission new car sales by 2035.

Experts anticipate EV prices to continue to decline over the next few years due to technological advancements and government policies and support; the Bloomberg New Energy Finance predicts that, the "price parity between EVs and internal combustion vehicles is reached by the mid-2020s in most segments".

EVs already offer significant cost savings over comparable internal combustion vehicles. A 2020 *Consumer Reports* study found that the owners of EVs are spending 50 percent less to repair and maintain their vehicles and 60 percent less to fuel their vehicles compared to similar internal combustion vehicles, with "most EVs offering savings of between $6,000 and $10,000" in their lifetime.

Electrification is not limited to the light-duty sector. Delivery companies like Amazon, UPS, and FedEx have shifted to electrify their delivery fleet, while other companies, like furniture giant IKEA, have directed their supply chain to "use electric vehicle or other zero-emissions solutions" for delivery.

Hydrogen has also been viewed as a viable option for where electrification is more difficult, such as long-haul freight and city buses. "There are dozens of fuel cell buses in use or planned" in several states and thousands of "fuel cell-powered forklifts in operation at warehouses and distribution centers across the U.S.", including Amazon and Walmart facilities. Excess renewable energy capacity from Maine's current onshore or future off-shore wind, solar, could be an opportunity for affordable clean-hydrogen production.

2. Increase fuel efficiency and alternative fuels

- **Maine will continue to support increased federal fuel efficiency standards.**
- **By 2024, Maine will significantly increase freight industry participation in EPA Smartway program.**

- **By 2024, local biofuel and biodiesel production and use in Maine transportation, especially heavy-duty vehicles, will increase** (*assuming Maine biofuels production becomes viable).*
- **Establish an incentive program to encourage drives to upgrade to higher-efficiency vehicles, targeted to low- and moderate-income drivers.**

With ambitious goals of widespread EV adoption in the light-duty vehicle market later in the coming decade, Maine must also seek to reduce transportation emissions from cars and trucks currently on the roads, where possible. An incentive program that encourages drivers to upgrade to higher-efficiency vehicles could drive emissions reduction in the short-term and create financial benefits for Maine drivers, especially those in rural areas, by reducing fuel costs. The program would provide incentives to income-eligible Maine households to purchase new and used fuel-efficient and hybrid vehicles.

In the heavy-duty freight transportation sector, EPA's SmartWay program helps improve efficiency and save money with new technologies such as aerodynamic design, low resistance tires, and reduced idling. Voluntary participation should be encouraged in Maine to significantly increase participation through loans or grants, by ensuring technology is available, and recognizing excellence within the program.

Maine should promote the increased production and use of biofuels. Unlike petroleum-based diesel, the biomass grown to sustain renewable biofuels will sequester much of the carbon emitted from the combustion and use of this fuel source, resulting in less carbon in the atmosphere over time. Limited production and lack of distributors in the state are currently a challenge. However, there is an economic opportunity for biofuels manufacturing in the state using Maine wood biomass. With future commercial production in Maine on the horizon, biofuels offer an opportunity for a renewable fuel source that supports Maine's forest products economy.

Federal fuel economy standards (the National Highway Traffic Safety Administration's [NHTSA] Corporate Average Fuel Economy [CAFE] standards) regulate how many miles vehicles must travel on one gallon of fuel and these standards have already led to emission reductions in Maine's transportation sector. The state should continue to support federal efforts to push ongoing improvement in national CAFE standards.

3. Reduce vehicle miles traveled (VMT)

- **Reduce light-duty vehicle miles traveled (VMT) over time, achieving 10% reductions by 2025, and 20% by 2030.**
- **Reduce heavy duty VMT by 4% by 2030.**
- **Deploy high-speed broadband to 95% of Maine homes by 2025 and 99% by 2030.**
- **Establish state coordination and strengthened land use policies and state grant programs to encourage development that supports the reduction of vehicle miles traveled by 2024.**
- **By 2024, increase public transportation funding to the national median of $5 per capita.**
- **By 2022, relaunch GO Maine to significantly increase shared public commuting options.**

By enabling and encouraging Mainers and visitors to drive less, while offering more alternative transportation options, we can reduce our greenhouse gas emissions.

Greater access to virtual work, medicine, education, and other opportunities that allow people to utilize online services without driving is key to this strategy. This action has assumed greater interest and relevance due to the COVID-19 pandemic and growing prevalence of remote work but is dependent on expansion of broadband internet access.

Expanding broadband is also a key recommendation in the state's 10-year economic strategy and was one of the top priorities identified by the Economic Recovery Committee to stabilize Maine's economy against the economic damage caused by COVID-19. These recommendations align with a recent finding that states one in six Americans is expected to switch to remote work for at least two days each week after the pandemic subsides, and that over 33% of U.S. companies say the practice will remain "more common" at their company after the pandemic is over.

Expanding public transportation and ride-sharing programs, such as the GO Maine commuter service and developing creative public transportation options in rural areas, can replace drive-alone trips and reduce household vehicle costs. Public-private partnerships like the Island Explorer in Acadia National Park can work for both Maine residents and decrease emissions from tourists.

Funding for public transit needs to increase, to make improvements necessary to expand participation and access for Maine people without other transportation options. Maine currently spends only 86 cents per capita on public transit, compared to the national median of $5 per capita.

Transportation emissions can be reduced when commuting is reduced. Development strategies that locate the services people need–like school, shopping and work—near where people live, reduce the need for driving. This facilitates walking and biking, and supports public transportation and ride-sharing. Co-benefits include improved public health, reduced costs of infrastructure, and aging in place.

Supporting development in Maine's village centers, cities, or rural crossroads would require effective local, regional, and state land use policies and could include encouraging state capital investments into affordable housing and schools, and safe pedestrian and bicycling infrastructure.

Strategy B: Modernize Maine's Buildings: Energy Efficient, Smart and Cost-Effective Homes and Businesses

Heating, cooling and lighting of buildings are responsible for 30 percent of Maine's greenhouse gas emissions. Maine can reduce greenhouse gases by modernizing our buildings to use cleaner energy, increase energy efficiency, and utilize lower carbon building materials.

Building codes to improve energy efficiency, heating and cooling homes and businesses with heat pumps and heat pump water heaters, and weatherization are among the most cost-effective ways to reduce greenhouse gas emissions. Promoting innovative wood products will reduce greenhouse emissions while supporting economic development in Maine's forest products sector. Implementing appliance standards will further reduce emissions.

These actions will make Maine's homes and businesses safer, healthier, more comfortable, and more affordable. Maine already has incentive programs for myriad efficiency measures such as heat pumps and weatherization that can be further expanded to achieve our goals.

Low-income households, and especially rural low-income households, often pay a higher percentage of their income to meet their home energy needs. To meet new plan goals, funding and program design should continue to expand to reach more Maine people, with special effort on targeting diverse communities and geographies, to reach Mainers with the greatest energy cost burdens.

Existing programs that target weatherization and heat-pumps installation for low-income groups has shown family savings and benefits for comfort. To ensure equity, additional financial incentives and installer capacity for low-income populations and underserved communities for weatherization, with special attention to how information about incentives is distributed, will be essential.

In addition, targeted programs that support weatherization and efficiency in affordable housing – both existing and new – along with new opportunities for renewable energy and electric vehicle charging in these locations will expand future options for residents and homeowners.

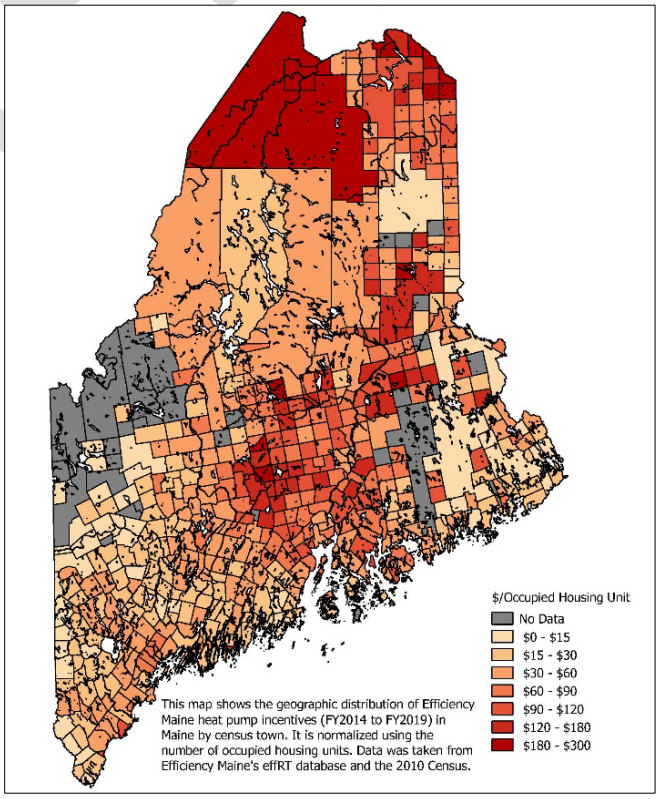
1. Transition to cleaner heating and cooling systems, efficient appliances

- **Install at least 145,000 heat pumps in Maine by 2025; by 2030, 130,000 homes will be using between 1-2 heat pumps and an additional 115,000 homes will be using a whole home heat pump system. At least 15,000 more heat pumps should be installed in income-eligible households by 2025.**
- **Implement Maine Appliance Standards requirements by 2022.**

Maine should encourage households, businesses and institutions to switch to cleaner heating and cooling systems. Nearly 70% of the fuels currently used for home heating in Maine are either oil or propane—the highest percentage in the country. There is a growing opportunity in Maine to transition to new technologies for heating that produce lower greenhouse gas emissions.

New high-performance electric heat pumps have 60 percent lower CO_2 emissions than oil burners. They are a cost-effective way to reduce emissions while saving homeowners money. Heat pumps have the added benefit of providing cooling in the summer months. These products have been shown to work well in the Maine climate, particularly as technology has continued to improve.

Figure 9: The Distribution of Heat Pump Incentives in Maine.



Annual operating costs of heat pumps are lower than for oil furnaces, saving consumers hundreds of dollars per year. Rebates available from Efficiency Maine can help to reduce upfront costs. To ensure equity, Maine should target financial incentives to those who most need the assistance to upgrade their heating systems.

With assistance from Efficiency Maine Trust incentives, more than 60,000 high performance heat pumps and 35,000 heat pump water heaters have been installed in Maine in the past several years. These are nation-leading installation results that will lower emissions and energy bills for Maine people.

Efficiency Maine Trust

Efficiency Maine Trust (EMT) is the independent administrator for programs to improve the efficiency of energy use and reduce greenhouse gases in Maine. By delivering education, training and financial incentives on the purchase of high-efficiency equipment or changes to operations, EMT helps Maine customers save electricity, natural gas and other fuels used in the state's economy. Funding for EMT programs comes from assessments paid by Maine's gas and electric utility ratepayers, revenues from the sale of interstate Regional Greenhouse Gas Initiative (RGGI) carbon allowances, the Forward Capacity Market payments at ISO-New England, settlements (such as the Volkswagen emissions cheating case), and government grants.

Efficiency Maine's current residential incentives include rebates for heat pumps and heat pump water heaters, and weatherization. Enhanced incentives are available for low-income households. For businesses, towns, institutions and manufacturers, EMT offers larger incentives to reduce the cost of energy efficiency projects as well as tailored energy efficiency and distributed generation projects that require site-specific engineering analyses.

Efficiency Maine also administers a suite of initiatives promoting electric vehicles and chargers. EMT plays a principle role in analyzing and promoting programs that promote distributed energy resources (DRE's) which distribute energy generation and energy storage to localized homes and businesses through a new program and process referred to as "Non-Wires Alternatives" which seek to avoid more expensive transmission upgrades.

Modern wood heating also presents an opportunity to support Maine's forest products industry while heating with a renewable Maine-grown heat source, as compared to oil or propane systems.

Appliance standards set performance requirements for home appliances, plumbing products, and lighting products in our homes and businesses. They can help Maine meet our greenhouse gas emission goals by reducing energy use or emissions. States can set standards for products not covered by national standards, which are set by the U.S. Department of Energy, such as computers, portable air conditioners, and water coolers. Maine should join with other U.S. states to adopt a consistent set of standards for appliances not yet covered by national standards. We can accomplish this by partnering with states who have already developed programs and standards.

Heat Pump Technology for Heating, Cooling and Hot Water

Modern heat pump technology can achieve exceptionally efficient heating (and cooling) powered by electricity, saving on monthly heating bills and reducing emissions. Heat pumps can be used for space heating in homes and businesses and for domestic hot water heating. A typical high-performance heat pump unit rebated through Efficiency Maine's programs can deliver a unit of heat with 60% less greenhouse gas emissions than an oil-fired furnace or boiler.

As the electric grid converts to renewable energy, the emissions reductions achieved by transitioning to electric heat pump will increase. Recent evaluations in Maine and Vermont confirm that high-performance heat pumps, engineered to operate in cold climates, can effectively deliver heat even when the outside temperature fall well below zero Fahrenheit. They also save homeowners, on average, from $300 - $600 per year in operating costs compared with common heating oil or propane costs.

Heat pumps may be effective for multiple types of heating and cooling scenarios. The most common configuration in Maine today is the installation of a "mini-split" ductless heat pump connected to one or more indoor heads, and retrofitting one or more units enables a home to displace all or a significant portion of the heating (and CO2 emissions). Other configurations include "whole-house" heat pump systems, which may use a central heat pump to distribute heating (and cooling) throughout the entire building using ducts or multiple mini-split units. A scalable system of ductless heat pumps can also serve a larger commercial space like an office building or a school.

A high-performance home unit costs between $2,500 and $5,000 installed, depending on the model and the complexity of the installation. Efficiency Maine offers rebates of between $500 and $1,000 per unit for most customers, and up to $2,000 for lower- and moderate-income customers, with additional support available for LIHEAP customers through Maine Housing programs. EMT incentives are also offered for heat pumps installed at businesses and public buildings.

Since Efficiency Maine started promoting heat pumps in 2013, more than 60,000 high-performance units have been installed across the state. During 2020 and despite a pandemic, the program is on pace to install more than 15,000 units, showing ongoing progress toward market transformation. The supply chain of manufacturers, distributors and Maine-based installers has ramped up capacity to meet the growing demand.

A similar story of market transformation is unfolding with water heaters. Last year Efficiency Maine's heat pump water heater initiatives rebated roughly 8,500 units, bringing the total installed over the last several years to 33,000 (including more than 3,000 installed in low-income households, at no cost to the customer). The geographic distribution of heat pumps and heat pump water heaters is widespread, with the highest percentage of incentives per home going to Northern Aroostook County.

