

A FOUR-YEAR PLAN FOR CLIMATE ACTION



MAINE

WON'T WAIT

DECEMBER 2020

MAINE CLIMATE COUNCIL

FROM GOVERNOR JANET T. MILLS

In the fall of 1970, 11-year-old Suzanne Clune wrote a letter to her United States senator.

She lived on the banks of the Little Androscoggin River, a once-pristine tributary where deer could see their reflection when drinking from the water and where spring pine and chokeberry blossoms “filled the air with the sweetest smell on earth.” That was before toxic chemicals polluted the waters and before noxious waste formed swells of thick discolored foam that ran downstream and coated the river banks.

“Now in any season,” Suzanne wrote to Senator Edmund S. Muskie, “you can smell the most sickening smell on earth, a stench that left frogs ‘gasping for air.’ I am sick of the river like this. Please do something about it.” Suzanne signed her letter, “One who loves Maine.”

Suzanne’s letter sparked Senator Muskie’s career-long fight for clean air and clean water. Today, as a result of his actions, the Little Androscoggin River is restored as a pristine waterway, like the Androscoggin, the Kennebec, and the Penobscot rivers — places where we now fish and sail and swim, places we love.

I am grateful that Suzanne did not wait to act.

Before us now is another threat — one that jeopardizes not only Maine’s natural resources but our state’s economic and social wellbeing, too. From our rocky coast to the western foothills, our pine tree forests, our bountiful farmland, and the people and creatures of all kinds who call these places home, the climate crisis poses a direct and immediate threat.

When I think about the current crisis, I think about Suzanne. I think about Senator Muskie, Senator George Mitchell, Senator William Cohen, former legislators like Harry Richardson, Hoddy Hildreth, and Sherry Huber — environmental champions bound not by ideology or political party but by a shared commitment to preserve and protect our cherished home, Maine.

I think of Maine’s indigenous people whose longtime stewardship and connection to the land is threatened by global warming. I think of thought leaders like Pope Francis, who requested an international conversation about the future of the planet, a conversation “which includes everyone, since the environmental challenge we are undergoing, and its human roots, concern and affect us all.” I think of our children and grandchildren and of generations yet to come.

With this crisis on our doorstep, we — like Suzanne Clune — can’t wait.

We must act now to honor the legacy of Maine’s environmental stewards who bequeathed this precious place to us, to preserve our state for our children and grandchildren to enjoy as we do, and to build a thriving economy with opportunities for growth far into the future.

Maine can’t wait to heed the warnings of scientists who tell us we cannot delay reducing carbon emissions to stem climate impacts, or preparing our communities to withstand extreme weather events, flooding, and warming that climate change is causing as we speak.

Maine can’t wait to improve the lives of Maine people through climate action: weatherizing homes and installing heat pumps to provide both comfort and savings; improving transportation options; increasing access to broadband; and creating greater energy efficiency to lower the maintenance and costs of our homes, cars, buses, and businesses.

Maine can’t wait to strengthen our economy by investing in renewable-energy infrastructure and providing good-paying jobs in clean energy and energy efficiency.

Maine can’t wait to stem the loss of more than \$4 billion a year which we send to out-of-state fossil-fuel companies every year, and instead keep that money here at home and transition to homegrown clean and renewable energy to power our homes, fight climate change, and move us toward energy independence.

Maine won’t wait to protect our natural resources and the industries that depend on them — forest products, agriculture, fishing and aquaculture — and support efforts to fight climate change while innovating and expanding our workforce.

Most of all, Maine can’t wait to make the most of this extraordinary moment in time. This plan against climate change comes in the midst of an unprecedented pandemic which has caused significant economic and social turmoil in Maine, across the country, and around the globe. It might be easier to put off climate action until calmer times. But Maine can’t wait. Maine shouldn’t wait. And Maine won’t wait.

This pandemic has only highlighted the need to diversify our economy, expand Maine’s workforce, and address the devastating consequences of climate change. The opportunity for a brighter, sustainable future is here and now. And the need is greater than ever before.

As Governor, this is what I propose:

We more than double the number of Maine’s clean-energy and energy-efficiency jobs by 2030. These 30,000 jobs will fight climate change while providing new opportunities to Maine working men and women and advancing long-term prosperity for our state.

I pledge that my Administration will support the outcomes laid out in this Climate Action Plan in every way possible.

I will submit bold legislation and proposals for public and private investment. We will seek federal officials etc. as partners in this effort, and keep a steady focus on our progress.

Eleven-year old Suzanne Clune’s letter to Senator Muskie 50 years ago was a call to action of that era.

Let this plan be today’s call to action — once again to protect the natural beauty of our state, to improve the lives of our families and the livelihoods of our people, and to ward off future natural disasters and economic crises.

Because, like Suzanne, we too are “ones who love Maine,” and we must do our best to preserve and protect it.

Sincerely,

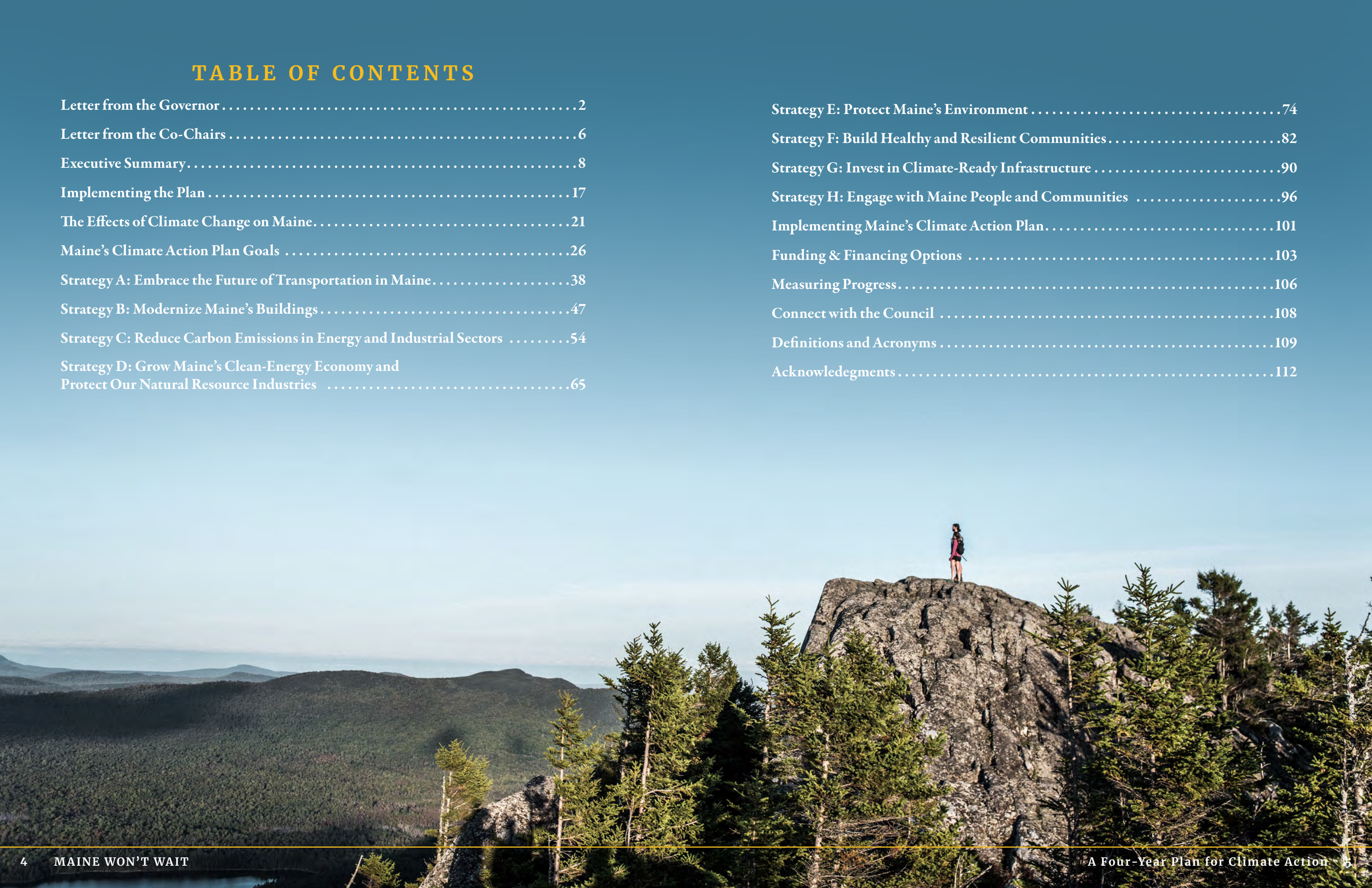


Janet T. Mills
Governor



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FROM THE CO-CHAIRS

Climate change represents the greatest threat of our age. There is widespread consensus on the urgent need to take action. But, during Maine’s first major planning process on climate in more than a decade, the COVID-19 pandemic and resulting recession put an unprecedented strain on our communities, businesses, and people.

The fast-moving devastation of COVID-19 exposed weaknesses in our national crisis response that mirrored the gradual effects of climate change, from inherent challenges of emergency preparedness and global supply chains, to the inequities and unequal burdens that economic and social disruptions have on vulnerable populations.

As the pandemic raged, grim reminders of climate change continued to emerge in Maine. The hottest ocean temperatures in the Gulf of Maine in a single day were recorded, and the most severe fire season and drought conditions in years punished the state, with devastating consequences for farmers.

Nevertheless, over the course of 14 months, hundreds of Maine people — despite the pandemic, while working from home and straining Internet connections, with kids learning remotely and dogs barking in the background — spent hundreds of their precious hours, one Zoom call at a time, considering and recommending actions to combat climate change.

Thousands more Maine people offered their climate concerns, observations, ideas, and encouragement to the Maine Climate Council, which was strongly urged to look past present-day pandemic challenges to set a course for bold action. Their dedication despite COVID-19 helped us all find our strength.

We are blessed to live in a state with world-class scientific institutions and researchers who helped us expand our knowledge. The expert Scientific and Technical Subcommittee created a foundation for the Council to understand the latest data, facts, and projections, as we know them today, about the effects of climate change in Maine.

The Council’s working groups — Transportation; Buildings, Housing, and Infrastructure; Energy; Natural and Working Lands; Coastal and Marine; and Community Resilience Planning, Emergency Management, and Public Health — presented robust, united strategies for action, sourced from the diverse expertise, interest, and concerns of their members including communities, businesses, organizations, government leaders, and youth.

The Maine Climate Council — a group of 39 committed leaders, experts, and advocates — took these detailed strategies and added groundbreaking economic and equity analyses and greenhouse emissions modeling to further inform their decision-making to develop this plan.

Lastly, we agreed — with full consensus — on this four-year plan for climate action. While we didn’t always agree easily, the plan reflects many of the diverse challenges Maine faces in the fight against climate change. It is centered on data-driven outcomes to achieve the ambitious emissions reductions goals laid out in law — a 45% reduction by 2030 and 80% by 2050.

Beyond reducing greenhouse gas emissions, the Plan also focuses on several other key goals. First is creating economic opportunity as we undertake climate and energy transitions. Second is preparing our communities, people, and economy for the impacts of climate change like rising sea levels, increased flooding, and changing weather conditions.

And finally, to advance equity as we undertake this work, to ensure communities and citizens who are often left behind can benefit from climate solutions by having access to opportunities and protection from threats.

Consistent and bold action on climate, over the next four years and into the decades beyond, will create a better future for our state and the next generations.

It will create thriving new economic sectors — from clean energy and efficiency to the forest products economy of the future, while ensuring a clean environment. It will save money for Maine people, towns, schools, and business each month from lower heating bills. It will improve rural transportation systems and open access to food grown and harvested by our fellow Mainers.

The pandemic also taught us that action to improve public health and emergency management systems, and to better prepare our communities, people, and infrastructure for the next crisis is critically important and saves lives.

Every individual, business, organization, and leader in Maine can play a role in making this plan a reality. This collective effort will be key to our success against the crisis that climate change poses for our state, nation, and world.

This starts with meeting the challenges of climate with action. That’s what this Plan does. And with your help and your action, we can make the most of this moment to address the challenge of our age.

But we can’t do it alone. Please join us in building a better future for Maine.



Hannah Pingree, Director
Governor’s Office of Policy Innovation and the Future



Melanie Loyzim
Acting Commissioner, Department of Environmental Protection

EXECUTIVE SUMMARY

In June 2019, Governor Janet Mills signed LD 1679 into law, with strong support from the Maine Legislature, to create the Maine Climate Council. The Council — an assembly of scientists, industry leaders, bipartisan local and state officials, and engaged citizens — was charged with developing this four-year Climate Action Plan to put Maine on a trajectory to decrease greenhouse gas emissions by 45% by 2030 and 80% by 2050, and achieve carbon neutrality by 2045.

Starting in September of that year, the Council and six working groups and a subcommittee — totaling more than 200 Maine people with a diverse set of experiences and backgrounds — began this work. This four-year Climate Action Plan, *Maine Won't Wait*, is the consensus result of those months of painstaking study, dialogue, discussion, and public deliberation to determine the steps Maine must take to combat climate change.

Backed by the first comprehensive scientific and technical assessment about climate change in Maine in a decade, *Maine Won't Wait* outlines the urgency with which Maine must slow the effects of climate change to make a meaningful contribution to global efforts, while also taking bold action to prepare Maine people, communities, and environment for climate-related harms to come.

At the same time, *Maine Won't Wait* details how addressing climate change presents transformational economic opportunities, such as from the growth of clean-energy sources and incentives for significant consumer, business and industrial investment in energy efficiency through weatherization, cutting-edge building materials, and alternative energy sources. These considerations take on added importance given the economic disruption caused by COVID-19.

Staving off climate change also protects the character of Maine — the pristine forests, rugged coastlines, and local farms that depend on strong, healthy, and vibrant natural ecosystems. These important natural and working lands are most at risk from climate change, and yet their ability to store carbon is a powerful tool against the harmful effects of climate change.

The failure to act against the effects of climate change carries a great risk for Maine, as doing nothing will cause costly damage to Maine's buildings and infrastructure, vulnerable ecosystems, iconic species, and public health.

This is why Maine won't wait, and why hundreds of volunteers gave their time and talents to develop this Climate Action Plan, and countless more Maine people offered insights, opinions, and inspiration during the process to inform this set of strategies that truly represents a plan that is right for Maine.

MAINE'S CLIMATE ACTION PLAN GOALS

Reduce Maine's Greenhouse Gas Emissions

While Maine has been among the leading U.S. states when it comes to mitigating greenhouse gas emissions, significant progress must still be made to meet the state's 2030 and 2050 targets.

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.

Foster Economic Opportunity and Prosperity

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 reverse workforce trends by supporting good-paying jobs that attract new workers and families, growing the economy, protecting key economic sectors most at risk from climate change, and fostering innovation in new business sectors that will drive climate solutions.

Advance Equity through Maine's Climate Response

Like other dislocations and disruptions to society, from recessions to pandemics, the costs of Maine's inaction on climate change will be acutely borne by vulnerable communities, which should be given foremost consideration for opportunities and support from climate action. A new Equity Subcommittee of the Maine Climate Council will support ongoing planning and implementation of Maine's climate strategies to ensure shared benefits across diverse populations of Maine people and to understand any concerns for implementation.





STRATEGY A Embrace the Future of Transportation in Maine

Transportation is responsible for 54% of Maine’s annual 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.

1

Accelerate Maine’s Transition to Electric Vehicles

- Achieve emissions-reduction goals by putting 41,000 light-duty EVs on the road in Maine by 2025 and 219,000 by 2030.
- By 2022, develop a statewide EV Roadmap to identify necessary policies, programs, and regulatory changes needed to meet the state’s EV and transportation emissions-reduction goals.
- By 2022, create 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.

2

Increase Fuel Efficiency and Alternative Fuels

- Continue to support increased federal fuel-efficiency standards.
- Significantly increase, by 2024, freight industry participation in EPA’s SmartWay program.
- Increase, by 2024, local biofuel and biodiesel production and use in Maine transportation sectors, especially heavy-duty vehicles (assuming Maine biofuels production becomes viable).
- Establish a time-limited incentive program, targeted to low- and moderate-income drivers, to encourage drivers to upgrade to higher-efficiency vehicles in the near term.

3

Reduce Vehicle Miles Traveled

- Reduce light-duty 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.
- By 2024, establish state coordination, strengthen land-use policies, and use state grant programs to encourage development that supports the reduction of VMT.
- Increase public transportation funding to the national median of \$5 per capita by 2024.
- Relaunch GO Maine to significantly increase shared public commuting options by 2022.

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

Heating, cooling, and lighting of buildings are responsible for almost one-third 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.

1

Transition to Cleaner Heating and Cooling Systems, Efficient Appliances

- Install at least 100,000 new heat pumps in Maine by 2025, ensuring that by 2030, 130,000 homes are using between 1-2 heat pumps and an additional 115,000 homes are using a whole-home heat-pump system. Install at least 15,000 new heat pumps in income-eligible households by 2025.
- Implement Maine Appliance Standards requirements by 2022.

2

Accelerate Efficiency Improvements to Existing Buildings

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

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.

4

Advance the Design and 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.

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 reductions. The state will produce a “Lead by Example” plan for state government by February 2021.
- Enhance grant and loan programs to support efficiency and renewable energy programs in municipal, tribal, school, and public-housing construction and improvements. Provide recognition programs for those projects making outstanding efforts.



“My prize thing is my heat pump. It worked out well for us financially, as well as it stabilizes our home.”

—Jim Fecondo, 86, Eagle Lake

6

Renewable Fuels Standard

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

7

Replace Hydrofluorocarbons with Climate-Friendly Alternatives

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



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 it even more essential to produce and consume electricity that is increasingly clean and from lower-emission resources. This transition must be managed effectively to ensure affordability and reliability.

1

Ensure Adequate Affordable Clean-Energy Supply

- Achieve by 2030 an electricity grid where 80% of Maine's usage comes from renewable generation.
- 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.

