

MCC Working Group June 2024 Deliverable Template - Buildings

Working Group Recommended Climate Strategies, Actions and Measurable Outcomes

BUILDINGS, INFRASTRUCTURE & HOUSING WORKING GROUP DELIVERABLE TEMPLATE

1. INTRODUCTION

The Buildings, Infrastructure, and Housing Working Group is pleased to submit the following recommendations to the Maine Climate Council to supplement and update the strategies and actions outlined in the State's 2020 climate action plan, *Maine Won't Wait*. These recommendations reflect many months of collaboration and consensus-building and are informed by the State's progress toward *Maine Won't Wait*; unprecedented federal funding through the Bipartisan Infrastructure Law and Inflation Reduction Act; the work of the Equity Subcommittee; and the growing urgency of climate action, evidenced by Maine's recent experience of extreme back-to-back storms.

The working group identified a new recommendation to modernize Maine's buildings:

- **Support measures that both reduce carbon and improve resilience**

and refined our 2020 recommendations with an equity lens:

- **Continue the progress on making homes and businesses more energy efficient by investing in weatherization and heating systems** is the next iteration of two actions recommended in *Maine Won't Wait: Transition to Cleaner Heating and Cooling Systems, Efficient Appliances and Accelerate Efficiency Improvements to Existing Buildings*.
- **Establish strong systems and processes to support rapid adoption and compliance with increasingly climate-friendly building codes and standards** reflects the next steps necessary to *Advance the Design and Construction of New Buildings*.
- **Promote the manufacture and use of climate-friendly building materials** specifies how Maine can *Advance the Design and Promote Climate-Friendly Building Products*.
- **Accelerate decarbonization technologies in industrial processes** recenters in the building sector the recommendation to *Accelerate Emissions Reductions of Industrial Uses and Processes*, which appeared in *Maine Won't Wait, Strategy*
- **Continue to lead by example in publicly funded buildings** carries forward the powerful directive to *Lead by Example in Publicly Funded Buildings*.

Members of the working group represent many perspectives on Maine's buildings, infrastructure, and housing, and include community advocates, architects and engineers, affordable housing experts, weatherization contractors, organized labor, municipal and state leaders, and more. As the group developed and approved these recommendations through an iterative process, members contributed invaluable resources and recommendations for effective, equitable, and economic implementation. In addition to the summary table of recommendations and actions below, additional implementation steps can be found in the summary table at the bottom of this report, and in Section 7, Implementation Next Steps.

Buildings play a central role in the lives of Maine people, providing places to live, work, learn, and gather, and efficiency and resilience improvements in Maine buildings have direct impacts on our daily lives. Energy efficient buildings designed with lower-carbon materials and powered by clean energy are

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safer, healthier, more comfortable, more affordable, more resilient to extreme weather, and have lower emissions. As State and federal investments spur progress toward – and beyond -- the heat pump, heat pump water heater, and weatherization targets established in *Maine Won't Wait*,¹ people are realizing these multifaceted benefits.

Even so, the climate benefits of modernizing Maine buildings are not always top of mind for residents. Again and again, this working group heard that immediate needs -- including the availability of housing that is safe, affordable, and accessible to transportation and community services -- must take priority for many residents. This both reflects and presents challenges for equitable implementation of the State's climate action plan. In some cases, structural and safety concerns in existing buildings preclude crucial efficiency improvements, meaning that residents of low-quality housing cannot access the energy- and money-saving benefits of key strategies. For example, Downeast Community Partners (DCP) reports that 61% of households that apply for weatherization services through MaineHousing are rejected because they need more pre-weatherization home repair than DCP can deliver.² For other residents, even deep concern about our climate future cannot compete with pressing basic needs and structural inequities including serious health and safety issues caused by landlord neglect.³

While many of these issues are beyond the scope of this working group, they are central to the people whose needs we hope will be served by our recommendations to reduce emissions in the building sector, avoid the impacts and costs of inaction, foster economic opportunity, and advance equity. At times, the working group struggled to balance our broad concern for Maine's housing challenges with our specific charge. We are heartened by the State's actions and investments to address the housing crisis,⁴ confident in our recommendations, and deeply aware that this report addresses only a portion of the pressing concerns Maine people and businesses have around buildings.

2. SUMMARY OF STRATEGIES AND ACTIONS

This is a high-level summary of the proposed strategies and actions. Additional implementation steps can be found in the summary table at the bottom of this report, and in Section 7, Implementation Next Steps.

Recommendations and Actions

RECOMMENDATION	ACTIONS
Continue the progress on making homes and businesses more energy efficient by investing in	<ul style="list-style-type: none">Extend funding and financing for weatherization and electric heating and water heating systems in homes and businesses beyond 2030.Expand education and outreach for programs that increase uptake of weatherization, clean heating, and water heating systems, including through partnerships with community-based organizations.

¹ <https://www.maine.gov/climateplan/dashboard>

² [Downeast Community Partners presentation](#) to the Buildings, Infrastructure, and Housing Working Group, March 20, 2024

³ Mitchell Center focus group with Community Organizing Alliance, May 20, 2024

⁴ Popp, Evan (2024, March 26). Announcing 105 new rental units, Mills calls on towns to do their part to alleviate housing crisis. *Maine Morning Star*. <https://mainemorningstar.com/2024/03/26/announcing-new-affordable-units-mills-calls-on-all-towns-to-do-their-part-to-alleviate-housing-crisis/>

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<p>weatherization and heating systems</p>	<ul style="list-style-type: none"> • Increase access and participation in energy efficiency programs for renters, low-income, and rural residents, including by supplementing existing home repair programs. • Explore the use of state emissions standards for heating appliances. • Give all buildings used for human habitation and sleeping that use electricity for space heating and water heating the same sales tax exemption that exists for heating with oil, coal, and wood. <p>Guidance on targets:</p> <ul style="list-style-type: none"> • Maintain existing targets for economy-wide heat pumps and weatherization. • Extend low-income targets for heat pumps and weatherization to 2030 and explore increasing the heat pump target for low-income households <ul style="list-style-type: none"> ○ Heat pumps: at least 32,000 heat pumps in low-income households by 2030 (13% of total heat pump installations) ○ Weatherization: 10,000 low-income households weatherized by 2030 (29% of total weatherization projects)
<p>Establish strong systems and processes to support rapid adoption and compliance with increasingly climate-friendly building codes and standards.</p>	<ul style="list-style-type: none"> • Move responsibility for building code adoption, compliance, and training to the new Office of Community Affairs (OCA) • Commit to adopt new building codes to reach net-zero carbon emissions for new construction in Maine by 2035, with the interim goal of defining a net-zero emissions stretch code by 2028. • Support contractors and code enforcement officers through training, technical assistance, and contractor licensing, particularly in small and rural communities. • Develop a program to incentivize the purchase of manufactured homes that meet the new US Department of Energy (DOE) Zero-Energy Ready Home (ZERH) standard.
<p>Promote the manufacture and use of climate-friendly building products</p>	<ul style="list-style-type: none"> • Building on Maine’s designation as a federal Tech Hub for Forest Bioproducts, identify and address the barriers for attracting a cross-laminated timber (CLT) plant and other future bio-based materials manufacturing in Maine. • Provide technical assistance to municipalities and larger institutional projects about whole-life carbon accounting and low-carbon building materials through programs such as the Community Resilience Partnership. Overall, increase awareness, educate, and provide technical around embodied carbon alongside operational carbon. • Use demonstration projects and incentive programs to address the current cost gap between high-embodied carbon (e.g., steel & cement) and low-embodied (e.g., wood and bioproducts) building products.

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<p>Support measures that both reduce carbon and improve resilience</p>	<ul style="list-style-type: none"> • Increase funding and financing options for building-scale distributed energy resources, such as solar and storage (including electric vehicle batteries that are used as energy storage). <ul style="list-style-type: none"> ○ Set targets for building-scale solar and storage consistent with the Maine Energy Plan: Pathway to 2040 planning process currently underway by the Governor’s Energy Office • Expand education and outreach for programs that increase uptake of building-scale distributed energy resources, including through partnerships with community-based organizations. • Manage the impact of building loads on the grid, as recommended by the cross-cutting working group on demand management. • Leverage building codes, education and outreach, and state-run resilience programs to assist Mainers to prepare their homes and businesses to be resilient in the face of climate disasters, focusing on low-income households and Mainers with the fewest resources to prepare. • Create a new program to mitigate risks of oil spills from residential oil tanks
<p>Accelerate decarbonization technologies in industrial processes</p>	<ul style="list-style-type: none"> • Promote emerging energy efficiency technologies in the industrial sector by piloting and demonstrating new heat pump applications for industrial steam and hot water and scaling up deployment of membrane filtration in food production and other industrial processes. • Continue traditional energy efficiency upgrades at small and mid-sized facilities. • Explore increased participation in federal grant-funding opportunities. • Maximize facilities’ participation in cost-effective demand management, including use of behind-the-meter batteries or thermal energy storage.
<p>Continue to lead by example in publicly-funded buildings</p>	<p>For buildings that are owned by the State of Maine:</p> <ul style="list-style-type: none"> • Starting in 2024, ensure that all new state-owned buildings and major renovations use zero-emissions heating, cooling, and water heating sources and are compliant with the most recent or stretch energy codes. • By 2034, reduce GHG emissions by at least 50% from existing state buildings. • Ensure that major parking-related renovations and new builds at state owned buildings include “EV Ready” parking spaces. • Determine what state buildings are a good fit for advanced wood products, based on criteria being developed by the end of 2024. • Require energy and cost savings data collection for all energy efficiency and renewable energy projects in state-owned buildings. • Require whole-life carbon accounting for all new state-owned and funded buildings to help the State understand embodied carbon emissions alongside operational carbon. <p>For schools:</p> <ul style="list-style-type: none"> • Establish a dedicated funding source and staff to support the new Green Schools Program to reduce energy costs in Maine’s 600 existing school buildings through the installation of zero-emissions heating and cooling technologies and renewable energy in new and existing schools.

- Develop a system to track energy and cost savings data for all school energy efficiency or renewable energy receiving state funds.
- Require whole-life carbon accounting in the construction of new schools.

Affordable Housing:

- Set an ambitious target for the number of clean and energy efficient affordable housing units Maine should produce each year, through consultation with community, industry, and government stakeholders.
- Increase the percentage of affordable housing projects that utilize solar energy and battery storage.
- Provide housing developers with robust guidance on accessing state and federal resources to build and renovate affordable, energy-efficient housing for low- and moderate-income Mainers.
- Require energy and cost savings data collection for all affordable housing projects receiving state funds, to help tell the story about the benefits of climate-friendly housing for Maine residents.

3. ANALYSIS AND SUPPORTING INFORMATION

For each strategy and its respective set of actions, provide concise analysis using the questions below. Analysis should focus mostly on new strategies and significant revisions to existing strategies.

Key Questions (provide analysis for each strategy and its respective set of actions.)

1. **Impacts** - Describe the recommended strategy and its actions and how they address Maine's four climate goals – *reducing greenhouse gas emissions, increasing resilience, creating economic opportunity, and achieving equity through Maine's climate response*. **Use the questions in Annex 1 of this document** to guide the analysis of impacts.

Recommendation 1: Continue the progress on making homes and businesses more energy efficient by investing in weatherization and heating systems.

In *Maine Won't Wait, Strategy B: Modernize Maine Buildings*, Recommendations 1 and 2 propose transitioning to cleaner heating and cooling systems and accelerating efficiency improvements to existing buildings. The working group recommends continuing to build on progress toward these goals, with a focus on the installation of high-efficiency electric heat pumps and weatherization measures in Maine homes and businesses. Along with market transformation, the State's next climate action plan should focus on increasing access and participation in energy efficiency programs for low-income households, rural communities, and other households and businesses that face barriers to improving efficiency in their homes and buildings.

This recommendation promotes access to safe and affordable heating and cooling, particularly in the oldest and lowest-quality housing stock, by continuing to increase participation by low-income households and by expanding pre-weatherization, which has essential health and safety benefits and leads to more equitable distribution of weatherization program benefits. The working group notes that this recommendation will be most effective if paired with strategies to maintain affordability of electricity.