2. Accelerate efficiency improvements to existing buildings

- **Double the current pace of state home weatherization programs so that at least 17,500 additional homes and businesses are weatherized by 2025, including at least 1,000 low-income units.**
- **Weatherize at least 35,000 homes and businesses by 2030.**

Many of the 550,000 existing homes in Maine are aging and energy inefficient. Maine should expand weatherization programs to reduce emissions and save home and business owners money on their utility bills by improving insulation and reducing air leakage.

Maine has successfully implemented weatherization programs to improve the energy efficiency of approximately 20,000 market-rate homes since 2010, and many thousands more through the low-income programs of Maine Housing and the Community Action Programs.

These programs should be accelerated and expanded to include commercial property owners, making thousands of homes and businesses more efficient and saving Maine people millions in savings in heating bills. Disclosure of energy usage in commercial buildings will also incentivize continuous improvements.

The U.S. healthcare sector is responsible for nearly 10% of all greenhouse gas emissions and hospitals make up more than one-third of those emissions. Given the importance of climate issues and health, public health professionals recommended that the state encourage incentives specifically targeted toward Maine's health care sector, supporting reductions of emissions and energy costs with efficiency and renewable energy investments.

3. Advance the design and construction of new buildings

- **By 2024, develop a long-term plan to phase-in modern, energy efficient building codes to reach net zero carbon emissions for new construction in Maine by 2035.**
- **Enhance existing training on building codes and expand these programs to support ongoing education of contractors and code enforcement officials.**

The most cost-effective time to improve a new building's energy efficiency is during the initial design and before construction.

To increase energy efficiency and reduce greenhouse gas emissions in the buildings sector, Maine should adopt more stringent building codes over time, reaching net zero emission building codes by 2035. Net zero buildings serve to combine energy efficiency and renewable energy generation to create homes with very low utility and operating costs and emissions. As a part of codes, transparency and disclosure requirements will support consumer information about building operational costs and incentivize high performance. Training for code officers and contractors to improve code compliance, and support for communities to improve enforcement will improve the effectiveness of the building code, and support Maine's builders and contractors.

4. Promote climate-friendly building products

- **Develop and enhance innovation support, incentives, building codes, and marketing programs to increase the use of efficient and climate-friendly Maine forest products, including mass timber and wood fiber insulation.**

Maine should promote the use of building materials such as mass timber and wood-fiber insulation. These innovative wood products reduce greenhouse emissions from the building sector, as wood products have lower "embodied carbon" values compared with steel, concrete, and many common

insulation products, while also supporting economic development opportunities in Maine's forest products sector.

The state should seek opportunities to use mass timber building technologies in state-funded construction projects and should also continue to support the recruitment of innovative wood-construction material manufacturing facilities to locate in Maine.

5. "Lead-by-Example" in publicly funded buildings

- **Use procurement rules and coordinated planning efforts for state government to promote high efficiency lighting, heating and cooling; climate-friendly construction materials; and renewable energy use for reduced operating costs and emissions. The state will produce a plan for action by February 2021.**
- **Enhance grant and loan programs to support similar efficiency and energy programs in municipal, tribal, school, and public housing construction and improvements. Provide recognition programs for those projects making outstanding efforts.**

The state should take a leadership role in reducing emissions from the buildings sector by requiring best practices in construction, including building materials selection, heating, cooling and lighting systems, and enhanced efficiency and weatherization.

This will save taxpayers money and show what modern construction materials, efficient systems and practices can achieve to reduce both emissions and the operating costs of state and local government buildings, schools, universities, and affordable housing.

"Lead by Example"

In January 2020, Governor Mills signed an executive order to require Maine state government to L*ead by Example* in investing in energy efficiency, renewable energy, and emissions reductions; promoting health and sustainability in the workplace; and building resilient infrastructure. State government will strive to equal or exceed Maine emissions reductions targets and seek cost efficiencies for taxpayers. State facilities will be designed with greater resilience to new climate conditions.

Maine joins more than 20 states whose initiatives achieve substantial cost savings and demonstrate energy and environmental leadership. *Lead by Example* programs raise public awareness of the ways that clean energy and energy efficiency technologies save public funds while reducing emissions, improving air quality, and encouraging markets for environmentally preferable products and services.

The state will prioritize energy and fuel efficiency when upgrading building systems such as lighting and heating, ventilation, and cooling (HVAC), install renewable energy and EV charging stations on state properties, and encourage telework to reduce vehicle miles traveled by state employees.

The state will identify opportunities to L*ead by Example* in the procurement of Maine-sourced and climate-friendly goods and services, such as carbon-storing mass timber for state construction projects, biofuels for state vehicles, and locally produced food. The state will also pursue efforts that lead to healthier workplaces and reduce solid waste from government facilities.

The state's *Lead by Example* projects will seek to support other public projects, including energy efficiency retrofits and renewable energy projects on municipal and tribal government properties, and climate-friendly practices and materials for school construction and affordable housing. Many Maine communities have led the way with efficiency, renewable energy, and transportation projects.

6. Renewable Fuels Standard (RFS)

- **Investigate options for establishing a Renewable Fuels Standard (RFS) for heating fuels.**

An RFS for the heating sector would require that a certain percentage of heating fuels be lower-carbon or carbon neutral in order to replace or reduce the quantity of fossil heating fuels in residential, commercial, and industrial sectors. This could encourage the development of renewable fuels and technologies in Maine, such as biofuels made from wood biomass, biodiesels from used vegetable oils, and fuels made from anerobic digesters on farms or in other waste environments. These projects would create jobs in Maine's rural communities and reduce both carbon and methane emissions, while reducing heating and operating costs. Maine should investigate the options for a RFS for heating fuels.

7. Replace Hydrofluorocarbons (HFCs) with climate-friendly alternatives

- **Adopt HFC phase-down regulations in 2021 to be implemented by 2022.**

Hydrofluorocarbons (HFCs) are referred to as climate "super-pollutants", or greenhouse gases with hundreds to thousands of times the heat-trapping power of carbon dioxide. HFCs are synthetic gases used in air conditioning systems, aerosol propellants, foam blowing agents, solvents, and flame retardants. These gases were first developed as alternatives to ozone-depleting chemicals, but their release to the atmosphere during manufacturing processes and leakage during use, servicing, and disposal of equipment poses a threat with significantly higher emissions. Maine should join other U.S. states and the international community to adopt a rapid phase-down schedule of the use of HFCs and replace them with climate-friendly alternatives where available.

Strategy C: Reduce Carbon Emissions in Maine's Energy and Industrial Sectors through Clean Energy Innovation

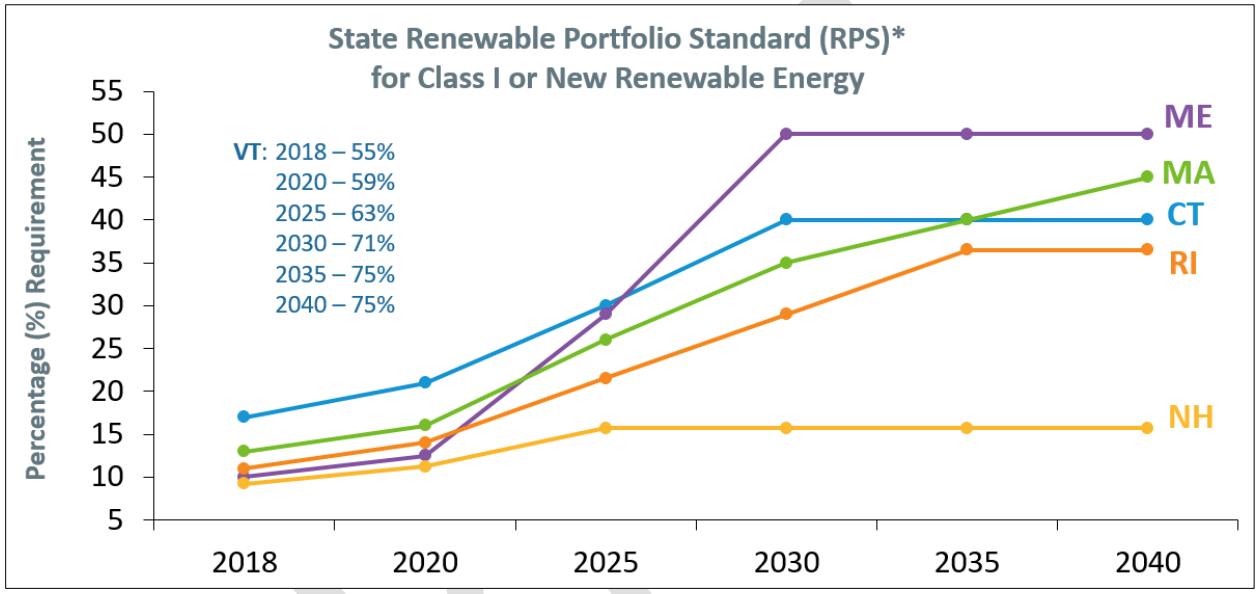
Sectors with high greenhouse gas emissions, such as transportation and heating, must shift their energy sources from fossil fuels to electricity and low-carbon fuels to achieve Maine's climate goals. This makes producing and consuming electricity that is increasingly clean and from low-carbon resources even more essential. This must be managed as effectively as possible in a manner that ensures affordability and reliability.

A renewable portfolio standard (RPS) establishes a percentage of electricity that a load-serving entity is required to provide from renewable resources. To encourage more generation of lower-emission electricity, Maine has increased the state RPS to 80% by 2030, with a goal of 100% renewable electricity

by 2050. Additionally, pairing energy storage with small distributed and large utility-scale renewable resources provides opportunities to maximize the value of renewable energy to our electric grid.

Figure 10 below from ISO New England, shows the percentage requirement from Class I (new renewable energy resources) and does not contain Class II (typically existing legacy resources) requirements of the states. Maine's current Class II requirement is 30%. With these two classes combined, it shows Maine will lead the region in clean power usage after 2025.

Figure 10: New England states' Class I Renewable Portfolio Standards (RPS). Source: ISO New England.



Maine's clean energy resources provide a significant opportunity to embrace energy innovations that can drive economic growth. As overall demand for electricity increases, continued efforts must also encourage energy efficiency, and support shifts of usage away from high-use periods through demand management and "load flexibility" strategies. This will not only make Maine's grid cleaner, but more reliable and affordable – key to ensuring a cost-effective transition to electrified heating and transportation sectors.

Reducing emissions and increasing energy generation in Maine carries important equity considerations. The Equity Assessment suggested that associated processes, procurements, and policies for clean energy development and deployment should seek price stability and affordability for all ratepayers.

Incentives that support targeted programs for low- to moderate-income access to cleaner, money-saving electrification technologies in heating and transportation will be key. In addition, focus on electric rate structure, charging availability, and diverse communications with trusted partners about program facts, savings, and opportunities will be essential to ensuring equity. Clean energy technology offers benefits for front-line communities like reduced pollution and job opportunities; meaning that to achieve equity outcomes, clean energy benefits should be targeted to communities who would most benefit.

1. Ensure adequate affordable clean energy supply

- **By 2030, Maine will have an electricity sector where 80% comes from renewable generation sources.**
- **Set achievable targets for cost-effective deployment of technologies such as offshore wind, distributed generation, and energy storage, and outline the policies, including opportunities for pilot initiatives, necessary to achieve these results.**

Maine will need to ensure adequate affordable clean energy supply to meet our 100% RPS goal and any increased load through the development of centralized generating resources, distributed energy resources, and other measures.

To ensure available resources, create new, or expand existing, clean energy procurements in 2021 and 2022 based on the results from the Governor's Energy Office report to the Legislature to be completed in January 2021. The state should also analyze how to achieve 100% clean energy earlier than the 2050 goal now in statute.

Maine should leverage this development of renewable energy resources to ensure the highest benefits for our residents and economy. This will require additional procurements of clean energy supply and could be supported through specific development targets for offshore wind, smaller distributed energy resources, and energy storage. We will also need to carefully consider siting concerns to minimize environmental and community impacts, by focusing on early engaging with key stakeholders and the public.

Research has demonstrated that renewable energy sources already can provide energy at a cost lower-than or comparable to non-renewable sources. And as renewable energy technology advances, the cost of renewable energy is expected to continue to decrease, ensuring lower and more stable energy costs for Maine's families and businesses.

Continued development of clean energy resources to meet the state's RPS and climate goals will create the opportunity for growth of a clean energy economy, including significant quality job creation. As Maine shifts to a cleaner power and heating sectors, efforts must be made to reduce negative impacts on workers in existing fossil fuel industries, giving careful consideration to support their transition.

Advances in Renewable Energy in Maine

Renewable energy technologies have advanced immensely over the last few decades to provide innovative clean energy solutions. These advancements, along with increased development of renewable energy projects, have resulted in lower cost, competitively priced renewable electricity generation and low-carbon energy sources.

The renewable energy sector in Maine has been experiencing growth, especially following the passage of numerous supportive clean energy policies in 2019. For example, solar energy generation, from small behind-the-meter to large utility-scale projects, has attracted significant investment and development interest. The majority of the over 500 MW of generation selected for the Renewable Portfolio Standard (RPS) procurement in October 2020 was large-scale solar projects. These selected projects were highly cost-competitive, with first-year energy prices averaging 3.5 cents per kWh.

Maine's Offshore Wind Clean Energy Opportunity

Offshore wind energy generation holds great potential in Maine; with some of the strongest offshore wind speeds in the country in the Gulf of Maine. Responsibly sited offshore wind represents a can both supply Maine's anticipated growing energy needs, while supporting significant economic opportunity.

As part of the state-initiated Maine Offshore Wind Initiative, Maine is working to position itself to benefit from future offshore wind projects, including opportunities for job creation, supply chain and port development, and offshore wind's impact on the state's energy future. To help fund this effort, the U.S. Economic Development Administration has provided the state with $2.2 million to develop a comprehensive roadmap that will build on Maine's national leadership on floating offshore wind reflecting the substantial work and research done in the state and Gulf of Maine.

This roadmap will assess Maine's competitive advantage on floating offshore wind and the state of associated supply chain, infrastructure, technology, and workforce opportunities. It will also identify gaps in infrastructure and investments needed to best position the state for these opportunities. Combined with the development of innovative floating wind turbine technologies—namely Aqua Ventus at the University of Maine—there is significant potential for homegrown offshore wind technology and related opportunity.

This roadmap, with the state's ongoing Offshore Wind Initiative, will take a thoughtful approach to identifying the best way to bring this powerful clean energy technology to the Gulf of Maine while minimizing impacts to existing ocean users, especially Maine's fishing industry, and maximizing economic opportunity.