2

Initiate a Stakeholder Process to Transform Maine's Electric Power Sector

- Establish a comprehensive stakeholder process in 2021 to examine the transformation of Maine's electric sector and facilitate other recommendations of the Maine Climate Council.

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.

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 production facilities that achieve significant net greenhouse gas reductions.



STRATEGY D

Grow Maine's Clean-Energy Economy 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.

Transitioning to cleaner energy generation and greater energy efficiency offers exciting new economic opportunity. Maine currently spends roughly \$4.4 billion annually on imported fossil fuels. Clean and renewable energy solutions can help keep those energy dollars in Maine, catalyzing a transformative economic impact, while significantly reducing emissions.

1

Take Advantage of New Market Opportunities

- Support the ability of Maine's natural-resource economies to adapt to climate-change impacts.
- Grow Maine's forest-products industry through bioproduct innovation, supporting economic growth and sustainable forest management and preservation of working lands.

2

Clean-Energy Jobs and Businesses in Maine

- Launch a workforce initiative by 2022 that establishes ongoing stakeholder coordination between industry, educational, and training organizations to support current and future workforce needs.
- Establish programs and partnerships by 2022 for clean-tech innovation support to encourage the creation of clean-energy and climate solutions.



"Maine's clean-energy economy is building great opportunities for Maine-based contractors and providing incentives for students to consider careers in innovative energy generation right here at home."

—Matt Marks, CEO of AGC Maine, Member, Maine Climate Council

- Establish the University of Maine as the coordinating hub for state-applied research on forestry, agriculture, and natural land-related climate concerns, including research and development of climate-friendly bio-based wood-market innovation; and research around climate-friendly agricultural practices.
- Increase the amount of food consumed in Maine from state food producers from 10% to 20% by 2025 and 30% by 2030 through local food system development.
- Launch the Maine Seafood Business Council by 2022.

STRATEGY E

Protect Maine's Environment and Working Lands and Waters: Promote Natural Climate Solutions 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. Protecting natural and working lands from development maintains their potential to draw back carbon from the atmosphere, as well as provide important co-benefits. Maine's coastal and marine areas also store carbon, while supporting our fishing, aquaculture, and tourism industries.

1

Protect Natural and Working Lands and Waters

- Increase by 2030 the total acreage of conserved lands in the state to 30% through voluntary, focused purchases of land and working forest or farm conservation easements.
 - » 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.
- Develop policies by 2022 to ensure renewable energy project siting is streamlined and transparent while seeking to minimize impacts on natural and working lands and engaging key stakeholders.

2

Develop New Incentives to Increase Carbon Storage

- DEP will conduct a comprehensive, state-wide inventory of carbon stocks on land and in coastal areas (including blue carbon) by 2023 to provide baseline estimates for state carbon sequestration, allowing monitoring of sequestration over time to meet the state's carbon neutrality goal.
- Establish by 2021 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.
- Engage in regional discussions to consider multistate carbon programs that could support Maine's working lands and natural-resource industries, and state carbon-neutrality goals.

3

Expand Outreach to Offer Information and Technical Assistance

- Increase technical service provider capacity by 2024 to deliver data, expert guidance, and support for climate solutions to communities, farmers, loggers, and foresters at the Department of Agriculture, Conservation and Forestry, Maine Forest Service, Department of Inland Fisheries and Wildlife, the Department of Marine Resources, and the University of Maine.
- Launch the Coastal and Marine Information Exchange by 2024.

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 statewide collaboration by 2024.

- Create the framework and begin pilot for a coordinated, comprehensive monitoring system by 2024.
- Incorporate climate research and climate-change-related technologies into Maine's research and development priorities such as those developed by the Maine Innovation Economy Advisory Board and the Maine Technology Institute.



STRATEGY F

Build Healthy and Resilient Communities

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

1

Empower Local and Regional Community Resilience Efforts

- Provide state leadership for robust technical assistance and funding to communities by 2024 to support local and regional climate-resilience initiatives.

2

Adopt Official Sea-Level Rise Projections

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

3

Emphasize Resilience Through Land-Use Planning and Legal Tools

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

4

Strengthen Public-Health Monitoring, Education, and Prevention

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

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.

1

Assess Climate Vulnerability and Provide Climate-Ready Design Guidance

- Complete a statewide infrastructure-vulnerability assessment by 2023, as well as develop and implement design standards for resilience in infrastructure projects.

2

Establish the State Infrastructure Adaptation Fund

- **Launch a State Infrastructure Adaptation Fund and predevelopment 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.**



STRATEGY H

Engage with Maine People and Communities about 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.**

2

Increase Public Education Offerings Related to Climate and 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.**

3

Start the “Maine Climate Corps” for Climate-Related Workforce Development

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

4

Recognize Climate Leadership by Maine Businesses and Organizations

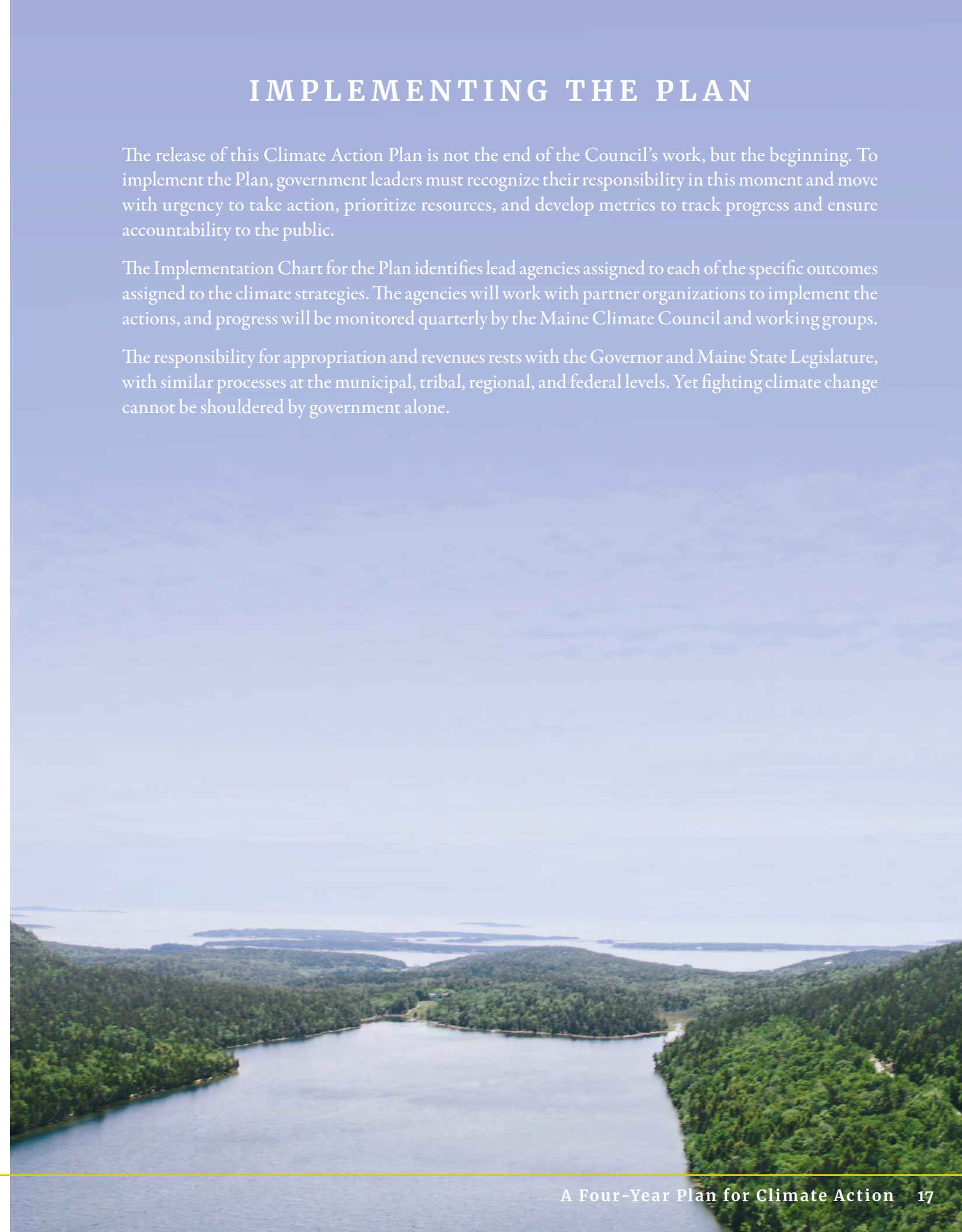
- **Launch the Governor’s Climate Leadership Council in 2021 to increase private-sector commitment toward voluntary climate actions.**

IMPLEMENTING THE PLAN

The release of this Climate Action Plan is not the end of the Council’s work, but the beginning. To implement the Plan, government leaders must recognize their responsibility in this moment and move with urgency to take action, prioritize resources, and develop metrics to track progress and ensure accountability to the public.

The Implementation Chart for the Plan identifies lead agencies assigned to each of the specific outcomes assigned to the climate strategies. The agencies will work with partner organizations to implement the actions, and progress will be monitored quarterly by the Maine Climate Council and working groups.

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. Yet fighting climate change cannot be shouldered by government alone.



PUBLIC INPUT AND SUPPORT

Hearing directly from Maine people — stakeholders, experts, local and regional leaders, legislators, businesses, youth, and the general public — was central in creating this plan and will continue to be important in the work ahead to turn the plan strategies into action.

From the beginning, Council working groups included 30-40 members with diverse perspectives and expertise. Each working group developed its draft recommendations in public via public meetings, conference calls, surveys, and individual and organizational input — a process that endured the rapid transition to virtual communication demanded by the COVID-19 pandemic.

In summer 2020, the Maine Climate Council released feedback surveys on climatecouncil.maine.gov about climate change and the working group strategies, which garnered more than 4,400 responses from more than 75% of Maine’s zip codes.

The Council also received many comments through its website from hundreds more people, stakeholders, advocacy, and industry groups. Staff, working group chairs, and members also conducted several presentations to stakeholder and community groups about aspects of the Plan.

This meant some communities, especially those with insufficient access to the Internet, are underrepresented in this Plan. As the Plan is implemented, Council leaders and staff will work to continue to find additional ways to reach these communities such as lower-income and rural residents, older adults, tribal communities, people of color, and new Mainers.

For this plan to be successful, the support and engagement of Maine people is critical: to mobilize a broad coalition of state, local, regional, and tribal governments, nonprofits, academic intuitions, and private interests taking collaborative, decisive action.

PLAN METRICS

To monitor progress, clear metrics for Maine’s climate goals are critical for both informing the public about whether policies are having intended outcomes, and for making evidence-based adjustments, enhancements, or replacements to policies in pursuit of our 2030, 2045, and 2050 targets. Suggested metrics to help Maine gauge its progress towards climate change goals are outlined on page 106.

FUNDING AND FINANCING

Climate action requires leveraging a variety of funding sources and 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 Plan, however, is emerging amid unprecedented conditions caused by the COVID-19 pandemic, which is stretching state revenues and many family budgets and has had a dangerous and disproportionate effect on Maine’s most vulnerable citizens.

This grave situation illustrates the urgent need to prepare our people, communities, and economy for 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 enable families to withstand major challenges in the future.

For a detailed funding and financing options for the Climate Action Plan, see page 103.

SOURCING AND CITATIONS

Facts and figures cited in the Plan come from several sources. Where sources are not otherwise specified in the text, data sources include analyses and references from the Scientific and Technical Reports produced for the Maine Climate Council (page 111); reports from Council working groups, the Intergovernmental Panel on Climate Change, the National Climate Assessment, United States Climate Alliance, U.S. Census National Oceanic and Atmospheric Administration, and the Maine Department of Environmental Protection.





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 have cataloged, and continue to catalog, the current and expected harms of climate change on our state. The Maine Climate Council’s expert Scientific and Technical Subcommittee (STS) is leading this charge. They identified the impacts on Maine from climate change in their exhaustive report, [“Scientific Assessment of Climate Change and its Effects in Maine.”](#)

The Assessment, which represents the contributions of nearly a hundred 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 harmful greenhouse gas emissions to support global efforts to slow climate changes and to prepare for the impacts of climate change.

As greenhouse gas emissions drive dramatic changes in Earth’s climate systems, the warming trends documented in Maine are more prominent than those observed by scientists globally.

Since 1895, Maine’s 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. Extreme weather conditions in Maine, such as drought and large rain events, are harming agriculture, shellfisheries, and freshwater and coastal ecosystems susceptible to climate change effects.

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.

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 environmental conditions.

Human and animal health are effected 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 floods that will erode infrastructure and degrade water quality in ponds, lakes, streams, rivers, and coastal areas.

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.

Rising greenhouse gases will also cause rapid 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.

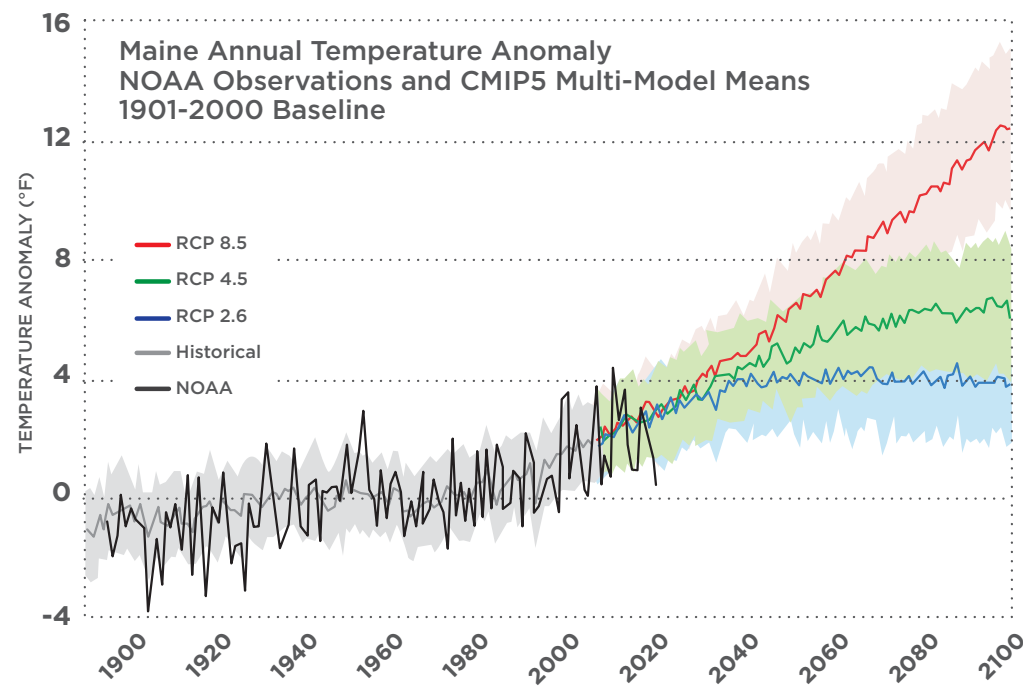
Looking ahead, if greenhouse gas emissions are brought under control so that global temperatures do not rise more than 2.7°F (1.5°C) above pre-industrial levels, it’s possible the southern coast of Maine may have an ocean climate akin to Massachusetts or Rhode Island today by the end of the century.

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 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 (approximately 0.1 inches/year) in the last few decades, after rising at 0.6 to 0.7 feet/century 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 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.

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



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

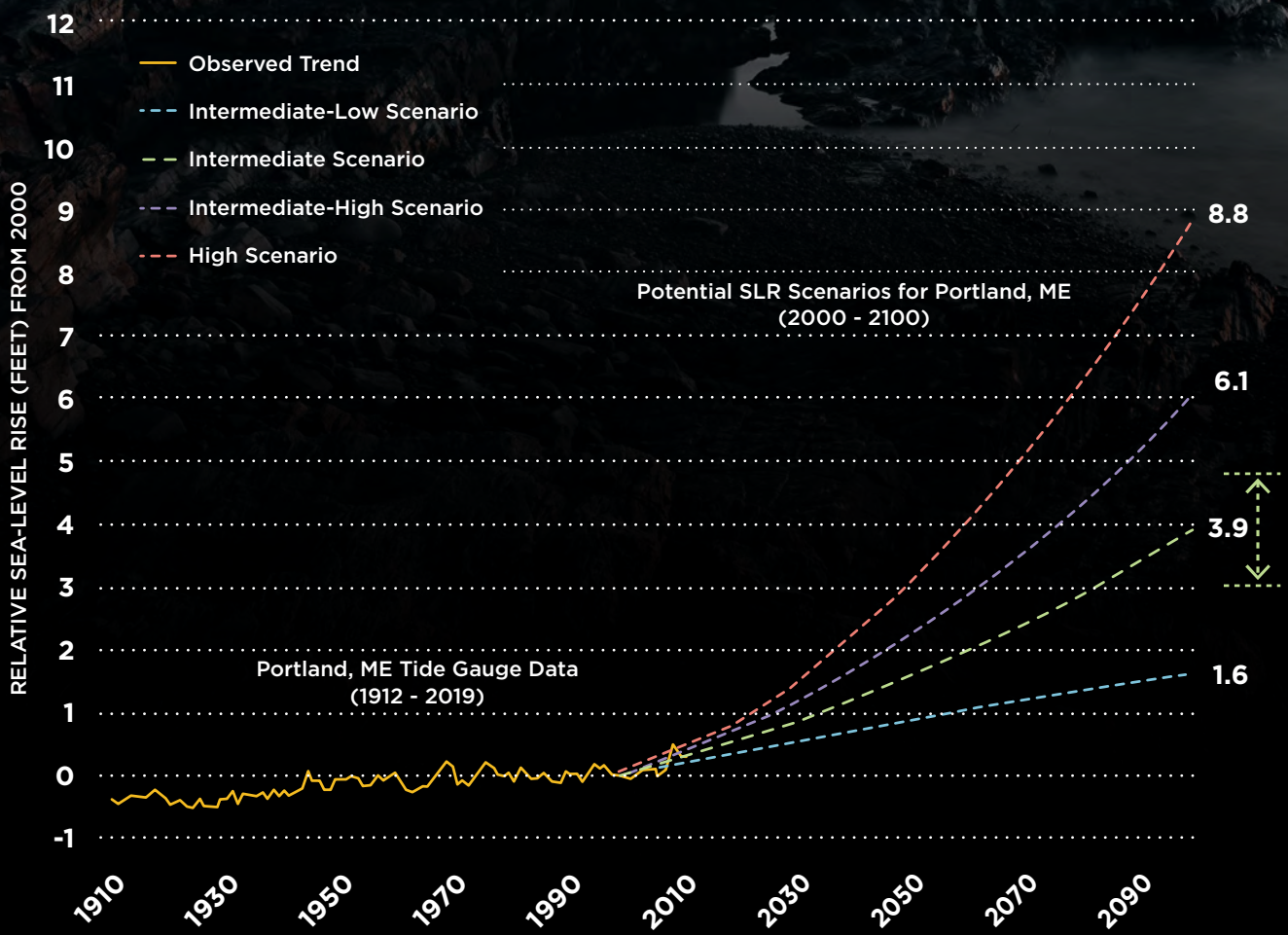


Chart by P.A. Slovinsky, MGS

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 (green 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 Scientific and Technical Subcommittee developed sea-level rise projections for Maine's coastal areas. Based on those projections, the Maine Climate Council recommends the state **commit to manage for 1.5 feet of relative sea-level rise by 2050, and 3.9 feet by 2100**. The Council also 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 it has been adopted by several New England states and municipalities.