This recommendation also can build community capacity within low-income and disadvantaged communities by providing technical support and funding to municipalities and community-based organizations to conduct education and outreach about energy programs. The working group notes that heat pumps and weatherization in low-income homes typically cost more to incentivize than market-rate programs. However, these programs benefit those who have the fewest resources to afford energy upgrades and may have other equity benefits. As an example, MaineHousing's Weatherization Assistance Program (WAP) average cost to weatherize a home is \$17,446. Since MaineHousing pays 100% of the project cost, this means each weatherized unit requires \$17,446 of public (federal) funds, not including any pre-weatherization repairs needed. By comparison, a typical market-rate weatherization project can be accomplished with \$4,000 rebate from Efficiency Maine (leveraging

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\$1,200 in federal tax credits). However, market-rate programs tend to have higher free ridership rates.⁵ A detailed analysis of all benefits and costs is in progress by GOPIF, including an analysis of the benefits that will accrue to low-income and disadvantaged households and communities.

Weatherization can have additional benefits beyond energy savings, including more livable homes and improved general health.⁶ In addition, weatherization and heat pumps have the following resilience benefits:

- Weatherization increases passive survivability in the event of a power outage.
- Heat pumps provide efficient cooling to reduce the impact of extreme heat for vulnerable populations.
- Pre-weatherization remedies common issues such as moisture, electrical or wiring issues, and structural/roofing issues that improve the quality of homes and make them more resilient to extreme weather events.

Finally, the working group noted that heating oil consumption in buildings used for “human habitation and sleeping,” including hotels, in Maine is exempt from sales tax, whereas electricity is taxed for commercial customers and for residential consumption exceeding 750 kW per month. This appears unfair to certain commercial and residential customers who use heat pumps for space heating and water heating. The working group recommends consideration of establishing an exemption on taxing the sale of electricity consumed for space heating and water heating, which in turn will make it more attractive for Mainers to purchase and use high-efficiency heat pumps.

Mitigation

In 2020, the Maine Climate Council estimated that transitioning to cleaner heating and cooling systems would reduce building sector GHG emissions between 24% and 35% by 2030 and 90% by 2050.⁷ An updated analysis of the emissions and air pollution benefits of this recommendation is underway by GOPIF and will be available later this year.

Workforce and Economic Opportunity

Energy efficiency is the fastest-growing sector in Maine’s clean energy economy, accounting for 8,685 jobs, or over half of clean energy jobs in 2022.⁸ Growth in this sector presents opportunities to create new well-paying jobs and small business ownership. For example, Coastal Enterprises, Inc. (CEI) is

⁵ See., e.g., Efficiency Maine’s 2019 HESP evaluation <https://www.energymaine.com/docs/HESP-Evaluation-2019.pdf>

⁶ Oak Ridge National Laboratory (2014). *Health and Household-Related Benefits Attributable to the Weatherization Assistance Program*. https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNL_TM-2014_345.pdf

⁷ Synapse Energy Economics (2020). *Mitigation Modeling Consolidated Energy Sectors Modeling Results*. https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/ERG_MCC_Vol3_MaineEmissionsAnalysisSynapse_11-9-2020.pdf

⁸ Maine Governor’s Energy Office (2024). *2023 Maine Clean Energy Industry Report*. <https://www.maine.gov/energy/sites/maine.gov.energy/files/2024-05/2023%20MECEIR%20Report%20Final.pdf>

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offering a new entrepreneurship class for weatherization contractors using funding from the Clean Energy Partnership through the Governor’s Energy Office.⁹

Achieving Equity

This recommendation focuses on increasing access and participation by low and moderate income (LMI) Mainers, rural residents, and renters. While existing energy efficiency programs serve LMI customers, there is opportunity to improve program design and outreach to serve more LMI customers. New recommendations in this section aimed at improving equity include:

- Expanding education and outreach that prioritizes LMI, rural residents, renters, and older adults;
- Addressing the funding shortage in pre-weatherization home repair programs that currently prevents many of the homes most in need of weatherization from accessing these programs; and
- Improving the affordability of electricity used for heating by extending the sales tax exemption that exists for heating oil to electricity used for space heating and water heating.

The recommendation includes partnering with community-based organizations for outreach and communication, which will help to ensure that programs reach individuals in ways that are most relevant to them and respect cultural values. The Equity Subcommittee’s 2023 report recommended that the Maine Climate Council “Assess and address remaining barriers to energy efficiency and clean energy improvements in rental housing, particularly in rural and low-income communities.”¹⁰ Work is currently underway by GOPIF and the University of Maine’s Mitchell Center to better understand barriers that priority populations face in accessing energy efficiency and renewable energy programs. When this work is complete, findings will be shared with the Maine Climate Council and the agencies that design energy and energy efficiency programs in the state such as Efficiency Maine and MaineHousing.

Additional Costs

A detailed analysis of the costs and benefits of this recommendation is underway by GOPIF and will be available to the MCC later this year. Several proposed actions in this section do not have existing funding sources and would require new funding to implement:

- Expanded education and outreach through community-based organizations: Partnerships with community-based organizations do not currently have a funding source in Maine, and a new funding source would need to be identified. Several communities in Southern Maine are planning to launch an energy “navigator” program using funding from the US Department of Energy’s Energy Efficiency and Conservation Block Grant Program, which could provide a model for how communities can harness federal funding to support local outreach and education.
- Addressing the funding shortage in current home repair programs: A new funding source would need to be established to supplement the WAP funds that MaineHousing currently uses for pre-

⁹ <https://www.ceimaine.org/advising/business/weatherization-business-lab/>

¹⁰ Maine Climate Council Equity Subcommittee (2023). *Final Recommendations of the Equity Subcommittee*. https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/Maine%20Climate%20Council_Equity%20Subcommittee%20Final%20Report_March%202023.pdf

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weatherization. The National Association for State Community Services Professionals identifies several ways that other states have funded pre-weatherization programs.¹¹

Weatherization and heating system programs have been implemented successfully in Maine for many years by Efficiency Maine and MaineHousing. New actions in this section that are not yet widely implemented in Maine include:

- Outreach and education through community-based organizations- York, Maine runs an “Energy Coach” program connecting volunteers with residents who want to make clean energy and energy efficiency upgrades.¹² The Cornell Cooperative Extension runs a similar “Energy Navigators” program.¹³
- Addressing the funding shortage in current home repair programs: Other states have identified ways to supplement funding for home repair programs including LIHEAP, ARPA, and State Energy Program (SEP) funds.¹⁴
- Tax exemption for electricity used for heat: In Maine, the sale of all fuels (e.g., coal, oil, gas, and wood) other than electricity is exempt from sales tax when used for cooking and heating in residential buildings.¹⁵ This exemption could be extended to electricity to ensure that homes and businesses are not disincentivized from using electricity for heating.

Recommendation 2: Establish strong systems and processes to support rapid adoption and compliance with increasingly climate-friendly building codes and standards.

In *Maine Won't Wait, Strategy B: Modernize Maine Buildings*, Recommendation 3 proposes steps to advance the design and construction of new buildings. This recommendation expands on the BIH WG recommendations from 2020 and focuses on the need to train and support the code enforcement and contractor community to make Maine’s building codes more effective. The working group also recommends increasing the percentage of manufactured homes in the state that meet US Department of Energy voluntary standards for Zero Energy Ready Homes (ZERH). This would improve energy use and resilience in a category of homes that provide significant affordable housing in Maine and are not subject to state building and energy codes.

Mitigation

A 2021 analysis by the Pacific Northwest National Laboratory estimates a life cycle energy cost savings of \$23,772 per home built to the 2021 International Energy Conservation Code (IECC) compared to a home

¹¹ <https://nascsp.org/wp-content/uploads/2019/08/Pre-WAP-Programs.pdf>

¹² <https://yorkreadyforclimateaction.org/energy-coaches/>

¹³ <https://smartenergychoices.org/energy-navigators>

¹⁴ E4TheFuture (2022). *Weatherization Barriers Toolkit: How to Address Health and Safety Barriers with an Income-Eligible Focus*. <https://e4thefuture.org/overcoming-weatherization-barriers-new-toolkit/>

¹⁵ Maine Revenue Service. *Sales, Fuel & Special Tax Division Instructional Bulletin No. 13*. https://www.maine.gov/revenue/sites/maine.gov.revenue/files/inline-files/IB13%20FINAL%20Sales%20of%20Fuel%20and%20Utilities%202022_11_15_0.pdf

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built to the 2015 IECC.¹⁶ The same analysis estimates a statewide emissions impact of 394,600 metric tons of CO₂ when using the 2021 IECC instead of the 2015 IECC.

In addition to energy cost savings, building codes directly enhance the health and safety of new buildings. Recent versions of the IECC have included new requirements related to mechanical ventilation systems, which remedies many of the problems leading to respiratory ailments, such as mold and mildew.¹⁷ Many of the benefits of weatherization mentioned in the previous recommendation are also benefits of building energy codes; adopting and implementing building codes leads to safer, more efficient, and more resilient buildings.

The Equity Subcommittee recommended that the state “strengthen building code education in small and rural communities.”¹⁸ While reaching more individuals in smaller, rural communities may require more resources, it will result in greater geographic distribution of code training and code compliance. Rural communities and communities with limited capacity; climate-frontline and low-income communities; tribal communities; and low-income, cost-burdened and manufactured / mobile home households are all particularly vulnerable to energy cost burdens and climate change impacts from severe weather and storms, and so these communities stand to benefit the most from safer and more efficient new buildings. Maine’s smaller and rural communities tend to have less capacity to implement building codes, so the actions that increase capacity will have an outsized impact in those communities.

Because manufactured/mobile homes are regulated at the federal level and are not subject to Maine’s building codes, the State has limited pathways to improving resilience and carbon emissions in this sector.¹⁹ Identifying these pathways is a high priority because manufactured homes regulated by the US Department of Housing and Urban Development (HUD-MH) comprise a meaningful share of the new housing market in Maine and offer a single-family home option that is affordable to many moderate- and lower-income Mainers. The Maine Housing Production Study, which uses annual building permits issued as a proxy for new home construction, reported an average of ~4800 permits issued each year from 2016 to 2021.²⁰ For the same five-year period, the US Census Bureau’s Manufactured Housing Survey (MHS) reported an average of 634 HUD-MH units shipped to Maine annually.²¹ These HUD-MH shipments to Maine jumped to 963 in 2022 and 830 in 2023. That means that manufactured homes have represented as much as 20% of Maine’s new housing market in recent years. Though the manufactured housing sector has improved energy efficiency through programs like EPA’s ENERGY STAR program,²² in

¹⁶ Pacific Northwest National Laboratory (2021). *Cost-Effectiveness of the 2021 IECC for Residential Buildings in Maine*. https://www.energycodes.gov/sites/default/files/2021-07/MaineResidentialCostEffectiveness_2021_0.pdf

¹⁷ Northeast Energy Efficiency Partnerships, *A Guide for Communities: Getting Involved with Building Energy Codes*, https://neep.org/sites/default/files/media-files/neep_equityresourceforcommunities_updated_final.pdf

¹⁸ https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/Maine%20Climate%20Council_Equity%20Subcommittee%20Final%20Report_March%202023.pdf

¹⁹ https://www.hud.gov/program_offices/housing/mhs

²⁰ MaineHousing (2023). *State of Maine Housing Production Needs Study*. https://mainehousing.org/docs/default-source/default-document-library/state-of-maine-housing-production-needs-study_full_final-v2.pdf

²¹ <https://www.census.gov/data/tables/time-series/econ/mhs/latest-data.html>

²² <https://www.energystar.gov/partner-resources/residential-new/national-page?tab=manufactured-tab>

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2020, only 29% of units delivered in Maine were certified as ENERGY STAR.²³ The 2022 Inflation Reduction Act (IRA) required US DOE to create a more rigorous voluntary standard and provided significant tax incentives (up to \$5,000 per home).²⁴ Creating new state-level incentives to leverage the new federal tax credits will help to fill the current gap in energy efficiency for manufactured homes.

