THE UNIVERSITY OF MAINE

Senator George J. Mitchell Center for Sustainability Solutions

Assessing the Potential Equity Outcomes of Maine's Climate Action Plan: Framework, Analysis and Recommendations

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Prepared for the Maine Climate Council by the University of Maine's Senator George J. Mitchell Center for Sustainability Solutions (Dr. Linda Silka, Sara Kelemen and Dr. David Hart). Information about the Mitchell Center is available at umaine.edu/mitchellcenter/. Additional staff support was provided by the Mitchell Center. We are grateful for the valuable guidance and feedback we received from our colleagues in the Governor's Office of Policy Innovation and the Future as well as the Climate and Equity Advisory Committee. The views expressed in this report are those of the authors and do not represent the University of Maine.

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Executive Summary of Equity Assessment

Welcome to the report of the Equity Assessment Team that analyzed the recommendations of the Maine Climate Council Working Groups. As will become apparent, addressing climate change in Maine will require all of us to put our knowledge together and work collaboratively if we are to successfully reduce Maine's contributions to climate change, create resilient systems that can adapt to climate change impacts, and do so in ways that do not disadvantage vulnerable groups. The Maine Climate Council was visionary in this respect and asked that an equity assessment be done of the plans emerging from each of the working groups: Buildings, Infrastructure and Housing; Coastal and Marine; Community Resilience; Emergency Management; Energy; Natural and Working Lands; Public Health; and Transportation.

The recommendations of these groups have now been completed and the equity assessment that you see before you contains an analysis that was carried out by the University of Maine's Senator George J. Mitchell Center for Sustainability Solutions (hereafter, Mitchell Center) to assess the recommendations' attention to equity issues.

While the impacts of Maine decreasing its greenhouse gas emissions will not be large relative to global emissions, the state's Climate Action Plan is an important step in the right direction. Maine is not only leading by example, but is also creating policies that will reduce emissions as well as enhance the lives and livelihoods of Maine people. This is laudable, and it is our hope that Maine can be a leader in both equitable emissions reductions, and adaptive capacity building.

The creation of Maine's Climate Action Plan offers an opportunity for transformational change. Many of the strategies put forth by the Working Groups would involve significant alterations, which are necessary both to reduce our state's greenhouse gas emissions and adapt to a changing climate. These strategies can also help alleviate inequality across the state if they target the needs of vulnerable citizens first. A more resilient Maine can also be a more equitable Maine, but climate action is not inherently just. With thoughtful analysis and deliberate action, the Maine Climate Council can recognize inequality, find the root causes, and seek to solve them using the strategies in the Climate Action Plan. We hope that this report will provide a solid foundation from which that work can be done.

Organization of Report

The report begins with an introduction in which we describe the framework we used to conduct our analysis, present key definitions, describe our process, present strengths and limitations, and provide some recommended next steps. In the next sections, we include an analysis of each strategy presented by the Working Groups. At the end of each Working Group section is a bibliography as well as a list of resources and recommended reading for that specific area of interest. The appendices include a glossary, and a list of the members of the Equity Advisory Committee.

Overall Findings

The Working Groups were highly conscientious in considering the possible ways that some of their recommendations might deserve a deep focus on equity. We found that creating venues for vulnerable populations to participate in conversations surrounding equity, climate change, and the effects of specific proposed strategies will be a critical step. We feel it is important to acknowledge that inclusion does not inherently lead to justice, and that just processes are in order here. Giving vulnerable citizens agency and political power to shape decisions based on

what they consider to be the root cause of their vulnerability will lead to equitable and just solutions.

Our Constraints as Researchers

We would like to acknowledge academia's inability to completely grasp the stories, voices, and lived experiences of marginalized and vulnerable people. We have tried to use the resources available to us as a method of illuminating inequality and potential equity issues. Our hope is that the ideas in this report will help create more opportunities for vulnerable Maine citizens to speak for themselves and actively shape these recommendations to meet their needs.

For Further Information

More information about the work of the Climate Council and the Working Groups is available at https://climatecouncil.maine.gov/. Information about membership and guiding principles can be found there.

Introduction

Our work brings together the insights and collective thinking of scholars and activists in the fields of environmental justice, climate justice, and energy justice. Each of these ways of thinking about the distribution of benefits and burdens, and the effects of systemic racism, oppression, and marginalization on people's lives has utility when considering the equity of a climate action plan. Environmental justice has primarily focused on the ways in which people of color and poor people are unequally exposed to environmental harms, and has probed the roots of inequality, asking why those who have already been subject to disadvantage are also exposed to environmental harms (Schlosberg and Collins, 2014). In the last two decades, this line of thinking has given rise to the climate justice movement, which stresses the ways in which the effects of climate change might further entrench unequal power structures and creating increased oppression and disenfranchisement (Schlosberg and Collins, 2014; Welton and Eisen, 2018). The energy justice movement takes this thinking a step further, suggesting that that a clean energy economy is not necessarily a just one, and focuses on inequities in the energy system that may persist or worsen when sustainable energy becomes a political priority (Welton and Eisen, 2018: 7). We utilized this collected knowledge to focus in on areas where the Working Group's proposed strategies could be strengthened to promote justice and equity for Maine's most vulnerable populations.

The Development of the Framework

The framework used to analyze the Working Group strategies was developed for this purpose specifically, but can also be applied to climate change mitigation and adaptation strategies broadly. Our intention was to draw upon prior work as much as possible. The framework is primarily based on the work of Karen Lucas and Kate Pangbourne (2014), but also builds upon ideas contained in documents, reports, and toolkits from many other regions (e.g. various U.S. cities and states, the UK, and EU), as well as research from the fields of climate and environmental justice. On page 10, we have provided a representative list of resources we referenced in the creation of our framework. It is not exhaustive and other sources were also read and referenced in our work, but we hope this will give a general idea of the breadth of work available in this field, as well as the range of sources from which we drew our information.

The Use of the Framework

For each strategy, the framework provides an opportunity to assess equity outcomes from several angles. When addressing climate change mitigation and adaptation strategies, the intended and unintentional outcomes are described as social and distributional impacts. This refers to both the risk of inequity arising due to unforeseen burdens, as well as the opportunity for positive benefits accruing as a side effect of the target policy, otherwise known as co-benefits (Pearce, 2000). Social and distributional impacts can generally be broken down into three categories: health, wealth, and accessibility (Lucas and Pangbourne, 2014). Efforts to assess the potential impacts of a particular climate strategy on these three categories can be enhanced by the use of prior specific and technical reports focused on climate equity as well as by engaging with experts from historically underrepresented populations.

The above categories are broad, so it is also crucial that the framework address potential equity impacts upon marginalized communities who will disproportionately face climate risks, while

having fewer resources to respond to those risks. The framework specifically considers impacts upon financially vulnerable populations, socially/demographically vulnerable populations, and geographically vulnerable populations. The choice of these categories reflects similar decisions made by the Equality and Human Rights Commission, authors of Boston's "Resilient Boston" Plan, and Georgetown Climate Center's "Equitable Adaptation Legal and Policy Toolkit."

The framework also addresses issues of participation. In situations where vulnerable populations are likely to be affected by the proposed policy, the framework asks about the extent those populations were meaningfully involved in the process of creating and/or implementing the policy. While meaningful is a subjective term, it should be clear whether the outreach in question is an afterthought ("checking the box" once the planning process is well underway), or if it reflects values and preferences of the community in question and provides an opportunity to "disrupt and reform unequal power dynamics that reinforce social, economic, and political disparities," (Georgetown Climate Center). These ideas come from scholars working in the fields of climate adaptation and just transformation, including Malloy and Ashcraft, and Schlosberg, Collins, and Niemeyer.

Finally, all of these issues must be considered on multiple time frames. Climate change affects us currently and will continue to alter the world we inhabit. Therefore, for each strategy considered, the following questions must be answered: How will this strategy affect social impacts (health, wealth, and accessibility) in 10 years, 20 years, 50 years, etc.? How will this strategy affect financially vulnerable, socially/demographically vulnerable, and geographically vulnerable populations in 10 years, 20 years, 50 years, etc.?

Equity Framework for Assessing Climate Mitigation and Adaptation Strategies

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

2. Health - any positive or negative health effects?

3. Accessibility - any improvements or reductions in access to services?

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

2. Social/Demographic vulnerabilities — How does this strategy impact Blacks, Maine Tribal citizens and other Indigenous people, people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Definitions

In this section, we offer definitions we have found useful for keywords found throughout this report. These words can be differently defined across disciplines, but the definitions here are those we used in our work. Throughout the report, terms with (gl) listed next to them have been defined in the glossary, which can be found on page 11. We have tried to keep the report relatively free of jargon for ease of reading.

Equity - We use equity rather than equality here, acknowledging that equal distribution of resources is not enough. Instead, equity takes into account the fact that systems of oppression keep certain people from accessing resources, and an equitable system seeks to provide increased resources to marginalized and disadvantaged communities. The risks and effects of climate change disproportionately fall upon people of color and low-income populations. It is, therefore, absolutely critical that policies intended to mitigate climate change or increase adaptive capacity to its impacts do not exacerbate existing burdens and, wherever possible, increase wellbeing and address the root causes of inequality.

Vulnerability - The term 'vulnerable' is not meant to imply a general sense of victimhood. Rather, it is used here to discuss the ways in which historical and systemic discrimination, exploitation, and underrepresentation have left some residents of Maine more vulnerable to the effects of climate change than others. Vulnerable populations are frontline communities when it comes to climate change. This means that due to systemic oppression and injustice, they will experience the first and worst effects of a changing climate.

Benefits and co-benefits - Benefits are outcomes that are explicitly targeted by the policy or strategy. For example, a benefit from a strategy aimed at increasing broadband across the state would be that more people have reliable access to the internet. Co-benefits are positive benefits which accrue as a side effect of the target policy or strategy. For example, a co-benefit from a strategy increasing broadband across the state would be that more people can work remotely, thereby decreasing vehicle miles traveled. As a secondary example, for a strategy encouraging weatherization of old houses —the benefit is decreased energy and fuel usage by the resident of the house or building. A co-benefit would be that the resident of the building pays smaller energy bills because they lose less radiative heat. Another co-benefit is that they may experience a decrease in the severity of a respiratory disease because their house is more constantly well-heated.

Our Process

In April 2020, the Mitchell Center received a request from the Governor's Office of Policy Innovation and the Future (GOPIF) to develop a framework that could be used to help enhance the equity outcomes of the Maine Climate Council's work. Following meetings with GOPIF staff, we began by gathering information on major equity assessments from cities, towns, and states across the country. Although much of the information was relevant, Maine is unique in many ways so the approach was formulated taking Maine's characteristics into account. We used the

information gathered to create the framework described above. Throughout the process of creating the framework, we continued to work closely with GOPIF staff.

Once the framework was finalized, it was used to analyze each report. The recommended strategies from each Working Group varied in their level of detail, and therefore, our analyses of the individual working group recommendations vary in length. Had time allowed, analysis of each strategy could have been much more extensive. Some strategies included highly specific details which are beyond the realm of what we could fully understand in our allotted time frame and thus, it will be important that the Climate Council to delve more fully into understanding potential inequalities that may arise.