2. Initiate a stakeholder process to transform Maine's electric power sector

- **Establish a comprehensive stakeholder process by 2022 to examine the transformation of Maine's electric sector and facilitate other recommendations of the Maine Climate Council.**

To meet Maine's greenhouse gas emission reduction targets, large portions of the energy used in the our economy will need to be converted from higher carbon-emitting sources, like fossil fuels, to electricity—a transition commonly referred to as beneficial electrification—and this electricity must increasingly come from cleaner generation sources. In addition, the way we use energy must change; instead of continually adding expensive infrastructure to meet peak loads, we can manage demand more wisely and improve markets to keep electricity affordable.

Beneficial electrification in heating and transportation may still require significant expansion and investment in Maine's electricity transmission and distribution system, or electric grid. Effective preparation for increased electricity usage requires increased energy efficiency efforts, thoughtful management of energy uses, modernization of the electricity grid, enhanced grid management systems, greater use of markets and aggregation, and accompanying statutory and regulatory policies to ensure that Maine's power sector evolves efficiently and affordably. These elements reflect a fundamental transformation of the electricity sector that is now underway nationally.

> ***Beneficial electrification:*** *Converting from higher carbon emitting sources, like fossil fuels, to electricity that is increasingly procured from clean, renewable resources will advance Maine's climate goals.*

Maine's stakeholder process will examine and provide recommendations regarding the transformation and planning of our electric sector to accomplish the recommendations of the Maine Climate Council, achieve Maine's greenhouse gas reduction requirements and clean energy goals, and help ensure that state's competitiveness well into the future.

The process will be managed by the Governor's Energy Office (GEO) in coordination with the Maine Public Utilities Commission (MPUC). Areas for consideration should include: utility structure, load management, data and information access, grid modernization and expansion, non-wires alternatives (NWA), interconnection, distributed energy resources, aggregation, equitable cost allocation, and rate design, integrated grid planning, regional and local electricity markets, regional collaboration, reliability and resiliency, and changes in law and regulation.

3. Accelerate emissions reductions of industrial uses and processes

- **Launch an Industrial Task Force to collaboratively partner with industry and stakeholders to consider innovations and incentives to manage industrial emissions through 2030 and reduce total emissions by 2050.**

Industrial facilities in Maine have historically participated actively in energy conservation programs; however, additional cost-effective opportunities remain to be pursued. Expanding programs like the industrial energy efficiency program offerings through Efficiency Maine Trust will encourage additional investments that will result in more competitive manufacturing businesses and reduce emissions.

Achieving deep emissions reductions in this sector by 2050 will likely require significant shifts away from petroleum based fuels to cleaner alternatives. Some fuel switching opportunities can be both cost-effective and reduce greenhouse gas emissions, such as converting from oil to natural gas and increasing efficiencies through combined heat and power technologies.

Emissions modeling also shows other greenhouse gas, non-CO2 emission sources, as reported in the "other" sector of emissions, which come from industrial processes, agricultural and landfill emissions and other types of waste. Stakeholders should also best practices and incentives to encourage mitigation of these emissions through innovation. Some of these same emission sources may provide unique opportunities for energy production – including biodigesters or landfill emissions capture technologies.

Many industrial facilities in Maine have already made these transitions in recent decades. Other opportunities, such as shifting to renewable fuels (e.g., hydrogen rich fuels produced using renewable

energy electrolysis or utilizing carbon capture and sequestration) are not yet widely commercially available or cost competitive, but they may be in the future. Longer term, investment in new technologies will support emission reductions, create new jobs, and secure current industries and employment by making Maine's industrial sector more competitive.

In an effort to stem future industrial emissions increases, and find innovative pathways for the long-term reductions required for Maine's 2050 goals, the Maine Climate Council should create an Industrial Task Force of Climate Council members with interest and expertise, and outside stakeholders, to focus on solutions to address industrial emissions over time, while supporting continued economic growth in this important sector.

4. Encourage highly-efficient combined heat and power facilities

> **Analyze policies, including the potential for long-term contracts, needed to advance new highly-efficient combined heat and power (CHP) production facilities that achieve significant net greenhouse gas reductions.**

Combined heat and power (CHP), sometimes referred to as cogeneration, is the production of both electricity and thermal energy, at the same location of the energy consumption. Where typically the heat produced by electricity generation is lost to the air, CHP facilities utilize the heat by-product for on-site activities, resulting in increased overall efficiency.

Highly-efficient CHP facilities capture heat from electricity generation to provide steam or hot water for use in space heating and cooling, water heating, and industrial processes, thereby increasing overall facility efficiency and reducing emissions. CHP avoids energy waste, reducing the need for additional energy consumption to accomplish heating and industrial processes. CHP can both reduce Maine's emissions and support existing industrial businesses and large institutions with lower operating costs.

CHP facilities can also offer equity benefits. The Equity Assessment pointed by that these projects, while benefitting all Maine ratepayers, often carry associated benefits to the rural communities in which they are usually located, by supporting local jobs and energy production.

Maine sawmills and wood manufacturers, for example, have installed boilers to provide steam for drying lumber are increasingly investing in CHP facilities that also generate power from the same wood fuel source. Technological advances are allowing smaller facilities the ability to install efficient burner technologies. These opportunities establish greater efficiencies in wood-derived energy and provide markets for mill waste that might otherwise be landfilled and decompose. These same facilities see opportunities to use the CHP energy platform to refine wood into biofuel and biochar products that could also support further reductions in emissions.

Maine should continue to support the growth of highly-efficient CHP facilities, including through the long-term contracting authority of the Maine Public Utilities Commission.

Strategy D: Grow Maine's Clean Energy Economy and Good Jobs and Protect Our Natural Resource Industries

Climate change threatens vital natural resource sectors of Maine's economy, like our forestry, farming, and fishing industries. Climate change will also impact community and economic infrastructure and leading economic sectors like tourism and hospitality – as sea levels rise and warming winters impact iconic Maine places and seasons.

Some of these same sectors also have new opportunity in the response to climate change. Locally-grown food offers economic development, emissions reductions, and increased sequestration through good soil practices. In the forestry sector, innovative technology can reduce emissions and support carbon neutrality goals.

Transitioning to cleaner energy generation and greater energy efficiency offers exciting new economic opportunity. Maine currently spends roughly $4.4 billion annually on fossil fuels. Keeping those energy dollars currently sent out-of-the-state for the purchase of imported fossil fuels in Maine through clean energy solutions can have a transformative economic impact, while significantly reducing emissions.

Growth in Maine's energy and efficiency sector will require a skilled workforce, creating good career opportunities for thousands of Maine people, especially when paired with focused education and training opportunities, and policies and incentives that reward quality jobs with family-supporting wages and benefits.

Equity considerations for the clean energy economy include ensuring broad access to job opportunities and important career training pathways into this growing fields, supporting the transition for fossil-fuel based industries, businesses and workers and ensuring stability of careers in natural resource-centric fields that are critical supports for rural communities. The public health benefits from transitioning to clean energy sources is also a positive benefit for all Maine people, but especially impactful for communities located near power generation sources.

1. Support Maine natural resource economies' ability to adapt to climate change impacts and take advantage of new market opportunities.

- **Grow Maine's forest products industry from an $8 billion dollar a year industry to $12 billion, through bioproduct innovation, meeting goals for industry growth and sustainable forest management.**
- **Increase the amount of food consumed in Maine from state farmers and harvesters from 10% to 20% by 2025; and 30% by 2030 through local food system development.**
- **Establish the University of Maine as the coordinating hub for applied research on forestry, agriculture, and natural land-related climate concerns, including research and development of climate-friendly bio-based wood market innovation; ensuring collaboration with other climate related monitoring and research efforts through the state, university and private institutions.**
- **Launch the Maine Business Seafood Council by 2022.**

Technical assistance and financial incentives will help Maine's fishing and aquaculture, farming, and forestry businesses and landowners prepare for the rapidly intensifying impacts of climate change.

Maine should provide clear information, forecasts, and tools about climate change impacts that are relevant to business planning, operations, and management.

New markets will offer new economic opportunities and create jobs. Together, these strategies will help build resilience within Maine's natural resource industries, while also helping to sequester more carbon by maintaining industries that support the stewardship of Maine's natural and working lands and waters.

Forests: Maine's forests cover 89% of the state and support an important forest industry sector that has at least an $8 billion dollar direct economic impact. Global trends for innovative, climate-friendly products offer new markets to diversify and grow Maine's forest products industry.

Maine should develop and enhance marketing programs for Maine forest products, in coordination with efforts such as ForMaine, focused on products such as mass-timber, biofuels, bioplastics, nano-cellulosic materials and wood-based insulation products. State construction projects should leverage opportunities to use mass timber and encourage related manufacturing facilities to locate in Maine. The state should continue to invest in the University of Maine research facilities to become a globally recognized hub for climate-friendly bio-based wood market innovation.

Maine's Forest Bioeconomy and Climate Change

Public awareness of global climate change has driven governments, consumers, and manufacturers to recognize that products produced with plant materials (cellulose) can be used to replace those made with petroleum products. The growing of biomass to replace plant materials used to produce these products will decrease greenhouse gases in the atmosphere over time through sequestration.

Growing world-wide demand for sustainably produced climate-friendly products is one of the greatest opportunities recognized by the industry-led effort to build a globally competitive forest industry, called FOR/Maine.

A bioeconomy strategy for Maine relies on diversification of our forest economy through the pursuit of the best and highest use for every part of the tree, resulting in greater environmental and economic resilience and the reduction and repurposing of waste.

Innovative new products include cross-laminated timber, a building material for multi-story building that stores carbon for the life of the building; the use of wood cellulose in building insulation products as a replacement to petroleum dependent fiberglass insulation; biodegradable and recyclable food packaging paper that replaces single use plastic; and transportation and heating biofuels derived from woody biomass.

Farms: Maine should provide clear information, forecasts, and tools about climate change impacts that are relevant to farm business planning, operations, and management.

A strong local food system will support Maine farmers and food producers and resilient Maine communities. Maine should provide financial support to strengthen Maine's food systems, so that more food can be produced and processed in state and distributed efficiently and affordably. This also includes promoting research, development and planning efforts that support the growth and stability of Maine food systems.

Approximately 10% of the food that Mainers consume is produced in our state, possibly even more than that since impacts of COVID-19 on markets accelerated interest in Maine-grown food. Recent legislation directed the Department of Agriculture, Conservation and Forestry to increase state purchasing of Maine-grown food, and to support institutions purchases in reaching the goal of purchasing 20% of the food they procure from Maine producers by 2025. Regional efforts to plan for strong local food systems across New England have set goals of increasing consumption of locally and regionally produced food to 35% by 2035 and 50% by 2050.

Maine should play an important role in achieving those goals due to our strong agricultural land base and agricultural and fishing sectors compared to other New England states.

Fisheries and Aquaculture: Maine should closely monitor species and habitat changes and provide information about ocean temperature, salinity and acidity changes at the local level to support fishing and aquaculture businesses.

Managing for resiliency of Maine's marine fisheries and aquaculture industries in the context of changing ecosystems and climate change adaptation includes both market support to support more stable businesses, as well as regulatory and policy changes.

A proposed Maine Seafood Business Council will work with Maine's seafood harvesters, shoreside businesses, and working waterfronts to provide them with access to information and tools to support operational decisions, capital investments, and long-range planning to implement climate adaptation and mitigation strategies.

To support diverse markets for Maine fishermen and aquaculture businesses, Maine should expand local and direct marketing opportunities for sustainably produced Maine seafood. Increased local consumption of Maine seafood is an important piece of strengthening our local food systems.

State support for the growing aquaculture sector can serve to increase Maine seafood production, provide important economic opportunities for coastal communities, while also harnessing potential ocean acidification mitigation and other environmental services -- especially with crops like seaweed and kelp (that can lower the acidity of surrounding waters), and shellfish, which are known to improve water quality. Technical assistance, financing tools and policy strategies will be needed to help fishing and aquaculture businesses plan for and transition activities in a changing ocean ecosystem.

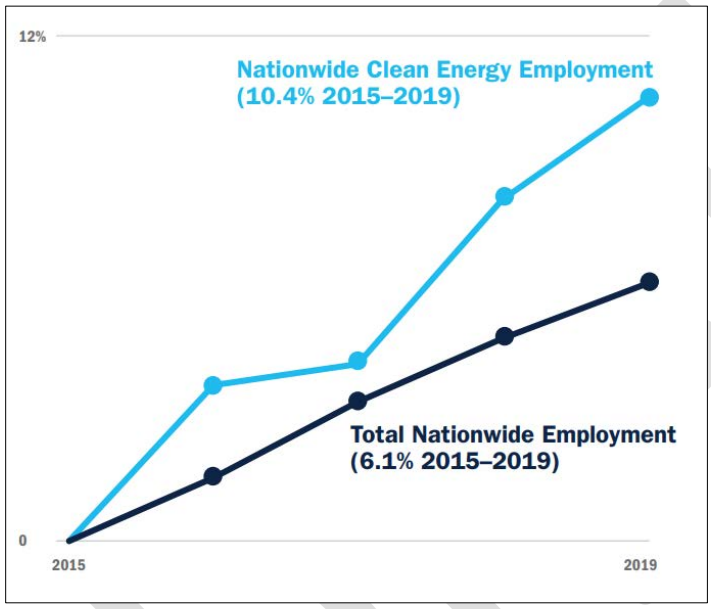
Maine should continue to evaluate and implement changes to Maine's fishery and aquaculture laws and regulations that provide the opportunity to address environmental change and emerging fisheries. And with both federal regulation and co-management roles, partnership and advocacy in regional and federal contexts will also be required.

2. Clean energy jobs and businesses in Maine

- **By 2022, launch a workforce initiative that establishes ongoing stakeholder coordination between industry, educational, and training organizations to support current future workforce needs.**
  By 2022, establish programs and partnerships for cleantech innovation support within the state to encourage the creation of clean energy and climate solutions.

Maine's climate goals and renewable energy policies mean that our clean energy sector is poised for robust growth. A supporting report to this Plan, *Strengthening Maine's Clean Energy Economy*, describes the opportunity to create economic recovery and good jobs in this fast-growing sector, and outlines the specific targeted investments, policies, and workforce training strategies that will be needed.

Figure 11. Clean Energy Employment.