Adaptation and Resilience

Both the International Building Code (IBC) and the IECC contain elements that make buildings more resilient. Benefits include:

- Energy efficient building envelopes increase passive survivability, or the amount of time that a building can remain comfortable in the event of a power outage or loss of the primary heating source.²⁵
- Building & energy codes have many resilience components, including insulation, fire resistance, structural integrity, indoor air quality, and more.²⁶ FEMA has estimated that building to the international building codes in Maine has prevented \$1.7 million in annual average avoided losses due to damages from hurricanes and flooding since 2000.²⁷

Workforce & Economic Opportunity

This recommendation focuses mostly on training and upskilling existing workers in Maine’s building and construction trades. However, there is also a corresponding increase in construction activity needed to make homes more energy efficient. The Pacific Northwest National Laboratory estimates a statewide increase of 33 jobs in the first year attributed to adopting the 2021 IECC.²⁸ Over 30 years, that amounts to 834 new jobs created due to an increase in construction-related activities. Prioritizing registered apprenticeships can help ensure the highly qualified workforce necessary to accomplish this recommendation.

Achieving Equity

The Equity Subcommittee recommended that the MCC “strengthen building code education in small and rural communities, by providing additional resources and training for code education, particularly for components of the code related to energy efficiency and among code enforcement officers and building

²³ Systems Building Research Alliance (2020). *ENERGY STAR Certified Manufactured Homes: Better is Better*. US Environmental Protection Agency. https://www.research-alliance.org/ENERGY_STAR_Manufactured_Homes_Market_Share_Report.pdf

²⁴ US Department of Energy (2022). *Zero Energy Ready Home Manufactured Homes National Program Requirements, Version 1*. <https://www.energy.gov/sites/default/files/2022-12/DOE%20ZERH%20MH%20V1%20National%20Program%20Requirements.pdf>

²⁵ Pacific Northwest National Laboratory (2023). *Enhancing Resilience in Buildings Through Energy Efficiency*. https://www.energycodes.gov/sites/default/files/2023-07/Efficiency_for_Building_Resilience_PNNL-32727_Rev1.pdf

²⁶ International Code Council (2019). *Resilience Contributions of the International Building Code*. https://www.iccsafe.org/wp-content/uploads/19-17804_IBC_Resilience_WhitePaper_FINAL_HIRES.pdf

²⁷ Federal Emergency Management Agency (2020). *Building Codes Save: A Nationwide Study*. https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf

²⁸ Pacific Northwest National Laboratory (2023).

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professionals in smaller and rural communities.”²⁹ In general, this will involve an increase in the number and location of trainings, to make them accessible to people in all parts of the state.

Additional Costs

There is a significant need for more building code training, both in frequency and in the geographic distribution of trainings throughout the state. A schedule of fees associated with building plans and permits provides the funding mechanism for building code trainings, but these fees are only assessed on new commercial construction projects, which are only a fraction of all new construction in the state.³⁰ Increased training would require additional funding; a full analysis of costs and potential funding sources is underway by GOPIF and will be completed later this year.

Proven Strategy & Feasibility

Funded by the Maine Jobs & Recovery Plan, the Clean Energy Partnership is an initiative focused on preparing Maine people for jobs in the growing clean energy and energy efficiency fields.³¹ It funds a variety of workforce development programs, including Code Builder Trainings from passivhausMaine that reached approximately 300 people in 2023. A recent award from the U.S. Department of Energy’s Buildings Upgrade Prize (Buildings UP) will support scaling these trainings.³²

Other states have implemented strategies to improve building code education and implementation. Some examples include:

- “Circuit rider” programs, where a code expert provides technical guidance, support, and advice to code officials and builders from multiple jurisdictions.³³ States that have implemented circuit rider programs include Nevada, Idaho, Florida, and Iowa.
- Illinois’ Smart Energy Design Assistance Center (SEDAC) offers free online trainings on the state’s latest energy codes, all on one website.³⁴ SEDAC also offers technical support via phone and email.
- Efficiency Vermont provides up-to-date resources on the state’s residential and commercial building energy codes on their website.³⁵ The website includes user-friendly resources such as a brochure highlighting what’s new in the most recent building energy codes.³⁶

Additional ideas for code implementation from Vermont

²⁹ Maine Climate Council Equity Subcommittee (2023).

³⁰ 25 M.R.S. §2374. <https://legislature.maine.gov/statutes/25/title25sec2374.html>

³¹ <https://www.maine.gov/energy/initiatives/cep/projects>

³² Passive House Accelerator (2023). *Buildings Up Award Goes To Passivhausmaine*.

<https://passivehouseaccelerator.com/articles/buildings-up-award-goes-to-passivhausmaine>

³³ <https://naseo.boxes.e4thefuture.org/energy-code-circuit-rider/>

³⁴ <https://smartenergy.illinois.edu/energy-code/online-training/>

³⁵ <https://www.efficiencyvermont.com/trade-partners/energy-code-support>

³⁶ <https://www.efficiencyvermont.com/Media/Default/docs/trade-partners/code-support/efficiency-vermont-residential-new-construction-energy-code-assistance-brochure-9-20.pdf>

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A Vermont committee was created to address issues related to declining compliance rates with Vermont's mandatory energy codes. One of their charges was to consider and recommend strategies to increase awareness of and compliance with the codes.³⁷ Recommendations included:

- Establish a directory of contractors that are trained in the state's energy codes.
- Work with the Department of Energy to develop a training certification that can be displayed in the contractor registry.
- Make training available regularly in various formats and venues in all areas of the state.
- Train, certify, and support third-party energy consultants such as the Building Performance Institute (BPI) certified energy specialists, Home Energy Rating System (HERS) raters, HEAT Squad, etc. to provide direct support to builders for both base-code and above-code services.
- Develop and mail out bill stuffers reminding utility customers about energy codes.
- Work with lenders and attorneys to include energy information on loan closing checklists.
- Use state, regional, and municipal websites to reinforce energy code requirements.
- Support efforts to create a radio show on building science and energy codes to educate the public.

Recommendation 3: Promote the manufacture and use of climate-friendly building products

In *Maine Won't Wait, Strategy B: Modernize Maine Buildings*, Recommendation 4 introduced steps to promote the manufacture and use of climate-friendly building products. This recommendation builds on that foundation by focusing on opportunities to reduce greenhouse gas (GHG) emissions from building materials, known as embodied carbon. This includes extraction of raw materials, transport, manufacturing the product, construction, demolition, waste, and end of life and contrasts with operational emissions, which are emissions caused by energy use in buildings. Globally, embodied carbon of building materials and construction is responsible for 11% of energy-related CO₂ emissions.³⁸ This recommendation highlights ways that Maine can decrease emissions from embodied carbon by including documentation of embodied carbon alongside operational carbon and encouraging the use of lower-carbon alternatives (such as wood fiber insulation and structural timber) in place of higher-carbon materials (such as cement and steel).

Mitigation

Wood products contribute to reducing Maine's net GHG emissions because they have dramatically lower GHG emissions than conventional building products and because they provide long-term storage of carbon sequestered during tree growth. In addition, encouraging sustainable wood products will extend Maine's long tradition as a leader in the forestry sector, which has long supported many jobs and communities throughout the state.

Adaptation and Resilience

³⁷ Act 47 Building Energy Code Study Committee, *Report To The Vermont Legislature*, 2023.

<https://publicservice.vermont.gov/sites/dps/files/documents/Act%2047%20Building%20Energy%20Code%20Study%20Committee%20Report%202012-1-23A.pdf>

³⁸ UN Environment and International Energy Agency (2017). *Towards a zero-emission, efficient, and resilient buildings and construction sector: Global Status Report 2017*. https://worldgbc.org/wp-content/uploads/2022/03/UNEP-188_GABC_en-web.pdf

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This recommendation is primarily about mitigating GHG emissions; however, encouraging climate-friendly building products also helps to support resilience in Maine’s forestry-dependent communities by ensuring that there is a long-term market for sustainable forest products. Maine has recently been designated as a federal “Tech Hub” for Forest Bioproducts, opening the door for investment and well-paying jobs in the innovation and manufacture of forest products.³⁹

Workforce and Economic Opportunity

As mentioned above, Maine is well poised to create and sustain well-paying jobs by encouraging the growth in sustainable forest products. This aligns well with the Maine Won’t Wait goal to “foster economic opportunity and prosperity.”

Achieving Equity

The workforce and resilience benefits mentioned above can help ensure that this recommendation contributes to equitable outcomes. As with any strategy that aims to reduce the cost barriers to lower-carbon alternatives, any incentive or education programs will need to be designed to ensure that low-income and other priority populations are able to participate. For demonstration projects, the State could invest in projects that are in low-income or disadvantaged communities. Technical assistance should be accessible to smaller and under-resourced communities in addition to larger and more-resourced communities.

Additional Costs

A detailed analysis of the costs of this recommendation is underway. In general, conventional materials such as steel and concrete cost less than advanced wood products, so there is a cost gap to building with climate-friendly alternatives. A new funding source would be required to fund demonstration projects using climate-friendly building products. A new funding source would also be required to supplement existing incentive programs for insulation to encourage people to choose more sustainable products such as wood fiber insulation.

Proven Strategy & Feasibility

Several projects in Maine have successfully used sustainable forest products in place of products with higher embodied carbon:

- Mills Hall and the Gibbons Center for Arctic Studies at Bowdoin College were built using mass timber, which was estimated to have one-fifth the GHG emissions of a structural steel system.
- The University of Southern Maine is using cross-laminated timber (CLT) in their new Portland Commons Residence Hall.
- AVESTA Housing used wood stud construction and cellulose insulation in new developments in Scarborough and Portland, where they could have used steel.

³⁹ <https://mainetechhub.us/>

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The Boston Planning and Development Agency has run a Mass Timber Accelerator program that could be a model for how Maine could run a program to encourage additional demonstration projects using climate-friendly building products such as CLT.⁴⁰

The working group identified the following barriers to implementation:

1. Cost, which is typically higher for sustainable wood products than conventional alternatives such as steel and concrete.
2. Lack of information and awareness about embodied carbon, compared to the more well-known operational carbon.
3. Current lack of a CLT plant in Maine, which makes it difficult to procure local CLT, even for projects that wish to use it. The working group did not conduct a thorough analysis of the barriers to attracting a CLT plant to Maine but noted that there is work underway at the state level and in the forestry industry to address these barriers.

Recommendation 4: Support measures that both reduce carbon and improve resilience

Recognizing that most of the buildings-related strategies to date have focused on reducing emissions, the BIH working group discussed strategies to improve resilience in Maine buildings. While climate and extreme weather impact all sectors, buildings in particular are affected because of their important role in people's safety and well-being. Maine buildings also face new challenges in our changing climate, including increased risk of wildfires. The working group discussed many of the ways that other recommendations elsewhere in this document can foster resilience, and also updated some recommendations to encourage greater resilience. In addition, the WG discussed topics being addressed in other working groups or stakeholder processes that are critical for helping Maine communities and households be more resilient, including getting out of harm's way and ensuring safe spaces for communities if houses are damaged or destroyed.

Mitigation

Several actions elsewhere in these recommendations have emissions benefits and also support more resilient homes and buildings (weatherization and building codes in particular). Similarly, deployment of community- and building-scale distributed energy resources such as solar and energy storage has multiple benefits, from reducing annual energy costs and the need for energy assistance benefits to reducing the amount of energy needed from the grid and enhancing resilience. Realizing these benefits requires thoughtful "demand management," which reduces the impact of building loads on the grid and supports emissions reductions by moderating the amount of electricity needed to power the grid during peak loads. The emissions benefits of this recommendation are discussed in greater detail in the Energy working group's recommendations.