Midway through this process, feedback on the emerging information was solicited from the nine member Climate and Equity Advisory Committee made up of leaders in Maine who bring in-depth knowledge of equity issues. A listing of Climate and Equity Advisory Committee members can be found on page 12.

Strengths and Limitations of our Process

Strengths

- In our work, it was clear that the working groups had already begun the process of considering equity concerns. Many of the strategies recommended by the working groups have great potential for positive benefits and co-benefits.
- Because we analyzed the work of each Working Group relative to all the others, we were able to identify many opportunities for increasing the collective equity of Maine's Climate Action Plan.
- Our work draws extensively from available literature, allowing us to learn from what others have done.
- To our knowledge, this is the first time a framework like this has been used to analyze potential equity impacts before strategies became policy. As a consequence, it may be easier to craft policies that enhance the equity outcomes of the State Climate Action Plan.

Limitations

- Our process was constrained by having very limited time available to do this initial analysis.
- With greater time, more analysis and more involvement by stakeholders representing vulnerable communities would have been possible.
- The Working Groups produced so much work that it was hard to be thorough enough: several weeks could have been dedicated to *each* strategy.
- It is impossible to anticipate all possible equity challenges or effective strategies for enhancing equity - this will require on-going systems thinking and learning by doing.

R*ecommendations*

We would like to offer some broad recommendations regarding the continued work that will be needed to enhance the equity outcomes of Maine's Climate Action Plan.

- Increasing equity within Maine's Climate Action Plan is a task that will take time and commitment, but the benefits will be well worth the investment. The work done this

summer should represent the beginning of a deep engagement with climate equity issues on the part of the Maine Climate Council, and it is necessary that this work continue throughout the process of shaping the policies this fall, as well as during the implementation process, and beyond, into the next version of the Climate Action Plan.

- Maine Climate Council should create an Equity Working Group to continue this work. Since Maine's Climate Action plan will be iterative, centering equity issues in Maine's ongoing work to combat and adapt to climate change is essential. This could function similarly to how Portland, OR created an Equity working group after the completion of their Climate Action Plan in 2015.

- Given the unique authorities of Tribal Nations, the Council and the State should include them as it considers communication, assistance, incentives, and programs for municipalities and vulnerable communities.

- Those administering the Climate Action Plan should be responsible for guiding implementation of equity-focused policies and ensuring that all policies that are implemented continue to take equity into consideration. This can be done by setting explicit goals in terms of equity outcomes, and building metrics for measuring progress into the implementation process.

- Participation and inclusion continue to be paramount to any effort to integrate equity into Maine's climate action plan. For all policies with potential to impact vulnerable stakeholder groups, timely and meaningful engagement is an important step, not to be overlooked in the name of reaching the destination more quickly. Some questions it is never too early to ask regarding participation are: Who should be involved, how can they shape the process, and what are their barriers to involvement?

- Even when they are invited, however, members of many vulnerable populations have limited capacity to participate in planning processes designed to promote equitable climate policies. As described in the Climate Action Though Equity report (https://www.portland.gov/sites/default/files/2019-07/cap-equity-case-study-web29jul.pdf) the city of Portland, Oregon obtained philanthropic support to provide grants in support of community engagement and equity integration efforts. This type of support could increase the ability of vulnerable populations to participate in the design, implementation and evaluation of equitable climate policies.

- Our assessment focused on how these mitigation and adaptation strategies might affect the well-being of vulnerable populations, and how equity outcomes can potentially be enhanced. Because climate change will affect all populations and sectors, it is also important to consider how the Climate Action Plan can address the broader needs of society. One promising approach for addressing these dual challenges is targeted universalism (Powell et al. 2019). This approach sets broad goals for the well-being of all members of society, while tailoring strategies for different groups that take into account their specific histories, sociocultural contexts and capacities.

- Although our focus was on ways to enhance the equity outcomes of the Climate Council's work, climate change is just one of many factors that influence the well-being of vulnerable populations. For example, when the Climate Council was created in June, 2019, it seems likely that few members expected a global pandemic to complicate their work, let alone become a central threat to societal well-being. Thus, efforts to create a more equitable, diverse, inclusive and just society need to consider many interconnected

factors (e.g. global trade, new technologies, infectious disease, climate change) that can potentially facilitate or hinder progress.

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Glossary

Ecological Gentrification - "The displacement of vulnerable human inhabitants resulting from an implemented environmental agenda driven by a totalizing environmental ethic."[1]

Energy Burden/Energy Poverty - "A household's energy burden is largely driven by household income, energy consumption, and energy prices. Higher-than-average energy consumption may be due to a number of factors, including the physical condition of a home, a household's ability (or lack thereof) to invest in energy-efficient equipment and upgrades, and the availability of energy efficiency programs and incentives that put energy-efficient technologies within reach."[2] While there is debate surrounding what percentage of a household's annual gross income going to energy bills constitutes a high energy burden otherwise referred to as energy poverty, it is generally agreed upon that those experiencing a high energy burden will experience difficulty keeping a house at a comfortable temperature meeting domestic energy consumption needs at an affordable cost.[3]

Procedural Justice - "Theories of procedural justice…address the justness of the institutional processes and procedures through which decisions are made. Focusing on issues of recognition, voice, and the role of unequal economic and political power in determining inequitable outcomes, they aim to conceptualize, deconstruct, and propose solutions to structural inequalities that make some people the subjects of institutionalized forms of domination and oppression."[4]

Transport Burden/Transport Poverty - The percentage of one's income that goes to paying for transportation is one's transport burden. Transport poverty is described as the condition of spending more than 10% of one's income on transportation. This specific definition is malleable but the concept is crucial to understanding the burden that paying for transportation puts on to some people more than others.[5]

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Governor's Office of Policy Innovation and the Future
Climate and Equity Advisory Committee

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Elmina B. Sewall Foundation

Lesley Fernow
Central Hall Commons

Representative Craig Hickman
Maine State Legislature

Deborah Ibonwa
Maine Equal Justice

Amara Ifeji
Bangor High School 2020 graduate

Chris Johnson
Sipayik Environmental Department

Suzanne MacDonald
Island Institute

Fowsia Musse
Maine Community Integration

Joy Barresi Saucier
Aroostook Agency on Aging

Spencer Thibodeau
Portland City Council

Buildings, Infrastructure, and Housing

Strategy 1: Improve the Design and Construction of New Buildings

a. Building codes: Phase-in building codes for new residential and commercial construction to improve resilience and reach net zero emissions by 2035.
b. Building Code Compliance: Establish mechanisms to expand and increase code compliance across the state.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Green development caused by new building codes aimed at reaching net zero emissions can potentially benefit vulnerable populations by lowering their energy burden, but green development can also have dramatically stratified economic effects on different groups of people. This strategy will potentially benefit landlords, developers, and owners of property, but similar strategies have sometimes burdened renters and low income households. Ann Dale and Lenore Newman report that, “greening’ of neighbourhoods can increase desirability and thus spur gentrification that drives up housing prices, making these developments increasingly less affordable,” as well as making them less diverse (Dale and Newman, 2009: 972). Potential benefits to vulnerable populations in Maine will depend in part on the affordability of housing with low/zero emissions, including the availability of such housing in different parts of the state.

2. Health - any positive or negative health effects?

Evidence shows that the built environment significantly impacts the health and well-being of individuals and entire populations (Worden et al., 2020; Jackson et al., 2013; Rao et al., 2007). Green buildings are often healthier buildings and so this strategy offers health co-benefits for those who work in/inhabit the new building stock. “The indoor environment is of key importance for human health and well-being, not only due to the time spent indoors during our lifespan (approximately 90%), but also due to the combination of health and safety threats encountered on a daily basis,” (Sarigiannis et al., 2019). These new buildings will also be very energy efficient, which has been shown to increase resident health (Curl et al., 2015; Maidment et al., 2014). Additionally, LEED and similar rating systems have been increasingly including health-relevant credits into their crediting process (Worden et al., 2020) and by making explicit the ability of green building to promote health, have begun to make this a mainstream thought. Health co-benefits from green building will only be equitably distributed, however, if provisions are made to ensure that ecological gentrification (gl) does not occur.

3. Accessibility - any improvements or reductions in access to services?

Though the sustainable development and green building movements purport to uphold all three “pillars” of sustainability, including environmental, economic, and social sustainability, social sustainability is often referred to as the “forgotten pillar” (Dale and Newman, 2009). By excluding social sustainability by design or by accident, green development often reduces vulnerable populations' access to healthy, efficient buildings. This strategy may reduce availability of housing to renters and low income people who live in subsidized housing. Generally, development of new green buildings is a face of gentrification and goes hand in hand with longtime and often low income residents losing their homes. “Caution is needed when we

assume that sustainable development projects will be inherently respectful of equity issues and naturally lead to meeting social imperatives that integrate both equity and livability concerns through affordability," (Dale and Newman, 2009: 672). For example, it will be important to ensure that housing developments with low/zero emissions are not only affordable but also accessible throughout the state. One potential obstacle to achieving this goal is that smaller and more rural communities may have greater difficulty paying for and enforcing code compliance required to achieve net zero emissions.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy will potentially have a negative impact on low income populations unless specific attention is paid to the issue of renters being priced out & overall gentrification.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Generally, this strategy has the potential to negatively impact socially/demographically vulnerable Maine people unless specific provisions are made to ensure equitable access to green buildings by preferentially giving space to socially/demographically vulnerable people. Green building can, if it is equitably distributed, be a catalyst for positive change by reducing exposure of vulnerable building occupants to climactic events, and enhancing community resilience and public health (Houghton and Castillo-Salgado, 2020). The siting of these green building endeavors should be intentional, lest the benefits disproportionately accrue in areas of high income, or low social/demographic vulnerability, as has been shown to occur by Houghton and Castillo-Salgado.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

For this policy specifically, geographically vulnerable areas include areas that are more prone to flooding, the urban heat island effect, and cities generally. Historically, patterns of growth have tended to segregate low-income and minority neighborhoods, and "these patterns of segregation and exclusion were codified by planning regulations and solidified through past underwriting standards attached to federal mortgage insurance," (Mueller and Steiner, 2011: 94). In cities, areas that tend to be targeted for re-development are generally home to populations who are most vulnerable to the effects of climate change, including low-income, and non-white communities. A vulnerability map that takes into account both social and environmental variables could be helpful in deciding upon the location of green development.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy? Financially vulnerable, and socially/demographically vulnerable Maine people could potentially be impacted by this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but

beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Stakeholder outreach and participation by disenfranchised groups is important in the planning and implementation of green building strategies. Feedback regarding the housing needs of these stakeholders should be taken into consideration during the planning process.