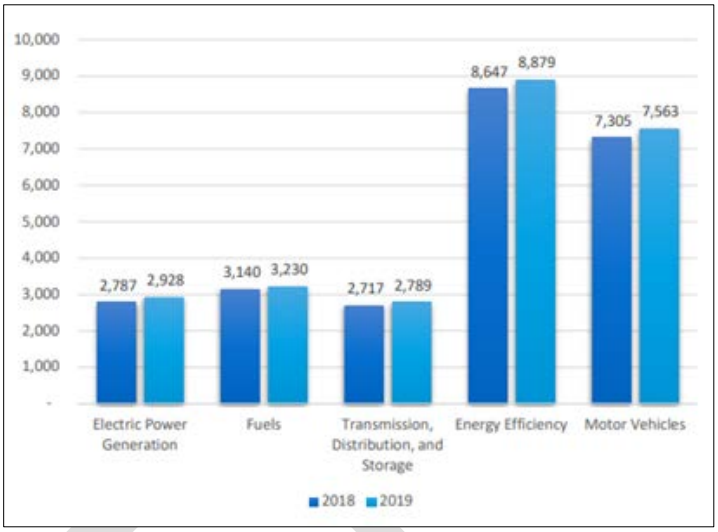


Nationally, the clean energy economy is growing faster than the economy as a whole. Between 2015-2019, the U.S clean energy sector added jobs faster than the rest of the U.S. economy.[2] The plan finds that median U.S. hourly wages for clean energy jobs are about 25 percent higher than the median wage. Clean energy careers also offer a higher prevalence of health insurance and retirement benefits.

[2] E2. *Clean Jobs America 2020: Repowering America's Economy in the Wake of COVID-19.* April 2020. Retrieved from https://e2.org/wp-content/uploads/2020/04/E2-Clean-Jobs-America-2020.pdf

In Maine, there were approximately 14,000 clean energy worker employed in 2019. Of that, nearly 8,900 people are employed in energy efficiency jobs, roughly the same as the total number of people employed in traditional energy jobs including electric power generation, fuels, and transmission, distribution and storage combined. From 2018 to 2019 in Maine, all sub-sectors within the energy industry experienced job growth.

Figure 12. Employment by Major Energy Technology Application.



At the same time, Maine is projected to lose overall employment in the next ten years due to demographic trends as older workers retire. The clean energy industry can help attract younger workers – both from within the state and outside of Maine.

The plan recommends that Maine commit to increasing its current clean energy workforce, while establishing new supply chains for Maine-based manufacturers to create sustained, good-paying skilled labor jobs across the state.

Workforce is the key component of Maine's transition to a clean energy economy. By supporting educational and training paths for Maine people to find new careers, and attracting a talented, diverse workforce to Maine, the clean energy industry has the potential to create new, sustained opportunities in sectors such as solar, wind, bioproducts and energy efficiency that are poised for major growth in the coming decade.

Specific recommendations to support the growth of Maine's clean energy economy and workforce include:

- **Continue to create and implement clean energy policies that are clear and consistent, provide certainty for ongoing development, and specifically focus on creating quality jobs;**

- **Attract and develop the workforce required for Maine's clean energy future with the following**:
  - Support and promote Science, Technology, Engineering, Arts, and Math (STEAM), Career and Technical Education (CTE) and Maine Community Colleges to provide pathways for Maine youth and residents to find fulfilling and quality job opportunities;
  - Promote and encourage training opportunities and industry participation as an avenue for skilled jobs in Maine to benefit participants as well as employers;
    Prompt industry to provide their own training or associated apprenticeship programs and job opportunities in coordination with existing training programs and needs;
  - Support existing programs and incentives, identify gaps and develop new programs, as needed, to create opportunities that assist and incentivize Maine workforce in growing the clean energy sector;

- Attract companies and workers looking to start or locate a company, conduct market research, develop innovative solutions, work for or partner with Maine companies, and create jobs through a diverse marketing plan to grow the state's economy and support workforce needs; and
- Launch a workforce initiative (led by the Governor's Energy Office and in partnership with the private sector) that: (a) creates an online database and resource for connecting job opportunities in clean energy with potential hires in order to streamline the job search process, and identifies training and educational opportunities, and (b) establishes ongoing stakeholder coordination between industry and educational and training organizations to understand and support future workforce needs.

- **Support a growing clean energy innovation ecosystem, encouraging investment dollars from the public and private sector for climate and clean energy focused products and services.** By increasing investment in cleantech innovation and continuing to expand the entrepreneurial ecosystem, Maine can support the development and commercialization of innovative products and services that will provide cost-effective clean energy solutions. The state should provide support to companies pursuing funding opportunities. **Investing in broadband expansion will** support business success and growth, as well as provide the platform for innovative clean energy and grid management solutions. This means achieving the state's goal of 95% broadband deployment by 2025, and striving to serve 99% of the state by 2030 with high-speed access.

- To ensure **equity of job opportunities, affordable energy, and public health benefits across the state, as well as just transition considerations** for those who may face adverse impacts as the state transitions to a clean energy economy, the plan recommends the following:
  - Include equity and cost considerations in the support and development of energy programs, particularly those targeted at low to moderate income households, to aid in decreasing overall energy burdens and shift towards low-carbon heat and energy sources;
  - Support policy solutions that ensure fair distribution of benefits within the state and access to those associated benefits across all communities; and
  - Identify opportunities to create programs that will assist traditional energy companies in transitioning to clean energy economy of the future.

The plan highlights the importance of encouraging efforts to target the creation of these high-quality job through strategies that pair job quality standards with clean energy investments. Some of these may include prevailing wages, project labor agreements, safety and health protections, community benefit agreements, registered apprenticeship utilization, and local hire provisions. Domestic content requirements can also assist in building local supply chain opportunities. These, and other related requirements, should be considered when developing clean energy projects and relevant policies.

Rebuilding Our Economy and Tackling Climate With Shovel-Ready Infrastructure Projects

Investments to prepare our communities and infrastructure for climate change impacts will create thousands of good paying jobs in the engineering, design, and construction sectors. Investing in shovel-ready projects during a time of significant economic hardship can help revitalize Maine's economy in the short and long term, while also making our communities and state infrastructure systems more resilient.

Maine should develop a list of climate-related infrastructure projects in early 2021 to utilize for near-term economic recovery, and track over the long term to identify backlogs. Maine communities and the state have already identified critical infrastructure projects related adapting to and reducing climate change impacts. Many of these projects do not have the necessary funding. This includes a backlog of $325 million in infrastructure projects that local communities have identified to reduce disaster risk.

Much-needed pre-development assistance would help ensure that infrastructure projects are made shovel-ready for state or federal support including design, engineering, and permitting; grant writing; and matchmaking with investors for public-private partnerships.

Strategy E: Protect Maine's Environment and Working Lands and Waters and Increase Carbon Sequestration

Climate change and development are harming Maine's natural and working lands and waters, which are key to the state achieving its carbon neutrality commitment by 2045.

By current estimates, Maine loses approximately 10,000 acres of natural and working lands to development each year – a figure which is projected to grow in coming years. This development is a direct source of carbon emissions and hinders the growth of natural climate change solutions, such as powerful carbon storage potential. Maine's forests alone can draw back, or sequester, an amount equal to at least 60 percent of the state's annual carbon emissions, a figure that rises to perhaps 75 percent if forest growth and durable products are included.

Protecting natural and working lands from development maintains their potential to draw back carbon from the atmosphere, as well as provide important co-benefits. In addition to storing carbon, Maine's natural and working land support our farming, forestry, and outdoor recreation industries. They provide clean drinking water, important wildlife habitat, and help moderate flooding events.

Maine's coastal and marine areas also store carbon, while supporting our fishing, aquaculture and tourism industries. Coastal and marine areas face rising sea levels and other climate change impacts, which could turn these areas from sinks of carbon, into sources of carbon. Maine's coastal sand dunes, wetlands, and marshes are also a powerful natural climate solution for protecting our coastal communities from flooding and erosion. Conserving and restoring coastal and marine areas will preserve their carbon storage value as well as their other benefits.

In addition to storing carbon, Maine's natural and working land support our farming, forestry, recreation, and tourism industries. Maine's coastal and marine areas support fishing and aquaculture. They provide clean drinking water, important wildlife habitat and Development of natural and working lands draws down decreases these co-benefits, while also harming their potential to draw back carbon from the atmosphere.

Financial incentives and technical assistance are required to support foresters, landowners, loggers, farmers, fishermen and communities to reduce emissions, increase their resilience to climate change, and implement enhanced opportunities for carbon storage initiatives.

Improved monitoring of these lands and waters, and better sharing of that information, will serve to support practitioners in making proactive, informed decisions to combat climate change.

1. Protect natural and working lands and waters

- **By 2030, increase the total acreage of conserved lands in the state to 30% through voluntary, focused purchases of land and working forest or farm conservation easements** (*staff will add estimate of additional acres to meet 30% of land area– number being fact checked*).
    - **Additional targets should be identified in 2021, in partnership with stakeholders, to develop specific sub-goals for these conserved lands for Maine's forest cover, agriculture lands, and coastal areas**
- **Focus conservation on high biodiversity areas to support land and water connectivity and ecosystem health.**
- **Revise scoring criteria for state conservation funding to incorporate climate mitigation and resiliency goals.**

Forests and Farms: Protecting natural and working lands is critical to maximize carbon storage, support working farms and forests, ensure valuable ecosystems remain in place for future generations, and contribute to Maine's fight against the effects of climate change.

Conserving forests and farmland through conservation easements is one of the more cost-effective strategies to help reach carbon neutrality by maintaining forest cover and ensuring the lands will be available for future timber harvesting and farming.

A combination of voluntary, focused purchases of working forest or farm conservation easements and lands will support robust forest products and agricultural economies, increase carbon storage opportunities, help food security, conserve biodiversity, and enhance climate adaptation and resilience for wildlife, people, and communities.

To that end, Maine should support dedicated and sustained sources of funding to protect natural and working lands. This should prioritize providing state matching funds for the newly renewed federal Land and Water Conservation Fund for state projects.

Coastal and Marine: Along the coast, protecting and restoring coastal and marine ecosystems benefits biodiversity, protects our communities from the impacts of climate change, and stores carbon. Sand dunes and beaches, seagrasses, and tidal salt marshes act as natural barriers to waves. Protecting floodplains, wetlands, and streams helps to reduce flooding damages.

Maine should ensure a network of biologically and geographically diverse lands, which are well connected, to allow plants and animals to move across the landscape to find the places they need to thrive as these habitats change over time.

2. Develop new incentives to increase carbon storage

- **By 2023, the Maine DEP will conduct a comprehensive, state-wide inventory of carbon stocks on land and in coastal areas to provide baseline estimates for state carbon sequestration, allowing monitoring of sequestration over time to meet the state's carbon neutrality goal.**
- **By 2022, Maine will establish a stakeholder process to develop a voluntary, incentive-based forest carbon program (practice and/or inventory based) for woodland owners of 10 to 10,000 acres and forest practitioners.**
- **Maine will engage in regional discussions to consider multi-state carbon programs that could support Maine's working lands and natural resource industries, and state carbon neutrality goals.**
- **By 2022, Maine will develop policies to ensure renewable energy project siting is streamlined, transparent and thoughtfully balances potential impacts on working land, engaging key stakeholders.**

With most of Maine's working lands privately owned, policies and incentives for landowners to improve land management are needed to maximize natural carbon sequestration and meet Maine's climate change goals and objectives. Opportunities to incentivize carbon storage in Maine's coastal and marine areas should be analyzed.

Additional attention needs to be focused on policies to ensure renewable energy project siting is streamlined, transparent and thoughtfully balances potential impacts on working land, engaging key stakeholders.

In coming years, Maine will engage in regional discussions to consider multi-state carbon programs that could support Maine's working lands and natural resource industries, and advance the state carbon neutrality goals. Careful study of the impact of out-of-state carbon markets and the impact they could have on Maine's sequestration targets; and potential regional concepts that could support state and land-owner goals should be evaluated.

Forests: Financial incentives should be developed to encourage the adoption of climate-friendly practices and investment in new technologies. Updating Maine's land taxation policies, including updating the Open Space Current Use Taxation Program and maintaining the Tree Growth Tax Law, could provide incentive for landowners to adopt land management practices with climate mitigation and adaptation benefits to increase carbon storage.

In addition, Maine should establish a stakeholder process to develop a voluntary, incentive-based forest carbon program (practice and/or inventory based) for woodland owners of 10 to 10,000 acres and forest practitioners to increase carbon storage in Maine's forests and encourage good forest management practices while maintaining current timber harvest levels.

Incentivizing high quality on-the-ground performance by loggers and facilitating the use of low-impact timber harvesting equipment would also support progress toward achieving climate goals.

Farms: Incentives to adopt climate-friendly agricultural practices that focus on soil health -- cover cropping, reduced tillage, and rotational grazing – will help sequester carbon on Maine farms, while improving water holding capacity and preventing soil erosion, which will help farms to be more resilient in the face of droughts or extreme weather events. Funding for farming infrastructure and technology upgrades, such as renewable energy generation and reduced fossil fuel usage, can also reduce greenhouse gas emissions attributed to agriculture.

Existing state programs, policies, and financial incentives should be updated and refocused to address climate change mitigation and resilience. This includes continuing and updating climate-friendly public land management practices and incentive programs to incorporate current climate science and support landscape and species resiliency.

Coastal and Marine: Since coastal and marine environments can store more carbon per unit area than either farms or forests, Maine's approximately 5,000 miles of total coastline is a prime opportunity to create long-term "blue carbon" storage that requires protection from development and sea level rise.

Maine should determine where and how much "blue carbon" can be stored by conducting a comprehensive coastwide survey of coastal environments like salt marshes, seaweeds, and seagrass beds. The state should also explore the opportunity for formal blue carbon storage incentives or carbon permit program to encourage blue carbon habitat conservation and restoration.

3. Expand outreach to offer information, technical assistance

- **By 2024, increase technical service provider capacity within the Department of Agriculture, Conservation and Forestry Maine Forest Service, Department of Inland Fisheries and Wildlife, and the Department of Marine Resources.**
- **By 2024, launch the Coastal and Marine Information Exchange.**

By reaching out to communities and stakeholders to offer information and technical assistance on adopting natural climate solutions, Maine can help increase carbon storage and protect Maine's natural and working lands and waters from the effects of climate change.

Increasing the number of field foresters at Maine Forest Service should support landowner and land-manager adoption of climate-friendly practices, as well as efforts to support good forest management practices.

Natural climate solutions, such as soil health practices, should be priorities for federal and state agricultural programs. Technical assistance to farmers via Soil and Water Conservation Districts, the University of Maine Cooperative Extension, Natural Resources Conservation Service (NRCS), and other non-governmental organizations about agricultural practices with mitigation and adaptation benefits should be made more widely available.