Optimizing solar resources through demand management can help support a lower-carbon electricity supply and reduce energy burden.⁴¹ "Energy burden" refers to how much a household spends on energy

⁴⁰ <https://www.bostonplans.org/planning/planning-initiatives/boston-mass-timber-accelerator>

⁴¹ O'Shaughnessy, E. Cutler, D., Ardani, K., Margolis, R. (2018). Solar plus: Optimization of distributed solar PV through battery storage and dispatchable load in residential buildings. *Applied Energy*, Volume 213, Pages 11-21. <https://doi.org/10.1016/j.apenergy.2017.12.118>

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as a percentage of income. The Equity Subcommittee reported that, in Maine, low-income households spend up to 24% of their income on energy, compared to 4-6% in moderate and high-income households.⁴² To address this disparity, the working group recommends setting targets for building-scale solar and storage consistent with the Maine Energy Plan: Pathway to 2040 planning process currently underway by the Governor’s Energy Office⁴³ and increasing funding, financing, education, and outreach to ensure benefit to low-income households. A recent \$62 million “Solar for All” award from U.S. EPA will help Maine provide financial and technical assistance that ensures access to solar + energy storage for renters and homeowners, rural and urban households, and low- income and disadvantaged households across the state.⁴⁴

Adaptation and Resilience

Solar and storage, including electric vehicle batteries that are used as energy storage, is a resilience strategy for buildings that mitigates the impacts of long-duration power outages.⁴⁵ Other resilience strategies for homes and buildings include basic steps such as having flood insurance and a sump pump with battery back-up. Flooding, increasingly associated with extreme storm events, has dramatically increased the number of oil spills from residential heating oil tanks,⁴⁶ threatening human health and the environment and straining DEP’s Ground and Surface Waters Clean-up and Response.⁴⁷ To mitigate these risks, the working group recommends creating a new program to properly drain, remove, and dispose of high-risk residential heating oil tanks, which could be funded by a surcharge on the purchase of any residential heating oil tank for oil or kerosene. Further, as Maine households transition to clean heating systems (and away from heating oil), the State should evaluate what would be necessary to establish a comprehensive management program for residential heating oil tanks.

Workforce and Economic Opportunity

Renewable electric power generation is the second fastest-growing sector in Maine’s clean energy economy, accounting for 2,925 jobs in 2022, and grid modernization and energy storage jobs are next at 1,609 jobs in 2022.⁴⁸ Prioritizing registered apprenticeships can help ensure the highly qualified workforce necessary to accomplish this recommendation.

Achieving Equity

Many of the strategies outlined elsewhere, including the energy coach and community-based programs discussed in Recommendation 1, will support equitable implementation of this recommendation.

⁴² Maine Climate Council Equity Subcommittee (2023).

⁴³ <https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/energyplan2040>

⁴⁴ <https://www.maine.gov/energy/index.php/initiatives/infrastructure/solar-for-all>

⁴⁵ Gorman, W., Barbose, G., Carvallo, J.P., Baik, S., Miller, C.A., White, P., Praprost, M. (2023).

County-level assessment of behind-the-meter solar and storage to mitigate long duration power interruptions for residential customers, *Applied Energy*, Volume 342. <https://doi.org/10.1016/j.apenergy.2023.121166>

⁴⁶ Yechivi, Hannah. “Recent powerful storms have led to more than 140 oil spill cleanups in Maine.” News Center Maine, 19 January 2024, <https://www.newscentermaine.com/article/weather/severe-weather/maine-department-environmental-protection-oil-spill-cleanup-funding/97-0f4e21d0-85a5-419b-a86b-f99839e72d8d>

⁴⁷ <https://www.maine.gov/dep/spills/groundwater/index.html>

⁴⁸ Maine Governor’s Energy Office, *2023 Maine Clean Energy Industry Report*, 2024.

<https://www.maine.gov/energy/sites/maine.gov.energy/files/2024-05/2023%20MECEIR%20Report%20Final.pdf>

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Recognizing that uptake of solar and storage has historically been strongest in wealthier communities, the working group discussed the importance of targeting programs that support access to community- and building-scale distributed energy resources to those who need it the most: low-income and other priority populations. This may require translation, not only from English to another language but also from technical speak to language that fits diverse backgrounds, cultures, and limited capacities to access this information in the context of meeting basic needs and dealing with other societal inequities on a regular basis. Program design should reflect the cost-benefit analysis of various distributed energy models⁴⁹ and would benefit from iterative, community-led discussions over a substantial time period.

Additional Costs

The State's \$62 million "Solar for All" award can be leveraged to increase the uptake of distributed energy resources in low-income and disadvantaged communities and reach targets for building-scale solar + storage informed by the Maine Energy Plan: Pathway to 2040 planning process currently underway by the Governor's Energy Office. A new funding source would be required to establish an oil spill risk mitigation fund and could come from a surcharge on the purchase of any residential heating oil tank for oil or kerosene.

Proven Strategy and Feasibility

As of June 2024, there are 99.2 megawatts (MW) of residential solar, 178.6 MW of community solar, and 28.7 MW of commercial solar installed in Maine.⁵⁰ The Governor's Energy Office (GEO) reported 275MW of planned and operating energy storage projects in Maine at the end of 2021, though this only represents grid-scale storage.⁵¹ Residential solar + storage systems have been shown to cover basic backup power needs during power outages, though winter heating loads can be a challenge for these systems in homes that use electrified heating systems.^{52,53} Demand management programs are already being implemented in Maine, with Efficiency Maine offering demand management incentives for small batteries, large batteries, and managed electric vehicle (EV) charging.⁵⁴

Recommendation 5: Accelerate decarbonization technologies in industrial processes

Maine Won't Wait in 2020 recommended that the state "Launch an Industrial Task Force to collaboratively partner with industry and stakeholders to consider innovations and incentives to manage

⁴⁹ Klein, S.J.W., Hargreaves, A., Coffey, S. (2021). A financial benefit-cost analysis of different community solar approaches in the Northeastern US. *Solar Energy, Volume 213*, Pages 225-245.

<https://doi.org/10.1016/j.solener.2020.11.031>.

⁵⁰ <https://www.maine.gov/energy/initiatives/renewable-energy/solar-distributed-generation>

⁵¹ Maine Governor's Energy Office (2022). *Maine Energy Storage Market Assessment*. Maine Governor's Energy Office. https://www.maine.gov/energy/sites/maine.gov.energy/files/inline-files/GEO_State%20of%20Maine%20Energy%20Storage%20Market%20Assessment_March%202022.pdf

⁵² Gorman et. al (2023)

⁵³ Gorman, W., Barbose, G., Miller, C., Carvallo, J., Baik, S., & White, P. (2023). *Solar+Storage for Household Back-up Power: Implications of building efficiency, load flexibility, and electrification for backup during long-duration power interruptions*. Lawrence Berkeley National Laboratory. <https://escholarship.org/uc/item/2wh1s030>

⁵⁴ <https://www.efficiencymaine.com/demand-management/>

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industrial emissions through 2030 and reduce total emissions by 2050.”⁵⁵ The Industrial Innovation Task Force met throughout 2021 to learn about opportunities for increasing industrial efficiency, new technologies and processes for reducing greenhouse gas emissions, and funding sources to support these projects. The BIH working group recommends continuing to support energy efficiency improvements at industrial facilities, as well as scaling up emerging technologies such as industrial heat pumps, membrane filtration, batteries, and thermal storage. The group also recommends increasing participation in federal grant opportunities for industrial decarbonization.

Mitigation

Efficiency Maine’s FY 2023 Annual Report estimates the impact of the Commercial and Industrial Custom Program, which serves large energy users including industrial and manufacturing customers, reduces GHG emissions by 14,725 tons of carbon dioxide equivalent (CO₂e) annually.⁵⁶ A detailed analysis of the emissions benefits of this recommendation is underway by GOPIF and will be available to the Climate Council later this year. This recommendation remains in line with the current *Maine Won’t Wait* strategy to manage industrial emission through 2030 and reduce them through 2050 through adoption of new fuels such as hydrogen.

Adaptation and Resilience

As mentioned in the Equity section below, the industrial sector is important to Maine’s economy and workforce. At the end of 2023, manufacturing accounted for over 52,000 jobs in Maine, with wood product manufacturing and paper manufacturing accounting for another 4,500 and 3,900 jobs, respectively.⁵⁷ Improving efficiency and reducing energy costs can help these businesses remain competitive, thereby helping Maine’s rural communities remain resilient to changing climate and economic conditions.

Workforce and Economic Opportunity

See “Adaptation and Resilience” above.

Achieving Equity

As mentioned above, the equity benefits of this recommendation are primarily in sustaining jobs and economic growth in Maine’s rural communities that rely on the industrial sector. Reducing emissions in the industrial sector may also have health benefits for individuals working and living near these facilities, but more information is needed to determine the health impacts of this recommendation. A detailed analysis of the costs and benefits to low income and disadvantaged communities is underway by GOPIF and will be available later this year.

Additional Costs

⁵⁵ Maine Climate Council (2020). *Maine Won’t Wait*.

https://climatecouncil.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_December2020.pdf

⁵⁶ Efficiency Maine Trust (2023). *FY2023 Annual Report*. <https://www.energymaine.com/docs/FY2023-Annual-Report.pdf>

⁵⁷ Maine Department of Labor, Center for Workforce Research and Innovation (2023). *Quarterly and Annual Industry Employment and Wages*. <https://www.maine.gov/labor/cwri/qcew1.html>

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A detailed analysis of the costs of this recommendation is underway by GOPIF and will be available later this year. Efficiency Maine currently incentivizes industrial efficiency projects through its Commercial & Industrial (C&I) Custom program, which had a budget of \$20M in FY2024.⁵⁸ Additionally, Efficiency Maine received an appropriation of \$500,000 for the Industrial Climate Transition Initiative established by the Maine Legislature in 2022.⁵⁹

Several federal funding and technical assistance opportunities are available to help industrial and other large energy users reduce emissions through energy efficiency and switching to alternative energy. The US Department of Energy (DOE) Industrial Efficiency and Decarbonization Office (IEDO) offers funding opportunities for applied research and development in the highest emitting sectors such as: chemicals and fuels, iron and steel, food and beverage, building materials, and forest products.⁶⁰ State agencies and industrial sector stakeholders should continue to track opportunities through IEDO as they become available. DOE has selected the University of New Hampshire (UNH) as a Technical Assistance Partnership (TAP) through its Onsite Energy Program.⁶¹ As a TAP, UNH can advise customers on technologies including battery storage, CHP, district energy, geothermal, fuel cells, industrial heat pumps, renewable fuels, solar, solar thermal, thermal storage, waste heat to power, and wind. Additionally, small and medium sized manufacturers are eligible for grants up to \$300,000 to implement recommendations made by TAPs through the DOE Industrial Assessment Centers Implementation Grant Program.⁶²

Several federal tax credit opportunities are available through the Inflation Reduction Act (IRA):

- Production Tax Credit for Electricity from Renewables (Sec. 45) - \$0.3/kW for production of renewable energy
- Investment Tax Credit for Energy Property (Sec. 48) – 6% of qualified investments in renewable energy, microgrid controllers, and combined heat and power properties
- Advanced Energy Project Credit (Sec. 48C) – 6% of qualifying investment in advanced energy projects, including production of clean energy equipment, critical minerals, and emissions reduction projects
- Additional credits for production of clean/alternative fuels, such as hydrogen and biofuels, and enhanced carbon capture

Proven Strategy and Feasibility

⁵⁸ Efficiency Maine Trust (2023). *FY2023 Annual Report*. <https://www.energymaine.com/docs/FY2023-Annual-Report.pdf>

⁵⁹ Public Law, Chapter 716, 130th Maine State Legislature, LD 1554, An Act To Provide Climate Change Transition Assistance for Maine's Energy-intensive Businesses

⁶⁰ <https://www.energy.gov/eere/iedo/iedo-funding-opportunities>

⁶¹ <https://betterbuildingssolutioncenter.energy.gov/onsite-energy>

⁶² <https://www.energywerx.org/opportunities/iacimplementationgrants>

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As mentioned in the 2020 BIH working group recommendations, Efficiency Maine has seen strong participation in energy efficiency programs through the C&I Custom Program, but these opportunities have historically been limited by funding availability.⁶³

Several emerging technologies show promise for continuing to improve efficiency in industrial settings. **Industrial heat pumps** are large water-to-water or air-to-water heat pump systems that are capable of generating steam when using waste heat (or waste hot water). Heat pumps also can be combined with thermal storage, electric boilers, and/or batteries to generate industrial process steam. Also, a new generation of heat pump technology is emerging that may be able to cost-effectively make steam even in the absence of an existing thermal source. **Membrane filtration** is a proven technology with large decarbonization potential in certain heat-driven separation processes. The filtration systems can replace heat-driven evaporative separation systems. This strategy is well-suited for food related production processes and may have broader industrial applications. Efficiency Maine has provided financial incentives for a spiral filtration system in a food processing facility in Maine that has been very successful. A type of high temperature membrane filtration technology recently received a large US DOE demonstration grant for use in a paper mill in Louisiana and may be a good fit with paper mills in Maine. **Energy storage** is currently being used by large electrical customers in Maine to reduce demand on the grid during summer peak demand hours. Efficiency Maine's Energy Storage System (ESS) Program Opportunity Notice (PON) offers incentives for such projects.⁶⁴

Recommendation 6: Continue to lead by example in publicly-funded buildings

State-Owned Buildings: Recognizing the recent and significant federal funding for energy efficiency, transportation and clean energy investments from the Bipartisan Infrastructure Law and the Inflation Reduction Act, there is ample opportunity for the state of Maine to continue to lead by example. In 2024, Governor Mills issued an executive order that directs the state to commit to goals that put Maine on a pathway to decarbonize state buildings.⁶⁵ The Governor's order also includes goals for electric vehicle charging stations, zero-emissions heating and cooling, and overall reductions in emissions and energy use in state buildings.