Strategy 2. Transition to Cleaner Heating and Cooling Systems

a. Accelerate Maine's transition to low-carbon heating systems for residential and commercial space heating by expanding financial incentive programs and phasing in progressively tighter regulations for space heating systems (or fuels) sold or installed in Maine.
b. Accelerate Maine's transition to low-carbon heating systems for residential and commercial water heating by expanding financial incentive programs and phasing in progressively tighter regulations for water heating systems (or fuels) sold or installed in Maine.
c. Develop mechanical licensing standards to ensure uniform quality control and safety of systems installation and servicing.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Generally, increasing low-carbon heating systems will have a positive impact on the wealth of those who participate. Increased efficiency of space/water heating systems lowers energy costs for ratepayers. However, financial incentive programs often provide assistance to those who need it least - "Unless the funding scheme foresees provisions for vulnerable people, 'first-come-first-served' will occur resulting in a more intense uptake by the more affluent, more educated, more informed, more socially connected, thus increasing inequalities," (Camprubí et al., 2016: 310). Thus, financial incentive programs must be explicitly targeted at those who need financial assistance most to upgrade their space/water heating systems. Additionally, even when financial incentives are provided, "low-income households and owners of multifamily buildings that provide affordable housing may find it challenging to participate in residential low-income energy efficiency programs that require a copay. These households may also lack the time, resources, and up-front capital to register and participate," (Drehobl and Ross, 2016: 28).

Phasing in progressively tighter regulations for space and water heating systems could present an equity concern if the financial incentive programs do not adequately cover those who are already experiencing high energy burdens. The regulations will disproportionately affect those who cannot afford to upgrade their residence to a low carbon space/water heating system. Additionally, if the regulations are targeted at residents rather than owners, renters will be disproportionately affected by tightening of regulations. Since low-carbon heating/water heating

systems have a high upfront cost, the financial incentives must provide sufficient assistance to those who otherwise would not be able to afford an upgrade.

2. Health - any positive or negative health effects?

Upgrading to a more efficient heating system will have positive health impacts if it is **paired** with weatherization. Well insulated homes that hold their heat plus an efficient, low carbon heating system can reduce health risks associated with high energy burdens. Several studies have shown potential positive impact of energy efficiency interventions on health and wellbeing (Curl et al., 2015; Maidment et al., 2014). “Consistent benefits are reported in mental health, well-being, comfort, self-perceived health, respiratory symptoms and even in reduced use of health services. In addition, these benefits appear to be larger in children, elderly people, people with chronic disease and with low income,” (Camprubí et al., 2016: 305) but these interventions must be paired with weatherization of old and drafty housing stock to ensure increased health co-benefits.

3. Accessibility - any improvements or reductions in access to services?

Developing mechanical licensing standards is a good step towards ensuring that proper installation and servicing of low-carbon heating/water heating systems is equitably available to all. Expanded financial incentive programs can increase accessibility if they are targeted at those who could not otherwise afford to upgrade.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

“[Rural low-income] households have a median [energy] burden of 9.0%, more than twice that of the rural median and almost three times higher than their non-low-income counterparts (3.1%). The highest median burdens for rural low-income households are in the New England and Mid-Atlantic regions (10.6%). In addition, a quarter of rural low-income households in these regions experienced an energy burden of 18% or higher,” (Ross et al., 2018: 18).”

These statistics illustrate the fact that low-income populations, and especially rural low-income populations, often pay a higher percentage of their income to meet their home energy needs. Low-income households “exist in an unfortunate paradox” wherein energy efficiency upgrades seem inaccessible due to the high upfront costs, but the low energy efficiency of their homes costs them more (Xu and Chen, 2019: 764). This strategy has great potential to benefit low-income populations if the financial incentives are distributed based on need, rather than on a first-come first-served basis.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

On average, people of color, older people, and renters experience high energy burdens. “The median energy burden of nonwhite households in rural areas is 19% higher than that of their white counterparts, the median energy burden of rural elderly households is 44% higher than that of non-elderly households, [and] rural renters experience a median energy burden 29%

higher than that of owners," (Ross, et al., 2018: 3). There is enormous potential to increase equity (not just climate equity, but social equity more broadly) when addressing issues related to energy efficiency of housing stock, but implementation must be thoughtful. The financial incentive aspect of this strategy should explicitly target those who experience high energy burdens and therefore cannot afford energy upgrades if the financial incentives are distributed on a first-come first-served basis, rather than based on need.

For this strategy to be equitably implemented, information about financial incentive programs and potential regulation changes must be distributed to all populations experiencing high energy burdens in a way that is culturally appropriate and understandable. Special efforts must be made to reach those who have historically been excluded from efficiency programs due to language barriers, and those who lack access to the internet and advertising and information available there. Outreach and information provision work should be monitored and measured to verify relative success during implementation.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Maine has high rates of fuel poverty, especially in the rural and island areas (Winner et al., 2018). The financial incentive aspect of this strategy should explicitly target those living in rural areas, and especially rural low-income households. "Rural low-income households experience the highest median energy burden at 9%, which is almost three times greater than the non-low-income rural median of 3.1%" (Ross et al., 2018: 3).

For this strategy to be equitably implemented, information about financial incentive programs and potential regulation changes must be specifically distributed to rural populations and assistance must be provided to overcome barriers to energy efficiency due to the challenges of living in isolated locations, a lack of qualified contractors willing to serve rural areas, potential lack of access to the internet and advertising and information available there, and potential lack of awareness of existing resources (Winner et al., 2018). Outreach and information provision work should be monitored and measured to verify relative success during implementation.

It is also important to note that natural gas pipelines do not reach many of Maine's more rural communities. Until vulnerable populations living in these regions have greater access to affordable heating systems powered by renewable energy, they are likely to experience higher energy burdens.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This is a broad strategy and impacts many stakeholder groups. It is most critical that Maine recognize those with the highest energy burdens and improve upon and increase the work done by Efficiency Maine. Renters should not be excluded from the benefits of this strategy and therefore, landlords also must be targeted.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement and education, so that vulnerable populations can participate in decisions regarding incentives and regulations. Outreach efforts should emphasize those with high energy burdens.

Strategy 3. Improve the Efficiency and Resiliency of Existing Building Envelopes

a. Expand access to weatherization programs for low- and moderate-income households.
b. Weatherize existing market-based dwellings.
c. Require commercial building energy benchmarking and labeling/disclosure.
d. Establish incentives for participating in smart device load management programs.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy has the potential to positively affect wealth for those who undergo weatherization retrofits and install smart device load management programs, though the upfront cost is high — in some cases prohibitively high (Camprubí et al., 2016). In the short term, the wealth impact is negative. No matter what the policy intervention, money will have to be spent to achieve weatherization. Over the long term, there is evidence that weatherization saves people money on their electric bills (Mueller and Steiner, 2011).

2. Health - any positive or negative health effects?

There are many health co-benefits associated with updating housing stock to be better weatherized (Golubchikov and Deda, 2012). Fuel poverty, defined as difficulty keeping a house at a comfortable temperature at a reasonable cost (Hills, 2011), has been shown to negatively affect the health of those living in the house (Camprubí et al., 2016; Bosch et al., 2019). Camprubí et al. state that, “Fuel poverty is connected to poor physical health through different pathways: inadequate temperature in homes, including ‘cold housing’ and exposure to great temperature variations; a deterioration of housing conditions with increased moisture, mold, allergens; and need to choose where to allocate scarce domestic financial resources, such as reduced food expenditure (‘heat or eat’) or forgoing health care” (Camprubí et al., 2016: 305). Alleviating fuel poverty though weatherization, therefore, can have major health co-benefits such as increased thermal comfort, respiratory health, and mental health (Willand et al., 2020).

3. Accessibility - any improvements or reductions in access to services?

The strategy states that Maine will “Accelerate the rate of whole-house retrofits in low-income households, as defined by eligibility for the federal Weatherization Assistance Program,” by “increas[ing] economic incentives for low-income homeowners and owners of rental properties,” but no additional details are provided other than that. A description of the “increased economic incentives” would be useful.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Special care must be taken to ensure that incentive programs target low income and otherwise vulnerable populations. Though the CAP program as well as LIHEAP and WAP already focus on low income families, the support that those programs provide should be increased. Camprubi et al. show that “Unless the funding scheme foresees provisions for vulnerable people, ‘first-come-first-served’ will occur resulting in a more intense uptake by the more affluent, more educated, more informed, more socially connected, thus increasing inequalities,” (Camprubí et al., 2016: 310). This proves the law of inverse care, wherein people in less need of interventions are the ones that receive the most. Energy efficient homes have historically been framed as a luxury in the United States, and this framing and subsequent policy interventions that reinforce it, continue to be a problem (Bird and Hernández, 2012).

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Weatherization and retrofit programs must specifically target households more prone to experiencing energy poverty. This includes low-income households, renting households, non-white households (Drehobl and Ross, 2016) and households where elderly people and people with pre-existing health conditions live (Golubchikov and Deda, 2012). The Working Group strategy addressed here does seek to assist those living in fuel poverty, though that is not explicitly stated and perhaps should be.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Maine has high rates of fuel poverty, especially in the rural and island areas (Winner et al., 2018). This strategy should explicitly target those living in rural areas, and especially rural low-income households. “Rural low-income households experience the highest median energy burden at 9%, which is almost three times greater than the non-low-income rural median of 3.1%” (Ross et al., 2018: 3).

For this strategy to be equitably implemented, information about expanded weatherization programs and smart device load management programs must be specifically distributed to rural populations and assistance must be provided to overcome barriers to energy efficiency due to the challenges of living in isolated locations, a lack of qualified contractors willing to serve rural areas, potential lack of access to the internet and advertising and information available there, and potential lack of awareness of existing resources (Winner et al., 2018). Outreach and

information provision work should be monitored and measured to verify relative success during implementation.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This is a broad strategy and impacts many stakeholder groups. It is most critical that Maine recognize those with the highest energy burdens and improve upon and increase the work done by Efficiency Maine. Renters should not be excluded from the benefits of this strategy and therefore, landlords also must be targeted.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement and education, so that vulnerable populations can participate in decisions regarding weatherization and other programs. Outreach efforts should emphasize those with high energy burdens.

Strategy 4. Lead-By-Example in Publicly Funded Building

a. Amend state rules and policies for affordable housing to further incentivize energy efficiency, clean heating and cooling, distributed energy resources, and emissions reductions.
b. Amend procurement rules for state government, University of Maine, and Maine Community Colleges to achieve low embodied carbon, zero emissions, zero-energy, and resilience in new construction by 2025.
c. Require 100% clean electricity in Maine public schools by 2025 and amend Standards & Guidelines for New School Construction & Major Renovation Projects to accelerate the transition to low embodied carbon, zero emissions, zero-energy, and resilience.
d. Demonstrate the successful use of low-carbon building materials, including those made in Maine, and high-efficiency systems through “showcase” projects.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Depending on how this strategy will be funded, it could have a positive effect on the wealth of low-income populations.

2. Health - any positive or negative health effects?

Evidence shows that the built environment significantly impacts the health and well-being of individuals and entire populations (Worden et al., 2020; Rao et al., 2007). Green buildings are

often healthier buildings and so this strategy offers health co-benefits for those who work in/inhabit the new building stock. Evidence shows that children and adults living in green low-income housing had improved health outcomes (Colton et al., 2015), including self-reported physical and mental health as well as decreases in hay fever, headaches, sinusitis, angina, respiratory allergy, and asthma severity, as well as sadness, nervousness, restlessness, and child behavior (Jacobs et al., 2015).