The state's "Beginning with Habitat" program at the Department of Inland Fisheries and Wildlife and "Maine Natural Areas Program" at the Department of Agriculture, Conservation and Forestry should be enhanced to support technical assistance to towns, land trusts, land managers and landowners to protect native species, conserve land and waters vulnerable to climate change, and address climate-related threats such as invasive species.

A new Coastal and Marine Information Exchange should be created by the state or supporting entities to provide accessible and relevant information and decision support to facilitate climate mitigation and adaptation in Maine's coastal communities and industries.

4. Enhance monitoring and data collection to guide decisions

- **Establish a "coordinating hub" with state and non-state partners for key climate change research and monitoring work to facilitate state-wide collaboration by 2024.**
- **Create the framework and begin pilot for a coordinated, comprehensive monitoring system by 2024.**

While Maine needs a comprehensive strategy for monitoring and gathering data on a variety of climate change related effects, special attention must be paid to both inland and marine ecosystems in order to understand impacts, identify future trends, and make adaptive decisions. This should also include tracking the economic and social conditions in Maine's natural resource dependent communities.

While Maine needs a comprehensive strategy for monitoring and gathering data on a variety of climate change related effects, special attention must be paid to both inland and marine ecosystems in order to understand impacts, identify future trends, economic and social conditions – all to encourage improved and adaptive local decision making.

Research and development of greenhouse gas mitigation and adaption land practices will support Maine's agriculture and forestry sectors, including how to maximize stand carbon dynamics, forest soils, agricultural soils, and coastal environments to sequester carbon.

The state should promote and encourage economic and ecological research that seeks to find a role for carbon storage, especially in the agriculture and forestry industries. There are significant research needs associated with the development of new wood-based products as well as continued development and planning efforts supporting the growth and stability of Maine food systems.

In the marine realm, tracking marine and coastal habitats and species, including economically important, at-risk, and invasive species will inform improved management practices, planning, and restoration priorities. Monitoring should include temperature, oxygen and ocean acidification.

Lastly, a comprehensive Maine carbon cycle analysis is needed for the state to understand and track its progress towards carbon neutrality and allow for accurate future participation in carbon-offset markets.

Strategy F: Build Healthy and Resilient Communities

As Maine reduces greenhouse gas emissions to combat climate change, we must also respond to climate effects either occurring now or expected soon. State support for communities to be proactive about understanding, planning and acting to reduce their risk from climate change is essential.

This support should focus on areas like emergency management, economic development, public health, transportation systems, energy systems, and infrastructure, and promote regional and municipal

collaboration to offer technical assistance, funding, updated land use planning, as well as expanded public health efforts.

Enhanced coordination of assistance and funding for community resilience will require meeting the needs of Maine's diverse communities, including small towns, large cities, coastal and inland communities. This includes making consistent and actionable climate data, tools, and guidance accessible; guiding and incentivizing towns toward activities that enhance community resilience; and funding the planning, implementation, and performance evaluation of resilience activities.

An important component of this assistance is the expansion of guidance products that help communities evaluate climate risk, understand their options, and prioritize actions. This includes case studies, best practices and lessons learned, and peer to peer learning opportunities.

Maine should ensure that the lowest capacity and most vulnerable communities are able to participate; the Equity Assessment also advises meaningfully engaging a broad number of stakeholders into planning processes to ensure a variety of perspectives inform climate planning, and to ensure equitable outreach to populations at risk from climate impacts, particularly emergency situations.

This outreach has been identified by the Equity Assessment as important for public health, where strategies to create and disseminate information about public health risks in a variety of forms, languages and mediums can lead to greater overall awareness, education and acceptance. Enhanced public health is also seen as a key consideration for workers in largely outdoor professions (such agriculture or forestry) who have a higher likely exposure, and vulnerability, to climate effects.

1. Empower local and regional community resilience efforts

- **Provide robust technical assistance and funding to communities by 2024 to support local and regional climate resilience initiatives**

Maine communities are coping with a variety of difficult and threatening challenges. Some are climate-related, others like COVID-19 are not. To thrive within continuous change and multiple, overlapping crises, communities must become proactive in understanding their risks, planning, and taking actions to safeguard their citizens.

"Resilience" will have different meanings to different communities, but generally the foundation of community resilience includes: 1) planning and decision-making processes that absorb information about climate and health risks and evaluate options for action; 2) individuals, committees, or offices in municipal and tribal governments who are responsible for planning, implementing, and monitoring the activities that reduce climate risk, improve health, and build the community's capacity to manage crises; and 3) community dialogue and participation that ensures the voices and needs of the most vulnerable citizens are elevated and prioritized.

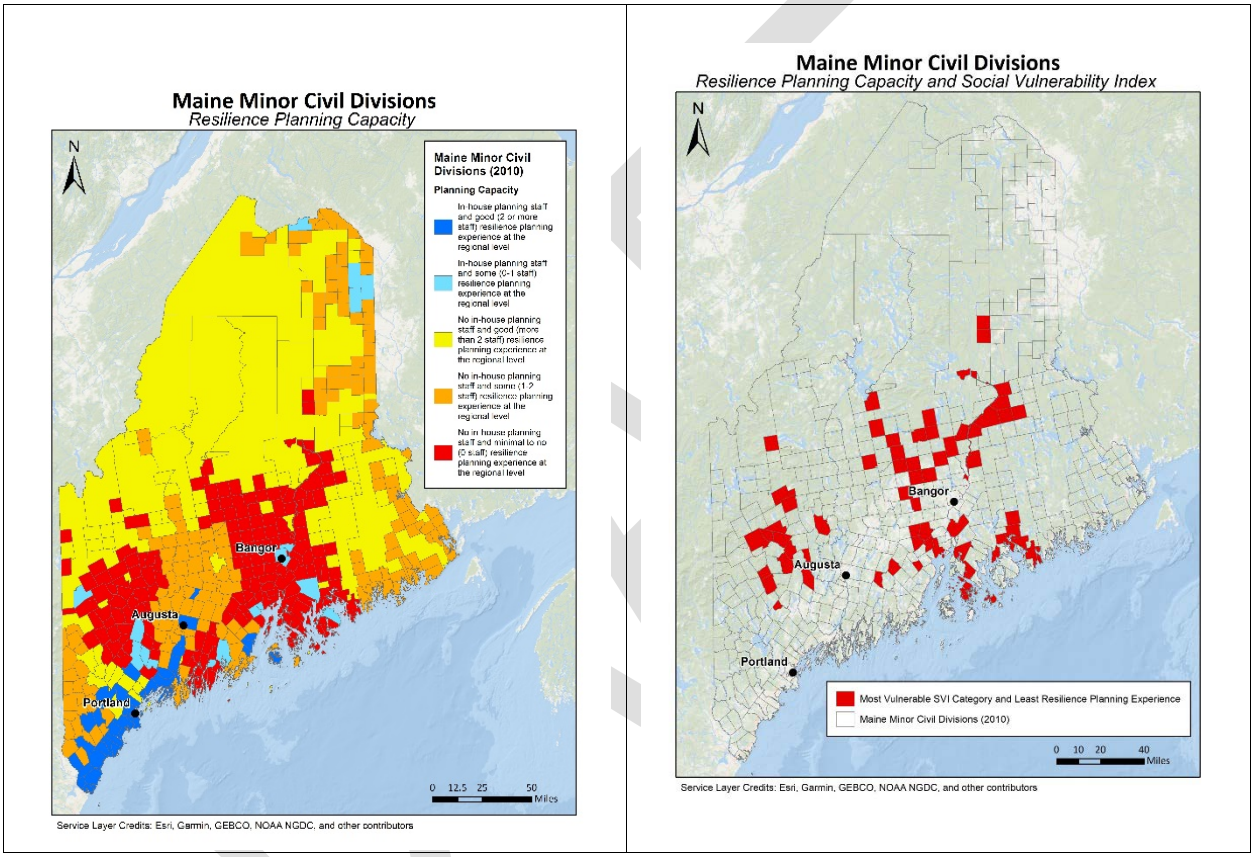
Progress on these foundations can also help communities become better prepared to manage unexpected challenges like pandemics and economic crises.

State government's current capacity to provide aid and financial support to towns is significantly undersized compared to the need and falling particularly short in supporting inland towns. Lack of capacity, expertise, and funding are consistently cited by municipalities as reasons why they are not able

to address their climate risks. Only 11% of communities in Maine have a town planner on staff, while 72% have no local planner and insufficient or no regional planning support.

The map on the left below shows the limited planning capacity of many Maine municipalities. The map on the right highlights those that have both limited capacity and higher social vulnerability to climate impacts based on factors such as socioeconomic status, minority status, household composition and disability, and housing and transportation.

Figure 12: Municipal Planning Capacity.



In addition to building state government's capacity to support communities and improving interagency coordination, regional approaches to planning and pooling resources are also cost-effective ways to build capacity. The state should encourage and support coordination among regional organizations, nonprofits, and the private sector efforts, many of which are already providing important services and planning capacity for communities.

2. Adopt official sea level rise projections

- **Incorporate official sea level rise projections into regulations by 2022 and require regular updates to ensure the projections utilize the latest scientific data.**

Official projections for sea level rise will give agencies, municipalities, tribal governments, and the private sector clear guidance for waterfront planning, development, risk reduction, and conservation. The guidance includes projections for 2050 and 2100 of the intermediate and high scenarios for sea level rise. While the intermediate scenarios may be useful for most planning activities, the high scenarios are important for decisions about long-lifespan infrastructure and facilities that are critical for public safety and local economies.

Following the science-based sea level rise projections from the Science and Technical Subcommittee, the Maine Climate Council is recommending the following be utilized in state planning and regulatory processes:

> The Maine Climate Council recommends that the state consider *committing to manage* for 1.5 feet of relative sea level rise by 2050, relative to the year 2000, and 3.9 feet of sea level rise by the year 2100.
>
> Additionally, the Maine Climate Council recommends that the state consider *preparing to manage* for 3.0 feet of relative sea level rise by 2050, and 8.8 feet of sea level rise by the year 2100.

The Science and Technical Subcommittees should update these projections every four years for state and Council consideration.

3. Emphasize resilience through land use planning, legal tools

- **Develop and implement updated land use regulations, laws, and practices in order to enhance community resilience to flooding and other climate impacts by 2024.**

An update of land use laws and practices will give communities the tools they need to build resilience, enhance ecosystem services, and get out of harm's way. Maine is a home rule state, which in a climate context means that local governments have the authority and responsibility for planning and implementing most activities for community resilience. In Maine's unorganized territories, the state's Land Use Planning Commission serves the planning function.

The tools communities currently use – including comprehensive planning, zoning, site location of development, and stormwater and floodplain management practices – were not designed with climate change in mind. They need be updated to:

- Consider climate hazards like sea level rise
- Leverage nature-based solutions
- Contain more consistent and scientifically sound definitions
- Provide more utility to communities for building climate resilience
- Support development and economic activity in areas less vulnerable to climate impacts.

The state should lead a process to update Maine's land use laws, tools, and practices to address the threats communities face from climate change impacts. The update process must include significant stakeholder participation, especially from vulnerable communities. The rollout of updates must be coordinated with technical assistance, training for planners and code enforcement officers, and incentives.

Recommended Land Use Stakeholder Processes

Land use emerged as an important issue throughout the Climate Planning Process. Maine needs to meet both the imperative to reduce carbon emissions and the duty to protect people and infrastructure from harm. In addition to addressing sea level rise, there are several topics in the Maine Climate Action Plan that require continued stakeholder processes to address. They include:

- **Clean energy siting**: Maine should balance our ambitious renewable energy goals with the protection of our natural resources and our agriculture, forestry and fishing industries.
- **Land use practices:** Maine should encourage and incentivize climate-friendly local land use policies that promote convenient, walkable communities and reduce the need to drive. Complete streets, mixed use, and housing density in downtowns and village areas are potential considerations for reducing vehicle miles traveled.
- **Community flood risk reduction:** Maine should develop guidance that helps the state and communities get out of harm's way. Long-term planning for sea level rise and riverine flooding should help equitably locate or relocate development in safer areas.
- **Anticipating growth:** Maine should anticipate the potential for growth, development, and economic opportunity as people migrate to Maine seeking refuge from severe climate impacts affecting other parts of the country.

4. Strengthen public health monitoring, education, and prevention

- **Develop and implement more robust public health monitoring, education, and prevention practices to achieve better health outcomes against climate change impacts by 2024.**

As COVID-19 has demonstrated, the ability to assess and understand the current state of wellbeing in our communities is critical to forming an effective response to stressors that threaten individual and collective health. And like COVID-19, climate change intensifies risks for socially vulnerable populations who have fewer resources to alleviate their hardship. Several key public health strategies are recommended:

Monitoring: Robust monitoring of public health impacts from climate change should: monitor for air allergens, particulate matter, and ozone; monitor for water-borne diseases, harmful algal blooms, and emerging threats in large lakes and public water supplies; monitor for vector-borne diseases from ticks and mosquitoes; and collect, analyze, and report these data disaggregated by age, race, ethnicity, gender, disability, geography, and other demographic factors to identify impacts on socially vulnerable populations and, accordingly, make interventions.

Education*:* Improved monitoring systems should feed information into education and outreach that will raise public awareness and help Maine people understand why it is important to

protect themselves and their families. Expanding public education about how climate change affects health and the resources available will help communities manage risks.

Education efforts should include air quality alerts, high heat and cold warnings, water contamination and health advisories, private well water testing, and awareness building of water- and vector-borne diseases.

Prevention: Nearly half of Maine people are served by public water systems that rely on surface water bodies like lakes and rivers as the source of drinking water (Maine CDC, 2018 Drinking Water Program Report). Every $1 spent on source water protection saves $27 in future water treatment costs (U.S. EPA, Economics and Source Water Protection, 2012), so there is an enormous financial advantage to taking proactive actions that prevent contamination.

To safeguard public health against water-related climate hazards, Maine should protect drinking water sources and downstream water bodies by: supporting activities that protect watersheds that supply drinking water; encouraging best management practices and low impact development; separating storm and sewer collection systems to prevent future sewage discharges into bays, estuaries, and rivers where contact with humans or shellfish is likely; and identify public water systems in danger of contamination by flood inundation due to climate change.

Strategy G: Invest in Climate-Ready Infrastructure

Maine must improve the climate readiness and resilience of infrastructure so that it serves Maine better under day-to-day conditions and functions reliably during emergencies.