Schools: Energy is an enormous cost for the more than 600 school buildings in Maine; by being more energy efficient, schools can help reduce GHG emissions, reduce operating costs, and improve students' learning environment through improved air quality. The state can support school decarbonization efforts through the provision of technical assistance, state and federal funding, and creating learning opportunities for school administration, teachers, and students. Establishing funding and staffing for the Green Schools Program will ensure that the benefits of this program are able to flow to communities.

Affordable Housing: The 2023 State of Maine Housing Production Needs Study found that Maine needs approximately 38,500 homes to remedy historic underproduction and will need an additional 37,900 to

⁶³ Maine Climate Council Buildings, Infrastructure & Housing Working Group (2020). *Strategy Recommendations to Mitigate Emissions and Support Resilience in Maine Buildings*.

https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/BuildingsInfraHousingWG_FinalStrategyRecommendations_June2020.pdf

⁶⁴ <https://www.energymaine.com/energy-storage-system-projects/>

⁶⁵ Executive Order No. 5. An Order to Lead by Example in State Owned and Leased Buildings (2023).

https://www.maine.gov/governor/mills/official_documents/executive-orders/2024-01-executive-order-5-order-lead-example-state-owned-and

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45,800 homes to meet expected population growth and household change by 2030.⁶⁶ A significant portion of these homes will need to be affordable to low- and moderate-income Mainers. Building on the promise of the advanced building standards adopted by MaineHousing, and on ample forthcoming federal funding provided through the Weatherization Assistance Program and various Inflation Reduction Act programs such as the Department of Energy Home Energy Rebate programs, the Greenhouse Gas Reduction Fund, and Solar For All, Maine can ensure that the benefits of new energy efficient housing can reach those facing the greatest need. MaineHousing will include all future projects to have, at a minimum, raceways for future PV and EV charging. To increase the number of projects with complete PV systems will require additional funding.

2. **Cross-over** - Does the recommended strategy involve other working groups/sectors? *Select all which apply.*

- Transportation
- Buildings, Infrastructure, and Housing
- Energy
- Community Resilience
- Coastal and Marine
- Natural and Working Lands
- Other (please describe)

How did the working group coordinate with others around these overlaps?

Members of the BIH working group participated in cross-cutting conversations on land use (with all WGs), industrial emissions (with Energy WG), and demand management (with Transportation and Energy WGs).

Specific issues that the WG wanted to flag for the Community Resilience Working Group included:

- Preparing homes for flood impacts, both through flood insurance, siting, and sump pumps with battery backup;
- The importance of creating safe spaces for communities if houses are destroyed, and equipping these locations with renewable energy generation and storage; and
- Coordinating disaster assistance with energy efficiency improvements, e.g., if homeowners and business owners are rebuilding after a disaster, ensuring they are building back with energy efficient buildings and heating systems.

Specific issues that the WG wanted to flag for the Energy Working Group included:

- Setting targets for building-scale renewable energy and storage, in addition to statewide renewable procurement targets, to ensure that households are receiving the benefits of the transition to renewable energy.

⁶⁶ MaineHousing (2023). *State of Maine Housing Production Needs Study*. https://mainehousing.org/docs/default-source/default-document-library/state-of-maine-housing-production-needs-study_full_final-v2.pdf

3. **Priority Populations** - Consider the priority populations impacted or affected by this recommended strategy. A list of priority populations is contained in **Annex 2** of this document.
- a. *POPULATIONS: Identify any priority populations impacted or affected by this recommended strategy.*

Because of the broad scope of housing and energy use, these recommendations have the potential to impact nearly every priority population. However, the working group’s conversations identified populations that could be **most** impacted by each recommendation (see “Impacts” section below).

- b. *IMPACTS: Using the Equity Sub-Committee analysis (see Annex 3) from March 2023 as a starting place, consider both potential positive outcomes and any unintended consequences/byproducts. Describe these potential impacts/benefits.*

Recommendation 1: Continue the progress on making homes and businesses more energy efficient by investing in weatherization and heating systems

- Low-income households
- Rural communities
- Older adults
- Low-income renters
- Residents of manufactured homes
- People with limited English proficiency including New Mainers
- People with health vulnerabilities (e.g., asthma)
- Small businesses
- Clean energy industries

The actions in this recommendation advance equity by focusing on access. Low-income families and communities; rural and disadvantaged communities; communities with limited municipal capacity; climate-frontline communities; tribal communities; renters; manufactured home residents; and individuals with health vulnerabilities are all at particular risk of the effects of inaction on a clean energy and energy efficient transition⁶⁷. Historically, only 40 percent of households in the state that are eligible for energy bill assistance apply for and receive support from programs like HEAP or LIAP⁶⁸, meaning the transition of Maine’s buildings must be accompanied by additional funding and improve access for these populations.

By extending funding and financing for energy upgrades and focusing on adequately funding programs that reach low-income households, Maine will ensure that the benefits of these actions reach key priority populations and address cost-burdens across the state. This action also supports additional benefits like the reduction of harmful health impacts from petroleum fuel use and increased resilience to severe storms and weather.

⁶⁷ Maine Climate Council Equity Subcommittee (2023).

⁶⁸ Ibid.

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Through the expansion of education, outreach, and technical support of programs focused on providing energy upgrades, the state will continue to reduce barriers to access and increase enrollment/participation in energy assistance programs. Common barriers to access include lack of knowledge about programs, limited understanding of how to participate, and difficulty completing applications.

Increasing access for renters, low-income, and rural residents will close gaps for those who may not be able to afford and/or cannot choose cleaner heating technology due to living in rural areas or in a landlord-controlled property. To increase access for these populations, the MCC must find ways to facilitate conversations with landlords and rural communities to increase awareness about weatherization and clean heating systems. It will be critical throughout this process to focus on allowing these populations the ability to participate in decision making.

Recommendation 2: Establish strong systems and processes to support rapid adoption and compliance with increasingly climate-friendly building codes and standards.

- Rural communities
- Small towns with limited staff capacity
- Residents of manufactured homes
- People with health vulnerabilities (e.g., asthma)
- Small businesses

While all Mainers are affected by the built environment, there are certain populations for whom these recommendations are most impactful. Rural communities and communities with limited capacity; climate-frontline and low-income communities; tribal communities; and low-income, cost-burdened and manufactured home households are all particularly vulnerable to energy cost burdens and climate change impacts from severe weather and storms, which makes building codes especially important in these communities.

Defining and adopting new building codes for new construction to reach net-zero emissions in the state by 2035 will, over time, lower energy costs for homes and businesses; improve indoor air quality and occupant health; reduce burdens on the energy grid; and create more market opportunities for the natural resource and clean energy industries. While these kinds of building code upgrades have been shown to be cost-effective in Maine, particularly in terms of GHG emissions, it is important to consider that with the adoption of new codes could come price increases in design and construction, which may inhibit new construction and/or lead to the gentrification of communities. It will be important to work with communities to help them understand the benefits of increasingly efficient building codes and communicate these benefits with residents and contractors.

Supporting contractors and code enforcement officers through training, technical assistance, and contractor licensing can provide equity benefits if directed to priority populations. The Equity Subcommittee highlighted in their report that certain communities, businesses, and individuals may have limited resources to easily accommodate new changes in their professions and industries. Support can come in the form of additional outreach about new changes; more frequent scheduling of trainings on building code education; and offering a variety of meeting types, including hybrid or virtual options, offering meeting translation or meetings in non-English languages, and/or accommodating meetings at

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different locations and times of day. Some contractors and code enforcement officers may not be prepared to take on changes to their daily work, so finding appropriate ways to communicate about shared interests and goals to create common understanding is critical. This action has the potential to create more clean energy jobs, as mentioned in the recommendations above.

Incentivizing manufactured homes that meet US DOE ZERH standards provides a benefit to a class of homes that provide affordable housing and yet are not subject to the same building codes as other Maine homes. This recommendation will help provide Mainers with homeownership options that are both affordable and energy efficient in the long term.

Recommendation 3: Promote the manufacture and use of climate-friendly building products

- Natural resource industries
- Small businesses

Bringing additional bio-based materials manufacturing to Maine could offer the state additional opportunities to expand the green workforce. This could promote economic development in rural and tribal communities, as well as smaller communities, and potentially offer employment opportunities for new Mainers and non-English speakers. As the MCC suggests identifying and addressing the barriers to attracting manufacturing plants, it is important for the Council to also consider consulting with priority populations in this process to allow them power in decision making.

By promoting the manufacture and use of climate-friendly Maine forest products, the state can further support the economic development of the forest products sector and expand workforce opportunities in natural resource industries. This can provide an inherent equity benefit to Maine's rural and tribal communities through economic growth and workforce development. Increasing education and technical assistance around embodied carbon and the benefits of climate-friendly building products is an important step to ensure that informational barriers are addressed for priority populations. Lowering embodied carbon by using more bio-based materials will lower GHG emissions for new construction, which will not only provide public health benefits but increase the state's capacity to mitigate climate change and its resulting impacts.

Recommendation 4: Support measures that both reduce carbon and improve resilience

- Low-income households
- Low-income renters
- Small towns with limited staff capacity
- Unhoused individuals and families
- People with health vulnerabilities (e.g., asthma)
- Older adults
- Clean energy industries

Maine's communities face a variety of challenges related to climate change. In the face of the potential impacts of severe weather and storms, higher heat risk, and rising seas, the BIH working group recognized the many ways that buildings can improve economic and environmental resilience for priority populations.

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Increasing funding and financing sources for the installation of building-scale energy sources, like solar and energy storage, can facilitate equity for several priority populations. Of these groups, low-income households and communities; rural and tribal communities; climate frontline and disadvantaged communities; and small towns with limited capacity stand out as being able to benefit from the expansion of renewable energy sources. This kind of energy source can provide a more stable and less costly source of heating and cooling than sources like heating oil and reduce the risk of losing power or being unable to shoulder the financial energy cost burden. Additionally, this can allow for community ownership of energy sources like solar panels, which can be associated with more equitable governance structures, transparency, and accountability to ratepayers. By doing so, the MCC can not only promote the creation of more resilient homes and businesses, but more resilient communities and energy systems across the state. Additional positive outcomes include a reduced need for LIHEAP, LIAP, or other energy assistance benefits.

If ownership of renewable energy & storage is not targeted to priority populations specifically, those options will likely be adopted by wealthy individuals and businesses who can afford the upfront cost. This effect could have unintended consequences: these priority populations would not achieve the same long-term cost-reduction and energy sovereignty benefits of these options, widening the energy equity gap; and reduced electricity demand from wealthier individuals and businesses, combined with increased climate change effects, could cause electric utilities to raise prices to unsustainable and unaffordable levels for these priority populations, further exacerbating their increased energy burden relative to the wealthier individuals/business able to afford the upfront costs.

“Demand management,” or managing the impact of building loads on the grid, can benefit vulnerable populations by strengthening the resilience of the electricity grid in the face of extreme weather events, and save ratepayers money on their energy bills. Please see the Energy working group’s recommendations for a full description of the impacts and benefits of this recommendation for priority populations.

Broadly speaking, information about the actions associated with this recommendation is likely to be new for many individuals and businesses within these priority populations. Effective communication may require translation, not only from English to another language but also from technical speak to language that fits diverse backgrounds, cultures, and limited capacities to deal with this information in the context of meeting basic needs and dealing with other societal inequities on a regular basis. Program design should reflect ongoing, iterative, community-led discussions.