3. Accessibility - any improvements or reductions in access to services?

Leading by example in publicly funded building in affordable housing, and public schools and universities is a good way to increase access to clean, green buildings for all.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy has potential to assist low-income populations who would live in green publicly funded housing.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

“Centuries of displacement have destabilized Black [and Indigenous] communities and undermined their access to opportunity,” and due to this legacy, people of color continue to experience high rates of poverty (Solomon et al., 2019). Most racial groups “have incomes that are between 50 % and 80% of the corresponding white income level consistently across the income distribution” (Akee et al., 2019). As a consequence of segregation and racism, ethnic and racial minorities have limited housing options. Research has found that racial and ethnic minorities tend to live in more marginal or low-quality housing (Crowder et al., 2012).This being the case, people of color stand to benefit from the health co-benefits of green building of affordable housing.

Leading by example in the creation of energy efficient public schools and universities stands to benefit young people in Maine. It has been shown that young people learn better when they have proper lighting, which can be provided by green buildings (Kelting and Montoya, 2012). Since children and young people spend large amounts of time in schools and universities, the facilities should be healthy, well lit, and comfortable.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy does not appear to have a disproportionate effect on those with geographic vulnerabilities.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This strategy has potential to positively impact financially and socially vulnerable populations across the state.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Care should be taken to ensure that the needs and desires of these stakeholders and impacted groups are taken into consideration during the implementation of this strategy (Holland, 2017).

Strategy 5. Accelerate the Decarbonization of Industrial Use and Processes

a. Expand funding for industrial energy efficiency program offerings through EMT.
b. Pursue a long-range plan for industrial fuel switching in process heating.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy does not appear to have a direct impact on the wealth of vulnerable populations.

2. Health - any positive or negative health effects?

Accelerating the decarbonization of industrial energy systems could potentially have positive health co-benefits for vulnerable populations.

3. Accessibility - any improvements or reductions in access to services?

This strategy does not appear to have a direct impact upon the accessibility of services for vulnerable populations.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy does not appear to have a direct impact on financially vulnerable populations.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not appear to have a direct impact on socially/demographically vulnerable populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy does not appear to have a direct impact on geographically vulnerable populations.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Industry stakeholders are likely to be affected by this strategy. They are not usually considered to be “vulnerable populations” in the context of climate change effects, however.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Industry stakeholders are likely to be affected by this strategy. They are not usually considered to be “vulnerable populations” in the context of climate change effects, however.

Strategy 6. Modernize and Optimize the Grid

a. Right-Size and Stabilize the Grid
b. Value electricity generation and consumption based upon the cost of providing the service both temporally and by location.
c. Review and reform government agency enabling statutes to include climate requirements in decision-making.
d. Promote planning and implementation of beneficial electrification of space heating, water heating, and transportation consistent with meeting Maine’s long-term carbon reduction requirements.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Given the high level of energy poverty in Maine (Winner et al., 2016; Chandler, 2016), these grid modernization strategies need to be implemented so that their distributional burdens do not fall hardest on low-income populations. Indeed, one goal should be to ensure that those experiencing energy poverty can benefit from, and hopefully end their energy poverty as a result of, grid modernization. Additionally, grid modernization provides an opportunity for job creation, which could lead to increased wealth.

Sub-strategy b, which suggests a shift towards dynamic pricing should be assessed with an eye towards equity. Studies suggest that “pricing changes that reward consumers for shifting their time of consumption might harm low-income and elderly consumers, since these groups might be least able to afford the technologies necessary to monitor and shift demand,” (Welton and Eisen, 2018: 24). This is not to say that dynamic pricing is inherently inequitable, but that it should be paired with aiding low income, elderly, and other demographic groups experiencing high levels of energy poverty.

2. Health - any positive or negative health effects?

This strategy does not appear to have direct effects on the health of Maine people, but potentially offers positive co-benefits. A stable grid will be more resilient to increased extreme weather events, ensuring that those whose health may be at risk during an outage, including older people, and those with pre-existing health conditions, are not in danger.

3. Accessibility - any improvements or reductions in access to services?

Currently, this strategy does not specify that it will increase access to a modernized grid to all Maine people, including vulnerable populations. Because a modernized grid has high potential to disproportionately benefit higher income consumers in the absence of policy intervention (Welton, 2017), a more explicit emphasis on mitigating uneven distribution of benefits is necessary.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

The needs of financially vulnerable Maine people must be advocated for explicitly in the details and implementation of this strategy. Modernizing the grid will not inherently decrease the price of electricity across all income brackets. In fact, unless specific provisions are made, low income populations may end up bearing a disproportionate financial burden associated with grid modernization and low-cost energy for high income consumers (Welton, 2017; Welton and Eisen, 2018).

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not appear to have a direct impact on socially/demographically vulnerable populations, except in instances in which social/demographic vulnerability overlaps with financial vulnerability. Socially vulnerable populations would suffer disproportionately in the event of extreme weather events causing extended outages, and thus a modernized grid would provide co-benefits.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy does not appear to have a direct impact on geographically vulnerable populations, except in instances in which geographic vulnerability overlaps with financial vulnerability.

Prolonged outages tend to disproportionately affect those living in rural areas, and a strengthened grid could ameliorate this issue.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Many different vulnerable populations could be impacted by this strategy, especially those experiencing energy poverty.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Those experiencing the effects of energy poverty, or stakeholder groups likely to experience energy poverty should participate in the process of crafting inclusive policy for identifying and reducing barriers to participation in grid modernization technology, including community decentralized generation (Welton, 2017).

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Coastal and Marine

Strategy 1: Track coastal and ocean climate impacts to support adaptive decision making.

Strategy 2: Provide technical assistance on and outreach networks for climate adaptation and mitigation to coastal and marine stakeholders.

Strategy 3: Enhance mitigation by conserving and restoring coastal habitats that naturally store carbon (blue carbon optimization).

Strategy 4: Promote climate-adaptive ecosystem planning and management using nature-based solutions

Strategy 5: Manage for resiliency of Maine's marine fisheries and aquaculture industries in the context of climate change adaptation.

Bibliography

Resources and Recommended Reading

Strategy 1. Track coastal and ocean climate impacts to support adaptive decision making. Establish a state-level strategy and coordinating body (the “Climate Collaborative for Coastal and Ocean Monitoring” or C2COM) to support adaptive decision making in the public and private sectors by collecting, assessing, and disseminating data and information on how climate change is affecting Maine’s coastal and marine areas.

a. Leverage existing private, nonprofit and state monitoring programs
b. Expand monitoring of coastal water quality
c. Characterize, map, and track marine and coastal habitats and species, including economically important and at-risk species.
d. Enhance invasive species monitoring and management.
e. Improve tracking of economic and social conditions in Maine’s coastal communities
f. Enhance and coordinate tracking and modeling of future changes to the extent of intertidal habitats and beaches including tidal marshes, mudflats, dunes, and beaches as well as to subtidal habitats, including their flora and fauna.
g. Develop and implement a coordinated funding strategy that leverages federal, state, foundation, and private sources towards an integrated monitoring system.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Information gathering and dissemination has the potential to mitigate potential financial harm to those working in Maine’s coastal and marine communities, but more information is needed to ascertain the direct effects on the wealth of vulnerable populations.

2. Health - any positive or negative health effects?

This strategy does not appear to directly affect the health of vulnerable populations.

3. Accessibility - any improvements or reductions in access to services?

By creating a model for gathering and unifying data related to climate change’s effects on Maine’s fisheries and local economies and communities, this strategy has the potential to increase access to information needed for adaptation planning. More information is needed, however, to ascertain how this would affect access to services for vulnerable populations.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Increased information regarding the effects of climate change on Maine’s fisheries can potentially increase the resilience of low-income people in the fishing industry and related

sectors if information is widely disseminated and equally available to all members of Maine's fishing community.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

More information is needed to ascertain how this strategy would affect these vulnerable populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has the potential to benefit coastal and marine communities, but more information is needed to ascertain how it would affect geographically vulnerable populations. Nonetheless, here are some potential benefits to geographically vulnerable communities synthesized from the working group's draft strategy:

- Increased information about changes in coastal ecosystems can lead to wise choices about placement of "new infrastructure, including new energy sources, to minimize impacts to aquatic resources and habitats and increase benefits to residents and businesses."
- Increased information on coastal change will help to "identify populations at risk due to climate change and associated ecological change. The information can be used to inform efforts to reduce the effects of unequal exposure to disaster, public health, or economic risks."

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

The lives and livelihoods of vulnerable populations living and working in coastal and marine environments could potentially benefit from this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

The information gathering process described here should be inclusive of vulnerable stakeholder groups as a method of determining their concerns and needs.

Strategy 2. Provide technical assistance on and outreach networks for climate adaptation and mitigation to coastal and marine stakeholders.

a. Create a Coastal and Marine Information Exchange to provide accessible, relevant informational and decision support to facilitate climate mitigation and adaptation in Maine's coastal communities and industries. The Coastal and Marine Information Exchange in coordination with the Climate Collaborative for Coastal and Ocean Monitoring and the Maine Seafood Business Council will help support and accelerate mitigation and adaptation actions by coastal and marine stakeholders and improve integration of environmental, economic, and social data to advance understanding of the consequences of climate change and the effectiveness and impacts of mitigation and adaptation strategies in coastal and marine areas.
    i. Engagement: Develop and implement an effective engagement strategy with coastal and marine stakeholders to identify and address priority climate information needs
    ii. Information Development & Dissemination: Develop relevant and accessible data, scientific information, and decision-support resources; and create an exchange- infrastructure to disseminate these resources (e.g., web/digital platform, outreach and peer networks, partnerships)
    iii. Decision-support: Increase the development and use of tailored coastal/marine mitigation and adaptation decision-support tools based on stakeholder feedback, improved access to and synthesis of information and monitoring data, and partnership networks with tool developers, outreach professionals, and stakeholders
    iv. Exchange and Assessment: Engage with coastal and marine monitoring, stakeholder, manager, and research groups to maintain relevant, useable, and accurate climate information and assess the effectiveness and impacts of mitigation and adaptation strategies in coastal and marine areas. Share and get feedback on Exchange information resources via targeted events for different marine and coastal stakeholders and policy briefings for policy makers.
b. Establish a Maine Seafood Business Council to provide Maine’s seafood harvesters, shoreside businesses, and working waterfronts with access to information and tools that can support operational decisions, capital investments, and long-range planning to implement climate adaptation and mitigation strategies.
    i. Information Exchange: Establish effective means for two-way communication with businesses; and assemble pertinent information from the Maine Coastal and Marine Information Exchange for each sector;
    ii. Business Planning: Conduct analyses of existing and emerging markets to identify trends and opportunities for growth; and assess existing infrastructure, infrastructure needs, and potential synergies and opportunities that align with future business directions and link to programs that support business improvements (e.g. efficiency and renewable programs);
    iii. Technical Assistance: Gather and organize information about business financing for startup, growth, mitigation and adaptation projects; and support implementation of pilot adaptation and mitigation projects in seafood businesses;

iv. Communication: Provide information in forms that are easily accessible to and usable by businesses in the seafood sector; and advise government entities on the needs of marine businesses as they attempt to implement mitigation or adaptation measures.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

By providing increased technical support and improving communication, this strategy has the potential to improve the economic well-being of vulnerable populations.