Functioning infrastructure is a basic requirement for public safety and health, thriving state and local economies, and the flow of people, goods, and information. Much of Maine's infrastructure was constructed well before climate change was understood as a threat. It is no surprise, then, that climate change is already having a negative impact on our roadways and bridges, working waterfronts, water treatment facilities, and utilities.

Aging infrastructure is both a burden on the state as well as an opportunity. Investing in climate-ready infrastructure increases day-to-day functional capacity and, during an emergency, improves performance and survivability of the asset or network.

For 25 years, the National Institute of Building Sciences has reported that every $1 invested in pre-disaster risk reduction results in $6 of avoided disaster damages. With the increasing pace of devastating and expensive disasters, the current disaster-rebuild cycle is increasingly unsustainable. An improved model for investing in resilient infrastructure is needed.

Maine should continue to promote pre-disaster risk reduction. New and upgraded infrastructure must be designed to withstand the conditions expected over a decades-long lifetime. Otherwise, any modest

cost savings today are purchased at the expense of much higher repair and replacement costs in the future, not to mention the public safety, health, and economic losses incurred when infrastructure fails.

1. Assess climate vulnerability and provide climate-ready design guidance

- **By 2023, Maine will complete a statewide infrastructure vulnerability assessment, as well as develop and implement design standards for resilience in infrastructure projects.**

Maine's state agencies, municipalities, tribal governments, and industries need a clear understanding of the risks to infrastructure assets posed by climate change. Not only is this a requirement for responsible planning and investment of taxpayer dollars, the major credit rating agencies are beginning to consider how well states, regions, and communities are anticipating climate risks when assigning credit ratings. Failure to understand and incorporate climate risk can increase the borrowing costs for the state and towns, making infrastructure projects even more expensive.

Statewide vulnerability assessments should be conducted for: transportation infrastructure (including roads, bridges, culverts, airports, railroads, ferries, ports and wharfs, maintenance facilities, and public transit systems); water infrastructure (including drinking water systems, wastewater treatment facilities, and dams and stormwater management assets); energy infrastructure (including electricity generation, storage, and transmission; and fuel supply infrastructure); communications infrastructure (including landline, mobile, and broadband); and community infrastructure (including health systems, public housing, state, tribal, and municipal government buildings, food systems, solid waste systems, etc.). Several regional-scale and asset-specific assessments (Washington County and culverts, for example) have already been completed and can serve models for statewide efforts.

Vulnerability assessments should provide an understanding of: 1) The climate hazards to which infrastructure assets are exposed, the likelihood of that hazard occurring, and how the intensity and likelihood of those hazards may change over time; 2) the asset's susceptibility to damage or failure given its location, design, age, condition, and state of repair; and 3) the consequences that impairment or failure of the asset will have on public safety and health, state and local economies, and the environment and natural resources.

The assessments should identify "critical infrastructure" assets that are important for public safety and health. Assessments should also give particular attention to areas of the state where socially vulnerable communities and vulnerable infrastructure overlap. These are communities whose struggle to recover may be improved by reliable and resilient infrastructure.

The vulnerability assessments should inform state and local adaptation strategies and capital investment plans. A maintenance database should track improvements and climate hazard impacts.

Maine should develop resilient design guidance and standards for different infrastructure types. An example is Maine Department of Transportation's Stream Smart Road Crossing design guide for culverts and bridges that provides for effective stormwater management, flood control, and habitat connectivity.

Agencies, supporting organizations, and the private sector should continue research into construction materials and green infrastructure practices that increase durability and resilience to climate hazards.

Nature-based solutions and green infrastructure should be prioritized where appropriate. Nature-based solutions provide effective and lower-cost protection for climate change related challenges while

restoring coastal and marine habitats. For example, green infrastructure helps with stormwater management, and "Living Shorelines" projects—those are projects constructed with plants, oyster shells, and other natural materials to protect against coastal erosion.

2. Establish the State Infrastructure Adaptation Fund

- **Launch a State Infrastructure Adaptation Fund and pre-development assistance program in 2021, designed to leverage federal recovery support in the short term, and in the long term to address the significant and ongoing infrastructure adaptation needs of the future.**

Maine's municipalities, tribal governments, and state agencies all struggle to fund infrastructure projects. Maine currently has a backlog of 1,798 infrastructure adaptation projects listed across all sixteen counties at a proposed cost of $325 million. These projects reduce a community's vulnerability to climate impacts and can also reduce costs to respond and recover when there is a disaster. While there are significant federal resources available, federal grant programs generally require cost-share or "matching" funds from state or local governments.

Maine should establish a new State Infrastructure Adaptation Fund to help local, regional, tribal, and state agencies meet these cost-share requirements, unlocking new federal funds for infrastructure projects. Because the cost-share requirements are frequently 10 to 25 percent of the total project cost, a relatively modest investment of state funds would result in leveraging four to ten times more federal funding.

Building a pipeline of infrastructure projects that are shovel-ready for federal support or private investment is important. And this kind of support could be essential when it comes to competing for one-time federal programs designed to support recovery and infrastructure investments.

To make a project shovel-ready, pre-development assistance is typically needed which includes resilient design, engineering, and permitting; grant writing and grant management; community engagement around why the project is important; and, in some cases, matchmaking with investors in public-private partnerships.

In both funding and predevelopment assistance, attention must be directed toward communities where high social and climate vulnerability overlap with low capacity and limited access to funding. Working waterfront protection must also be an area of focus, given that they are among Maine's most threatened infrastructure.

It is important to invest up front to reduce vulnerability and avoid post-disaster expenses. However, there will continue to be a need for the state and local cost-share dollars necessary to leverage federal disaster relief funds. Having state emergency funds at the ready allows us to more quickly access federal funds, supporting local recovery and helping to prevent disaster impacts from reinforcing economic disparity.

Strategy H: Engage Maine People and Communities in Climate Impacts and Program Opportunities

Effective communication about Maine's climate strategies will be critical to the success of the Maine Climate Action Plan. Highlighting leadership and climate innovations can help people better understand the challenges, and the opportunities. Maine students should understand the science of Maine's changing natural systems and climate and be prepared with the necessary skills to meet future workforce opportunities.

1. Raise awareness about climate change impacts and opportunities

- **Launch a multifaceted, ongoing communications effort in 2021 based on the Climate Action Plan to raise public awareness and understanding about climate change in Maine, the state's climate response actions, and climate-related programs and opportunities,**

Regular communication with the public and stakeholders about the impacts of climate change and progress on climate strategies is critical to the implementation of the Maine Climate Action Plan. The state will develop a dashboard for key indicators and regular communications about climate council activities, and provide clear, easy access to information about climate policies and programs.

Creative and diverse means of communication should also be employed to promote state climate programs, incentives, and opportunities. Partnerships with business groups, non-profits, tribal governments, municipalities, and community groups will help spread key messages. Multiple forms of communication, and ongoing efforts will be necessary to support the state's goals.

Communications should also include translated materials into multiple languages for diverse audiences, using infographics in addition to text. Additionally, partnerships with community groups and organizations known as trusted resources can help reach vulnerable populations.

2. Increase public education offerings related to climate, energy

- **Develop enhanced educational opportunities for climate science and clean energy careers in Maine public schools to meet increasing interest from students and educators; launch a process in 2021 to engage key stakeholders including students, older youth, educators, and state leaders in next steps.**

Many student and teacher groups advocated for expanding PK-12 educational programs about climate during the development of the Climate Action Plan. To address this interest and advance leadership among Maine's youth and students, Maine should consider directions for how schools could develop new offerings in STEAM (science, technology, engineering, arts and math) based climate education, and leverage new and existing partnerships with philanthropies, nonprofits, and youth-led to organizations. Stakeholders should convene in 2021 to consider next steps to implement increased climate and career education, including student and youth leaders, educators, and state education and workforce leaders.

In addition to PK-12, Maine should examine how to expand secondary career and technical education (CTE) programs, and higher education programs to connect to existing and emerging workforce

pathways in climate and energy-related careers. Further details about workforce development strategies are included the supporting report, *Strengthening Maine's Clean Energy Economy.*

3. Start the "Maine Climate Corps" for climate-related workforce development

- **Partner with service-learning organization and non-profit organizations to launch a Maine Climate Corps program by 2023.**

With collaboration from existing service-learning organizations (like Volunteer Maine and Americorps), establish a Maine Climate Corps or Clean Energy Corps to support climate related actions and engagement from recent college graduates, and utilize these Corps members to engage broad community support and engagement, including older adults, students, and diverse community groups. The program should be launched with private and public sector support and Corps members could support mitigation, sequestration and resilience programs. From weatherization actions and education, clean transportation education, resilience planning, to land protection efforts – service members could contribute meaningfully Maine's climate progress.

4. Recognize climate leadership by Maine businesses and organizations

- **Launch the Governor's Climate Leadership Council in 2021 to increase private sector ambition toward voluntary climate actions.**

Establish a leadership group of leading Maine businesses, non-profits, and institutions to highlight organizations taking climate action to reduce greenhouse gas emissions and address climate change while strengthening Maine's economy. The network will recognize innovation and leadership, establish partnerships, and share best practices.

Implementing Maine's Climate Action Plan

Maine's climate action plan is a blueprint for bold, specific and immediate action. To implement the plan, government leaders must not only recognize their responsibility in this moment, but also move with urgency to achieve its outcomes. Resources will be needed do this, as will clear, transparent metrics to ensure accountability to the public and convey where progress is occurring.

The responsibility for appropriation and revenues rests with the Governor and Maine State Legislature, with similar processes at the municipal, tribal, regional, and federal levels. This plan seeks to provide a roadmap for actions will meet the state goals, urging leaders at all levels of government and society to consider how to prioritize investments toward these actions.

Yet fighting climate change cannot be shouldered by government alone. For this plan to be successful, the support and engagement of Maine people is critical, in service of a broad coalition of state, local, regional and tribal governments, nonprofits, academic intuitions, and private interests taking collaborative, decisive action.

Significant and sustained investments, well-financed programs and properly capitalized lending entities are needed to implement to Climate Action Plan, and realize outcomes like a modern electricity grid that delivers clean energy needed to power climate-friendly innovations, transportation infrastructure resilient against rising sea levels and more frequent, intense storms, and enhanced incentive programs that make cleaner vehicles and energy efficiency improvements within reach of everyone in Maine.

No single funding stream will achieve our climate goals. Climate action requires leveraging a variety of sources– existing and new, private and public, local, state and federal -- and fresh, innovative financing mechanisms to support sector-level transformations and the ability of Maine lenders to make crucial long-term investments in climate-focused projects and initiatives.

This four-year Climate Action Plan, however, is emerging amid unprecedented conditions caused by the global COVID-19 pandemic, which is stretching state revenues and many family budgets without relief in sight, and further exposing inherent inequities within our economy that puts Maine's most vulnerable citizens at risk from even minor disruptions.

This grave situation illustrates the urgent need to prepare our people, communities, and economy for the disruptions that climate change will cause. Investments to create a sustainable economy that is less reliant on global supply chains and imported fossil fuels, while leveraging Maine's abundance to source essential goods, from fresh food to building supplies, will reinforce the bedrock of Maine's economy and families to withstand major challenges in the future.

Funding & Financing Options

Near term

Use general fund bonds for essential, focused capital investment: Maine should leverage record-low borrowing rates to support critical infrastructure projects that will generate economic activity, create jobs for Maine people, and signal bold action to addressing climate change and implementing this plan. Specific bonding priorities should include:

- **State Infrastructure Adaptation Fund:** Establish this fund to support local and state projects, such as modern transportation investments, urgently needed broadband deployments, and overdue wastewater and drinking water projects to address risk from climate impacts, while also leveraging federal matching funds to unlock further federal grant support.
- **Energy Innovation, Weatherization, and Clean Transportation**: Expand and enhance state research and development programs; re-capitalize incentive programs that generate jobs and savings for families, businesses, and communities.
- **Natural and Working Lands:** Investments to protect at-risk working lands and support business growth of natural resource-based businesses.
- **Clean Energy Workforce:** Support targeted career training programs like CTEs and those within Maine's community colleges and university system to ready Maine people for new and growing well-paying employment opportunities.

Pursue current and new federal grant opportunities: Maine should aggressively support energy, infrastructure, and climate strategies through new federal Land and Water Conservation Funds, emerging climate-focused state funds, federal FEMA hazard mitigation grants, and ongoing federal transportation, environmental infrastructure, and energy programs. The state should also prioritize providing match dollars when significant federal investments are available.

Maximize one-time funding streams and settlement dollars: These funds, like those received from the Volkswagen emissions settlement, may continue to flow into the state from renewable energy and power projects and should deployed aggressively to support emissions mitigation actions.

Enact a Commercial Property Assessed Clean Energy (C-PACE) program: This financing mechanism would support investments by Maine businesses into clean energy and energy efficiency improvements.

Deploy and retool of existing state resources, staff, and grant programs: The state should review and revise existing state programs and grants to align with climate mitigation and adaptation goals, like through the state drinking water revolving fund, Tax-Increment Finance (TIF) programs, or other municipal infrastructure grant and loans programs.

Stable budget support for long-term actions: At the time of this report's publication, Maine's general fund budget is under significant strain from revenue reductions associated with the recession and pandemic. But, as Maine recovers, state leaders should allocate funding for programs that require ongoing support, such as technical assistance, tax-credits and incentives, and monitoring.

Long term

Identify revenue sources for long-term funding for:

- **Essential transportation infrastructure and clean transportation:** Maine needs to fund basic transportation infrastructure needs, including the adaptation work required to make Maine's transportation systems and emergency evacuation routes able to withstand increasing storm events and rising sea levels. In addition, clean transportation programs will also require sustained support for EV and clean care rebates, public charging infrastructure, pedestrian and bicycle infrastructure, broadband expansion, and clean public transportation options, including buses, school buses and ferries.

- **State Infrastructure Adaptation Fund and Disaster Funds:** The proposed State Infrastructure Adaptation Fund supports long-term infrastructure needs for cities and towns, regional units, and state agencies by meeting cost-share requirements to unlock federal funding for infrastructure projects and pre-disaster funds. Pre-development assistance is also much needed to ensure infrastructure projects are made "shovel-ready" for federal support or private investment. Maine also has two funds that typically support disaster recovery including the State Disaster Recovery Fund and a State Contingency Account. Maine should ensure that they are funded to provide match to towns for federal disaster relief.
- **Funding for Natural and Working Lands conservation and easements –** the Natural and Working Lands Working Group identified the need for a dedicated, sustained funding source, driven by the state's ambitious targets and sequestration needs to support conservation and easements purchases; and supporting agricultural, forestry, fishing, and recreation access and opportunities. Securing Maine's natural lands preserves an essential economic asset and protects the state's special natural places.