Special consideration is required in working with the Wabanaki Nations. If communication does not center the inherent sovereignty of tribal nations, some actions associated with this recommendation could *increase* reliance on entities outside of the tribes and undermine tribal self-determination. For example, information dissemination approaches that do not understand and respect sovereign tribal government structures and tribal community dynamics could undermine tribal self-determination, create confusion, and exacerbate tenuous relations between the Wabanaki Nations and the State. It would be more respectful and effective to develop resilience strategies and programs in partnership with tribal leaders.

Recommendation 5: Accelerate decarbonization technologies in industrial processes

- People with health vulnerabilities (e.g., asthma)
- Rural communities

While emissions from the industrial sector have decreased since 1990, the industrial sector accounts for 20% of Maine’s gross GHG emissions, with significant amounts of biomass being combusted for energy.⁶⁹ Industrial emissions primarily affect individuals with health vulnerabilities such as asthma, who are more vulnerable to respiratory impacts. For instance, air pollution from paper mills has been linked to numerous health impacts for mill workers and surrounding communities.⁷⁰ However, more information is needed to determine whether transitioning to cleaner energy sources at the facility level can reduce other harmful pollutants in addition to GHGs. Many rural communities rely on jobs linked to the forestry sector in particular, and maintaining competitiveness in these industries can help sustain the viability of Maine’s rural communities. For industrial decarbonization projects using federal funds, Justice40 requirements can help to ensure that at least 40% of benefits of these investments are directed to disadvantaged communities.

Recommendation 6: Continue to lead by example in publicly-funded buildings

- Small towns with limited staff capacity
- Low-income communities
- Unhoused individuals and families
- Low-income renters
- Youth/students

This recommendation focuses on certain sub-sectors of buildings where Maine has larger opportunities to lead by example and benefit populations facing greater challenges. The new Green Schools Program can benefit small, under-resourced communities by providing technical assistance to help schools participate in the transition to electric heating and cooling and renewable energy. It will also benefit another priority population, young people/students, by improving learning environments with more effective heating/cooling and building envelopes and providing opportunities to learn about the clean energy transition. The Green Schools program can direct funding and resources to small towns and low-income communities which may face greater financial and capacity barriers to adopting new technologies in schools.

Finally, this recommendation sets a new, bold target for clean and energy efficient affordable housing, recognizing that the housing crisis calls for huge investments in affordable housing, and these investments should be aligned with the state’s climate goals. Recognizing that some housing developers may need additional assistance to incorporate clean and energy efficient building practices, the WG

⁶⁹ Maine Department of Environmental Protection (2024). *Tenth Biennial Report on Progress toward Greenhouse Gas Reduction Goals*.

⁷⁰ Joelle Dionne, Tony R. Walker (2021). Air pollution impacts from a pulp and paper mill facility located in adjacent communities, Edmundston, New Brunswick, Canada and Madawaska, Maine, United States. *Environmental Challenges*, Volume 5. <https://doi.org/10.1016/j.envc.2021.100245>.

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recommends technical assistance and information sharing to help the industry evolve to meet new standards and practices.

- c. *SOURCES OF INFORMATION: Describe how you know what groups are impacted/affected. Cite relevant data sources⁷¹ and/or formal conversations (MCC-organized panels, focus groups, etc.) with priority populations.*
- d. *RESULT OF ENGAGEMENT: Describe any consultation or engagement with these priority population (either by the Working Group or through GOPIF's community engagement contractor). Describe how the Working Group's recommendations have changed as a result of these conversations.*

The University of Maine Mitchell Center presented preliminary findings from their outreach to priority populations at the BIH working group meeting on May 21, 2024. The following key takeaways informed the working group's conversation:

- Clean energy and climate action are not “at the top of the list” for many of these groups because they are dealing with other structural inequities. For instance, a group of New Mainers discussed enduring serious health and safety issues caused by landlord neglect. Though these issues are related to energy efficiency, they may not always come up when people are asked about barriers to participating in energy programs.
- 54% of survey respondents who are members of priority populations identified buildings-related issues among their top community priorities, including:
 - Housing shortages and the need to reduce housing costs;
 - Reduce heating and energy costs;
 - Walkable, bikeable, resilient communities; and
 - Waste management, both in terms of landfills and recycling.
- Most people identified cost as the greatest barrier to making energy efficiency improvements. For people who are renters, they feel that their landlords don't have enough incentive to make the changes, because the tenants pay all the utilities
- Solar panels, heat pumps, heat pump water heaters, and weatherization top the list of the alternative energy options that people are most interested in accessing.
- People are very concerned with the cost of their electricity bills, especially as they consider upgrading their heating systems to use electricity.
- Older adults in particular have trouble understanding and accessing available energy programs.
- Energy assistance programs such as LIHEAP/LIAP can be difficult for people to understand/access.
- CAP agencies see far more demand than they can meet with limited funding sources for home repair/weatherization programs.

⁷¹ Some available data sources include:

U.S. Council on Environmental Quality [Climate and Economic Justice Screening Tool](#) (CEJST) (select by census tract)

U.S. Census Bureau [Rural America](#) tool

The Nature Conservancy [Coastal Risk Explorer](#) (w/ particular focus on Social Vulnerability Ranking)

Climate Mapping for Resilience and Adaptation [Assessment Tool](#) (select by census tract, county, or Tribal land)

[Maine Social Vulnerability Tool](#)

U.S. Department of Energy [Low-Income Energy Affordability Tool](#) (LEAD)

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- Builders are not prepared to adopt updates to building codes, especially in rural areas.
- Rooftop solar is seen favorably by respondents, compared with other alternative energy options such as utility-scale solar.
- People in low-income residential facilities commented on poor temperature control; drafty windows, faulty heating systems, a lack of air conditioning; there is lack of understanding in the industry around indoor air quality needs and technologies.

Changes to the recommendations that resulted from this conversation include:

- Adding “older adults” to the list of populations prioritized for increased education and outreach.
- Ensuring that additional programs and subsidies are funded in a way that keeps energy costs affordable for vulnerable populations.
- Exploring increased low-income heat pump targets to better match the percentage of low-income households in the state, based on further research into possible funding sources to supplement existing heat pump programs.
- Including more actionable language around preparing vulnerable homes and communities to climate impacts, especially flooding.
- Highlighting the many challenges that low-income households and other priority populations face, which they report makes it difficult to prioritize climate action.

e. *IMPLEMENTATION: How might the recommended strategy be implemented in consultation with priority populations? Do priority populations have the resources and capacity necessary to implement or access this recommended strategy? How might you make recommendations to improve equitable access to resources and capacity-building? You might consider planning capacity, financial capacity, programmatic capacity, human capital, and other.*

Included in the “Impacts” section above.

4. **Timeframe** - What is the timeframe for this strategy and its actions?

	Short-term (2025)	Mid-term (2030)	Long-term (2050+)
Weatherization and heating systems			
To implement	Extend funding & financing, Education & outreach, Increase access (can be implemented within the next year)	Appliance standards Tax policy	
To realize outcomes		Extend funding & financing, Education & outreach, Increase access (results may take several years to show impact) Tax policy	Appliance standards

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Building codes			
To implement	Building codes to OCA (can happen immediately) Support for contractors/CEOs	Net zero building codes ZERH standard	
To realize outcomes		Move building codes to OCA Support for contractors/CEOs ZERH standard	Net zero building codes
Climate-friendly building products			
To implement	CLT barriers Embodied carbon education/TA	Demonstration projects	
To realize outcomes		CLT barriers Embodied carbon education/TA Demonstration projects	
Resilience			
To implement	Emergency preparedness Oil tank fee	Funding for DERs Demand management	
To realize outcomes		Funding for DERs Demand management Emergency preparedness Oil tank fee	
Industrial processes			
To implement	Heat pumps & membrane filtration		
To realize outcomes		Heat pumps & membrane filtration	
Lead by Example			
To implement	Zero emissions heating in state buildings Green Schools Program	New energy efficient/affordable housing	
To realize outcomes		Reduce GHG emissions from state buildings Green Schools Program	

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		New energy efficient/affordable housing	
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5. Implementation Next Steps - What types of next steps would be required to implement the strategy?

- Legislation, rules/regulation, internal program guidance changes
- Establishment of a new program or a fund,
- Conduct additional research
- Provide education or training
- Coordinate with other parties/agencies/states
- Other (please describe)

Please provide some detail around these steps. If possible, identify **specific actors** who would lead in the implementation of the strategy and actions.

Recommendation 1: Continue the progress on making homes and businesses more energy efficient by investing in weatherization and heating systems

Funding/financing details

- Prioritize programs that maximize carbon reduction per dollar invested and provide benefits to low-income households.
- Seek to address the limited funding for home repairs necessary before weatherization
- Extend financing to more commercial customers
- Study the benefits and costs of thermal energy networks and decarbonized district heat.

Education, outreach, and support details:

- Fund and support community initiatives such as “navigator” programs, prioritizing low-income/disadvantaged communities and households, and older adults. Partnerships with community-based organizations can help to increase the reach of energy programs, particularly in communities that are “hard to reach” due to financial and other barriers.
- Consider the implications of the use of biomass for heating and industrial energy on Maine’s gross greenhouse gas emissions. Study the potential for use of waste biomass for biofuel blends.

Increasing access details:

- Design energy efficiency and carbon reduction programs to be broadly accessible, including to those who face additional barriers to participation such as language barriers and renter status.
- On April 30, 2024, Maine applied to the U.S. Department of Energy (DOE) for nearly \$72 million to support home energy rebates for income-eligible households in the state. The Governor’s Energy Office, Efficiency Maine, and MaineHousing expect that these funds will outfit

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approximately 4,800 low-income multifamily and manufactured homes with high-efficiency heat pumps, and an additional 2,000 market-rate homes as funds allow.

Standards:

- Continue work with the Ozone Transport Commission— an association of 12 states and DC, including Maine – to analyze and collaborate on strategies to reduce emissions of NOx from buildings, including building appliances.
- Continue work with the building electrification task force led by Northeast States for Coordinated Air Use Management (NESCAUM), exchanging information on zero-emission building equipment, including model rules to address pollution from water and space heating.

Tax policy:

- Legislation to update Maine State Sales Tax policy to provide tax exemption to electricity used for heat.

Recommendation 2: Establish strong systems and processes to support rapid adoption and compliance with increasingly climate-friendly building codes and standards.

Legislation needed to:

- Clarify that all funding collected through building permit fees for the purpose of training about codes should also be transferred to the new Office of Community Affairs (OCA).
- Set a clear deadline by which rulemakings adopting updated codes must be completed and take effect.
- Clarify that MUBEC Board members are authorized to serve until a replacement is appointed.
- Eliminate the exemption for enforcing code in communities with fewer than 4000 residents.

Additional actions not requiring legislation:

- Direct the OCA to provide enhanced support to communities to adopt the stretch code.
- Study: track the trajectory of IECC codes toward net-zero targets (for some or all segments) and determine which sectors might lead to a more rapid transition.

Support contractor community:

- Licensing: Require contractor licensing to accelerate adoption of and compliance with increasingly climate-smart building codes.
 - Build on the platform created by LD 1929.
 - Help contractors to achieve licensure with funding, education & training, including licensing training program that incorporates high performance construction techniques, IE Passive House, LEED, Building Performance Institute (BPI).

Voluntary standards:

- Adopt policies and create incentives to increase the percentage of the ~900/yr new Manufactured Homes (MH) delivered to Maine that are certified to meet US DOE's Zero Energy Ready MH standard (ZER-MH) in order to leverage the new Section 45L federal tax credit that provides \$5,000

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per qualifying home.⁷² The ZER-MH standard is still in pilot stage and the DOE will be conducting additional research and stakeholder work over the next few years to support the manufactured home industry in reaching the ZERH standard.⁷³ Maine should continue to follow this work to determine how best to encourage the purchase of ZER manufactured homes on the state level.

Recommendation 3: Promote the manufacture and use of climate-friendly building products

Awareness, education, and technical assistance:

- Provide technical assistance to municipalities and larger institutional projects about whole-life carbon accounting and low-carbon building materials through programs such as the Community Resilience Partnership.
- Contractor licensing can improve uptake and awareness, as mentioned in the above recommendation.