2. Health - any positive or negative health effects?

This strategy does not appear to directly affect the health of vulnerable populations, but offers potential positive co-benefits if it improves economic well-being and/or reduces vulnerability to flooding or other climate impacts. For example, improvements in flooding information could be useful to harvesters of sweet grass or clams.

3. Accessibility - any improvements or reductions in access to services?

This strategy seeks to improve access to information and other resources to support adaptation and mitigation planning. Further details are needed, however, to ensure that this information aligns with the needs of vulnerable populations, and that they benefit from this strategy.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy does not particularly impact financially vulnerable people. To the extent that it seeks to facilitate capital investments, however, it will likely need to include a strong focus on tailored strategies that are targeted to facilitate low-income investors.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy may not have a direct effect on socially/demographically vulnerable populations, unless the technical assistance is carefully tailored to address their needs and capacities.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

One of the central goals of this strategy is to reduce vulnerability to climate change for people living and working along the coast and on the ocean. It will also be important, however, to identify and minimize possible unintended consequences of these efforts. For example, reducing vulnerability to sea level rise via coastal shoreline retreat could potentially have an adverse effect on the availability of working waterfronts, or on access to coastal habitats used by wild shellfish harvesters.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

This is a broad strategy and impacts many stakeholder groups. But the technical assistance needs of vulnerable populations may be very different from those of other stakeholder groups. .

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Extra attention will be needed to ensure that vulnerable populations can participate in the design, and benefit from the implementation of, the different components of this strategy. Traditional education and outreach programs are not likely to achieve these goals (O'Keeffe et al., 2020).

Strategy 3. Enhance mitigation by conserving and restoring coastal habitats that naturally store carbon (blue carbon optimization).

Determine blue carbon stocks and mitigation values by:

a. Conducting a comprehensive, coast-wide inventory of coastal blue carbon resources* to inform baseline estimates of current storage and sequestration. Track changes in sequestration/emissions over time.
b. Determining the role that strategic management of seaweed aquaculture plays in long term carbon burial and in locally reducing coastal acidification impacts.
c. Encouraging blue carbon habitat conservation and restoration through formal carbon sequestration incentives or carbon permit program.

Blue carbon mitigation potential must be achieved by conserving and restoring:

d. Tidal marshes: Identifying priorities to secure greenhouse gas stores from tidal marshes through restoration of currently degraded marshes including restoring tidal flow where possible and conservation of current marshes and migration pathways.
e. Eelgrass: Protect current eelgrass and historically-mapped eelgrass habitat from direct and indirect impacts of shoreline development, commercial harvesting activities, and aquaculture operations through informed lease siting and by enhancing local and state regulations to restrict fishing methods and reduce impacts. Restore eelgrass by improving water quality and promoting transplanting and/or seeding.
f. Seaweed: Manage the harvest of subtidal and intertidal species of seaweed through the DMR and use aquaculture techniques to restore kelp.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Further details are needed to ascertain whether this strategy will affect the wealth of vulnerable populations.

2. Health - any positive or negative health effects?

Although this strategy appears unlikely to directly affect the health of vulnerable populations, further information is needed to determine whether it might have indirect effects on health.

3. Accessibility - any improvements or reductions in access to services?

This strategy does not appear to have direct effects on access to services by vulnerable populations.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy does not appear to have a direct effect on financially vulnerable populations.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not appear to have a direct effect on populations with social/demographic vulnerabilities.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy does not appear to have a direct effect on geographically vulnerable populations, except to the extent that its focus on coastal regions affects their lives and livelihoods.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

To the extent that this strategy impacts coastal environments and economies, its impact could potentially be felt by many vulnerable groups.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Because this strategy has potentially important consequences for the lives and livelihoods of vulnerable populations, extra efforts will likely be needed to ensure that the stakeholder engagement process is responsive to their concerns and capacities.

Strategy 4. Promote climate-adaptive ecosystem planning and management using nature- based solutions

a. Foster climate-adaptive planning in marine, coastal, and inland areas for the State and municipalities. Support use of the latest monitoring and assessment information related to climate change and resiliency in coastal areas for land use planning by municipalities and regional Councils of Government. Outreach efforts need to be coordinated across federal, state, and regional programs by a central entity to make information and technical assistance more widely accessible for planners, regulators, landowners, and resource managers.
b. Promote nature-based solutions (NBS, also known as natural infrastructure or green infrastructure) for climate change related challenges that impact non-tidal and coastal rivers, shorelines, and coastal and marine habitats. NBS foster the value of Maine's natural resources, and proactively mitigate risk for the state's citizens and infrastructure often with less expense. This includes the use of green infrastructure for stormwater management, increased buffering to wetlands and waterways, and "Living Shorelines" (LS) to address coastal erosion issues.
c. Conserve and restore ecosystems to foster resiliency. Protect ecosystems and restore degraded habitats to benefit biodiversity, rare species, and species most vulnerable to climate change using a variety of tools including voluntary, management, incentive-based, or regulatory.
d. Restore hydrological connectivity in coastal watershed freshwater streams and tidal systems: Use climate-adaptive upgrades to road crossing infrastructure to improve our climate adaptation and benefit communities, habitats, fish, and other aquatic animal life.
e. Protect and restore beaches and sand dunes in order to help coastal marshes, beaches and dunes migrate inland with sea level rise and continue to support both biodiversity and community resilience**.** Consider the use of selective or proactive beach nourishment to help manage coastal erosion while also protecting crucial habitat for rare species.
f. Characterize and map marine and coastal habitats to inform climate adaptive management, planning, and conservation and restoration priorities.
g. Strengthen stormwater management tools to reduce nitrogen and pollutant inputs which harm marine life, lead to coastal acidification, and negatively impact shellfish harvesting and aquaculture. Enforce and strengthen land-based stormwater management tools to improve the quality of stormwater runoff and the receiving water downstream.
h. Recalibrate and strengthen protections of inland natural resources to detain storm flows and recharge groundwater, decrease nitrogen pollution of nearshore waters, reduce flood risks, protect aquifers, and maintain habitat connectivity and climate refugia. Review and reframe regulations as climate-adaptive protection of natural resources, based on current climate projections and Maine monitoring data.
i. Improve other regulatory approaches to protect coastal areas from development that will impede marsh migration, impact water quality, and directly or indirectly affect the function and viability of coastal habitats.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Further details are required to determine how this strategy would affect the wealth of vulnerable populations. For example, improved stormwater management can enhance water quality, but it can also cause property taxes to increase.

2. Health - any positive or negative health effects?

Further details are required to determine how this strategy would affect the health of vulnerable populations.

3. Accessibility - any improvements or reductions in access to services?

Coastal property values are typically out of reach for most Mainers, yet those who can afford these properties are making land use decisions that have impacts far beyond the physical limits of their properties. Increased conservation efforts will not only limit these impacts, but also increase opportunities for coastal public access and recreation. Equal access to incentive and technical assistance programs for nature-based solutions will be needed to support communities with fewer planning resources (e.g., access to GIS or an on-staff planner). Both restoration and conservation goals need to be considered within the constraints of the community or region. For example, conservation of large habitat blocks may be a viable nature-based solution in more rural communities, while restoration of riparian habitats may be more suitable in urbanized and fragmented landscapes. Promoting multiple approaches is key to ensuring all communities have support for the tools most appropriate to their own setting and vision.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Financially vulnerable populations are generally less able to cope with environmental, social and economic disruptions. To the extent that this strategy results in greater resilience, it could potentially benefit these populations.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Populations characterized by greater social and demographic vulnerability are generally less able to cope with environmental, social and economic disruptions. To the extent that this strategy results in greater resilience, it could potentially benefit these populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Further details are needed to determine how this strategy would affect geographically vulnerable populations.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy? This strategy could potentially affect a wide range of vulnerable stakeholders.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement, so that vulnerable populations can participate in adaptation planning and shape decisions (Amaru and Chhetri, 2013; Holland, 2017; González, 2019).

Strategy 5. Manage for resiliency of Maine's marine fisheries and aquaculture industries in the context of climate change adaptation.

Information support

a. Enhance and provide sustainable funding for marine resource monitoring programs to better detect changes in ecosystem conditions, including the composition and distribution of species and habitats along Maine's coast, as well as socio-economic conditions related to fisheries and aquaculture.
b. Develop stock assessments, ecosystem-based management approaches, risk policies, and harvest strategies that account for ecosystem changes, including shifts in species-environment relationships and in productivity and distribution of species along the coast.
c. Implement forecasts for key environmental parameters at spatial and temporal scales that are relevant to business planning, operations, and management of Maine's fisheries and aquaculture sectors.

Market support and business resilience

d. Evaluate and implement ways to expand local and direct marketing opportunities for sustainably produced Maine seafood.
e. Support the growing aquaculture sector as a means to increase Maine seafood production, provide important economic opportunities for coastal communities, and harness potential acidification mitigation and other environmental services.
f. Develop technical assistance, financing tools, and policy strategies to help fishing and aquaculture businesses plan for and transition activities in a changing ocean ecosystem

Regulatory and Policy

g. Evaluate and implement ways in which Maine's fishery and aquaculture laws and regulations can provide the opportunity to address environmental change and emerging fisheries while recognizing the need for regulatory stability.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy has the potential to enhance the economic well-being of people involved in the marine fisheries and aquaculture sectors, with potential co-benefits. The strategy should focus particular attention on how to ensure that vulnerable populations benefit from the strategy.

2. Health - any positive or negative health effects?

This strategy does not directly affect the health of vulnerable populations, but it potentially offers positive co-benefits.

3. Accessibility - any improvements or reductions in access to services?

This strategy seeks to improve the scientific information and technical support needed to enhance economic well-being and create effective policies. Further details are needed, however, to ensure that this strategy aligns with the needs of vulnerable populations, and that they benefit from this strategy.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Although this strategy is designed to increase the sustainability of fisheries and fishing livelihoods, further information is needed to determine its potential impacts on financially vulnerable populations.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Because these populations may be more vulnerable to the impacts of climate change on coastal and ocean livelihoods, it will be important to tailor this strategy to align with their unique circumstances and assets.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy is specifically focused on coastal regions in which that are uniquely vulnerable to the impacts of climate change (e.g. sea level rise, extreme weather, ocean acidification, harmful algal blooms).

C. Participation and Inclusion

1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

This is a broad strategy and impacts many stakeholder groups. But the technical assistance needs of vulnerable populations may be very different from those of other populations.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Additional efforts will be required to ensure that vulnerable populations can participate in the design, and benefit from the implementation, of the different components of this strategy. For example, marine resource monitoring programs should strive to incorporate both formal scientific knowledge as well as local and indigenous knowledge.