Enhance supports from visitors: The state should consider funding opportunities drawn from Maine's millions of annual visitors, who utilize our transportation systems and contribute emissions in order to experience our iconic landscapes and clean environment, that support infrastructure investments and natural lands investments.

Revenue bonding: Long-term capital support for long-term state climate infrastructure projects could also be identified through revenue bonding activities for state and local needs.

Innovation Funding: From new vehicle batteries that offer more cost-effective transportation solutions to advances in building material and heating technology, solutions to advance our climate. Some of these innovations can grow and emerge in Maine. The state should invest in the most promising sectors with targeted research and development, commercialization, and business attraction support. Potential high-value forest products like cross-laminated timber, wood-fiber insulation, biofuels, agriculture production and innovation, and floating offshore wind could help Maine emerge a national leader in climate and energy innovation. A complimentary policy framework, ongoing state and federal investments in innovation and workforce, and stable business program supports should be bolstered to encourage their growth as highlighted in the *Clean Energy Economy Plan.*

Financing and Policy Options for Consideration:

Maine Green Bank or Green Fund: A green bank or fund could leverage significant, low-cost private sector capital to finance clean energy projects, climate initiatives, and infrastructure over the long-term, based on the successful experience of other states. Options to establish a green bank or fund could include launching a new program through an existing state finance entity or creating a new fund, both of which would require capitalization and staff expertise.

Power sector transformation: This plan proposes a significant process to investigate structural approaches and make recommendations on required transitions needed for our electricity delivery system to meet projected electrification demands, stable and affordable prices, and reduced infrastructure costs. Some options considered by the Energy Working Group included public financing mechanisms for additional grid or generation capacity; consumer ownership of all or part of Maine's power delivery systems; and examining the viability of a "Maine Power Authority" existing as the primary energy planning and financing authority in the state.

Carbon market programs: Working groups recommended ongoing consideration of multistate or national carbon market programs. Carbon pricing is generally viewed by economists as needed to address climate change, but many also recommend these policies are best implemented at the federal level. Maine already prices power sector carbon emissions through its participation in the Regional Greenhouse Gas Initiative (RGGI) and returns the revenues back to participating states and consumers to invest in energy efficiency. The Transportation Working Group recommended Maine continue to monitor the Transportation Climate Initiative (TCI), a proposed regional initiative in the Northeast to implement a cap, trade and invest system to reduce transportation emissions and generate revenue for transportation transitions, as well as other options, as transportation funding solutions.

Measuring Progress

Clear metrics for Maine's climate goals are critical for informing the public about whether policies are having the intended outcomes and making evidence-based adjustments, enhancements, or replacements to policies in pursuit of our 2030, 2045, and 2050 targets.

Two types of metrics will help Maine gauge its progress against climate change:

Actions Taken: These are indicators that evaluate numerical progress toward climate mitigation and adaptation goals, such as the number of heat pumps installed or green industry jobs created, as measures of effort and effectiveness.

Others that should be tracked include:

- Progress toward 80% renewable energy by 2050
- Energy saved via ongoing efficiency measures
- Green jobs created, and per capita
- Increase EVs, total and per capita
- Access to broadband
- Acreage of conserved/protected lands
- Towns or regions with resilient community plans
- Significant critical adaption infrastructure projects completed.
- Climate Infrastructure Investment funding
- Federal and private dollars leveraged as climate per state dollar

Emissions and Adaptation Impacts Achieved: These are indicators that evaluate our collective efforts, as exemplified by the Maine Department of Environmental Protection's Biennial Emissions Report: "Progress Toward Greenhouse Gas Reduction Goals," which charts Maine's sector-based emissions. With the next emissions report in January 2022, the state will also determine measures to track and report on sequestration of carbon emissions, as well progress toward gross emissions reduction goals.

Other example includes changes in ocean acidification or reductions heat-related emergency room visits. Because of the global nature of climate change, some of these indicators are only available on a planetary scale, like atmospheric CO_2 concentration, and may respond slowly to the actions that state and country jurisdictions take collectively.

Measuring Equity: In addition to these measures, the Maine Climate Council Equity Subcommittee will recommend targeted goals and program metrics for key populations and groups, providing additional key equity outcome indicators, along with program suggestions, for Council consideration by September 2021.

Reducing Carbon Emissions Implementation – Key Actions

Sector	Metric	2025	2030	2050
Transportation	Number of Light-duty EVs on the Road	41,000	219,000	904,000
	EV Share of New Light-duty Vehicle Sales	28%	85%	100%
	Reduction in Light-duty VMT per Vehicle	10%	20%	20%
	ZEV Share of New Heavy-duty Vehicle Sales	12%	55%	100%
	Reduction in Heavy-duty VMT per Vehicle	2%	4%	4%
Buildings	Number of Households with Retrofit Heat Pumps (installed after 2018) and Legacy Fossil Systems	80,000	130,000	26,000
	Number of Households with Whole Home Heat Pump Systems	35,000	116,000	487,000
	Weatherized Households	17,000	35,000	105,000
All	GHG Emissions (MMT)	14.50	11.67	3.72
	Emissions Reduction from 1990 Levels	32%	45%	82%

Definitions and Acronyms

Adaptation - an adjustment by nature or a community that reduces the hazardous effects of climate change.

Biodiesel - a form of diesel fuel derived from plants or animals.

Biofuel - fuel that is derived from biomass such as plant or algae material, wood or animal waste.

Biomass - generally in this report, we refer to biomass in relation to wood biomass which is any timber-derived product (softwood or hardwood) capable of being converted to energy through direct combustion or gasification; to solid fuel through pelletizing; or to liquid fuel through myriad processes. Biomass can also be renewable organic material that comes from plants and animals.

Clean energy - Clean energy is the production of electricity or heat from renewable or low-carbon resources such as solar, wind, water, biomass or geothermal. Energy efficiency measures that improve the output of or reduce energy consumption, and innovative grid technologies such as energy storage, may also be included in the broad definition of clean energy.

CHP - Combined heat and power

Climate - the average weather conditions at a given place over a period of time. For example, meteorologists often make comparisons against a 30-year period, called a climate normal.

Climate Change - a difference in the climate over multiple decades or longer. Long-term changes/shifts in climate can result from both natural and human factors.

DEP – Maine Department of Environmental Protection

EEE - eastern equine encephalitis

EPA - Environmental Protection Agency

EVs - Electric Vehicles

Fossil Fuels – a hydrocarbon fuel (such as coal, oil, or natural gas) formed in the earth from plant or animal remains over millions of years

GEO - Governor's Energy Office

GDP - Gross domestic product - a monetary measure of the market value of all the final goods and services produced in a specific time period.

GHG - Greenhouse Gases - gases that absorb/act as a blanket, trapping heat in the atmosphere, including but not limited to water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

GOPIF - Governor's Office of Policy Innovation and the Future

(Climate) Mitigation - a human intervention intended to reduce the rate of climate change by limiting the emission of greenhouse gases or by removing greenhouse gases from the atmosphere through natural or technological processes.

(Hazard) Mitigation - any sustained action taken intended to reduce or eliminate the long-term risk to human life and property from natural hazards.

HFC – Hydrofluorocarbons, which are greenhouse gases with global warming potentials of hundreds to thousands of times that of carbon dioxide

HVAC - heating, ventilation and air conditioning

HPEV - Hybrid plug-in vehicle

IPCC - Intergovernmental Panel on Climate Change

MPUC - Maine Public Utilities Commission

Particulate Matter - also known as particle pollution or PM, a complex mixture of extremely small solid particles and liquid droplets found in the air, which can pose a danger to human and animal health.

PHEV - Plug-in Hybrid Electric Vehicle

Resilience - the ability of a community, business or the natural environment to prepare for, withstand, respond to and recover from a hazardous event.

RGGI - Regional Greenhouse Gas Initiative

RFS - Renewable Fuel Standards

RPS - Renewable Portfolio Standard

Sequestration or Carbon Sequestration - the process of capturing carbon dioxide from the atmosphere or industrial processes and storing it for years to centuries; sometimes referred to as “negative emissions”. Carbon may be stored in biomass (such as trees, branches, wood products, foliage, and roots), soils, and rocks for varying periods of time, or reused in industrial applications; research and technological development into direct air capture of carbon dioxide for storage or reuse is ongoing but not yet developed at a large scale.

STS - Scientific and Technical Subcommittee

Weather - atmospheric conditions at any given time or place, measured from variables such as wind, temperature, humidity, air pressure, cloudiness, and precipitation. Weather can vary from hour-to-hour, day-to-day, and week-to-week.

Scientific and Technical Reports

The work of the Maine Climate Council is informed by scientific and technical analyses including:

- A summary of the impacts of climate change in Maine by the Maine Climate Council Science and Technical Subcommittee (Scientific Assessment of Climate Change and Its Effects in Maine)

- An analysis of the costs and benefits of the strategies recommended by the Working Groups (Assessing the Impacts Climate Change May Have on the State's Economy, Revenues, and Investment Decisions, an analysis by Eastern Research Group and Synapse Energy Economics). The report includes 4 volumes and a Summary report
    - Volume 1, Vulnerability Mapping: A mapping analysis that identifies vulnerable communities, geographies, and economic sectors.
    - Volume 2, Cost of Doing Nothing Analysis: Estimates of losses that the State of Maine and its citizens could incur if the State does not take action to prevent or prepare for climate change. The cost of not adapting to a changing climate is large and will accelerate over time, with flooding serving as the largest overall threat.
    - Volume 3, Maine Emissions Analysis: An energy use and emissions baseline based on current state and regional policies, as well as an assessment of options for meeting Maine's energy needs (and allowing economic growth) while reducing greenhouse gas emissions.
    - Volume 4, Economic Analyses of Adaptation and Mitigation Strategies: Economic analyses to provide context for the majority of the adaptation and mitigation strategies developed by the Maine Climate Council.

- An Equity Assessment of Working Group Recommendations conducted by the University of Maine's Senator George J. Mitchell Center for Sustainability solutions

- The report, Strengthening Maine's Clean Energy Economy, provides specific strategies to leverage Maine's renewable energy resources and energy efficiency services to recover and grow Maine's economy.

Acknowledgements

On June 26, 2019, the Governor and Legislature created the Maine Climate Council, an assembly of scientists, industry leaders, bipartisan local and state officials, and engaged citizens to develop a four-year Climate Action Plan for Maine.

The members of the Maine Climate Council are:

Co-Chairs:

- Hannah Pingree, Director of the Governor's Office of Policy Innovation and the Future
- Melanie Loyzim, Acting Commissioner of the Department of Environmental Protection

Members of the State Legislature:

- Representative Lydia Blume (D)
- Representative Richard Campbell (R)
- Senator Everett Brownie Carson (D)
- Senator David Woodsome (R)

Members of the Executive Branch, or their designees:

- Amanda Beal, Commissioner of the Department of Agriculture, Conservation and Forestry
- Dan Burgess, Director of the Governor's Energy Office
- Judy Camuso, Commissioner of the Department of Inland Fisheries and Wildlife
- Major General Doug Farnham, Commissioner of the Department of Defense, Veterans and Emergency Management
- Kirsten Figueroa, Commissioner of the Department Administrative and Financial Services
    - Designee: Elaine Clarke, Chief Facilities Officer
- Laura Fortman, Commissioner of the Department of Labor
    - Designee: Kim Moore, Director of the Bureau of Employment Services
- Heather Johnson, Commissioner of the Department of Economic and Community Development
- Patrick Keliher, Commissioner of the Department of Marine Resources
- Pender Makin, Commissioner of the Department of Education
    - Designee: Scott Brown, Director of School Facilities and support from Page Nichols, DOE Director of Innovation
- Bruce Van Note, Commissioner of the Department of Transportation
- Jeanne Lambrew, Commissioner of Department of Health and Human Services
    - Designees: Nirav Shah, Director of the Maine Centers for Disease Control and Prevention; Susan Breau, Hydrogeologist - Water Resources Team Manager, Maine Centers for Disease Control and Prevention

Members of Quasi-Government Agencies:

- Dan Brennan, Executive Director of the Maine State Housing Authority
- Michael Stoddard, Executive Director of Efficiency Maine Trust

Members Representing Environmental Nonprofit Organizations or Foundations:

- Alexander Buck, President, Horizon Foundation
- Kate Dempsey, Maine State Director for The Nature Conservancy

Members with Expertise in Climate Change Science:

- Ivan Fernandez, Distinguished Professor at the University of Maine's Climate Change Institute & School of Forest Resources
- Andrew Pershing, Chief Scientific Officer, Gulf of Maine Research Institute

Members with Expertise in Resilience, Climate Change Adaptation, Emergency Management, or Disaster Risk Reduction:

- Judy East, Executive Director of the Land Use Planning Commission
- Kristina Ford, Selectwoman for Town of Boothbay

Other Members:

- Lori Parham, Maine State Director for AARP
- Jessie Perkins, Executive Director of the Bethel Chamber of Commerce
- Expert on State's Energy Sector: Ken Colburn, energy and climate expert
- Representative of Manufacturing Industry: Benedict Cracolici, Energy Manager for Sappi North America
- Representative of Maine's Tribes: Ambassador Maulian Dana, Penobscot Nation
- Representative of Municipal Government: Steven C. Golieb, Town Councilor for the Town of Millinocket
- Representative of Small Business: Daniel Kleban, Owner of Maine Beer Company
- Representative of Agriculture: Melissa Law, Owner of Bumbleroot Organic Farm in Windham
- Representative of Building and Construction Trades: Matt Marks, Executive Director of the Associated General Contractors of Maine
- Representative of Marine Fisheries: Patrice McCarron, Executive Director of Maine Lobsterman's Association
- Representative of Business: Jeff Saucier, Environmental Control for McCain's Foods
- Representative of Labor: Matt Schlobohm, Executive Director of the Maine AFL-CIO
- Representative of Forest Industry: Patrick Strauch, Executive Director of the Maine Forest Products Council
- Representative of Maine Youth: Ania Wright, Student at the College of the Atlantic

The Maine Climate Council includes a Science and Technical Subcommittee and six working groups, each comprised of diverse stakeholders with expertise and experience in their topic areas. We would like to express appreciation for the incredible work accomplished by the subcommittee and working groups over the last year, and to the many staff who supported their work.