Addressing the cost gap:

- Invest in demonstration projects using climate-friendly building products such as cross-laminated timber (CLT)
- Phase out, where feasible, high-carbon materials, such as foam insulation, in existing and future incentive programs
- Support Maine manufacturing firms to produce Environmental Product Declarations.
- Incentivize, through the Historic Preservation Tax Credit and other sources, preserving old buildings that have large amounts of embodied carbon.

Recommendation 4: Support measures that both reduce carbon and improve resilience

- Support coordination that will bring efficiency upgrades to buildings recovering from natural disasters
- Several ideas from WG members overlap with topics addressed in the Community Resilience WG:
 - Getting out of harm's way (flooding, and other risks)
 - Safe spaces for communities if houses are destroyed or damaged.
- Establish an oil spill risk mitigation fund:
 - to properly drain, remove and dispose of high-risk residential heating oil tanks. High risk residential heating oil tanks include tanks that are abandoned, in poor physical condition, improperly installed, located in an area that may pose an elevated risk to the environment (e.g., near a drinking water source), or otherwise installed in a way or location that makes them vulnerable to damage from falling ice, flooding, etc.;
 - to supplement the DEP's Ground and Surface Waters Clean-up and Response Fund. and;

⁷² <https://www.energy.gov/eere/buildings/section-45l-tax-credits-zero-energy-ready-homes>

⁷³ <https://www.energy.gov/sites/default/files/2022-12/DOE%20ZERH%20MH%20V1%20National%20Program%20Requirements.pdf>

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- funded through a surcharge assessed on the purchase of any residential heating oil tank for oil or kerosene.
- Evaluate what would be necessary to establish a comprehensive management program for residential heating oil tanks in Maine.

Recommendation 5: Accelerate decarbonization technologies in industrial processes

Industrial heat pumps:

- Large water to water or air to water heat pump systems are capable of generating steam when using waste heat (or waste hot water).
- Heat pumps also can be combined with thermal storage, electric boilers, and/or batteries to generate industrial process steam.
- Also, new a generation of heat pump technology is emerging that may be able to cost-effectively make steam even in the absence of an existing thermal source.

Membrane filtration:

- This is proven technology with large decarbonization potential in certain heat-driven separation processes. The filtration systems can replace heat-driven evaporative separation systems. This strategy is well-suited for food related production processes and may have for broader industrial applications.
- Efficiency Maine has provided financial incentives for a spiral filtration system in a food processing facility in Maine that has been very successful.
- A type of high temperature membrane filtration technology recently received a large US DOE demonstration grant for use in a paper mill in Louisiana and may be a good fit with paper mills in Maine.

Additional details:

- Monitor U.S. DOE's industrial grant opportunities at <https://www.energy.gov/industrial-technologies/doe-industrial-decarbonization-roadmap>.
- Survey Maine's existing industrial energy users to evaluate the feasibility and/or barriers to transitioning each to electricity or clean non-fossil derived fuels.
- Prioritize registered apprenticeships to ensure the highly qualified workforce necessary to accomplish this task.

Recommendation 6: Continue to lead by example in publicly-funded buildings

- Identify new funding source for Green Schools Program
- Legislation to require whole-life carbon accounting for new schools
- Legislation to require energy & cost savings data collection for affordable housing projects

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6. **Measuring Outcomes** - How will you know the recommended strategy is effective? *Are outcomes measurable using current monitoring/data collection? Are there benchmarks or short-term indicators of success?*

The Maine Climate Council currently tracks the following metrics related to Buildings:

- Heat pump rebates, including low and moderate income
- Weatherization rebates, including low and moderate income
- Heat pump water heater rebates, including low and moderate income
- Energy cost burden among households eligible for fuel assistance
- State agency GHG reductions compared to a 2020 baseline
- Affordable housing units built or renovated with clean or energy efficient technologies
- Clean energy jobs
- Clean energy jobs held by priority populations

Some additional “equity monitoring metrics” identified by the Equity Subcommittee that could help to track progress:

- Income-qualified households enrolled in energy bill assistance
- Number, location, and attendees in Building Codes trainings
- Priority population trainees in state-funded clean energy industry workforce development programs

7. **Other** - Additional Rationale/Background Information

**Please footnote substantive disagreements among the Working Group members

Annex 1: Key questions for analyzing impacts

<p>Mitigation</p> <p>Reducing greenhouse gas emissions</p>	<ul style="list-style-type: none"> A. Does the recommended strategy reduce air pollution (ozone, VOC, NOx, etc)? B. What is the estimated CO2e savings or sequestration (metric tons) by 2030, 2050? C. What is the cost effectiveness of those reductions (cost per ton of CO2e reduced) and the total cost? D. Does the cost or impact change if the recommended strategy is designed to prioritize priority populations? E. Does the recommended strategy create a healthier living environment and improved quality of life for Mainers, particularly Maine’s priority populations?
<p>Adaptation and resilience</p> <p>Decreasing vulnerability to, and increasing the ability to recover from, climate hazards</p>	<ul style="list-style-type: none"> A. Does the recommended strategy decrease the <i>likelihood</i> of climate hazards (i.e. wildfires, flooding) occurring? B. Does the recommended strategy decrease the <i>risk</i> from climate hazards for individuals, communities, or sectors, and particularly priority populations? C. Does the recommended strategy increase any climate risks or burdens for any Maine people? D. Does the recommended strategy expand access to essential services (transportation, healthcare, etc.) in underserved or priority communities? E. Does the recommended strategy help build community capacity through funding, educational opportunities, and/or other resources? F. Are there any natural environment co-benefits (i.e. habitat creation, connectivity improvements, etc) associated with this recommendation?
<p>Workforce + Economic Opportunity</p> <p>Creating jobs and fostering innovation</p>	<ul style="list-style-type: none"> A. Will the recommended strategy create new jobs, prevent job loss, or cost the state jobs? B. Does the recommended strategy attract new workers and families to Maine, and/or employ un/underemployed people who already reside in Maine? C. Does the recommended strategy grow the economy and foster innovation in a way consistent with the state’s climate goals? D. Does the recommended strategy protect or strengthen Maine’s most climate-vulnerable economies, including natural heritage industries?

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	E. Does the recommended strategy address any potential displacement of residents or small businesses?
<p>Achieving Equity</p> <p>Increasing resources to priority populations and those most impacted by climate change</p>	<p>A. Does the recommended strategy offer options that are affordable to low-income residents? Fixed-income residents?</p> <p>B. How might the recommended strategy address any barriers to access for priority populations? <i>For this question, please document any potential barriers and address how this recommendation removes/lessens them.</i></p> <p>C. Does the recommended strategy acknowledge/respect the culture, historic assets, and traditions of low income and communities of color, especially tribal communities?</p>
<p>Additional Costs</p>	<p>A. What are the estimated fiscal costs and other costs to carry out this recommended strategy? To the state? To municipalities?</p> <p>B. What resources do you anticipate needing to inform Mainers about the strategy and the opportunity/costs of the strategy?</p> <p>C. Where would financing likely come from?</p>
<p>Proven Strategy & Feasibility</p>	<p>A. Has this strategy been implemented successfully elsewhere?</p> <p>B. Is it feasible with today's technology?</p> <p>C. What barriers to implementation exist (e.g., financial, structural, workforce capacity, public/market acceptability)?</p>
<p>Other Criteria (Optional)</p>	<p>A. Are there other co-benefits of your recommendation not covered above?</p> <p>B. Are there any other criteria important to this working group not covered above?</p>

Annex 2: Priority Populations

Individuals and Households	Geographic Areas and Communities	Businesses/Economic Sectors
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Low-income individuals <input checked="" type="checkbox"/> Cost-burdened renter or owner households <input checked="" type="checkbox"/> Mobile home residents <input checked="" type="checkbox"/> Unhoused individuals and families <input checked="" type="checkbox"/> Older adults (65+) <input checked="" type="checkbox"/> Youth/Students <input type="checkbox"/> LGBTQIA+ populations <input checked="" type="checkbox"/> People with health vulnerabilities (i.e. asthma) <input checked="" type="checkbox"/> People with physical mobility challenges <input type="checkbox"/> People with limited access to transportation <input type="checkbox"/> Members of tribal nations <input checked="" type="checkbox"/> Non-White Mainers (Black, Indigenous, Asian, and Hispanic populations) <input checked="" type="checkbox"/> Non-native English speakers or people with limited English proficiency <input checked="" type="checkbox"/> New Mainers (immigrant and refugee populations) <input type="checkbox"/> Migrant workers <input type="checkbox"/> Undocumented individuals <input type="checkbox"/> Other (please describe) 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Low-income communities <input checked="" type="checkbox"/> Rural communities <input checked="" type="checkbox"/> Small towns with limited municipal capacity <input type="checkbox"/> Climate-frontline communities (“first and worst impacted by climate change”) <input type="checkbox"/> Tribal and Indigenous communities <input type="checkbox"/> Disadvantaged communities (please describe) <input type="checkbox"/> Other (please describe) 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Natural resource industries (e.g., agriculture, forestry, and fishing) <input checked="" type="checkbox"/> Clean energy industries <input checked="" type="checkbox"/> Small businesses <input type="checkbox"/> Minority- or women-owned businesses <input type="checkbox"/> Other (please describe)

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Annex 3: Information from the Equity Sub-Committee Report.

[tailored content to be inserted for each WG, along with a link to the full report]

Buildings, Infrastructure & Housing (BIH) Working Group

Proposed Recommendations and Actions

Updated 6/5/2024

RECOMMENDATION	ACTIONS	IMPLEMENTATION DETAILS
<p>Continue the progress on making homes and businesses more energy efficient by investing in weatherization and heating systems</p>	<ul style="list-style-type: none"> • Extend funding and financing for weatherization and electric heating and water heating systems in homes and businesses beyond 2030. • Expand education and outreach for programs that increase uptake of weatherization, clean heating, and water heating systems, including through partnerships with community-based organizations. • Increase access and participation in energy efficiency programs for renters, low-income, and rural residents, including by supplementing existing home repair programs. • Explore the use of state emissions standards for heating appliances. • Give all buildings used for human habitation and sleeping that use electricity for space heating and water heating the same sales tax exemption that exists for heating with oil, coal, and wood. <p>Guidance on targets:</p> <ul style="list-style-type: none"> • Maintain existing targets for economy-wide heat pumps and weatherization. • Extend low-income targets for heat pumps and weatherization to 2030 and explore increasing the heat pump target for low-income households <ul style="list-style-type: none"> ○ Heat pumps: at least 32,000 heat pumps in low-income households by 2030 (13% of total heat pump installations) 	<p>Funding/financing details</p> <ul style="list-style-type: none"> • Prioritize programs that maximize carbon reduction per dollar invested while leveraging funding and financing to provide benefits to low-income households. • Seek to address the limited funding for home repairs necessary before weatherization. • Extend financing to more commercial customers. • Study the benefits and costs of thermal energy networks and decarbonized district heat. <p>Education, outreach, and support details:</p> <ul style="list-style-type: none"> • Fund and support community initiatives such as “navigator” programs, prioritizing low-income/disadvantaged communities and households, and older adults. Partnerships with community-based organizations can help to increase the reach of energy programs, particularly in communities that are “hard to reach” due to financial and other barriers. • Consider the implications of the use of biomass for heating and industrial energy on Maine’s gross greenhouse gas emissions. Study the potential for use of waste biomass for biofuel blends. <p>Increasing access details:</p> <ul style="list-style-type: none"> • Design energy efficiency and carbon reduction programs to be broadly accessible, including to