Strategy 6. Climate-Ready Working Waterfronts

a. Develop innovative funding mechanisms: Infrastructure Trust Fund, Revolving Loan Fund or similar mechanism to provide funding for small to medium sized wharf and pier owners to plan for and install resilient infrastructure.
b. Improve Guidance and Technical Assistance for municipalities and business owners regarding conducting vulnerability assessments, feasibility and design of resiliency measures, and information on funding sources.
c. Reform and improve regulatory and non-regulatory approaches to development and redevelopment of WWFs to: reduce redundant and confusing statutes and rules, address challenges associated with increased flood insurance costs, and pass regulations that address sea-level rise, flooding, and storm surge as part of a simplified regulatory scheme.
d. Publicize case studies of successful examples of mitigation and adaptation already happening at Maine's ports and WWFs. Incentivize this work through business recognition programs. Conduct additional education and outreach about the importance of WWFs and Ports to Maine's economy and culture.
e. Continue discussions in summer 2020 with the MCC CMWG WWF and Ports subcommittee, the MCC Transportation Working Group, and a wider circle of port and ferry managers, harvesters and business owners/managers of small to midsize WWFs, cruise ship representatives and NGOs, with the objective of assessing opportunities for reducing emissions at ports and WWFs and associated industries. This includes: potential for a pilot Green Port project to showcase resilient waterfronts, development of best practices, and improved understanding of local and regional threats and opportunities.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

The impact of this strategy on vulnerable populations is unclear. The direct effects are primarily focused on owners of WWF properties, coastal municipalities, and those involved in marine transportation. Adverse wealth impacts on vulnerable populations could potentially occur, however, if this strategy reduces job opportunities, increases housing costs, etc.

2. Health - any positive or negative health effects?

Emissions reductions in ports and at WWFs could potentially offer positive health co-benefits.

3. Accessibility - any improvements or reductions in access to services?

Accessibility could potentially be enhanced by developing resilient infrastructure, although this may depend in part on the costs of using such infrastructure.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

It is not clear that this strategy will have a direct effect on financially vulnerable populations. However, there could be indirect effects that adversely impact low income populations. For

example, low-income families from island communities are particularly vulnerable to increases in the price of ferry service that might increase due to rising infrastructure costs.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

More information is needed to assess how this strategy will impact socially/demographically vulnerable populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Vulnerable populations that are dependent on WWFs may be strongly affected by this strategy.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This is a broad strategy that could have direct and/or indirect effects on many different vulnerable stakeholder groups.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Although the strategy appears to focus on municipal planning and business development as it pertains to WWF, it will also be important to create an inclusive and transparent public engagement process in which vulnerable populations can participate.

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Community Resilience Planning

Strategy 1: Comprehensive Review of Maine Laws to Achieve Resilience and Economic Security in the Face of Climate Change

Strategy 2: Improve Delivery System of Technical Assistance on Resilience to Municipalities

Strategy 3: Funding Mechanisms to Achieve Resilience

Resources and Recommended Reading

Strategy 1. Comprehensive Review of Maine Laws to Achieve Resilience and Economic Security in the Face of Climate Change

a. Review sub-strategy recommendations (Sub-Strategies 1a – 1hi) of the resilience working group and propose revisions to Maine laws to improve resilience of Maine communities in the immediate (3-6 month) term.
    1a. Improve Site Location of Development Act ('Site Law') Regulations and Rules
    1b. Improve Stormwater Management & Erosion and Sedimentation Control Regulations and Rules
    1c. Comprehensive Planning Statute/Rule Changes
    1d. Shoreland Zoning Statute/Rule Changes
    1e. Authorize a Sea Level Resilience Overlay Zone
    1f. Improve Floodplain Management Model Ordinance, Incentives, and Assistance
    1h. Land Use Planning Commission - Regulatory Changes to Help Achieve Community Resilience
    1i. Natural Resources Protection Act Statute/Rule Changes
b. Direct the review and revision of all sub-strategies to ensure consistency and scientifically defensible definitions across all statutes and rules. For example, but not limited to: Align definitions and rules of wetlands and floodplains in Natural Resource Protection Act (NRPA) and Shoreland Zoning statutes where they overlap or are inconsistent, and Reference the highest astronomical tide, rather than the highest annual tide, Achieve consistency across statutes and rules over what is protected and/or subject to the jurisdiction of each in terms of actions that are exempt or subject to permit by rule with particular focus on culvert replacement.
c. Be deliberate in minimizing the burden created by such statutory and rule changes on applicants and their consultants, permitting and compliance staff across all state agencies, and the review and permitting demands on local Planning Boards and Code Enforcement Officers.
d. Seek to modernize the regulatory review process for activities related to climate resilience.
e. In concert with Resilience Strategy #2 (Improve Delivery System of Technical Assistance on Resilience to Municipalities) coordinate roll out of any statutory or rule changes with robust technical assistance and training efforts within state agencies, at the regional level, and for municipalities.
f. Codify guidance that results from any statutory or rules changes and develop certification programs for engineers and climate change professionals.
g. Improve rules and regulations to enable more dense development and interconnected street networks (currently made challenging by wetlands / setback / sewer rules) in areas that are specifically identified by communities for walkable development.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Additional information is needed to ascertain whether and how this strategy might affect the wealth of vulnerable communities. The comprehensive review of Maine laws to achieve resilience and economic security of communities is important and should include clear efforts to take into account the economic differences *among* communities and *within* individual

communities. To ensure equity, does the analysis of the laws take into account the *median* income in the community, the *range* of incomes, as well as the monetary resources available to the community government? What assumptions are made in the laws about the availability of sufficient community staff and the extent they have the resources to implement changes?

2. Health - any positive or negative health effects?

This plan for a comprehensive review of Maine laws to achieve resilience and economic security in the face of climate change is an important step, but its effects on the health of vulnerable populations cannot be easily ascertained. Throughout the implementation of this review, it will be important not to treat all of the communities as the same but rather to consider how the laws can be implemented fairly across the various communities where health issues vary widely.

3. Accessibility - any improvements or reductions in access to services?

Accessibility to services is likely to be improved through an effective comprehensive review of Maine laws that takes into account the differences across communities.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy, carried out with care, could potentially assist low income populations by making community resources more available and perhaps streamlined and with no added costs.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy, carried out thoughtfully, could serve to make more resources available to vulnerable populations. It is important that the efforts to integrate efforts across different agencies be done in ways that make it easier for vulnerable populations to know who to approach and how to approach the various agencies. Care should be taken to ensure that these agencies are communicating in ways that reduce the overall effort needed by vulnerable people to avoid and recover from climate change impacts.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Geographical vulnerabilities can exacerbate several of the predicted effects of climate change such as flooding and sea level rise. Many different legal overlays may be in play in those areas, with different agencies having different responsibilities. Strategies that serve to decrease the need for individual communities to make sense of different messages from different agencies will greatly reduce the burden on these communities.

C. Participation and Inclusion

1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

The comprehensive review process would greatly benefit if communication occurs with various groups in communities. Certainly communication needs to occur with community municipal leaders but it is equally important to success that ways be found to include other types of groups and leaders in the communities (religious leaders, educational leaders, elders, business owners, etc.).

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

As the above summary indicates, if the participation of members of stakeholder groups is to be adequate and meaningful, it is important that attention be paid to identifying where and how people tend to meet and what forms those meetings and discussions typically take across the various groups in the communities. Taking the time to learn meeting practices in the different parts of the state is likely to pay off in obtaining meaningful involvement. Without such efforts participation may not be sufficient.

Strategy 2. Improve Delivery System of Technical Assistance on Resilience to Municipalities

a. Expand state level support of technical assistance on the impacts of a changing climate and develop resilience into all activities.
b. Support regional delivery of technical assistance on climate impacts and resilience across the state.
c. Seek efficiencies in the creation and delivery of technical assistance.
d. Use existing governing structures and processes rather than creating new ones
e. Support municipalities to understand the impacts of a changing climate and develop resilience and mitigation into all activities.
f. Provide a clearing house to coordinate public and non-profit sector data and decision-support tools to ensure use of consistent, current data on vulnerability and risk, assets, economics, demographics, nature-based solutions, and mitigation opportunities.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

The proposed strategy is designed to keep the costs contained while at the same time improving the delivery systems by which technical assistance on resilience is provided to municipalities. The cost savings will come through such steps as using existing governing structures and processes. The effects of this strategy on the wealth of vulnerable populations will depend in part on the extent to which assistance is directed towards the needs of those populations, and the degree to which they can make use of the assistance.

2. Health - any positive or negative health effects?

By potentially making key information more available to groups needing this information, the likelihood is increased that positive health effects could be achieved. The challenge will be to ensure that these steps work and that evaluations are put in place to see that the information is reaching those most at risk and those most in need of the information.

3. Accessibility - any improvements or reductions in access to services?

This step has the potential to improve accessibility. It is intended to increase accessibility of key information. It will be important to track whether the changes have been effective in reaching people.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

The operationalization of these steps, if carried out effectively, has the potential for communities and rural areas with low income populations to be reached. Careful attention will need to be paid to how the strategy is carried out.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

If the communities in which diverse people reside are carefully targeted and reached, this strategy has the potential to serve diverse people well. Careful attention will need to be paid to operationalization as well as evaluation so as to ensure that changes in procedures are put in place if the initial procedures are unsuccessful in reaching diverse groups.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

As noted above, this strategy has the potential to assist rural populations and others. The success will depend on the operationalization of the approach. Have attempts been made to ensure that those who live in highly rural areas, for example, are reached effectively and in ways that work for those communities, the risks they face, and the resilience challenges they are likely to encounter?

C. Participation and Inclusion

1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

This approach is likely to impact all communities and stakeholders. The challenge will be to ensure that the approach is operationalized to reach those who are hard to reach and to do so in effective ways so that they can act on the information and develop resilient approaches.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

The design of the approach is intended to make participation by members of stakeholder groups adequate and meaningful. It will be very important to have in place strategies to evaluate how the approach is implemented, what is working and what needs to be improved. Careful attention should be given to building in a consistent way to obtain feedback and strengthen the approach based on that feedback.