The members of the Science and Technical Subcommittee are:

Co-chairs:

- Ivan Fernandez, University of Maine
- Robert Marvinney, Maine Geological Survey

Members:

- Representative Brian Hubbell, Maine State Legislature
- Senator Russell Black, Maine State Legislature
- Susie Arnold, Island Institute
- Brian Beal, University of Maine at Machias
- Sean Birkel, University of Maine
- Alix Contosta, University of New Hampshire
- Amanda Cross, Maine Department of Inland Fisheries and Wildlife
- Adam Daigneault, University of Maine
- Stephen Dickson, Maine Geological Survey
- Susan Elias, Maine Medical Center Research Institute
- Glenn Hodgkins, U.S. Geological Survey
- Joe Kelley, University of Maine
- Rick Kersbergen, University of Maine
- Glen Koehler, University of Maine
- Rebecca Lincoln, Maine Center for Disease Control
- Pamela Lombard, U.S. Geological Survey
- Bradfield Lyon, University of Maine
- Andrew Pershing, Gulf of Maine Research Institute
- Nichole Price, Bigelow Laboratory for Ocean Sciences
- Jonathan Rubin, University of Maine
- Joseph Salisbury, University of New Hampshire
- Robert Steneck, University of Maine
- Sally Stockwell, Maine Audubon
- Rick Wahle, University of Maine
- Aaron Weiskittel, University of Maine
- Carl Wilson, Maine Department of Marine Resources

The six working groups of the Climate Council—(1) Transportation; (2) Buildings, Infrastructure and Housing; (3) Energy; (4) Community Resilience Planning, Emergency Management and Public Health; (5) Coastal and Marine; and (6) Natural and Working Lands—developed the draft strategies for the Climate Council to consider.

The details of the working group strategies are a resource for policymakers as Maine begins to implement the strategies in the Climate Action Plan. The working group reports are available at https://www.maine.gov/future/initiatives/climate/climate-council/reports.

Transportation Working Group Members

Co-chairs:

- Sarah Cushman, Cushman Transportation Consulting, LLC
- Joyce Taylor, Maine Department of Transportation

Members:

- Representative Bettyann Sheats, Maine State Legislature
- Senator Brownie Carson, Maine State Legislature
- Senator Brad Farrin, Maine State Legislature
- Kendra Amaral, Town of Kittery
- Mackenzie Bowe, VHB
- Tom Brennan/Nathan Sinclair, Poland Spring Bottling Co. / Nestle Waters North America Inc.
- Director Dan Burgess, Governor's Energy Office
- Benedict Cracolici , Sappi North America
- Nell Donaldson, City of Portland
- Kristina Egan, Greater Portland Council of Governments
- Maria Fuentes, Maine Better Transportation Association
- Judy Gates, HNTB
- Emily Green, Conservation Law Foundation
- Jay Kamm, Northern Maine Development Commission
- Ben Lake, VEIC
- Matt Marks, Associated General Contractors of Maine
- Jess Maurer, Maine Council on Aging
- Peter Merfeld, Maine Turnpike Authority
- Lori Parham, AARP Maine
- Brian Parke, Maine Motor Transport Association
- Patricia Quinn, Northern New England Passenger Rail Authority
- Jonathan Rubin, University of Maine Margaret Chase Smith Policy Center
- Tim Seymour, Darling's Auto Group
- Beckett Slayton, Bowdoin College, Youth Representative
- Jim Tassé, Bicycle and Pedestrian Coalition of Maine
- Mike Williams, BlueGreen Alliance
- Rob Wood, The Nature Conservancy in Maine

Buildings Infrastructure and Housing Working Group

Co-chairs:

- Kathleen Meil, Maine Conservation Voters
- Michael Stoddard, Efficiency Maine Trust

Members:

- Representative Dick Campbell, Maine State Legislature
- Representative Denny Keschl, Maine State Legislature
- Senator David Woodsome, Maine State Legislature
- Senator Bill Diamond, Maine State Legislature
- Kay Aikin, Introspective Systems
- Naomi Beal, PassivHaus Maine
- Ellen Belknap, SMRT
- Scott Brown, Maine Department of Education
- Laney Brown, Iberdrola Solutions

- Dan Burgess, Governor's Energy Office
- Elaine Clark, Maine Dept. of Administrative and Financial Services
- Dan Dixon/Keisha Payson, University of Maine/Bowdoin College
- Steve Hudson, Preti Flaherty Beliveau & Pachios
- Rick Karg, Residential Energy Dynamics, LLC
- Jerry Livengood, Bangor Natural Gas Company
- Daniel Kleban, Maine Beer Company
- Jeff Marks, Acadia Center
- Suzanne McDonald, Island Institute
- Don McGilvery, Maine State Housing Authority
- Steve McGrath, Maine Energy Marketers Association
- Matt Nazar, City of Augusta
- Rozanna Patane, Town of York
- Greg Payne, Maine Affordable Housing Coalition
- Cordelia Pitman, Wright-Ryan Construction, Inc.
- Steve Shaler, University of Maine
- Jason Shedlock, Maine Building & Construction Trades Council
- Jesse Thompson, Kaplan Thompson Architects
- Dylan Voorhees, VEIC
- Ania Wright, College of the Atlantic; Maine Youth for Climate Justice, Youth Representative

Energy Working Group

Co-chairs:

- Co-chairs: Dan Burgess, Governor’s Energy Office
- Ken Colburn, Energy and Climate Expert

Members:

- Representative Seth Berry, Maine State Legislature
- Senator Paul Davis, Maine State Legislature
- Kurt Adams, Summit Utilities
- Beth Ahearn, Maine Conservation Voters
- Phil Bartlett, Maine Public Utilities Commission
- Matt Beck, IBEW 1837
- Tony Buxton, Preti Flaherty
- Steve Clemmer, Union of Concerned Scientists
- Greg Cunningham, Conservation Law Foundation
- Evelyn deFrees, Maine Department of Labor, MCC Member
- Carrie Gilbert, Daymark Energy Advisors
- Ben Gilman, Maine State Chamber of Commerce
- Marty Grohman, E2Tech
- Abigayle Hargreaves, University of Maine, Youth Representative
- Katryn Mitchell, SEARCH
- Jeremy Payne, Maine Renewable Energy Association
- Julie Rosenbach, City of South Portland

- Jeff Saucier, McCain Foods USA, Inc.
- Rich Silkman, Competitive Energy Services, LLC
- Eric N. Stinneford, Central Maine Power Company
- Michael Stoddard, Efficiency Maine Trust
- Robert Stoddard, Power Market Economics, LLC
- Jeff Thaler, University of Maine
- Sarah Tracy, Pierce Atwood LLP
- Jake Ward, University of Maine
- Tom Welch, Energy Policy Expert

Community Resilience, Public Health and Emergency Management Working Group

Co-chairs:

- Judy East, Land Use Planning Commission
- Dr. Nirav Shah, Maine Center for Disease Control
- Rebecca Boulos, Maine Public Health Association
- Anne Fuchs, Maine Emergency Management Agency

Members:

- Senator David Miramant, Maine State Legislature
- Senator Marianne Moore, Maine State Legislature
- Rep. Genevieve McDonald, Maine State Legislature
- Rep. Beth O'Connor, Maine State Legislature
- Anne Ball, Maine Downtown Center
- Andrew Barton, University of Maine
- Bruce Berger, Maine Water Utilities Association
- Lance Boucher, American Lung Association
- Howard Carter, City of Saco
- Joe Chappell/Margaret Cushing, Cumberland County Emergency Management Agency
- John Egan, Coastal Enterprises, Inc.
- Bob Faunce, Town of Damariscotta
- Elsie Flemings/Katie Freedman, Healthy Acadia
- Kristina Ford, Town of Boothbay
- David Gardner, Maine Department of Transportation
- Steven C. Golieb, Town of Millinocket
- Mark Green, Downeast Community Partners
- Nancy Hasenfus, retired physician
- Gwen Hilton, Maine Land Use Planning Commission
- Chace Jackson, American Heart Association
- Tora Johnson, University of Maine at Machias
- Eileen Johnson, Bowdoin College
- Debbie Johnson, Maine Department of Economic and Community Development
- Nan Johnson, Federal Emergency Management Agency

- Kohl Kanwit, Department of Marine Resources
- Chuck Lubelczyk, Maine Medical Center Research Institute
- Jessie Perkins, Bethel Area Chamber of Commerce
- Patricia Pinto, AARP Maine
- Michael Plaziak, Maine Rural Water Association
- Hayley Prevatt, City of Portland Public Health
- Grainne Shaw, Sagadahoc County Emergency Management Agency
- Abbie Sherwin, Southern Maine Planning and Development Commission
- Anna Siegel, U.S. Youth Climate Strikes, Youth Rep.
- Ray Sisk/Leticia vanVuuren, Knox County Emergency Management Agency
- Peter Slovinsky, Maine Geological Survey
- Lisa Sockabasin, Wabanaki Public Health
- Charlie Soltan, Soltan Bass, LLC
- Esperanza Stancioff, University of Maine/Maine Sea Grant
- Marla Stelk, Association of State Wetland Managers
- Michele Walsh, Maine Department of Agriculture, Conservation and Forestry

Coastal and Marine Working Group

Co-chairs:

- Kathleen Leyden, Maine Department of Marine Resources;
- Heather Leslie, University of Maine

Members:

- Senator Justin Chenette, Maine State Legislature
- Representative Will Tuell, Maine State Legislature
- Representative Lydia Blume, Maine State Legislature
- Susie Arnold, Island Institute
- Nick Battista, Island Institute
- Jeremy Bell, The Nature Conservancy
- Kathleen Bell, University of Maine
- Sebastian Belle, Maine Aquaculture Association
- Curtis Bohlen, Casco Bay Estuary Partnership & University of Southern Maine
- Angela Brewer, Maine Department of Environmental Protection
- Curt Brown, Ready Seafood
- Jonathan Carter, Town of Wells
- Amanda Cross, Maine Department of Inland Fisheries and Wildlife
- Andy Dorr, Town of Vinalhaven
- Flora Drury, Maine Department of Marine Resources
- Greg Dugal, Hospitality Maine
- Claire Enterline, Maine Department of Marine Resources
- Christine Feurt, Wells National Estuarine Research Reserve
- Ivy Frignoca, Friends of Casco Bay

- John Hagan, Maine Climate Table
- Dawn Hallowell, Maine Dept. of Env. Protection
- Beverly Johnson, Bates College
- Stacey Keefer, Maine Marine Trades Association
- Robert Marvinney, Maine Geological Survey
- Patrice McCarron, Maine Lobstermen's Association
- Kathy Mills, Gulf of Maine Research Institute
- Bill Mook, Mook Sea Farm
- Bill Needelman, City of Portland
- Chris Petersen, College of the Atlantic
- Kristen Puryear, Maine Department of Agriculture, Conservation & Forestry
- David Townsend, University of Maine
- Hattie Train, University of Maine alumna, Youth Representative
- Steve Walker, Maine Coast Heritage Trust
- Carl Wilson, Maine Department of Marine Resources
- Donald Witherill, Maine Department of Environmental Protection

Natural and Working Lands Working Group

Co-chairs:

- Commissioner Amanda Beal, Department of Agriculture, Conservation and Forestry
- Tom Abello, Senior Advisor and Legislative Director, Governor's Office

Members:

- Senator Cathy Breen, Maine State Legislature
- Representative Mary Anne Kinney, Maine State Legislature
- Doug Baston, Town of Alna
- Mark Berry, The Nature Conservancy
- Hannah Carter, University of Maine
- Phillip DeMaynadier, Maine Department of Inland Fisheries and Wildlife
- Tom Doak, Maine Woodland Owners
- Molly Docherty, Maine Department of Agriculture, Conservation and Forestry
- Eliza Donoghue, Maine Audubon
- Dana Doran, Professional Logging Contractors of Maine
- Maureen Drouin, Maine Conservation Voters
- Ivan Fernandez, University of Maine
- Ellen Griswold, Maine Farmland Trust
- Juan Hernandez, USDA Natural Resources Conservation Service
- Ruby Jovin, Grace Pond Farm
- Melissa Law, Bumbleroot Organic Farm
- Ellen McAdam, McDougal Orchards
- Heather Spalding, Maine Organic Farmers and Gardeners Association
- Pat Strauch, Maine Forest Products Council

- Carol Weymouth, Maine Association of Conservation Districts
- Dave Struble, Maine Forest Service (retired)
- Karin Tilberg, Forest Society of Maine
- Nate Webb, Maine Department of Inland Fisheries and Wildlife
- Andy Whitman, Manomet

Equity Advisors

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- Dr. Gabriela Alcalde, Elmina B. Sewall Foundation
- Lesley Fernow, Central Hall Commons
- Representative Craig Hickman, Maine State Legislature
- Deborah Ibonwa, Maine Equal Justice
- Amara Ifeji, Bangor High School 2020 graduate
- Chris Johnson, Sipayik Environmental Department
- Suzanne MacDonald, Island Institute
- Fowsia Musse, Maine Community Integration
- Joy Barresi Saucier, Aroostook Agency on Aging
- Spencer Thibodeau, Portland City Council

Consultants

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Staff

Thank you to the staff of the Governor's Office of Policy Innovation and the Future and the Governor's Energy Office for their work on the plan:

- Brian Ambrette, Senior Climate Resilience Coordinator
- Sarah Curran, Senior Policy Analyst, Climate & Economic Development
- Taylor LaBrecque, Senior Planner, Transportation Climate Coordinator
- Cheryl Miller, Office Specialist

- Dr. Cassaundra Rose, Senior Science Analyst & Climate Council Coordinator
- Melissa Winne, Energy Policy Analyst

Public Input

Hearing directly from Maine people -- including stakeholders, experts, local leaders, legislators, youth, among other important groups was key to the process of creating this plan and it will continue to be important, including those who disagree with some of these proposed actions.

Public input has been sought throughout the climate planning process. The working groups each included 20-30 members with diverse perspectives and expertise, and the working group process to develop the draft recommendations was conducted via public meetings, calls, surveys, and individual and organizational input.

Over the summer, we received more than 4,400 responses through feedback survey on the website, climatecouncil.maine.gov. Members of the public were invited to learn about the impacts of climate change on the State, read the strategies recommended by the working groups, and provide feedback through a series of short surveys. Residents from almost three quarters of Maine communities submitted comments. Additionally, specific comment was submitted through the Council website, from numerous stakeholders, advocacy and industry groups.

Staff and working group leaders and members have also been conducting webinar presentations to groups of citizens, stakeholders, and communities. Due to the pandemic, much of this activity was conducted online, via zoom meetings, online surveys, and some limited, socially distanced outdoor meetings. We recognized that some communities may be harder to reach, especially those who lack access to the internet, and so as the work of implementation begins, staff will continue to work with key partners to reach groups that may be underrepresented in the climate process and/or experience disproportionate impacts, such as lower-income and rural residents, older adults, tribal communities, people of color, and New Mainers.