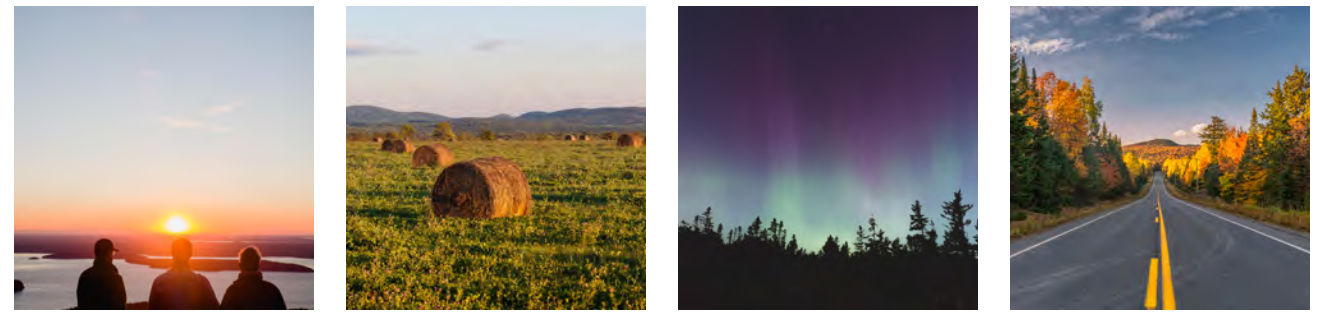
Changing climate conditions, particularly more extreme precipitation and declining snowpack from warmer winter seasons, create significant stress in

Maine's forests, which cover 89% of the state and support an important forest industry sector that has at least an \$8 billion direct economic impact. Maine also has some of the highest densities of non-native forest pests in the United States, further stressing important tree species.

Maine's forests and forestry sector are important resources for meeting our climate goals. Forests sequester over 60% of our annual carbon emissions (approximately 75% including forest growth and durable products).

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, including droughts and extreme weather events, are causing damage to farm livelihoods, impacting farmers, workers, crops, and livestock. Warming temperatures may provide a new season and opportunities, a potential transition and benefit.

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 lie ahead.

MAINE'S CLIMATE ACTION PLAN GOALS



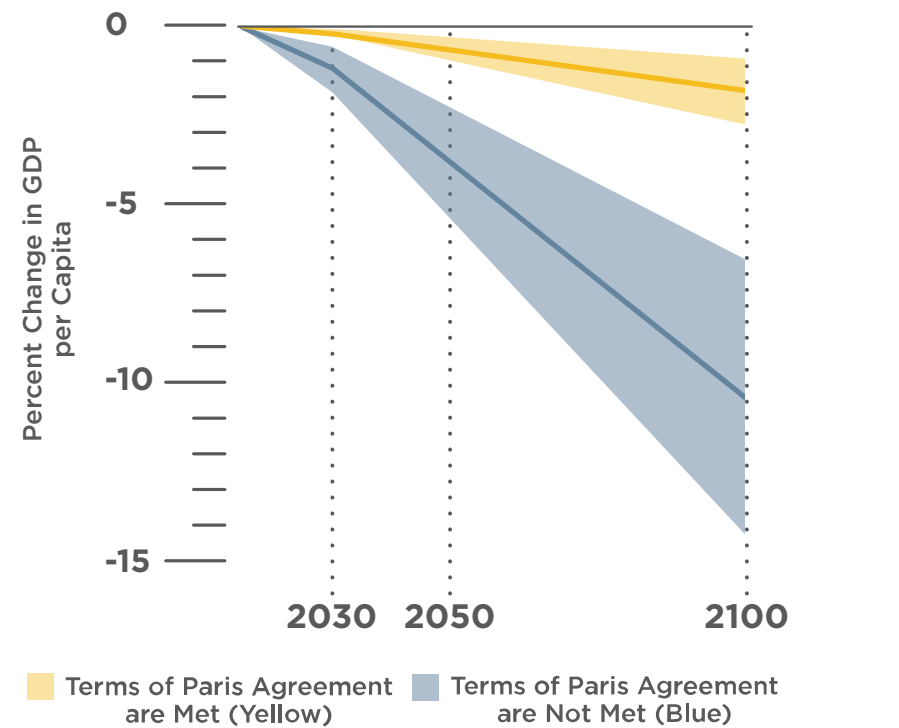
REDUCE MAINE'S GREENHOUSE GAS EMISSIONS

The consensus of climate scientists worldwide is 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 (CO₂) and other greenhouse gases. The increased challenges of extreme weather activity and rising temperatures highlight that these changes are already here.

Greenhouse gas emissions are rising at increasing rates in the United States and around the world. Global average atmospheric carbon dioxide levels reached 409.8 ± 0.1 parts per million in 2019 — a level of CO₂ not experienced on Earth for at least 3 million years.

Climate science indicates at least 1.8° F (1.0°C) of global warming has happened since pre-industrial times, and that the Earth will likely warm by 2.7°F (1.5°C) between 2030 and 2052 at current emissions 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 less. To accomplish this, the IPCC has found that we need to globally reach net zero CO₂ emissions, meaning that emissions sources are balanced by uptake of CO₂ by ecosystems and other processes, and greatly reduce other greenhouse gas emissions by 2050.

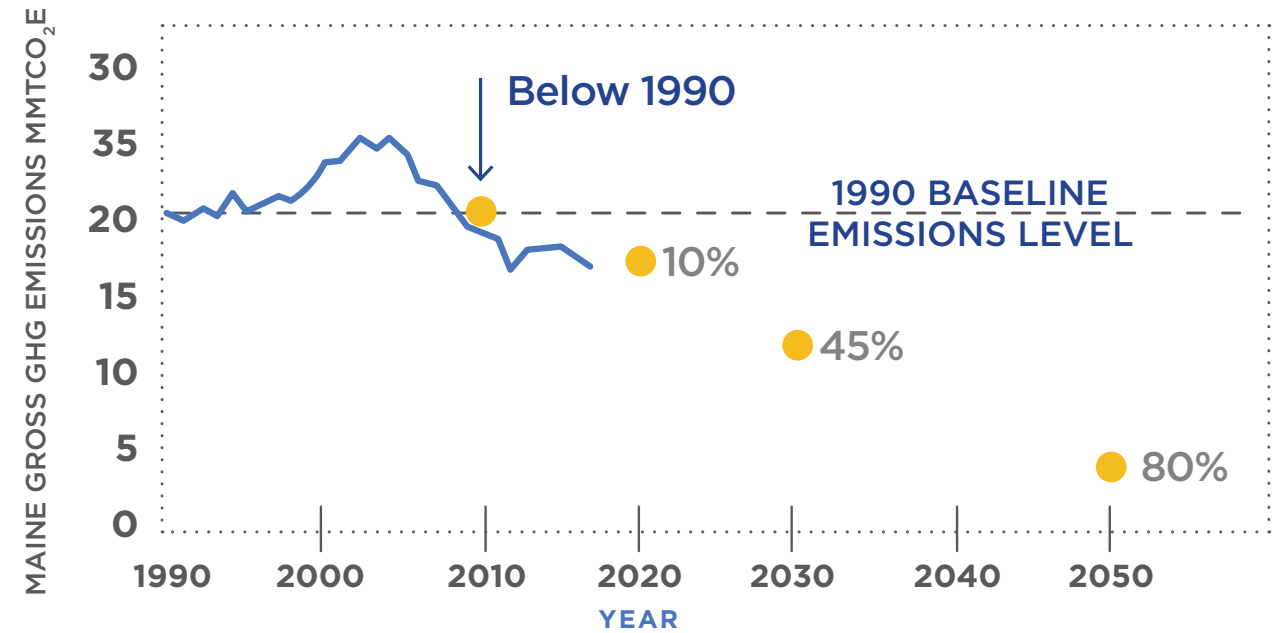
Figure 3: The Costs of Climate Change in GDP.



Wide band of color displays rate of adaptation to climate change. Top of band = rapid, Center/solid line = moderate, Lower = very slowly

Source: "Long-Term Macroeconomic Effects of Climate Change: A Cross-Country Analysis." by Matthew E. Kahn et. al. National Bureau of Economic Research, August 2019

Figure 4: Maine's Annual Greenhouse Gas Emissions and Reductions Goals.



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

To limit warming and reduce the severe impacts of climate change, the science is clear that the world must reduce greenhouse gas emissions as quickly as possible. In 2019, Governor Janet Mills signed legislation to require the reduction of Maine's greenhouse gas emissions 45% by 2030 and by at least 80% by 2050, and to create Climate Action Plans every four years to ensure the state has a roadmap for actions to accomplish these targets. In addition to these reductions set forth in law, Governor Mills has signed an Executive Order committing Maine to an additional target of carbon neutrality by 2045.

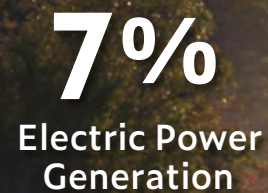
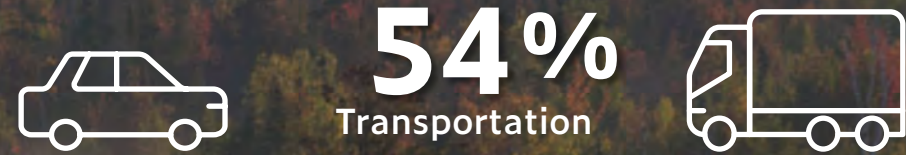
The strategies in this Climate Action Plan offer specific actions that support the state's meaningful contributions to the international efforts to slow global climate change, in alignment with the scientifically rigorous emissions reductions goals recommended by the IPCC. The 2016 Paris Climate Agreement aims to keep a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. These

same goals have been adopted by the United States Climate Alliance (USCA), a bipartisan coalition of 25 states including Maine formed when the U.S. withdrew from the Paris Climate Agreement.

While Maine has been among the leading U.S. states when it comes to mitigating greenhouse gas emissions, reducing our annual emissions from a high of 26.53 million metric tons of CO₂ equivalents (MMTCO₂e) in 2002 to 17.5 MMTCO₂e in 2017 (a reduction of 34% from 2002 levels, or 17.5% from 1990 levels), 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 and commercial buildings and operations, then industrial sources, and lastly from electricity generation. This Climate Action Plan outlines strategies to reduce emissions from all sectors, with an emphasis on the most significant sources of Maine's emissions.

FIGURE 5: MAINE GREENHOUSE GAS EMISSIONS BY SECTOR



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

The Maine Climate Council analyzed the future scenarios for Maine's greenhouse gas emissions, modeling different pathways for reductions and the status quo. There is always some uncertainty in projections and models, but they are a valuable tool for quantifying the impacts of particular strategies and clarifying the timing required to achieve our state's emissions-reductions goals.

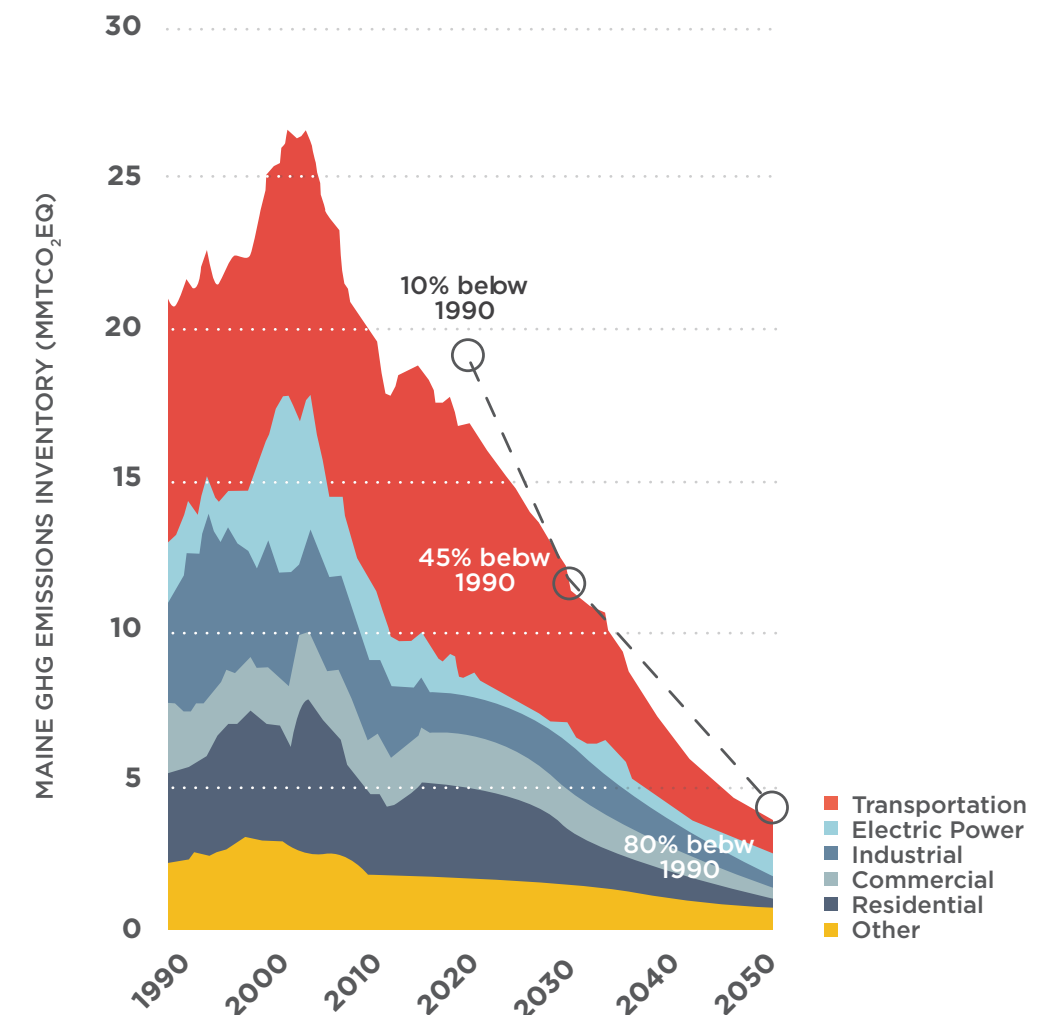
The analysis showed that if Maine continues on a "business as usual" path, emissions will slowly decline through 2030 and then flatten out in later years. Under that scenario, our 2050 emissions will be 13.8 million metric tons, which is 9.6 million metric tons greater than our 2050 target. In this scenario, transportation

accounts for 41% of emissions in 2050 and remains Maine's largest emissions source.

Figure 6 demonstrates a potential pathway that utilizes the strategies proposed by the Maine Climate Council in this plan, including a transition over time to a largely electrified transportation and buildings sector, combined with a transition to a clean electricity sector, allowing for significant greenhouse emissions reductions.

This pathway meets Maine's 2030 and 2050 emissions-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

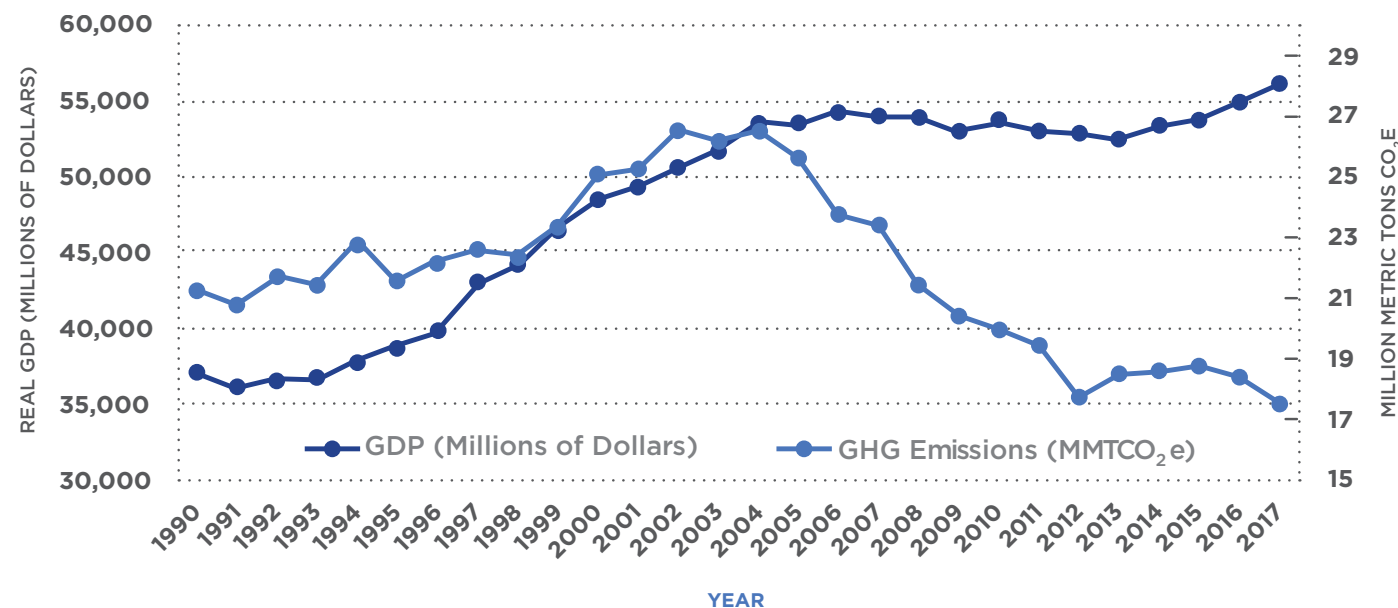
SECTOR	2017 GHG Inventory (MMTCO ₂ e)	2030 Projected Emissions	2050 Projected Emissions
Transportation	8.57	5.19	1.10
Electric Power	1.03	0.39	0.70
Industrial	2.46	2.37	0.78
Commercial	1.71	1.31	0.36
Residential	3.00	1.83	0.30
Other	0.74	0.59	0.49
Total	17.51	11.68	3.73

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 lands — to store carbon (or sequester that carbon in natural materials) 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 natural and working forests, farmland, and coastal lands.