Strategy 3. Funding Mechanisms to Achieve Resilience

a. Issue Executive Order that all state agencies support communities in the preparation of climate resilience assessments and plans as needed
b. Reward communities who cooperate regionally and leverage public funds with non-profit and private sources (For example Island Institute, The Nature Conservancy, Soil & Water Conservation Districts, Maine Municipal Bond Bank)
c. Issue Executive Order that state funding programs that have climate mitigation and adaptation implications include provisions that award preference to those communities, or multi-municipal districts, with locally adopted planning initiatives that develop resilience
d. Incentivize and reward municipalities and regions who incorporate mitigation and resilience into planning documents, local regulations, capital investment planning, and resilience staffing support.
e. Create a clearing house for grant, loan, foundation, bond, and local finance programs and mechanisms available for resilience planning and resilience adaptation.
f. Develop model Memorandum of Understandings among public, private and non-profit partners that establishes mutually reinforcing duties and obligations
g. Modify existing financing mechanisms to support local adaptation projects, such as Tax Increment Financing (TIF) districts.
h. Develop new financing mechanisms (resilience, catastrophe bonds, special purpose districts, public private partnerships) to finance natural infrastructure for risk reduction
i. Create a Maine Infrastructure Bank (alternatively, house within Maine Municipal Bond Bank) to provide municipal financing for resilience and green infrastructure. Merge existing loan funds (Clean Water, Drinking Water, Wastewater, Land Acquisition, Energy Efficiency) so that: Access is customer-centric rather than program-centric, Infrastructure financing is tied to economic development (brownfields, transportation, housing) and Green House Gas mitigation (clean energy and energy efficiency), Create self-sustaining revolving loan funds; establish low interest incentives for resilience projects.
j. Seek legislative and voter approval for a climate resilience bond issue like the Mass. Municipality Vulnerability Preparedness Program or the Rhode Island Clean Water and Green Economy Bond, or the Atlanta Environmental Impact Bond, and others.
k. Seek legislative authorization to establish Climate Resilience Authorities to undertake or support resilience infrastructure projects by financing or refinancing the capital costs associated with resilience infrastructure.
l. Stay informed about the Transportation and Climate Initiative (TCI) (similar to Regional Greenhouse Gas Initiative) and learn of funding sources used by the other 12 Northeastern and Mid-Atlantic states and DC collaborating to improve transportation, develop a clean energy economy and reduce carbon emissions in the transportation sector.

m. As recommended by the Emergency Management sub-group, establish a “State Infrastructure Climate Adaptation Fund” that would allow municipalities and state agencies to access the funds needed to supplement the often-excessive local cost shares associated with large adaptation projects.
n. Establish a Maine Climate Corps for climate-related workforce development. Engage private and public sector support in mentoring, internship, and work/study programs in fields related to resilience planning, design and implementation (legal, financial, real estate, GIS mapping, geotechnical, fluvial hydrogeology, architecture, engineering, all construction trades, etc.). Include robust involvement with higher education, K-12 programs across the state and requirements to stay in Maine for a period of time to apply workforce training to resilience projects within Maine communities. Examine economic benefits of restoration (Massachusetts example) and resilient workforce training (Oregon analysis).
o. Establish climate incentive/reward system(s) for development that is carbon neutral or of resilient design. Carbon neutrality would be demonstrated by practices used in construction and operation. Resilient design would be demonstrated by on-site stormwater capture, reducing heat effect, planting and tree canopy retention, among others. Direction is available from the American Society of Landscape Architects’ Sustainable Sites Initiative (SITES) that is comparable to the Leadership in Energy and Environmental Design (LEED) green building rating system.
p. Develop legislation to create the legal authority for Land Banks and a State inter-agency Real Estate Investment Trust (REIT) as an additional tool for communities to evaluate and strategically fund projects that support state and local climate, economic, and quality of life goals. A late breaking recommendation, this item needs further definition as to how it fits into a climate strategy and helps real estate, conservation, and economic development entities reach resilient solutions for land use and development.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy includes many thoughtful steps for developing funding mechanisms to assist communities in achieving resilience, but its effects on the health of vulnerable populations cannot yet be ascertained. Very careful consideration has been given of the kinds of funding mechanisms that need to be put in place for the various components of resilience. These proposed funding mechanisms attend to many different elements that need to be tackled to achieve resilience, and they focus on the importance of recognizing that localities differ in the resources they have available and the risks due to climate change that they are likely to face. The approach identifies different elements (such as finance mechanisms, education and workforce development, and partnerships that will all be key parts to success). In the past, however, affluent communities have been more likely to benefit from such programs than have vulnerable communities.

2. Health - any positive or negative health effects?

The proposed approach is very comprehensive and, if fully enacted, has the potential to put in place activities and actions that will lead to positive health benefits. The challenge will be to ensure that the extensive list of actions/laws/mechanisms is carried out and that the activities are coordinated in effective ways. Any single action may be insufficient to achieve the intended goals if not coupled with the others.

3. Accessibility - any improvements or reductions in access to services?

This strategy is very much focused on improvements that, if successful, would directly and indirectly increase access to services.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy is very much designed to increase the likelihood that climate resilience programs are available to those communities most in need. It will be important that the information about all of the initiatives is widely disseminated and made available in effective ways to diverse groups.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

The many elements of this strategy are designed to increase the funding for municipalities that may be home to those who have social and demographic vulnerabilities. If carried out as outlined (and with all of its planned elements in place) this strategy has the potential to reach those with social and demographic vulnerabilities.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy is intended to reach and impact rural populations, those living in proximity to rivers and coastal waters, those dependent on natural resources, and those living in seasonally dependent areas. Because the strategy has so many interlinked components, it will be crucially important that not just one or a few are implemented but that methods are found to ensure that all components are implemented.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

This strategy is designed to be comprehensive in reaching communities. Given that comprehensive intent, it will be very important that effective, frequent communication strategies are employed and regularly evaluated to assess what is working and what needs to be improved.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

The involvement of members of stakeholders will need to be adequate and meaningful as all of these elements go forward. Stakeholder groups should be encouraged to suggest improvements or ways that the strategy as planned might miss key groups and individuals.

Careful and frequent evaluation of what is working and what is not working to reach key groups should be a central part of the implementation.

Resources and Recommended Reading

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Emergency Management

Strategy 1: Develop and implement a non-disaster related “State Infrastructure Climate Adaptation Fund” that would allow municipalities and state agencies to access the funds needed to supplement the often-excessive local cost shares associated with adaptation projects

Strategy 2: Invest in further coastal and riverine gauges for a better analysis and early detection purposes.

Strategy 3: Perform a state-wide comprehensive Vulnerability Assessment of At-Risk Infrastructure through expanded use of flood inundation mapping.

Strategy 4: Continued risk assessment for lifeline sectors to populate infrastructure improvement project pipeline

Strategy 5: Expand deployment of distributed grid technologies (specific focus on renewable resources to link with achieving state GHG reduction goals)

Strategy 6: Develop a guidance document addressing policy options for development practices across working groups

Strategy 7: Facilitate DEP and LUPC adoption of MaineDOT culvert sizing guidance as regulatory standard

Strategy 8: Increase engagement with community officials to raise emergency management and adaptation/resilience as a priority

Bibliography

Resources and Recommended Reading

Strategy 1. Develop and implement a non-disaster related "State Infrastructure Climate Adaptation Fund" that would allow municipalities and state agencies to access the funds needed to supplement the often-excessive local cost shares associated with adaptation projects

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A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Increased access to the funds for adaptation projects could increase wealth in the long term as successfully completed projects bolster state resiliency. This strategy could also benefit vulnerable populations if it helps lower (or prevent the increase of) local property taxes,

2. Health - any positive or negative health effects?

This strategy does not seem likely to have direct effects on the health of vulnerable populations.

3. Accessibility - any improvements or reductions in access to services?

This strategy has great potential to increase access to adaptation projects for municipalities and state agencies. Access to the financial means to move forward with essential adaptation projects has been lacking in much of Maine, and this strategy seeks to solve that problem. When implementing this strategy and creating a State Infrastructure Climate Adaptation Fund, care should be taken to ensure that financially, socially, and geographically vulnerable populations are prioritized. This can be done by combining social and geographical data to assess locations that are the most physically and socially vulnerable. Adaptation projects should be targeted in those areas to ensure that wealthy communities do not disproportionately benefit from access to increased funding opportunities (Dash et al., 2010).

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy has the potential to benefit financially vulnerable populations. Low income populations proportionately lose more during disasters, and face difficulty recovering (Dash et al., 2010). Making funds for adaptation projects more readily available to low income communities increases equity.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Socially/demographically vulnerable populations are often disproportionately impacted by disaster events. "The same social systems that generate vulnerability also impact short-term and long-term recovery by limiting access to recovery aid," (Dash, 2010:110). Making funds for adaptation projects more readily available to communities with socially/demographically vulnerable populations will increase equity.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has potential to benefit geographically vulnerable communities, namely communities at risk of sea level rise, erosion, and inundation.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This strategy has potential to impact all Maine people, and particularly those most vulnerable to increased likelihood of natural disasters and large precipitation events caused by climate change.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

“As long as we continue to impose ‘one size fits all’ emergency plans on all parts of a community, we fail to address the special needs of those that bear the greatest burden in disaster.” - Dash et al., 2010: 96.

The emergency management working group acknowledges the need for expanded outreach and engagement and says that a goal of the strategy is to empower localities to develop “strong” and “appropriate” project proposals. They also note on page six that as an aspect of the engagement process, “community resilience principles should be included so that projects are developed with social and physical vulnerability considerations.” Including members of climate change frontline communities in the creation of resilience and adaptation plans is key to developing projects and proposals that pay particular attention to the needs of community members. If a target audience for an adaptation plan does not feel included in the planning process from the beginning it is more likely that they will not listen or participate later in the process (Dash, 2010).

Strategy 2. Invest in further coastal and riverine gauges for a better analysis and early detection purposes.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy does not directly affect the wealth of Maine people, but offers positive co-benefits. The development of an improved gauging network could strengthen the capacity for flood forecasting and enhance associated planning processes, which could in turn benefit wealth.

2. Health - any positive or negative health effects?

This strategy does not directly affect the health of Maine people, but offers positive co-benefits. . The development of an improved gauging network could strengthen the capacity for flood forecasting and enhance associated planning processes, which could in turn benefit health.

3. Accessibility - any improvements or reductions in access to services?

To the extent that this gauging network improves flood forecasting and the development of flood-resilient infrastructure, it could enhance access to services (e.g. safe routes to hospitals during floods).

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

If this gauging network helps improve flood forecasts that in turn help reduce flood impacts, it could benefit low-income populations that live in or travel through low-lying areas.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Additional information is needed to ascertain whether and how these communities might be affected by this strategy. For example, are they more likely to live in low-lying areas? Many of these populations lack adequate flood insurance.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has potential to benefit geographically vulnerable communities, namely communities at risk of sea level rise, erosion, inundation, and inland flooding. .

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This strategy primarily affects Maine people who live in proximity to rivers and coastal waters.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Those who live in flood prone areas should be involved in the planning and implementation process.

Strategy 3. Perform a state-wide comprehensive Vulnerability Assessment of At-Risk Infrastructure through expanded use of flood inundation mapping.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy may not directly affect the wealth of vulnerable populations, but potentially offers positive co-benefits. A state-wide comprehensive vulnerability assessment of at-risk infrastructure could promote adaptation planning, which could in turn benefit wealth.

2. Health - any positive or negative health effects?

This strategy does not directly affect the health of vulnerable populations, but potentially offers positive co-benefits. A state-wide comprehensive vulnerability assessment of at-risk infrastructure could promote adaptation planning, which could in turn benefit health.

3. Accessibility - any improvements or reductions in access to services?

A state-wide comprehensive vulnerability assessment of at-risk infrastructure could promote more effective resilience planning, which could in turn increase access to essential services during periods of flooding.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

If this strategy contributes to the development of more resilient infrastructure, it could provide financial co-benefits for vulnerable people living, working or traveling in flood-prone areas.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

If this strategy contributes to the development of more resilient infrastructure, it could have health, wealth, and accessibility co-benefits for socially/demographically vulnerable populations living, working or traveling in flood-prone areas.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has potential to benefit vulnerable people living and working in flood-prone areas. . Improved flood mapping can strengthen planning processes that lead to more resilient infrastructure.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Maine people who live, work and travel in areas where critical infrastructure is at risk due to climate change are affected by this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement, so that vulnerable populations can participate in decisions related to the design and use of the assessment. The assessment should also be shared widely with vulnerable stakeholder groups to ensure that they are aware and prepared in the event of an emergency.