	<ul style="list-style-type: none"> ○ Weatherization: 10,000 low-income households weatherized by 2030 (29% of total weatherization projects) 	<p>those who face additional barriers to participation such as language barriers and renter status.</p> <ul style="list-style-type: none"> ● On April 30, 2024, Maine applied to the U.S. Department of Energy (DOE) for nearly \$72 million to support home energy rebates for income-eligible households in the state. The Governor’s Energy Office, Efficiency Maine, and MaineHousing expect that these funds will outfit approximately 4,800 low-income multifamily and manufactured homes with high-efficiency heat pumps, and an additional 2,000 market-rate homes as funds allow. <p>Standards- Engage in regional and national initiatives, including:</p> <ul style="list-style-type: none"> ● Continue work with the Ozone Transport Commission– an association of 12 states and DC, including Maine – to analyze and collaborate on strategies to reduce emissions of NOx from buildings, including building appliances. ● Continue work with the building electrification task force led by Northeast States for Coordinated Air Use Management (NESCAUM), exchanging information on zero-emission building equipment, including model rules to address pollution from water and space heating.
<p>Establish strong systems and processes to support rapid adoption and compliance with increasingly climate-friendly building</p>	<ul style="list-style-type: none"> ● Move responsibility for building code adoption, compliance, and training to the new Office of Community Affairs (OCA) ● Commit to adopt new building codes to reach net-zero carbon emissions for new construction in Maine by 2035, with the interim goal of defining a net-zero emissions stretch code by 2028. 	<p>Improving building code process:</p> <ul style="list-style-type: none"> ● Amend state statute governing building codes to: <ul style="list-style-type: none"> ○ Clarify that all funding collected through building permit fees for the purpose of training about codes should also be transferred to the OCA

<p>codes and standards.</p>	<ul style="list-style-type: none"> • Support contractors and code enforcement officers through training, technical assistance, and contractor licensing, particularly in small and rural communities. • Develop a program to incentivize the purchase of manufactured homes that meet the new US Department of Energy (DOE) Zero-Energy Ready Home (ZERH) standard. 	<ul style="list-style-type: none"> ○ Set a clear deadline by which rulemakings adopting updated codes must be completed and take effect ○ Clarify that MUBEC Board members are authorized to serve until a replacement is appointed <ul style="list-style-type: none"> • Eliminate the exemption for enforcing code in communities with fewer than 4000 residents. • Direct the new Office of Community Affairs to provide enhanced support to communities to adopt the stretch code. • Track the trajectory of IECC codes toward net-zero targets (for some or all segments) and determine which sectors might lead to a more rapid transition <p>Support contractor community:</p> <ul style="list-style-type: none"> • Licensing: Require contractor licensing to accelerate adoption of and compliance with increasingly climate-smart building codes. <ul style="list-style-type: none"> ○ Build on the platform created by LD 1929. ○ Help contractors to achieve licensure with funding, education & training, including licensing training program that incorporates high performance construction techniques, IE Passive House, LEED, Building Performance Institute (BPI), etc. <p>Workforce development:</p> <ul style="list-style-type: none"> • Prioritize registered apprenticeships to ensure the highly qualified workforce necessary to accomplish this task. <p>Voluntary standards:</p>
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		<ul style="list-style-type: none"> • Adopt policies and create incentives to increase the percentage of the ~900/yr new Manufactured Homes (MH) delivered to Maine that are certified to meet US DOE’s Zero Energy Ready MH standard (ZER-MH) in order to leverage the new Section 45L federal tax credit that provides \$5,000 per qualifying home. • Federally regulated MH are not subject to Maine’s building codes. Therefore, the state’s only option to improve resilience and the carbon footprint of this sector is for more buyers to upgrade to MH built to a voluntary standard. • Historically, only 20% of units delivered in Maine were certified as ENERGY STAR. • The 2022 IRA required US DOE to create a more rigorous voluntary ZER-MH standard and provided significant tax incentives for manufacturers to deliver higher-quality homes. <p>Additional code details: A 2021 analysis by the Pacific Northwest National Laboratory found a life cycle cost savings of \$23,772 per home built to the 2021 IECC compared to a home built to the 2015 IECC. The same analysis estimates a statewide emissions impact of 394,600 metric tons of CO2 when using the 2021 IECC instead of the 2015 IECC.</p>
Promote the manufacture and use of climate-friendly building products	<ul style="list-style-type: none"> • Building on Maine’s designation as a federal Tech Hub for Forest Bioproducts, identify and address the barriers for attracting a cross-laminated timber (CLT) plant and other future bio-based materials manufacturing in Maine. 	Details on awareness, education, and technical assistance: <ul style="list-style-type: none"> • Contractor licensing can improve uptake and awareness, as mentioned in the above recommendation. Details on addressing the cost gap:

	<ul style="list-style-type: none">• Provide technical assistance to municipalities and larger institutional projects about whole-life carbon accounting and low-carbon building materials through programs such as the Community Resilience Partnership. Overall, increase awareness, educate, and provide technical around embodied carbon alongside operational carbon.• Use demonstration projects and incentive programs to address the current cost gap between high-embodied carbon (e.g., steel & cement) and low-embodied (e.g., wood and bioproducts) building products.	<ul style="list-style-type: none">• Invest in demonstration projects using climate-friendly building products such as cross-laminated timber (CLT)• Phase out, where feasible, high-carbon materials, such as foam insulation, in existing and future incentive programs• Support Maine manufacturing firms to produce Environmental Product Declarations.• Incentivize, through the Historic Preservation Tax Credit and other sources, preserving old buildings that have large amounts of embodied carbon.
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<p>Support measures that both reduce carbon and improve resilience</p>	<ul style="list-style-type: none"> • Increase funding and financing options for building-scale distributed energy resources, such as solar and storage (including electric vehicle batteries that are used as energy storage). <ul style="list-style-type: none"> ○ Set targets for building-scale solar and storage consistent with the Maine Energy Plan: Pathway to 2040 planning process currently underway by the Governor’s Energy Office • Expand education and outreach for programs that increase uptake of building-scale distributed energy resources, including through partnerships with community-based organizations. • Manage the impact of building loads on the grid, as recommended by the cross-cutting working group on demand management. • Leverage building codes, education and outreach, and state-run resilience programs to assist Mainers to prepare their homes and businesses to be resilient in the face of climate disasters, focusing on low-income households and Mainers with the fewest resources to prepare. • Create a new program to mitigate risks of oil spills from residential oil tanks 	<p>Funding /financing details</p> <ul style="list-style-type: none"> • Prioritize programs that maximize carbon reduction per dollar invested and provide benefits to low-income households. • Leverage Maine’s \$62 million “Solar for All” award from U.S. EPA to provide financial and technical assistance that ensures access to solar and energy storage for renters and homeowners, rural and urban households, and low- income and disadvantaged households across the state. <p>Education, outreach, and support details:</p> <ul style="list-style-type: none"> • Leverage community initiatives such as “navigator” programs to increase awareness and access to building-scale distributed energy resources, prioritizing low-income/disadvantaged communities and households, and older adults. <p>On resilience actions:</p> <ul style="list-style-type: none"> ○ Multiple actions in this document support more resilient homes (stronger building codes and insulation, local energy storage, etc.) and the STS has cited the cost-effectiveness of solar + storage as a resilience strategy for buildings. ○ Maine buildings face new challenges, such as wildfire risk. ○ Support households to take basic steps such as having flood insurance and a sump pump with a battery back-up and preparing homes for external power sources. ○ Support coordination that will bring efficiency upgrades to buildings recovering from natural disasters.
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Accelerate decarbonization technologies in industrial processes	<ul style="list-style-type: none"> ● Promote emerging energy efficiency technologies in the industrial sector by piloting and demonstrating new heat pump applications for industrial steam and hot water and scaling up deployment of membrane 	<p>Details on industrial heat pumps:</p> <ul style="list-style-type: none"> ● Large water to water or air to water heat pump systems are capable of generating steam when using waste heat (or waste hot water).

	<p>filtration in food production and other industrial processes.</p> <ul style="list-style-type: none"> • Continue traditional energy efficiency upgrades at small and mid-sized facilities. • Explore increased participation in federal grant-funding opportunities. • Maximize facilities' participation in cost-effective demand management, including use of behind-the-meter batteries or thermal energy storage. 	<ul style="list-style-type: none"> • Heat pumps also can be combined with thermal storage, electric boilers, and/or batteries to generate industrial process steam. • Also, new a generation of heat pump technology is emerging that may be able to cost-effectively make steam even in the absence of an existing thermal source. <p>Details on membrane filtration:</p> <ul style="list-style-type: none"> • This is proven technology with large decarbonization potential in certain heat-driven separation processes. The filtration systems can replace heat-driven evaporative separation systems. This strategy is well-suited for food related production processes and may have broader industrial applications. • Efficiency Maine has provided financial incentives for a spiral filtration system in a food processing facility in Maine that has been very successful. • A type of high temperature membrane filtration technology recently received a large US DOE demonstration grant for use in a paper mill in Louisiana and may be a good fit with paper mills in Maine <p>Details on energy storage:</p> <ul style="list-style-type: none"> • See, for example, EMT's initiative promoting Energy Storage System Projects at: https://www.energymaine.com/energy-storage-system-projects/ <p>Additional details</p> <ul style="list-style-type: none"> • Monitor U.S. DOE's industrial grant opportunities at https://www.energy.gov/industrial-technologies/doe-industrial-decarbonization-roadmap.
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<p>Continue to lead by example in publicly-funded buildings</p>	<p>For buildings that are owned by the State of Maine:</p> <ul style="list-style-type: none"> • Starting in 2024, ensure that all new state-owned buildings and major renovations use zero-emissions heating, cooling, and water heating sources and are compliant with the most recent or stretch energy codes. • By 2034, reduce GHG emissions by at least 50% from existing state buildings. • Ensure that major parking-related renovations and new builds at state owned buildings include “EV Ready” parking spaces. • Determine what state buildings are a good fit for advanced wood products, based on criteria being developed by the end of 2024. • Require energy and cost savings data collection for all energy efficiency and renewable energy projects in state-owned buildings. • Require whole-life carbon accounting for all new state-owned and funded buildings to help the State understand embodied carbon emissions alongside operational carbon. <p>For schools:</p> <ul style="list-style-type: none"> • Establish a dedicated funding source and staff to support the new Green Schools Program to reduce energy costs in Maine’s 600 existing school buildings through the installation of zero- 	<p>Lead By Example</p> <p>Recognizing the recent and significant federal funding for energy efficiency, transportation and clean energy investments from the Bipartisan Infrastructure Law and the Inflation Reduction Act, there is ample opportunity for the state of Maine to continue to lead by example. In 2024, Governor Mills issued an executive order that directs the state to commit to goals that put Maine on a pathway to decarbonize buildings statewide. The governor’s order also includes goals for EV charging stations at public buildings, zero-emissions heating and cooling, and overall reductions in emissions and energy use in state buildings.</p> <p>Schools: Energy is an enormous cost for the more than 600 school buildings in Maine; by being more energy efficient, schools can help reduce GHG emissions, reduce operating costs, and improve students’ learning environment through improved air quality. The state can support school decarbonization efforts through the provision of technical assistance, state and federal funding, and creating learning opportunities for school administration, teachers, and students.</p> <p>Affordable Housing</p> <p>The 2023 State of Maine Housing Production Needs Study found that Maine needs approximately 38,500 homes to remedy historic underproduction and will need an additional 37,900 to 45,800 homes to meet expected population</p>

	<p>emissions heating and cooling technologies and renewable energy in new and existing schools.</p> <ul style="list-style-type: none"> • Develop a system to track energy and cost savings data for all school energy efficiency or renewable energy receiving state funds. • Require whole-life carbon accounting in the construction of new schools. <p>Affordable Housing:</p> <ul style="list-style-type: none"> • Set an ambitious target for the number of clean and energy efficient affordable housing units Maine should produce each year, through consultation with community, industry, and government stakeholders. • Increase the percentage of affordable housing projects that utilize solar energy and battery storage. • Provide housing developers with robust guidance on accessing state and federal resources to build and renovate affordable, energy-efficient housing for low- and moderate-income Mainers. • Require energy and cost savings data collection for all affordable housing projects receiving state funds, to help tell the story about the benefits of climate-friendly housing for Maine residents. 	<p>growth and household change by 2030. A significant portion of these homes will need to be affordable to low- and moderate-income Mainers. Building on the promise of the advanced building standards adopted by MaineHousing, and on ample forthcoming federal funding provided through the Weatherization Assistance Program and various Inflation Reduction Act programs such as the Department of Energy Home Energy Rebate programs, the Greenhouse Gas Reduction Fund, and Solar For All, Maine can ensure that the benefits of new energy efficient housing can reach those facing the greatest need.</p>