Curbing emissions can also be done while growing a state’s economy. The 25 states of the United States Climate Alliance, including Maine, are reducing emissions and growing their economies at a faster pace than non-USCA states. Maine cut emissions by 32% from 2005 to 2017 while the state’s GDP grew.

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



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

Economic benefits, including job and business creation as well as savings for consumers, are also expected through advancements in technological innovation, particularly in the transportation, energy, and industrial sectors. In addition, bold renewable-energy production targets now enshrined in Maine law for the electricity sector —

80% renewable sources by 2030 and 100% by 2050 — are strong incentives for emissions reductions and concurrent sustained economic growth. Utilizing renewable energy produced in Maine to replace fossil fuels imported from elsewhere will spur significant economic benefit.

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. While mitigating the causes of climate change and better preparing Maine for its financial 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” 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.

VECTOR-BORNE DISEASES

In 2018
1,400
New Cases of
Lyme Disease



\$11.5
Million
in Treatment Costs



\$40,000
of Medical Costs
per Patient during
an EEE Outbreak in
Massachusetts

Per Patient Lifetime
Costs, up to
\$5.7
Million

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

Coastal beaches and dunes 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 1 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, nitrogen removal, and other ecosystem services that support Maine's coastal communities and commercial fisheries. The loss of these ecosystem services due to sea-level rise is estimated at between \$34 million and \$104 million by 2030 and between \$103 million and \$260 million by 2100.

Nearly \$700 million in direct value annually (and more in supporting businesses) 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 over the last few decades 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 30 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 through proactive actions.

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

FOSTER ECONOMIC OPPORTUNITY AND PROSPERITY

Even before the downturn as a result of the COVID-19 pandemic, Maine faced structural economic challenges. 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 like abundant natural resources, 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 reverse workforce trends by supporting good-paying jobs that attract new workers and families, growing the economy, protecting key economic sectors most at risk from climate change, and fostering innovation in new business sectors that will drive climate solutions.

The public and private investment required for climate change solutions represents a significant economic and workforce development opportunity for Maine in a broad range of career sectors, from existing fields such as engineering and the construction trades, to emerging fields like solar installation, offshore wind, and new advanced wood-products manufacturing.

Maine has a backlog of infrastructure projects for working waterfronts, roads and bridges, wastewater and water systems, and broadband deployment that will also create jobs and significant economic opportunities, support local communities and their economies, and increase Maine's resilience to the impacts of climate change.

Maine is poised to expand its clean-energy economy through continued development of renewable energy and energy efficiency. A report prepared for the Maine Climate Council, *Strengthening Maine's Clean Energy Economy*, outlines emerging job-growth trends in Maine and across the country, as well as near-term opportunities in clean energy that can support immediate economic recovery from the COVID-19 downturn and long-term career prospects in the emerging clean-energy and clean-tech 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, construction trades, and Maine-grown offshore-wind technology that offer significant opportunities, particularly in rural areas hardest hit by past losses of manufacturing jobs.

Coupled with bold targets for action and growth in energy-efficiency and electrification projects, such as doubling the pace of weatherization and installing at least 100,000 more high-efficiency heat pumps by 2025, the clean-energy economy is already creating jobs, reducing energy emissions, and providing cost savings to Maine consumers, as well as keeping energy dollars here in the Maine economy instead of exporting them out of state.

These strategies offer improvements in quality of life for Maine people, as homes are made more comfortable and affordable to operate. Heat-pump technology provides efficient heating, as well as cooling, which will be needed as summers get hotter. Electric vehicles have enhanced performance and cheaper operating and maintenance costs. These are critical co-benefits to the reductions in emissions that come through the reduced reliance of fossil fuels.

Climate change creates urgency for developing a clean-energy economy. At the same time, Maine's employment is projected to decline over the coming decade, due to demographic trends that see a large swath of the workforce entering 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 and climate-action goals, Maine will experience both immediate and long-term benefits for the people, the businesses, and the communities of our state.

ADVANCE EQUITY THROUGH MAINE'S CLIMATE RESPONSE

Like other dislocations and disruptions to society, from recessions to pandemics, climate change creates the greatest hardships for marginalized communities, many of whom are most vulnerable to its effects.

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

Floods affect more than buildings and infrastructure; they have devastating impacts on communities, businesses, local economies, and public health. If infrastructure is not adapted to better withstand sea-level rise, riverine flooding, and increased storm activity, small, rural, and under-resourced communities will struggle to rebuild their livelihoods and economies.

At the same time, high heat days and nights are a health risk for Maine people, especially older and lower-income residents, who are both vulnerable to these impacts and least able to afford improved insulation for cooling or air conditioning. 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 pregnant mothers and their babies.

The healthcare dollars required to treat high heat risk are also expected to escalate. With treatment costs at \$224,000 for 200 cases of heat illness in 2019, and healthcare costs forecast to be nine to 14 times higher in 2050, heat-related illnesses could cost as much as \$3.2 million annually, if hospital admissions 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. In addition, the benefits of climate-related job growth also require

attention to support opportunities in communities and among workers in the greatest economic distress. Deeply considering those impacts and maintaining an ongoing focus on issues of equity is essential in Maine's response to climate change. Throughout implementation of this Climate Action Plan, continuous engagement with diverse groups of Maine people and communities, especially those most impacted by climate and climate actions, is required for the development of fair and effective programs and policies.

A new **Equity Subcommittee** of the Maine Climate Council will support ongoing planning and implementation of Maine's climate strategies to ensure shared benefits across diverse populations of Maine people and to understand any concerns for implementation. The Equity Subcommittee will be tasked in 2021 with setting clear equity outcomes for proposed actions, monitoring progress, and making recommendations to ensure that programs and benefits reach the intended populations and communities.

An Equity Assessment of Maine's Climate Goals 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, and provided high-level recommendations and detailed considerations for many of the proposed climate strategies in this plan. Where the Equity Assessment called for further analysis of equity impacts, the Equity Subcommittee's ongoing engagement with diverse communities will inform the development of climate policies and programs.

Why is climate an important issue to you and the Penobscot Nation?

The Penobscot Nation, like the other Wabanaki and Indigenous Nations in North America, sees the earth as a living breathing being that is part of our families, communities, and central to our survival. It is part of our culture to be stewards of the earth, and as we grow and evolve we hold steady to that part of our philosophy as a people. I was honored to be asked to sit on the Climate Council because part of the tensions between the tribes and the state has to do with natural resources, and part of the healing should be coming together when we can for the common good of Maine.

How will an equity focus on climate contribute to the Plan's success?

Frontline communities like tribal nations, new Mainers, those in poverty, people of color, and more are disproportionately affected by the climate crisis. If we overlook their needs and experiences, we are not only doing them a disservice, we are setting back all of our work because it will be less effective in meeting our goals. A society is only as strong as its most vulnerable populations, and this holds true in climate work. As we make policy, we need to work from a place of inclusivity and equity to make sure our work is lasting and meaningful.

What do you want the Equity Subcommittee to accomplish?

I hope to continue important discussions around the intersections of climate and equity. As a subcommittee, we can inform the Council's work as well as the legislative process. I am hoping to shed a light on the experiences of marginalized people in Maine and how the climate crisis affects us, as well as solutions based on thoughtful consideration of these stories.

—Ambassador Maulian Dana, Penobscot Nation, Co-Chair, Equity Subcommittee and Member of the Maine Climate Council



STRATEGY A

EMBRACE THE FUTURE OF TRANSPORTATION IN MAINE



Transportation is responsible for 54% of Maine’s annual 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% of Maine’s transportation-related emissions are from light-duty passenger cars and trucks; 27% are from medium- and heavy-duty trucks; and the remaining 14% come from rail, marine, aviation, and utility equipment vehicles.

The most significant reductions of greenhouse gas emissions in Maine’s transportation sector will come through the long-term and large-scale electrification of our transportation systems, combined with strategies to increase the efficiency of gas- and diesel-powered vehicles, and to reduce the number of miles Mainers drive through expanded options and funding for public transportation, increased broadband deployment across the state, and support for policies that encourage development of housing, schools, and shopping areas in pedestrian-friendly downtowns and villages.

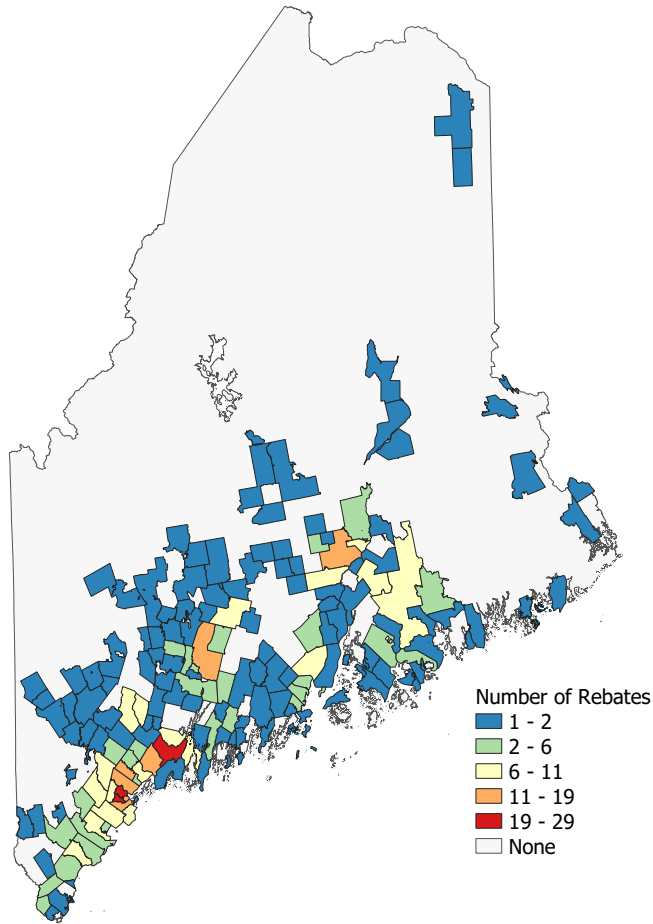
In addition to reduced carbon dioxide (CO₂) emissions to achieve Maine’s emissions-reduction goals, there are also major health benefits associated with cleaner air from reduced transportation emissions, including reduced nitrogen oxides, sulfur dioxide, and particulate matter.

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 found that 65% of our driving occurs on rural roads, with 35% in urban and suburban areas. Most of these total miles are driven in the southern half of Maine.

Maine’s transportation emissions also include emissions attributable to visitors to Maine — an estimated 37.4 million seasonal visitors and tourists in 2019, according to the Maine Office of Tourism.



Efficiency Maine Electric Vehicle Rebates
(8/28/2019 - 9/28/2020) by ZIP code



Maine's Expanding Network of Public EV Chargers

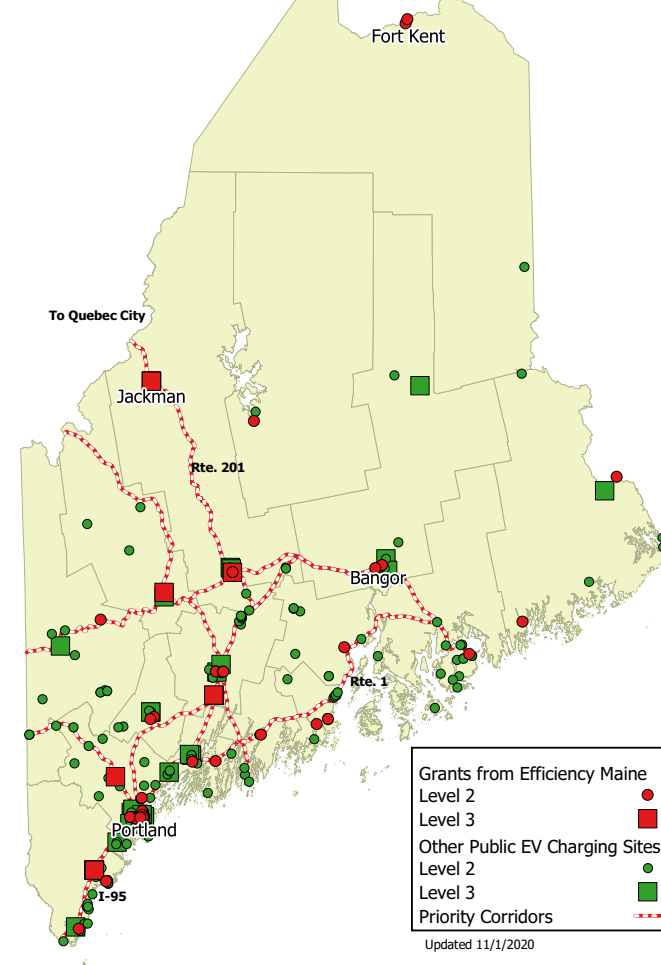


Figure 8: Year 1 of Maine's EV Rebate Program and State-wide Charging Infrastructure Distribution.

These visitors generate emissions when they arrive and travel through Maine by road, boat, air, or rail. In order to help Maine meet its climate-change goals we should consider options that shift some of the burden for emissions reductions and associated costs to these visitors.

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 include targeted incentives for low- to moderate-income drivers, such as for purchasing new or used electric vehicles (EVs) including 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.

In addition, the Assessment highlighted the equity benefits of expanding broadband and online services, bringing virtual educational, health, work, and business opportunities to more people, while reducing the need for driving and associated emissions.



In 2021, ecomaine of Portland is expected to become the first company in the U.S. to use all-EVs for waste hauling powered by its own waste-to-energy operation. The purchase of the EVs to replace diesel-powered trucks was made possible in large part by a combined grant from the U.S. Environmental Protection Agency's Diesel Emissions Reduction Act program and the Maine Department of Environmental Protection. The grant, combined with funds matched by ecomaine, allowed the company to secure two electric trucks from the Lion Electric Company of St. Jerome, Quebec. In addition to reduced maintenance costs, ecomaine expects to save 75% on fuel compared to diesel over the first six years.

1

Accelerate Maine's Transition to Electric Vehicles

- Achieve emissions-reduction goals by putting 41,000 light-duty EVs on the road in Maine by 2025 and 219,000 by 2030.
- By 2022, develop a statewide EV Roadmap to identify necessary policies, programs, and regulatory changes needed to meet the state's EV and transportation emissions-reduction goals.
- By 2022, create 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.

Maine's clean electric grid means that EVs emit significantly less greenhouse gas emissions per mile compared to gas or diesel vehicles. EVs currently account for less than 0.5% of registered vehicles in Maine. However, the market for, and supply of, EVs is expected to increase in coming years, due to advancements in technology, reductions in cost, and growth in consumer demand. Maine is also one of 13 states that has adopted California's emissions standards under the Clean Air Act, a foundational policy for accelerating EV adoption.

Adoption targets to incentivize the EV market are also growing; California, New Jersey, and Quebec have committed to reach 100% zero emission new car sales by 2035, with other states considering similar goals. Delivery companies like Amazon, UPS, and FedEx are also shifting 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.

PHEVs can also be part of a potential transition to increased electric driving, with more and more vehicles on the market getting from 20 to as many as 100 miles from a single charge before utilizing their gas engine.

EVs and other zero-emissions vehicles in the heavy-duty market are also a key target for emissions reductions, with early examples like school buses, garbage trucks, and public transit buses arriving in Maine in late 2020 and 2021. The heavy-duty market is important to long-term emissions reductions. Evolving technology innovations with new electric and hydrogen vehicles emerging in both national and international markets will help support reduced emissions in this sector.

To outline a specific plan to accelerate the widespread adoption of EVs, PHEVs, and other clean-car technologies in Maine, an “EV Roadmap” will be completed by 2022. This statewide EV Roadmap will 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.

Equitable access to EVs and PHEVs and charging is key — ensuring all Maine people have an opportunity to these new, lower-emissions transportation options that can save families money in operations and maintenance costs.

Utilizing current settlement dollars, Maine has both established a state EV-incentive program and has been installing charging infrastructure across the state through the Efficiency Maine Trust. While federal tax incentives for many vehicles are attractive (at \$7,500 for many EV models), as currently designed they decrease and disappear entirely with more EV adoption (for example, Tesla and GM have both exceeded the limits on number of vehicles and are no longer eligible). A renewal of the federal incentives is needed. Additional purchase incentives and targeted program design, including enhanced rebates, supportive charging

infrastructure and utility policies, used clean-vehicle options, and potential financing support, should be part of the Roadmap planning to ensure access to EVs, regardless of income and location.

2

Increase Fuel Efficiency and Alternative Fuels

- **Continue to support increased federal fuel-efficiency standards.**
- **Significantly increase, by 2024, freight industry participation in EPA’s SmartWay program.**
- **Increase, by 2024, local biofuel and biodiesel production and use in Maine transportation sectors, especially heavy-duty vehicles (assuming Maine biofuels production becomes viable).**
- **Establish a time-limited incentive program, targeted to low- and moderate-income drivers, to encourage drivers to upgrade to higher-efficiency vehicles in the near term.**

With ambitious goals of widespread EV adoption in the light-duty vehicle market later in the coming decade, Maine must also seek, where possible, to reduce transportation emissions from cars and trucks currently on the roads. A time-limited incentive program that encourages drivers to upgrade to higher-efficiency vehicles would 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 higher-fuel-efficiency 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



TRAVIS RITCHIE

Travis Ritchie, a STEM teacher at Geiger Middle School in Lewiston, is co-founder of the Maine Electric Vehicle Association (a community of EV enthusiasts) and a former EV mechanic. He leads “EV 101” seminars for prospective EV owners looking to flip the switch — which Maine will need to reach projected EV targets for curbing greenhouse gas emissions.

Why does an EV make sense for you?

I like driving but not commuting. I struggled between having a car I enjoyed and a great commuter that cut my driving costs. Prior to my EV, I would tally my fuel and maintenance expenses from commuting and say, ‘What a waste.’ Now, I have the best of both worlds using an EV as a daily driver. It costs pennies to get to work, and I have the instant torque to keep me interested in the drive.

What do you think is the biggest obstacle to EV adoption?

Range and cost are clearly the two most obvious hurdles, but I would say education is a close third. I think if more people understood how EVs work, how you don’t need a public charger if you can plug in at home, the reduced maintenance costs, and winter driving characteristics, they’d look forward to owning one someday. Most people I know can’t buy a new car, but once there is a better market for used EVs (choice and all-wheel-drive options), they will be on board.

What do you think of the Council’s recommendation on EVs?

The fact that they are considering the environment as well as the economy makes me impressed already. I am worried about the future of our planet, and I think EVs are one of many steps that must happen to transition to a sustainable future. I am already taking action, and hope to continue driving EVs and eventually switch to sustainable energy sources for heat and electricity in the future. I think the governor and legislature should try to find a way to include small, local businesses in the implementation of this plan wherever possible.

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 in applications where electrification is not currently practical. Unlike petroleum-based diesel, biofuels are based on plant- or algae-based carbon that was recently in the atmosphere, which means that when these fuels are burned, net emissions are lower than for fossil fuels. When these fuels are produced in Maine, there are economic benefits from their production that support both the forest-products industry and rural communities, and further emissions reductions from reduced fuel-transportation costs.

Federal fuel-economy standards (the National Highway Traffic Safety Administration’s Corporate Average Fuel Economy [CAFE] standards) regulate how many miles vehicles must travel on 1 gallon of fuel, and these standards have already led to emission reductions in Maine’s transportation sector. The Trump Administration rolled back the Obama-era CAFE, so the current standards are very weak. Maine has adopted California vehicle standards which are more stringent than federal standards. The state should continue to support efforts to push ongoing improvement in national CAFE standards.



3

Reduce Vehicle Miles Traveled

- **Reduce light-duty 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.**
- **By 2024, establish state coordination, strengthen land-use policies, and use state grant programs to encourage development that supports the reduction of VMT.**
- **Increase public transportation funding to the national median of \$5 per capita by 2024.**
- **Relaunch GO Maine to significantly increase shared public commuting options by 2022.**

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 with the growing prevalence of remote work, but it’s dependent on expansion of high-speed 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 Governor’s Economic Recovery Committee to stabilize Maine’s economy against the economic damage caused by COVID-19.

These recommendations align with a recent finding that one in six Americans is expected to switch permanently 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 innovative public transportation options in rural areas can replace the number of single-occupancy trips and also reduce household vehicle and commuting costs. Public-private partnerships like the Island Explorer (at far left) in Acadia National Park have shown that increased public transportation can support both commuting options for Maine residents and also decreased emissions from tourists.

To make the improvements necessary to expand participation and access for Maine people without other transportation options, funding for public transit needs to increase. Maine currently spends less than the national median of \$5 per capita.

Transportation emissions can be reduced when commuting is reduced. Development strategies that locate schools, workplaces, and shopping opportunities near where people live will reduce the need for driving.

These kind of cities, villages, and communities facilitate walking and biking, and support easier public transportation and ride-sharing options. Co-benefits include improved public health, reduced costs of infrastructure, and support for 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 would include encouraging state capital investments such as affordable housing and schools, and safe pedestrian and bicycling infrastructure in these areas.





STRATEGY B

MODERNIZE MAINE'S BUILDINGS

Energy-Efficient, Smart, and Cost-Effective Homes and Businesses

Heating, cooling, and lighting of buildings are responsible for almost one-third 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 efficiency measures such as heat pumps and weatherization that can be further expanded to achieve our goals.

Low-income households, especially rural low-income households, often pay a higher percentage of their income to meet their home energy needs. To meet Maine's climate and equity goals, weatherization and heat-pump incentive programs should continue to expand to reach more Maine people, with special efforts to engage diverse communities and geographies, especially those with the greatest energy cost burdens.

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 100,000 new heat pumps in Maine by 2025, ensuring that by 2030, 130,000 homes are using between 1-2 heat pumps and an additional 115,000 homes are using a whole-home heat-pump system. Install at least 15,000 new heat pumps 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. **About 60% of Maine households rely on heating oil as their primary home heating source — the highest percentage in the country — with an additional 12% utilizing propane.** There is a growing opportunity in Maine to transition to new technologies for heating that produce lower greenhouse gas emissions.

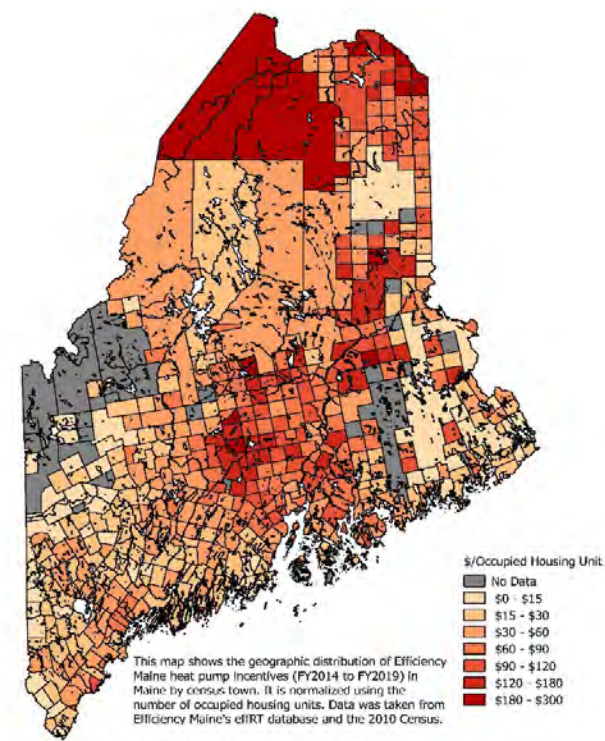
New high-performance electric heat pumps have 60% lower carbon dioxide (CO₂) emissions than oil burners. They are a cost-effective way to reduce emissions while saving homeowners money. Heat pumps have the added benefit of providing cooling in the summer months, which will be even more important as the number of high-heat days increases due to warming trends caused by climate change. These products have been shown to work well, even with Maine’s cold winters, particularly as technology has continued to improve.

Annual operating costs of heat pumps are lower than for oil furnaces. 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.

Modern high-efficiency wood heating is also an opportunity that supports Maine’s forest products industry and heating with a renewable Maine-grown heat source, as compared to oil or propane systems.

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



Appliance standards set performance requirements for home appliances, plumbing products, and lighting products in homes and businesses. They can help Maine meet our greenhouse gas emissions goals by reducing energy use and 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.

2

Accelerate Efficiency Improvements to Existing Buildings

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

Many of the 550,000 existing homes in Maine are aging and energy inefficient. More than half of owned and two-thirds of rented housing units were built in 1960 or earlier. 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 more homes, public buildings, and businesses energy efficient and saving millions in heating and operating costs. 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 healthcare sector, supporting reductions of emissions and energy costs through efficiency and renewable energy.



Cross-laminated timber, a value-added and climate-friendly construction material in lieu of steel, is used during construction of a 40-unit apartment building in Portland in summer 2020.

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 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-emissions 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 the transition to modern codes, transparency and disclosure requirements will support consumer information about building operational costs and incentivize high performance.

4

Advance the Design and 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.**

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.

Maine should promote the use of building materials such as mass timber and wood-fiber insulation. These innovative wood products reduce greenhouse emissions in construction, as wood products have lower "embodied carbon" values compared with steel, concrete, and many insulation products, while storing carbon for the life of the product. These products, if produced in Maine, also support 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 encourage innovative wood-construction material manufacturing facilities to locate in Maine.



Maine-based startup GoLab is expected to start making climate-friendly wood-fiber insulation in this former Madison paper mill in 2021.

Efficiency Maine Trust

Efficiency Maine Trust (EMT or Efficiency Maine) 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.

EMT's current residential incentives include rebates for heat pumps and heat-pump water heaters along with weatherization. Greater 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.



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, when paired with a clean electricity supply. Heat pumps can be used for space heating in homes and businesses and for domestic hot-water heating. The combined heating and cooling ability is another advantage of heat pumps over gas and oil systems. A typical high-performance heat-pump unit rebated through Efficiency Maine's programs can deliver a unit of heat with 60% less emissions today 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 falls well below 0°F. Over the life of the product, a heat pump will save homeowners, on average, from \$300 to \$600 per year in operating costs compared with 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 a significant portion of the current heating system and 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 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 support for LIHEAP customers through Maine Housing. Incentives are also offered for heat pumps 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. Despite a pandemic, the program is on pace to install more than 15,000 units in 2020, 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 water heaters is widespread, with the highest percentage of incentives per home going to northern Aroostook County.

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 reductions. The state will produce a “Lead by Example” plan for state government by February 2021.**
- **Enhance grant and loan programs to support efficiency and renewable 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 design and construction, including building materials selection; heating, cooling, and lighting systems; and enhanced efficiency and weatherization.

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

6

Renewable Fuels Standard

- **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 anaerobic 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 an RFS for heating fuels.

7

Replace Hydrofluorocarbons with Climate-Friendly Alternatives

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

Hydrofluorocarbons (HFCs), often referred to as climate “super pollutants,” are greenhouse gases with hundreds to thousands of times the heat-trapping power of CO₂. 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 significant climate threat. 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.

“LEAD BY EXAMPLE”

In January 2020, Governor Mills signed an executive order to require Maine state government to *Lead by Example* through energy efficiency, renewable energy, and related emissions reductions and savings, promoting health and sustainability in the workplace and building resilient infrastructure. It requires that state government will strive to equal or exceed Maine emissions-reductions targets and seek cost efficiencies for taxpayers and that new 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 cleaner and safer 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, invest in EVs and lower-emissions state fleet vehicles, and encourage telework to reduce vehicle miles traveled by state employees.

The state will identify opportunities to *Lead 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 will also seek to support similar efforts in local community buildings, 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 already led the way with efficiency, renewable energy, and clean transportation investments.



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 it even more essential to produce and consume electricity that is increasingly clean and from lower-emissions resources. This transition must be managed effectively to ensure affordability and reliability.

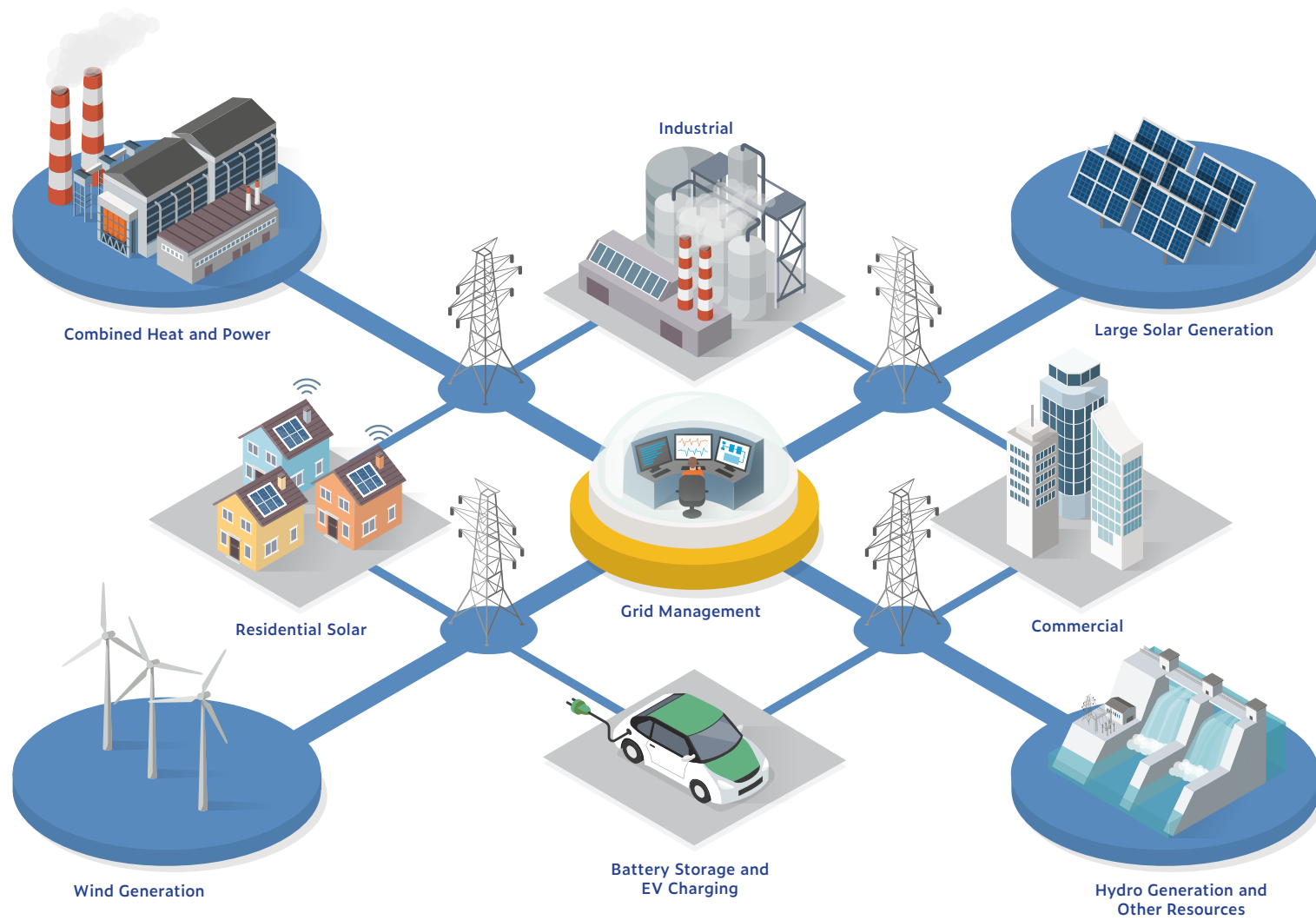
Maine is a member of a cooperative effort by 10 Northeast and Mid-Atlantic states to limit emissions called the Regional Greenhouse Gas Initiative (RGGI). RGGI is the first mandatory, market-based carbon dioxide (CO₂) emissions reduction program in the United States, and it is focused on the power-generating sector. RGGI proceeds in Maine have been used to provide technical assistance and financial incentives to help Maine's residents, institutions, businesses, and industries make investments in energy efficiency.

A Renewable Portfolio Standard (RPS) establishes the percentage of electricity that an electricity supplier is required to provide from renewable resources. To encourage more generation of lower-emissions 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.



DISTRIBUTED ENERGY RESOURCES

Distributed energy resource (DER) generally refers to small-scale electricity generation and controllable loads that are spread out and are connected to the distribution grid system, as opposed to the larger transmission system, or directly to a building or other host facility. The most common examples of DERs are residential solar installations, but DERs can also include larger solar installations, wind, small-scale hydro, tidal, and even energy storage. Distributed energy systems can also support investments in infrastructure that can lead to overall reduced costs (providing savings for ratepayers and supporting equity goals) and can avoid barriers that often accompany small-scale renewable energy projects.



In Maine, a distributed generation resource is defined by statute as being fueled by renewable technologies, and programs have recently limited the size to being less than 5 MW in capacity. Additionally, DERs can include demand-response technologies and interactive resources, such as electric vehicle smart chargers, smart thermostats, and heat-pump water and space heaters. These resources either provide energy to the electrical grid or allow for greater control of demand for electricity and are located at various geographic locations across the grid system, sometimes “behind the meter.”

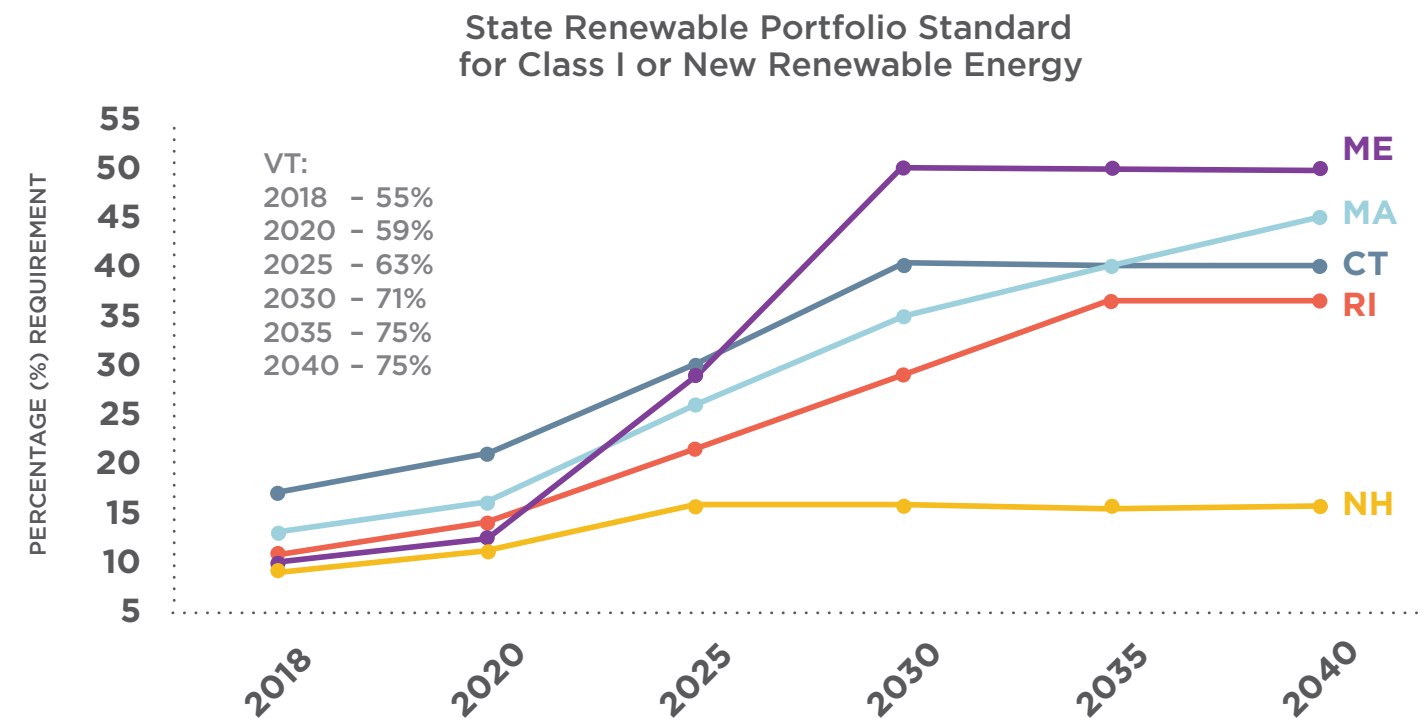
Figure 10 below from ISO New England shows the percentage requirement from Class I (new renewable-energy resources). It does not include Maine’s current Class II requirement of 30% which includes the existing forms of renewable energy generation. With these two classes combined, Maine will lead the region in clean power usage after 2025.

Maine’s clean-energy resources provide a significant opportunity to embrace energy innovations that can drive economic growth. As overall demand for electricity increases, we must continue to encourage energy efficiency and support shifting use away from high-use time periods (peaks) through demand management and “load flexibility” strategies. This will not only make Maine’s grid cleaner, but more reliable and affordable — critical 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, a focus on electric-rate structure, charging availability, and diverse communications with trusted partners about programs and savings will be essential to ensure equity. Clean-energy technology offers benefits like reduced pollution and job opportunities for frontline communities. Therefore to achieve equity outcomes, clean-energy benefits should be targeted to communities who would most benefit.

Figure 10: New England States’ Class I Renewable Portfolio Standards.



Source: ISO New England.
This chart is showing just Class I (and Class IA in Maine) resource requirements; the 80% RPS by 2030 includes Class II resources which can make up the remaining 30% in Maine.

1

Ensure Adequate Affordable Clean-Energy Supply

- **Achieve by 2030 an electricity grid where 80% of Maine's usage comes from renewable generation.**
- **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, it will be necessary to create new or expand existing clean-energy procurements in 2021 and 2022 based on the results from the Governor's Energy Office study due in January 2021. The state should 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. The state should work with landowners, developers, fishermen, and other important stakeholders to develop siting guidelines that seek to minimize impacts to communities, fishing, and the environment, and avoid significant losses of key farmlands.

Research has demonstrated that renewable energy sources can provide energy at a cost lower than or comparable to non-renewable sources. And as renewable-energy technology continues to advance, the cost of renewable energy is expected to further 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 the creation of thousands of high-quality jobs. As Maine shifts to a cleaner electricity and heating sectors, efforts should be made to reduce negative impacts on workers in existing Maine-based fossil-fuel businesses, like heating-fuel delivery, giving careful consideration to support the transition for these workers.

ADVANCES IN RENEWABLE ENERGY IN MAINE

Renewable energy technologies have advanced immensely over the last few decades. These advancements, along with supportive state and federal policies, have resulted in deployment of competitively-priced renewable electricity generation. The clean-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 residential projects to large utility-scale projects — has attracted significant investment and development interest. In the most recent RPS procurement in 2020 run by the Public Utilities Commission, solar was the majority of the large-scale generation selected. These 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; some of the strongest offshore wind speeds in the country are in the Gulf of Maine. Responsibly sited offshore wind can 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 a \$2.2 million grant 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 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 led by the University of Maine and a first-in-the-nation floating research array in the Gulf of Maine, there is significant potential for homegrown offshore wind technology and related opportunity.

Prior to any application for offshore-wind activities in the Gulf of Maine, in federal or state waters, it is essential that the state require meaningful consultation with stakeholders including Maine's fishing industry, on the identification of a site.



Turbines from Fox Island Wind generate power for the neighboring island communities of Vinalhaven and North Haven.

2

Initiate a Stakeholder Process to Transform Maine's Electric Power Sector

- **Establish a comprehensive stakeholder process in 2021 to examine the transformation of Maine's electric sector and facilitate other recommendations of the Maine Climate Council.**

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

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 reduced 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 (CHP) technologies.

Emissions modeling also shows other greenhouse gas, non-CO₂ emissions sources, as reported in the “other” sector of emissions, which come from industrial processes, agricultural, and landfill emissions along with other types of waste. Best practices and incentives

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.

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 the state's competitiveness well into the future.

The process will be managed by the Governor's Energy Office in coordination with the Maine Public Utilities Commission. Areas for consideration should include: utility structure, load management, data and information access, grid modernization and expansion, non-wires alternatives, 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.

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

can encourage mitigation of these emissions through innovation. Some of these same emissions 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. In the longer term, investment in new technologies will support emissions 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, as well as 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 production facilities that achieve significant net greenhouse gas reductions.**

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 byproduct 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.

Maine sawmills and wood manufacturers, for example, that 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.

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.

For sawmills and paper mills that produce wood chips, sawdust, and residuals during their manufacturing process, the best option for this material may be a highly efficient combined heat and power facility. At Robbins Lumber (at right), a fifth-generation family-owned white pine sawmill in Searsmont, a newly-installed combined heat and power facility handles the sawmill’s residuals, while generating heat to dry lumber, heat buildings, and renewable electricity. This supports the mill’s economic viability, adds value to lumber grown through sustainable forestry practices, and provides locally-sourced construction materials that sequester carbon for the long-term.





STRATEGY D

GROW MAINE'S CLEAN-ENERGY ECONOMY

Protect Our Natural-Resource Industries

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

Some of these same sectors will also have new opportunities in response to climate change. Locally-grown food offers economic development, emissions reductions, and increased carbon sequestration through good soil practices. In the forestry sector, innovative technology can reduce emissions and support carbon-neutrality goals. The Equity Assessment pointed out that these industries often carry associated benefits, such as supporting local jobs, to the rural communities in which they are located.

Transitioning to cleaner energy generation and greater energy efficiency offers exciting new economic opportunity.

Maine currently spends roughly \$4.4 billion annually on imported fossil fuels. Clean and renewable energy solutions can help keep those energy dollars in Maine, catalyzing 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 these 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

Take Advantage of New Market Opportunities

- **Support the ability of Maine’s natural-resource economies to adapt to climate-change impacts.**
- **Grow Maine’s forest-products industry through bioproduct innovation, supporting economic growth and sustainable forest management and preservation of working lands.**
- **Establish the University of Maine as the coordinating hub for state-applied research on forestry, agriculture, and natural land-related climate concerns, including research and development of climate-friendly bio-based wood-market innovation; and research around climate-friendly agricultural practices.**
- **Increase the amount of food consumed in Maine from state food producers from 10% to 20% by 2025 and 30% by 2030 through local food system development.**
- **Launch the Maine Seafood Business 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 direct economic impact. Global trends for innovative, climate-friendly products offer new markets to diversify and grow Maine’s forest-products industry. Supporting industry innovation can make the most efficient possible use of sawmill residuals and other residual biomass from timber, adding value for the industry while also reducing waste that could potentially be landfilled, causing additional climate impacts.

Maine should develop and enhance marketing programs for Maine forest products, in coordination with efforts such as FOR/Maine, 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

Sustaining and developing new markets for Maine's forest products is critical to maintaining the working forests that provide significant benefits to Maine's climate goals by sequestering carbon.

Low-grade wood harvest is an important sustainable forestry tool, which helps landowners grow better quality timber. At the same time, sawmills and paper mills produce a lot of chips, dust, and residuals as waste from the production process. Innovation is driving new market opportunities for these waste wood materials.

Public awareness of global climate change has driven governments, consumers, and manufacturers to recognize that products produced with plant materials (cellulose) from trees and other plant products can be used to replace those made with petroleum products. As new biomass from trees grows and replaces the plant materials used to produce these products, it removes carbon from the atmosphere and contributes to carbon neutrality.

Growing worldwide 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 buildings 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 information, tools, and technical assistance to enhance farm resilience and profitability in the face of climate change. This includes technical tools that translate weather and other environmental data into decision-support resources for farmers, guidance on incorporating climate risk into farm business models including access to crop insurance, the latest information on pest and pathogen risks and strategies to avoid related losses, and guidance to better protect the health of farmers to escalating risks like heat stress and vector-borne disease. It should also include greater access to funding to support implementation of soil-health practices and on-farm energy efficiency and renewable-energy projects. Enhancing on-farm adaptation to climate change with data, support, and incentives is the foundation upon which a resilient and vibrant food system in Maine is built.

A strong local food system will support Maine farmers, fishing and aquaculture harvesters, and other food producers while also supporting more resilient Maine communities. Maine's most recent experiences during the COVID-19 pandemic showed the challenges of global supply chains for a variety of basic needs, including food. 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. Reducing food waste that contributes to Maine's greenhouse gas emissions is an important aspect of a strong local food system.

Approximately 10% of the food that Mainers consume is produced in our state, possibly even more than that since the 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

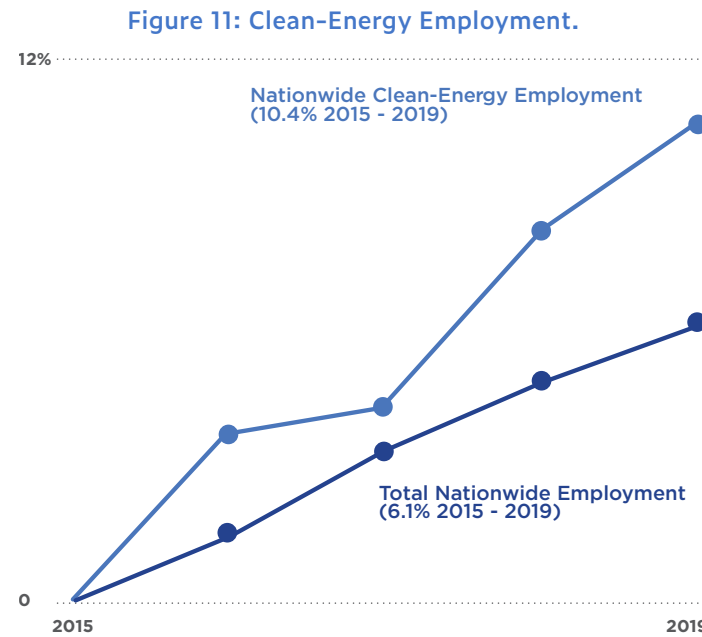
Maine should closely monitor species and habitat changes and provide information about ocean temperature, salinity, and acidity changes at the local level to support fishing and aquaculture businesses.

Maine’s wild fisheries and aquaculture industries will need to be managed in the context of changing ecosystems and a changing climate. This will require market support to promote stable businesses. It will also require industry groups and the state to work together to develop regulatory and policy changes at the local, state, and federal levels that promote the long-term productivity of valuable marine resources.

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.



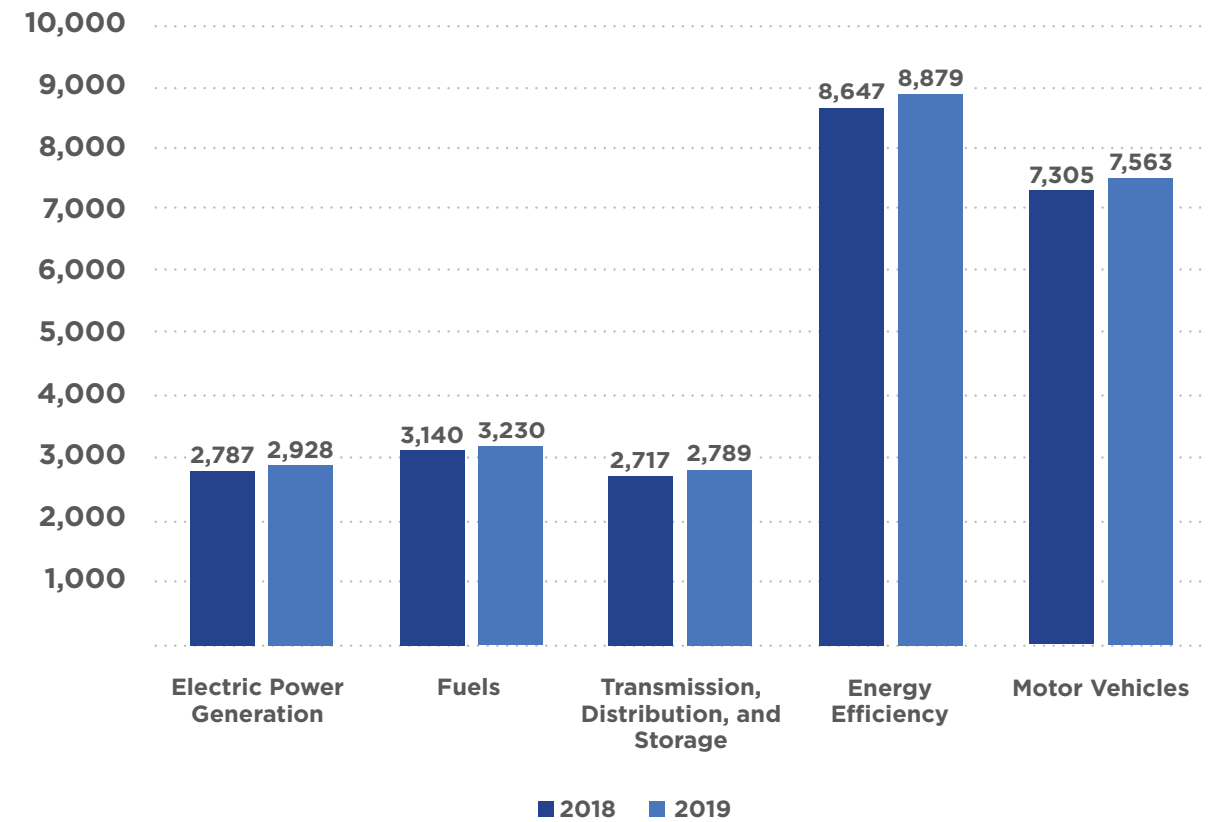
Maine should continue to evaluate and implement changes to Maine’s fishery and aquaculture laws and regulations that provide the opportunity to address environmental change and emerging fisheries. And with both federal regulation and co-management roles, partnership and advocacy in regional and federal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

2

Clean-Energy Jobs and Businesses in Maine

- **Launch a workforce initiative by 2022 that establishes ongoing stakeholder coordination between industry, educational, and training organizations to support current and future workforce needs.**
- **Establish programs and partnerships by 2022 for clean-tech innovation support to encourage the creation of clean-energy and climate solutions.**

Figure 12: Employment by Major Energy Technology Application.



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.

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.

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. The plan finds that median

U.S. hourly wages for clean-energy jobs are about 25% higher than the median wage. Clean-energy careers also offer a higher prevalence of health insurance and retirement benefits.

In Maine, there were approximately 14,000 clean-energy workers employed in 2019. Of those, 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.

At the same time, Maine is projected to lose overall employment in the next 10 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.

A skilled workforce is a key component of Maine’s transition to a clean-energy economy. By supporting educational and training pathways for Maine people to find careers, and attracting a talented, diverse workforce to Maine, the clean-energy industry has the potential to create new, sustained opportunities.

The Strengthen Maine’s Clean Energy Economy Plan highlights the importance of encouraging efforts to target the creation of these high-quality jobs 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 (guarantees of components and contracting with Maine workers and businesses) 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 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 aimed at 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.



MOISE MULAMBA KALONJI

Moise Mulamba Kalonji of Portland, a native of the Democratic Republic of the Congo, is an electrical engineering student at Southern Maine Community College.

Why did you choose Maine to live and study?

Prior to the U.S., I earned an engineering degree from the American Christian Liberal Arts University in Kinshasa, studied engineering and energy project management at Technische Universität Berlin, and worked for Greening Africa Together to promote solar energy and access to clean water. When I came to the U.S., I heard that Maine was safe and welcoming to immigrants, and the future here is bright in the clean-energy fields in which I want to work.

What do you want to achieve in clean energy?

My passion is solar, and I want to own my own solar energy company someday. My experiences in Africa and Europe showed me the great potential for clean energy to improve our environment and our economy, which is a sentiment I share with many of my classmates at SMCC. We are all excited about the opportunities the renewable-energy industry could have for us and for Maine.

What should be considered for this Plan as it moves forward?

There is more to be done to ensure new Mainers like me have access to the clean-energy economy, as energy consumers and also to support its growing workforce needs. We must think boldly about our actions and realize what we do in Maine has an effect across the world. And we should rise to the challenge before us — I’m proud to be here for the greening of Maine, and ask others to join in and help our state thrive against climate change.

STRATEGY E

PROTECT MAINE'S ENVIRONMENT AND WORKING LANDS AND WATERS

Promote Natural Climate Solutions 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 the powerful carbon-storage potential of forested lands. Maine's forests alone can draw back, or sequester, an amount equal to at least 60% of the state's annual carbon emissions, a figure that rises to perhaps 75% if forest growth and durable products are included.

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.

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.

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

1

Protect Natural and Working Lands and Waters

- **Increase by 2030 the total acreage of conserved lands in the state to 30% through voluntary, focused purchases of land and working forest or farm conservation easements.**
 - » **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.**
- **Develop policies by 2022 to ensure renewable energy project siting is streamlined and transparent while seeking to minimize impacts on natural and working lands and engaging key stakeholders.**

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 forest and farmland ecosystem services. A 2019 report on land conservation suggested that Maine currently has approximately 20% conserved lands or about 4 million acres.

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 support the conservation target and 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, the Agricultural Conservation Easement Program, and other applicable grant programs that leverage additional dollars.

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.

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.

MELISSA LAW

Melissa Law is the co-owner of Bumbleroot Organic Farm, an organic vegetable and flower farm in Windham, an award-winning entrepreneur, and a member of the Maine Climate Council.

Why is it important for farmers to engage in climate issues?

Farmers are on the frontlines of climate change — our livelihoods literally depend on the weather. As weather becomes less predictable and more severe, it will be increasingly difficult for farmers to grow the food that sustains us all. As a young farmer, I view climate change as the biggest challenge my business will face in the decades to come. I want to make sure young voices are heard, as future generations will bear the burden of this crisis. I view climate action as nonnegotiable.

What is your concern for farming’s future with climate change?

The climate crisis threatens farms of all sizes and sectors — from vegetables and specialty crops to dairy, livestock, and commodities. It will undermine crop yields, supply chains, and food security. Supporting farm businesses and strengthening local and regional food systems are key to building resilience to the instability and economic impacts of climate change in our state.

What should farmers know about this plan?

This plan protects farmland from development, promotes climate-friendly practices in agriculture, and strengthens our local food system — all of which are critical for farmers and for Maine communities. Not only will this result in increased carbon sequestration and reduced emissions, this will ensure that our communities have local food producers, enhance food security for Maine people, and reduce our dependence on food transported thousands of miles to our state.



2

Develop New Incentives to Increase Carbon Storage

- **DEP will conduct a comprehensive, statewide inventory of carbon stocks on land and in coastal areas (including blue carbon) by 2023 to provide baseline estimates for state carbon sequestration, allowing monitoring of sequestration over time to meet the state's carbon-neutrality goal.**
- **Establish by 2021 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.**
- **Engage in regional discussions to consider multistate carbon programs that could support Maine's working lands and natural-resource industries, and state carbon-neutrality goals.**

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.

In coming years, Maine will engage in regional discussions to consider multistate 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 landowner 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.

3

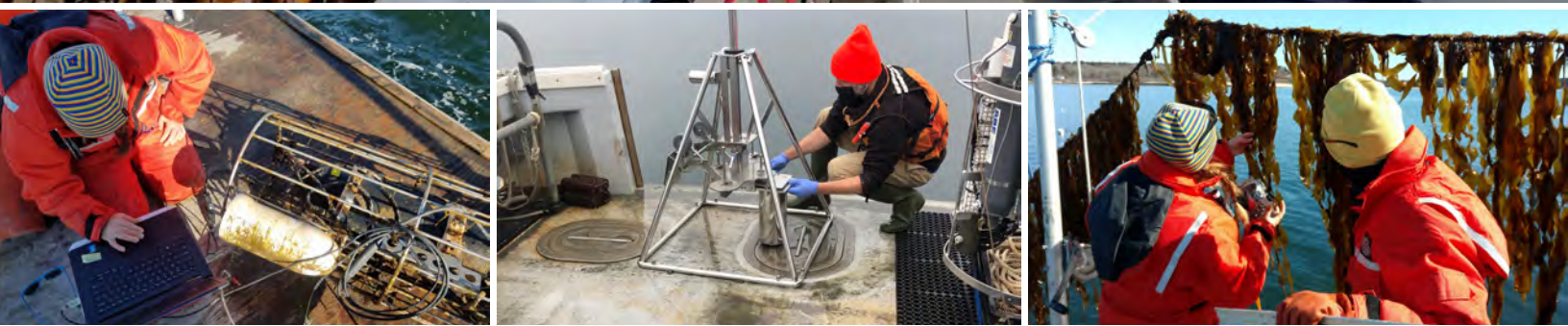
Expand Outreach to Offer Information and Technical Assistance

- **Increase technical service provider capacity by 2024 to deliver data, expert guidance, and support for climate solutions to communities, farmers, loggers, and foresters at the Department of Agriculture, Conservation and Forestry, Maine Forest Service, Department of Inland Fisheries and Wildlife, the Department of Marine Resources, and the University of Maine.**
- **Launch the Coastal and Marine Information Exchange by 2024.**

COASTAL AND MARINE Coastal and marine environments store carbon, and some such as salt marshes may store more carbon per area than land. 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.

As part of the comprehensive, statewide carbon inventory conducted by DEP, in partnership with the Scientific and Technical Subcommittee, Maine should determine where and how much blue carbon can be stored by conducting a coastwide survey of coastal environments like salt marshes, seaweeds, and seagrass beds. We should explore innovative solutions like opportunities for seaweed aquaculture to enhance long-term carbon burial and to support targeted reductions of coastal acidification. 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.





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 a priority for state agricultural programs. Technical assistance to farmers via Soil and Water Conservation Districts, the University of Maine Cooperative Extension, Natural Resources Conservation Service, 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 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 statewide collaboration by 2024.**
- **Create the framework and begin pilot for a coordinated, comprehensive monitoring system by 2024.**
- **Incorporate climate research and climate-change-related technologies into Maine’s research and development priorities such as those developed by the Maine Innovation Economy Advisory Board and the Maine Technology Institute.**

Photos at left: Kelp can provide a natural climate solution to draw down greenhouse gases and reduce acidification and nutrient pollution in coastal waters. As it grows, kelp draws carbon out of ocean water, creating a “halo effect” that can help improve nearby water quality. Scientific researchers, like those shown here from the Bigelow Laboratory for Ocean Sciences, and aquaculture businesses in Maine are now partnering to experiment with growing kelp alongside shellfish growing operations to naturally improve water quality and reduce local acidification.

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 monitor 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 potential future participation in carbon-offset markets.

STRATEGY F

BUILD HEALTHY AND RESILIENT COMMUNITIES

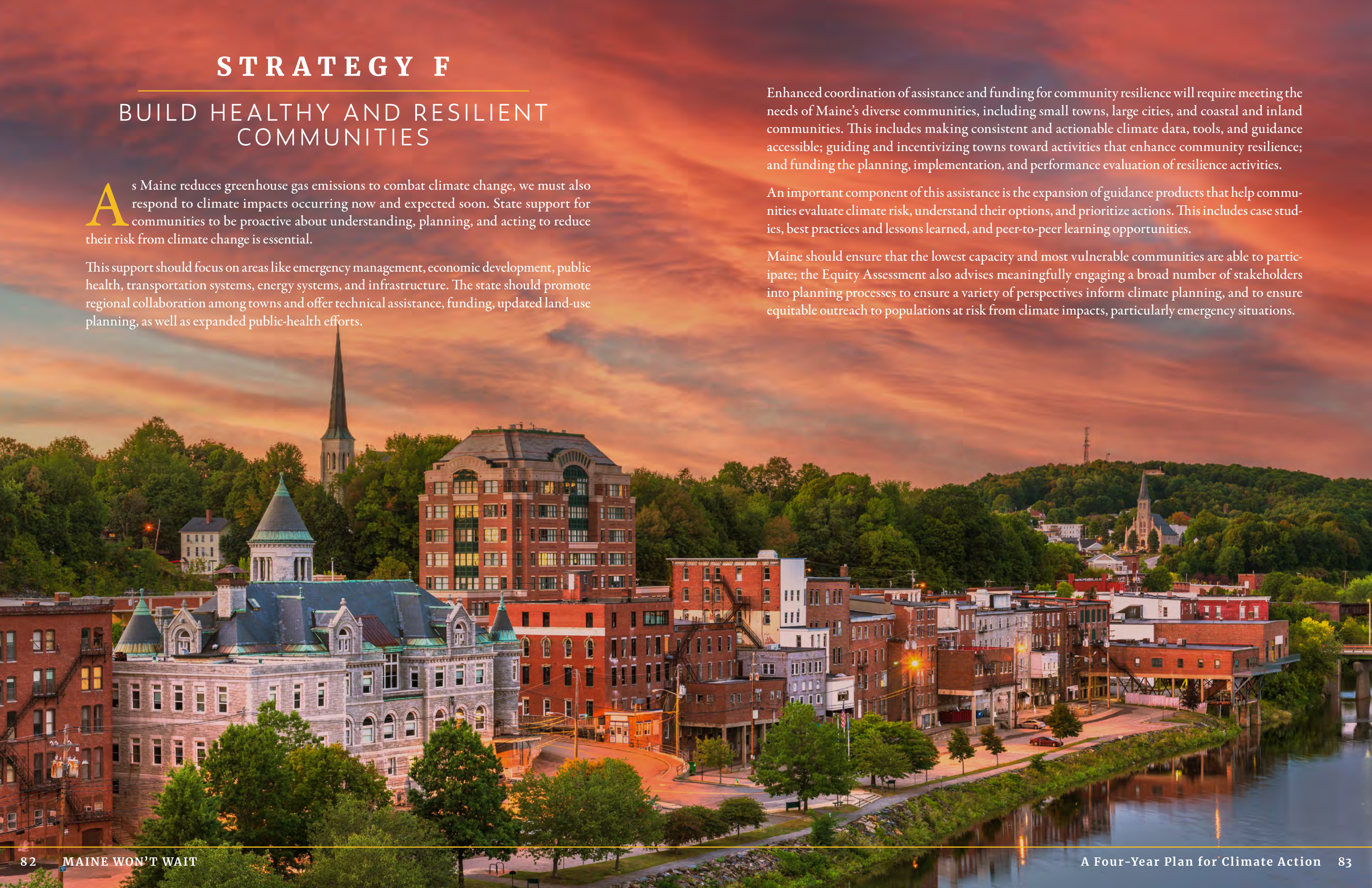
As Maine reduces greenhouse gas emissions to combat climate change, we must also respond to climate impacts occurring now and expected soon. State support for communities to be proactive about understanding, planning, and acting to reduce their risk from climate change is essential.

This support should focus on areas like emergency management, economic development, public health, transportation systems, energy systems, and infrastructure. The state should promote regional collaboration among towns and 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, and 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.





KARINA GRAETER + ABBIE SHERWIN

Karina Graeter and Abbie Sherwin are on the front lines of climate resiliency with the Southern Maine Planning and Development Commission in coastal York County, where rising sea levels portend serious economic and environmental damage. As Sustainability Coordinator and Senior Planner & Coastal Resilience Coordinator, respectively, they work collaboratively with several coastal towns on resiliency strategies, a regional approach the Climate Action Plan endorses as a model for other communities to consider.

What inspires you to do this work?

Southern Maine municipalities are on the front lines of climate change, and we're inspired by their enthusiasm to work together in a true regional effort to address climate issues and impacts. In a home-rule state like Maine, there is so much opportunity for communities to test creative and novel approaches to tackle climate challenges, be leaders on climate action, and help protect the places, natural resources, and way of life so valued by our communities for future generations.

What do you think is the biggest obstacle to your work? Or the biggest opportunity?

For our communities, the biggest obstacle to mitigating and adapting to climate change is the lack of capacity, guidance, and support. A regional strategy like ours is the biggest opportunity for addressing these needs. By helping the towns communicate and work together on climate change initiatives, we can leverage peer learning to share knowledge and experiences, and we can pool resources for regional initiatives that have a broader impact.

This sort of regional collaboration is just one piece of the puzzle for understanding and addressing local climate impacts. The Climate Action Plan will help to address some obstacles and information needs, but substantive work on climate change and mobilization of the Climate Action Plan will require coordinated and comprehensive action across all levels of government in Maine.

What would you like the governor or legislature to consider when they read this Climate Action Plan?

When reading the Climate Action Plan, we would like our state decisionmakers to keep in mind that our municipalities enthusiastically support the State's efforts to address climate change, and they are eager to play key roles in meaningful climate action. To do that, municipalities need useful and usable information, technical resources, direct assistance, and financial support for understanding and addressing the impacts of climate change.

1

Empower Local and Regional Community Resilience Efforts

- **Provide state leadership for 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 while 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 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.

On page 86, the left-hand map 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.

The state should establish cabinet-level leadership (for example, a state resilience officer) and coordination across state agencies and with nonprofits, university experts, and other partners.

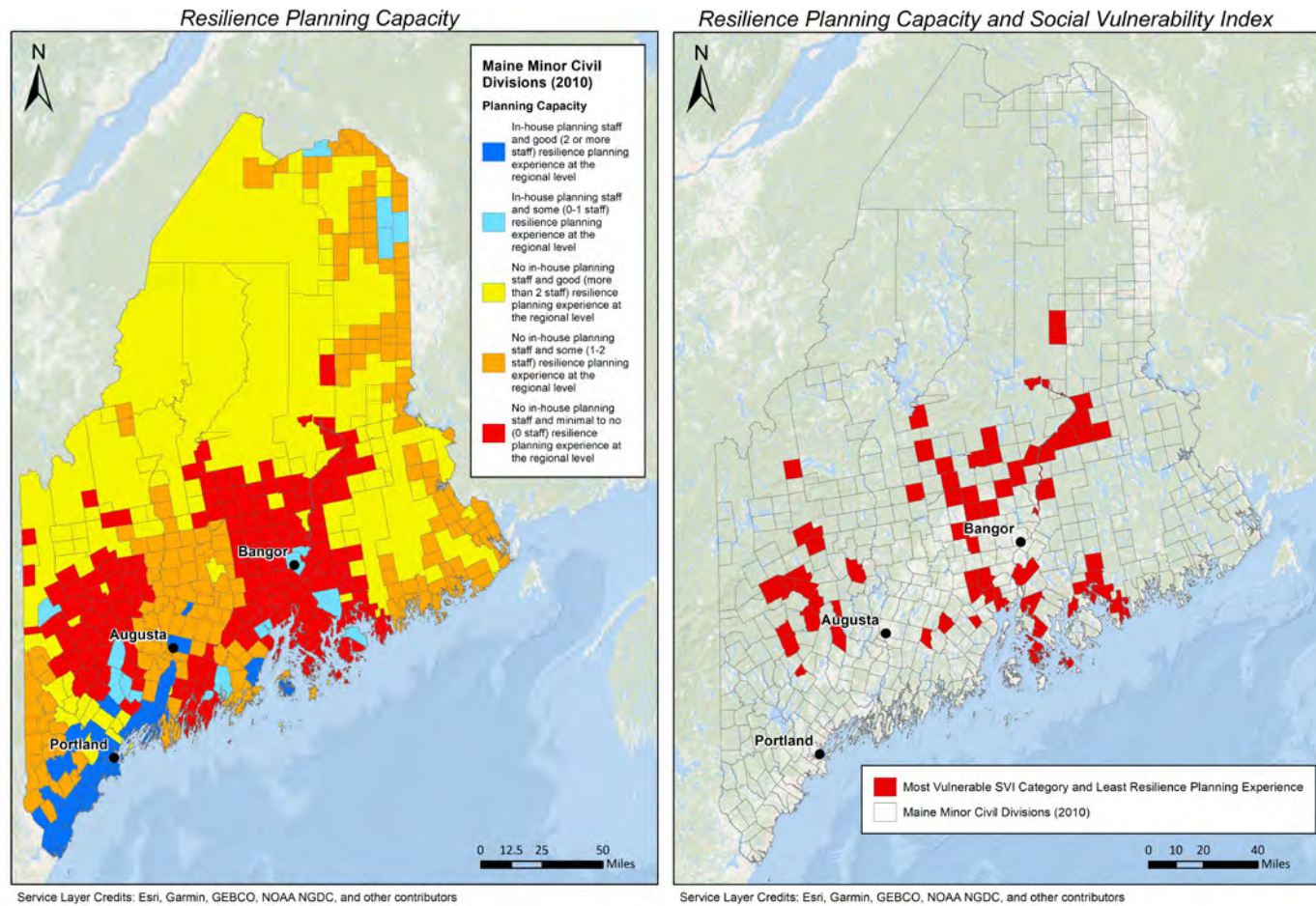
Expanded state assistance should include a clearing-house for climate information, best practices, case studies, and funding resources to help towns understand climate risk, evaluate options, and prioritize actions. Increased funds should be available to incentivize regional resilience planning and cooperation and the inclusion of climate resilience in local and regional plans, regulations, and capital-investment plans. 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 state sea-level rise projections into regulations by 2022 and require regular updates to ensure the projections utilize the latest scientific data.**

Figure 13: Municipal Planning Capacity.



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 Scientific 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 Scientific and Technical Subcommittee should update these projections every four years for Council and state consideration.

3

Emphasize Resilience Through Land-Use Planning and Legal Tools

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

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 to 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.



This causeway is a vulnerable portion of the only road that connects the communities of Deer Isle-Stonington to the mainland. Yet with increasing severity of storm surge and rising seas, this vital transportation link is threatened.

4

Strengthen Public-Health Monitoring, Education, and Prevention

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

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-borne 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. Every \$1 spent on source water protection saves \$27 in future water-treatment costs, so there is an enormous financial advantage to taking proactive actions that prevent contamination.



Clean water is important for public health and economic development. 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.

By 2024, Maine will have convened stakeholder processes to make specific recommendations for changes in state regulations on the following land-use issues.

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 continue to work to achieve its ambitious renewable energy goals while balancing protection of our natural resources, seeking siting that has the least impact on prime agriculture lands, and fishing and marine industries.
- **LAND-USE PRACTICES:** Maine should encourage and incentivize climate-friendly local land-use policies that promote convenient, walkable, and bikeable communities and reduce the need for driving and commuting. 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 to support flood risk reductions for communities and state infrastructure. 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.



“Like COVID-19, climate change most affects people who already have low health equity to begin with — those who, for a number of reasons, don’t have opportunities to be healthier. Indeed, it’s these health inequities that place individuals and communities at the greatest risk for the harmful effects of climate change.”

—Nirav D. Shah, Maine Center for Disease Control, Maine Climate Council Member

STRATEGY G

INVEST IN CLIMATE-READY INFRASTRUCTURE

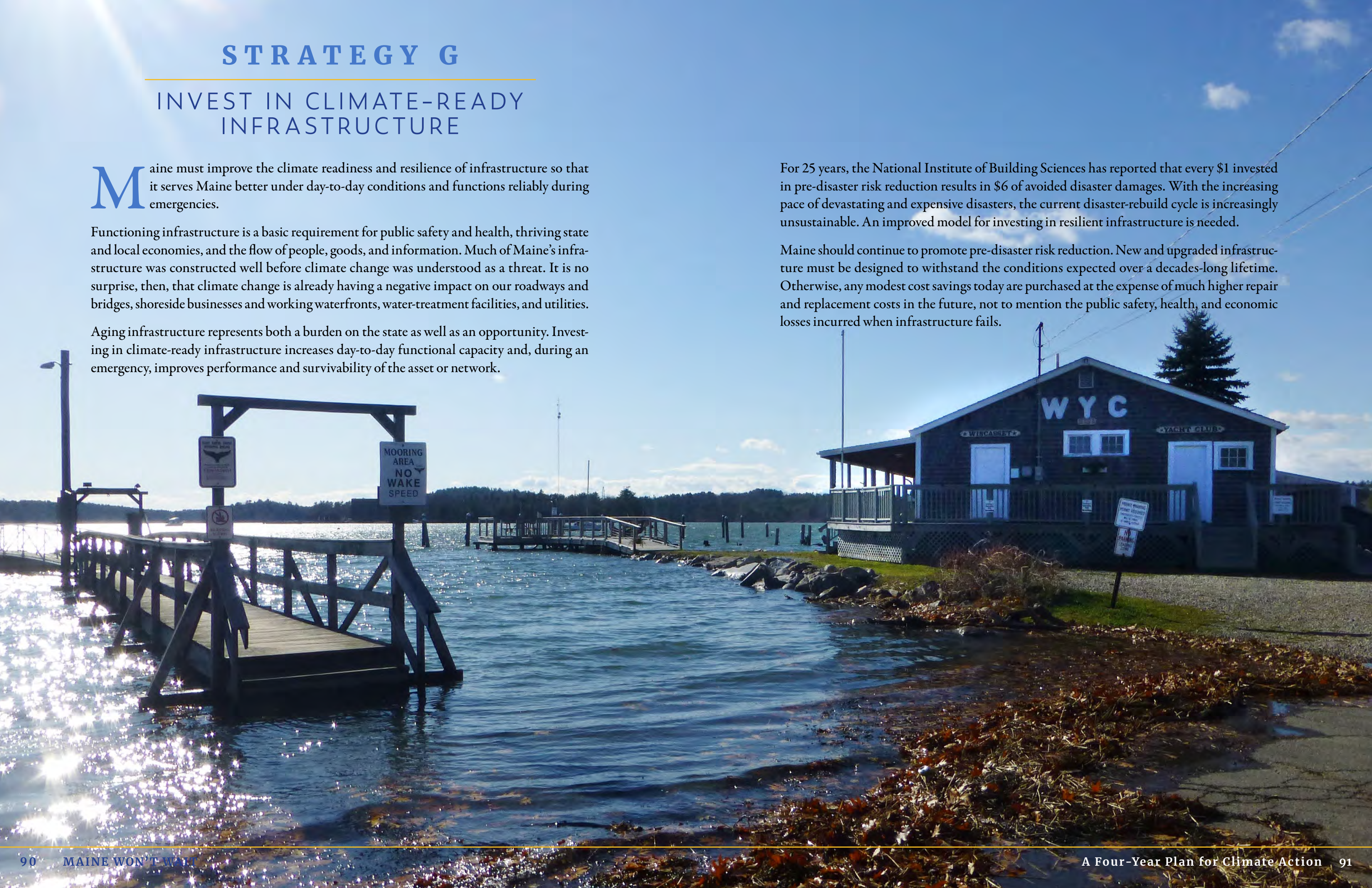
Maine must improve the climate readiness and resilience of infrastructure so that it serves Maine better under day-to-day conditions and functions reliably during emergencies.

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, shoreside businesses and working waterfronts, water-treatment facilities, and utilities.

Aging infrastructure represents 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.





MATT LUTKUS

Matt Lutkus is Town Manager in Damariscotta. The town is taking action to protect its historic downtown from rising sea levels with a comprehensive waterfront infrastructure project to guard against flooding, replace sewer lines, improve drainage and pedestrian access, and build new public restrooms. This work was funded by a \$3 million federal grant and \$1.3 million in funds raised locally after being planned for a decade — a timeline the Climate Action Plan wants to accelerate for towns through a State Infrastructure Adaptation Fund.

Was there a “lightbulb moment” for you regarding climate impacts?

In early 2012, the Board of Selectmen first viewed inundation scenarios prepared by the Lincoln County Regional Planning Commission, which identified our downtown village as one of the areas in Lincoln County most vulnerable to coastal flooding.

For years, the downtown parking lot flooded several times a year, but except when first-floor businesses were flooded, it was viewed as a nuisance the community always dealt with. The inundation scenarios, however, showed that flooding was going to get worse — and soon. This got everyone’s attention, and shortly after flood resilience was made a top planning priority.

What should towns do to start preparing for climate change?

Use federal, state, and regional data to educate the public on the effects of climate change in their community. Then, work to build a consensus on an action plan. Beyond the first steps, planning, engineering, designing, and having projects “shovel ready” pays off. When construction dollars do become available at the Federal and State levels, decision-makers want to see results within a few years versus a decade. Other than that, I recommend patience and perseverance. Try never to miss an opportunity to tell your story to whomever will listen.

What should the governor or legislature consider for towns when they read this report?

Officials from various State agencies have been extremely helpful to us in our flood resiliency planning activities, and more generally in the Town’s efforts to reduce dependence on fossil fuels. Currently, the electric energy for all of the municipal facilities is derived from a solar array, we are in the process of converting all of our street lights to LED, and we are installing a two-unit electric vehicle charging station in our parking lot. I encourage the governor and legislature to continue to encourage these and similar efforts in municipalities and in the private sector.

1

Assess Climate Vulnerability and Provide Climate-Ready Design Guidance

- **Complete a statewide infrastructure-vulnerability assessment by 2023, 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, but 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 as 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.



This stream crossing on Bottle Brook in Kingsbury Plantation is an example of a climate-ready infrastructure project that is also geared to improve habitat connectivity.



Maine should develop resilient design guidance and standards for different infrastructure types. An example is Maine Department of Transportation's Bridge Design Guidelines and Highway Design Guidance.

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" 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 predevelopment 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.**

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 16 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% of the total project cost, a relatively modest investment of state funds would result in leveraging four to 10 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, predevelopment assistance is typically needed which includes resilient design, engineering, and permitting; grant writing and grant management; community engagement regarding 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 it is 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 access federal funds more quickly, supporting local recovery and helping to prevent disaster impacts from reinforcing economic disparity.

STRATEGY H

ENGAGE WITH MAINE PEOPLE AND COMMUNITIES

About 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.**



2

Increase Public Education Offerings Related to Climate and 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 organizations. The state should convene stakeholders 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.

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, nonprofits, tribal governments, municipalities, and community groups will help spread key messages. Multiple forms of communication, consumer education, and ongoing efforts will be necessary to support the state's goals.

Communications should also include materials translated 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.

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*. They include:

- **Attract and develop the workforce required for Maine's clean-energy future with the following:**
 - » **Support and promote STEAM, 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.**



"Public education on climate change is crucial in addressing and resolving climate-related issues. It is only when citizens are aware of how the global phenomenon is impacting land, communities, and human lives that they'll be prompted to be a part of rectifying the problem."

—Amara Ifeji, Maine Environmental Changemakers Association, Northeastern University Student, and member of the Equity Assessment's Advisory Committee

3

Start the “Maine Climate Corps” for Climate-Related Workforce Development

- **Partner with service-learning organizations and nonprofit 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. Service members could contribute meaningfully to Maine’s climate progress through weatherization actions and education, clean-transportation education, resilience planning, and land-protection efforts.

4

Recognize Climate Leadership by Maine Businesses and Organizations

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

Establish a group of leading Maine businesses, nonprofits, 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.



“I started Maine Beer Company with a simple motto, ‘Do What’s Right.’ When it comes to climate change, doing what’s right means understanding that small businesses must be a part of the solution, not part of the problem — and this isn’t a bad thing. For too long we have been fed the fallacy that a healthy bottom line and a healthy planet are mutually exclusive ideals each in inherent tension with one another. Small businesses, however, can thrive by embracing new opportunities and taking daily steps toward a more sustainable future.”

“Breweries don’t stand alone in this, and here in Maine we are part of a larger economy and ecosystem, both of which are reliant on each other for success. The farmers in Aroostook, the men and women engaged in fishing and aquaculture in the waters off our coast, those whose living depends on outdoor recreation in our western mountains — can only prosper if we take action now. It is not just the health of our people that depends on us taking action, it is the health of our economy.”

—Dan Kleban, Co-founder and Owner of the Maine Beer Company, and Member of the Maine Climate Council

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 to do this, as will clear and 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 that will meet the state’s 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 — to mobilize a broad coalition of state, local, regional, and tribal governments, nonprofits, academic institutions, and private interests taking collaborative, decisive action.

Significant and sustained investments, well-financed programs, and properly-capitalized lending entities are needed to implement the Climate Action Plan. Such investments and partnerships will be needed to 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 enable 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 for 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 risks 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; recapitalize incentive programs that generate jobs and savings for families, businesses, and communities.

Natural and working lands: Invest 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 be 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, such as the state drinking-water revolving fund, Tax-Increment Finance programs, or other municipal infrastructure grant and loans programs.

Seek 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.

Convene: State leaders, stakeholders, and finance experts should convene in 2021 to consider additional creative funding and finance solutions to support Maine’s climate strategies, and they should work collaboratively with Maine’s federal delegation and federal agencies around emerging climate funding opportunities.

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 electric vehicles (EVs) and clean-car 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.

Coordinated climate-change monitoring: Maine will need to identify a combination of federal, state, foundation, and private funding sources in order to support a comprehensive climate-change data and monitoring system. Consistent funding over time will help detect changes to land, coastal, and marine ecosystems, avoid data gaps, and support improved and adaptive local decision making.

Enhance supports from visitors: The state should consider funding opportunities that support infrastructure, investments, and natural lands investments 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.

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: Provide funding that supports innovations, from new vehicle batteries that offer more cost-effective transportation solutions to advances in building material and heating technology. 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 complementary 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 generation and 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 consider that 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 and returns the revenues back to participating states and consumers to invest in energy efficiency. The Transportation Working Group recommended that Maine continue to monitor the Transportation Climate Initiative, 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 for making evidence-based adjustments, enhancements, or replacements to policies in pursuit of our 2030, 2045, and 2050 targets.

Actions Taken: These indicators will help Maine evaluate 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.

Proposed Metrics for Tracking:

- **Progress toward 80% renewable energy by 2050**
- **Energy saved via ongoing efficiency measures**
- **Clean-energy jobs created**
- **Electric Vehicle on the road, Plug-in EVs, total**
- **Heat-pump installations total**
- **Total percentage of Mainers with access to high-speed broadband**
- **Percentage of state lands conserved**
- **Number of towns or regions with resilient community plans**
- **Significant critical adaption infrastructure projects completed**
- **Climate infrastructure and investment funding and leveraged**
- **Federal and private dollars leveraged per state dollar**

Reducing Carbon Emissions - 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
	Newly Weatherized Households (after 2019)	17,000	35,000	105,000
All	GHG Emissions (MMT)	14.50	11.67	3.72
	Emissions Reduction from 1990 Levels	32%	45%	82%

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.

The Implementation Chart for the Four-Year Climate Action Plan (available at www.maine.gov/future/initiatives/climate/climate-council) identifies the lead agencies assigned to each of the specific outcomes assigned to the climate strategies. The agencies will work with partner organizations to implement the actions, and progress will be monitored quarterly by the Maine Climate Council and working groups.

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.

New emissions reductions and carbon-neutrality goals outlined in Maine law require the state to include both gross emissions from all sources, including from the combustion of biomass, as well as a carbon sequestration estimate, in the biennial greenhouse gas report submitted to the Legislature, starting in January 2022.

The Maine Department of Environmental Protection (DEP) is also required by law to adopt rules to track and report annual gross and net greenhouse gas emissions by July 2021. The DEP is also developing the methodology for calculating net emissions, in consultation with the Scientific and Technical Subcommittee, and will be working with stakeholders in early 2021 to develop a proposed rule for adoption by the Board of Environmental Protection.

Other examples of possible measures include changes in ocean acidification or reductions in 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 carbon dioxide concentration, and may respond slowly to the actions that state and country jurisdictions take collectively.

Connect With the Council

On June 26, 2019, Governor Mills signed legislation to create the Maine Climate Council, an assembly of scientists, industry leaders, bipartisan local and state officials, and engaged citizens to develop this four-year Climate Action Plan.

Following the release of this Plan, the Maine Climate Council will continue to meet at least quarterly to track the plan's implementation and progress. Council working groups and subcommittees will also continue to meet to review the latest science, data, and program developments. The Council is charged with creating a revised Climate Action Plan every four years, going forward.

The Council welcomes public comments and questions. To contact the Council, invite the Council to speak to your group, organization or class, sign up for the Council email list, or find out where to follow the Council on social media, please visit climatecouncil.maine.gov.

Climate actions that meet the urgency of the challenge facing us will take all of us, doing what we can, to make a difference. Join us!

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.

Blue Carbon: Carbon that is buried or sequestered away from the atmosphere by coastal ecosystems like salt marshes, seaweeds, and seagrass beds

Carbon Neutral: Emissions are balanced by the uptake of carbon dioxide by forests and other ecosystems

Clean Energy: 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

DER: Distributed energy resource. Small-scale resources that produce and supply electricity, or controllable loads, that are connected to a local distribution system or installed at a host facility, and may be spread out over a wide area. These resources either provide energy to the electrical grid or allow for greater control of demand for electricity, and are located at various geographic locations across the grid system, sometimes "behind the meter."

EEE: Eastern equine encephalitis is a rare but dangerous infection spread by mosquitoes

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 are 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 emissions 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 Scientific 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.

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>.

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The Maine Climate Council expresses its deepest thanks and appreciation to all the people and organizations who contributed to this Plan.

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
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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 (resigned November 9, 2020)

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 Scientific and Technical Subcommittee and six working groups, each composed 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 SCIENTIFIC AND TECHNICAL SUBCOMMITTEE:

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
Linda Bacon, Maine Department of Environmental Protection
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.
Jennifer Brennan, Efficiency Maine Trust
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
Greg Jordan, Greater Portland
Transit District
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 Richard Campbell, Maine State Legislature
Representative Dennis Keschl, Maine State Legislature
Senator David Woodsome, Maine State Legislature
Senator William 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, Natural Resources Council of Maine/VEIC
Ania Wright, College of the Atlantic; Maine Youth for Climate Justice, Youth Representative

ENERGY WORKING GROUP

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
Abigail Hargreaves, University of Maine, Youth Representative
Barry Hobbins, Maine Public Advocate
Andy Lubershane, Energy Impact Partners
Katrjn 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 PLANNING, EMERGENCY MANAGEMENT, AND PUBLIC HEALTH

Co-Chairs:

Judy East, Land Use Planning Commission
Dr. Nirav D. 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

Representative Genevieve McDonald, Maine State Legislature
Representative 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

With additional assistance from:

Sam Belknap, The Island Institute
Stacie Beyer, Land Use Planning Commission
Timothy Carr, Land Use Planning Commission
Ruta Dzenis, Municipal Planning Assistance Program
Lee Jay Feldman, Southern Maine Planning and Development Commission
Benjamin Godsoe, Land Use Planning Commission
Bill Hinkel, Land Use Planning Commission

Tom Miragliuolo, Municipal Planning Assistance Program
Marybeth Richardson, Maine Department of Marine Resources

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 Department of Environmental 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

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STAFF

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Brian Ambrette, Senior Climate Resilience Coordinator, GOPIF

Sarah Corkum, Intern, GOPIF

Sarah Curran, Senior Policy Analyst, Climate & Economic Development, GOPIF

Taylor LaBrecque, Resource Management Coordinator, MaineDOT, Senior Planner, Transportation Climate Coordinator, GOPIF

Anthony Ronzio, Deputy Director, GOPIF

Dr. Cassandra Rose, Senior Science Analyst & Climate Council Coordinator, GOPIF

Liz Theriault, Intern, GOPIF

Melissa Winne, Energy Policy Analyst, GEO

Anastasia Hediger, Program Manager, Climate and Policy Initiatives, EMT

Tom Gordan, Policy & Planning Coordinator, DACF

Nathan Robbins, Climate Change Specialist, Office of the Commissioner, DEP

Lynne Cayting, Mobile Sources Section Chief, Bureau of Air Quality, DEP

Erle Townsend, Policy Development Specialist, Office of the Commissioner, DEP

Eric Kennedy, Division of Licensing and Compliance Director, Bureau of Air Quality, DEP

Stacy Knapp, Emissions Inventory Section Manager, Bureau of Air Quality, DEP

Rebecca Peters, DMR

Jessica Waller, DMR

Jessica Reilly-Moman, University of Maine

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“Maine cannot wait to make the most of this extraordinary moment in time. This plan against climate change comes in the midst of an unprecedented pandemic which has caused significant economic and social turmoil in Maine, across the country, and around the globe.

“It might be easier to put off climate action until calmer times. But Maine can’t wait. Maine shouldn’t wait. And Maine won’t wait.”

—Governor Janet T. Mills





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