Strategy 4. Continued risk assessment for lifeline sectors to populate infrastructure improvement project pipeline
a. Assess risks to sites and transport of chemicals in priority areas.
b. Obtain additional and more complete knowledge of the locations of chemical storages
c. Provide technical support for local vulnerability assessments of at-risk infrastructure through expanded use of flood inundation mapping (commercial facilities and government facilities)

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy does not appear to directly affect the wealth of Maine people, but potentially offers positive co-benefits. Continued risk assessment for lifeline sectors could strengthen adaptation planning processes, which could in turn benefit wealth.

2. Health - any positive or negative health effects?

This strategy does not directly affect the health of Maine people, but potentially offers positive co-benefits. Continued risk assessment for lifeline sectors, and especially assessing risks to sites and transport of chemicals in priority areas could strengthen adaptation planning processes, which could in turn positively impact public health.

3. Accessibility - any improvements or reductions in access to services?

This strategy does not directly affect access to services for Maine people, but offers positive co-benefits. Continued risk assessment for lifeline sectors could promote positive adaptive decision making, which could in turn increase accessibility of services in the event of an extreme weather event.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

Through continued risk assessment for lifeline sectors, this strategy could potentially provide financial co-benefits for low-income Maine people in areas and localities where risk assessment occurs.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Through continued risk assessment for lifeline sectors, this strategy could potentially provide health, wealth, and accessibility co-benefits for socially/demographically vulnerable Maine people in areas where risk assessment occurs. Historically, socially/demographically vulnerable populations have lived in close proximity to environmentally contaminated areas, and have suffered negative health impacts as a result. An outcome of this strategy should be to ensure that socially/demographically vulnerable populations are not in harm's way (e.g. if an extreme weather event damages a facility storing chemicals).

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Living or working in an area where chemicals are stored or commonly used constitutes a geographic vulnerability. Areas where known higher risk chemicals, or sectors (industries/businesses) are located should be prioritized for risk assessment.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Vulnerable people living or working near at-risk infrastructure, and especially areas where chemicals are stored, transported, or commonly used could be impacted by this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Education and outreach is essential here as vulnerable communities deserve to be aware of the risks associated with the areas in which they work and or live. They should also be included in decisions about the siting of lifeline infrastructure, and in emergency response planning.

Strategy 5. Expand deployment of distributed grid technologies (specific focus on renewable resources to link with achieving state GHG reduction goals)

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy does not appear to directly affect the wealth of vulnerable populations, but potentially offers positive co-benefits. The expansion of resilient distributed grid technologies might increase wealth in the short term by providing jobs, as well as in the long term, by creating a more resilient and affordable energy economy.

2. Health - any positive or negative health effects?

This strategy does not appear to directly affect the health of vulnerable populations, but potentially offers positive co-benefits. Distributed grid technologies with a focus on renewable resources in Maine would decrease air pollution, thereby positively impacting health.

Additionally, if distributed grid technologies are more resilient to extreme weather, this could help support essential health services during weather-related emergencies.

3. Accessibility - any improvements or reductions in access to services?

Extreme weather events often have a significant impact on aging power distribution infrastructure, causing extended outages and loss of critical services and impacting customer safety (Poudel and Douby, 2019). Research suggests that distributed grid technologies may be more resilient to extreme weather events driven by climate change, exhibiting characteristics such as robustness, resourcefulness, redundancy, response and recovery, and adaptability (Panteli and Mancarella, 2015). Such resilience could potentially increase access of vulnerable populations to critical services.

Increased deployment of distributed grid technology would not specifically target any one type of vulnerable community, but it is important to note that financially vulnerable, socially vulnerable, and geographically vulnerable populations are often highly impacted by loss of power and access to critical services during emergency situations (Thomas et al., 2009). This strategy should strategically target those vulnerable communities first.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy may not directly impact financially vulnerable populations, though increased deployment of distributed grid technologies could have positive health, wealth, accessibility co-benefits. Research shows that financially vulnerable populations experience difficulty accessing the resources to utilize distributed grid technologies (Welton, 2017) and therefore, resources should be allocated towards creating a more equitable distribution of distributed grid technologies in Maine.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy may not directly impact socially/demographically vulnerable populations, though increased deployment of distributed grid technologies could potentially have positive health, wealth, accessibility co-benefits.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy may not directly impact geographically vulnerable populations, though increased deployment of distributed grid technologies could have positive health, wealth, accessibility co-benefits. This is especially true for those living in areas where power outages are frequent and do not get fixed quickly. Expanded distributed grid technologies could help these communities during extreme weather events (e.g. wind or ice storms) when power outages are widespread.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Financially, socially and geographically vulnerable populations could be positively impacted by this strategy. Care should be taken to ensure that financially vulnerable, and socially vulnerable people are given equal access to distributed grid technologies as this has historically not been the case (Welton and Eisen, 2018).

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement, so that vulnerable populations can participate in decisions related to distributed grid technologies. Moreover, information about provision of essential services during emergencies should be made available to vulnerable communities in a linguistically accessible and culturally sensitive manner.

Strategy 6. Develop a guidance document addressing policy options for development practices across working groups

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Additional information is needed to ascertain how this strategy would affect the wealth of vulnerable communities.

2. Health - any positive or negative health effects?

Additional information is needed to ascertain how this strategy would affect the health of vulnerable communities.

3. Accessibility - any improvements or reductions in access to services?

Additional information is needed to ascertain how this strategy would affect the access of vulnerable communities to services.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

Additional information is needed to ascertain how this strategy would impact low income communities.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Additional information is needed to ascertain how this strategy would impact communities experiencing social/demographic vulnerability.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Additional information is needed to determine how this strategy would impact geographically vulnerable communities.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

Additional information is needed to determine what vulnerable groups might be impacted.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Additional information is needed to determine what kinds of stakeholder engagement processes might be needed to address the needs of vulnerable populations.

Strategy 7. Facilitate DEP and LUPC adoption of MaineDOT culvert sizing guidance as regulatory standard

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Additional information is needed to ascertain how this strategy might affect the wealth of vulnerable communities.

2. Health - any positive or negative health effects?

Additional information is needed to ascertain how this strategy might affect the wealth of vulnerable communities.

3. Accessibility - any improvements or reductions in access to services?

This strategy has potential to increase access to essential services for Maine people living in flood prone areas, because efforts to increase the size of culverts can reduce the risk of road failure during flooding. However, the benefits to vulnerable populations depend in part on how culverts and road networks are prioritized, which is a potential equity issue.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy could have an impact on low-income populations because of its influence on the availability of climate-resilient road networks.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Additional information is needed to ascertain how these communities might be affected by this strategy.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has potential to impact geographically vulnerable populations, especially if they are strongly dependent on roadways susceptible to culvert failure. If those culverts are undersized relative to increasing peak stream flows, road failure could become more frequent.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

There is a dense network of culverts that convey water under public and private roads in Maine. Many vulnerable stakeholder groups could be impacted by this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Communities should be engaged in the process of creating adaptation plans for their cities/towns and flood management is a part of that planning process. In particular, vulnerable populations should be encouraged to help shape culvert replacement strategies.

Strategy 8. Increase engagement with community officials to raise emergency management and adaptation/resilience as a priority

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy does not directly affect the wealth of vulnerable populations, but may offer positive co-benefits. Prioritization of emergency management and adaptation/resilience by community officials can improve decision-making processes, which has the potential to benefit Maine people both in the short term and long term. But vulnerable populations do not necessarily benefit from such planning processes, so it will be important to develop tailored strategies that focus on their well-being.

2. Health - any positive or negative health effects?

This strategy does not directly affect the health of vulnerable populations, but may offer positive co-benefits. Prioritization of emergency management and adaptation/resilience by community officials promotes adaptive decision making, and smart, community minded adaptation to the effects of climate change can potentially bolster public health in Maine. But vulnerable populations do not necessarily benefit from such efforts, so it will be important to develop tailored strategies that focus on their well-being.

3. Accessibility - any improvements or reductions in access to services?

This strategy is designed to improve access to information and resources relevant to adaptation and resilience to municipalities across Maine. Tailored approaches will likely be needed, however, to ensure that vulnerable communities have improved access to such services.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy does not appear to have a direct effect on financially vulnerable populations, but targeted sub-strategies focused on the needs of low income residents could result in adaptation planning efforts that benefit these populations.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not particularly impact socially/demographically vulnerable populations, but targeted sub-strategies focused on the needs of socially/demographically vulnerable residents could result in adaptation planning efforts that benefit these populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy does not particularly impact geographically vulnerable Maine people but targeted sub-strategies focused on the needs of geographically vulnerable residents could result in adaptation planning efforts that benefit these populations.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Community officials across the state of Maine are potentially impacted by this strategy directly, and many vulnerable populations are potentially impacted by this strategy indirectly.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

As with all community planning, it is critical that vulnerable stakeholders are able to participate in the process from the outset. Making adaptation/resilience a priority for a particular municipality necessarily involves both leaders, and community members. A common pitfall of well-intentioned participatory actions is described by Arnstien (1969) as being “closer to educating and informing people and securing their support for plans rather than ceding them a genuine voice in shaping those plans.” Another common issue is the use of the term “stakeholder participation” for what is actually a “consultation” during which proposals are presented for comment and feedback (Treby and Clark, 2004). These limited forms of inclusion reinforce pre-existing power relations between government officials, or local leaders, and members of the public, and often the final outcome is a reification of inequity in policy, rather than a transformative and empowering experience for community members (Few et al., 2007). A particularly impactful quote from Arnstein on this matter is as follows: “Participation without redistribution of power is an empty and frustrating process for the powerless” (Arnstein, 1969: 216).

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Energy

Strategy 1: Ensure adequate affordable clean energy supply to meet Maine's 100% RPS goal and any increased load through the development of centralized generating resources, distributed energy resources, and other measures.

Strategy 2: Initiate a Power Sector Transformation Stakeholder Process managed by the Governor's Energy Office (GEO) in coordination with the Maine Public Utilities Commission (MPUC)to examine and provide recommendations regarding transformation and planning of Maine's electric sector to address and facilitate the recommendations of the Maine Climate Council (MCC)and achieve Maine's greenhouse gas reduction requirements.

Strategy 3: Encourage the utilization of MPUC's long-term contracting authority to include highly efficient combined heat and power (CHP) production facilities.

Strategy 4: Institute a Renewable Fuel Standard for all heating fuels, with incentives sufficient to drive rapid reductions in emissions from heating and process fuels(e.g., for industrial processes)used in Maine.

Strategy 5: Develop and implement new financing options necessary to meet Maine's clean energy and emission reduction targets.

Bibliography

Resources and Recommended Reading

Strategy 1. Ensure adequate affordable clean energy supply to meet Maine's 100% RPS goal and any increased load through the development of centralized generating resources, distributed energy resources, and other measures.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

A transition to a clean energy economy does not necessarily translate to a more just economy. It is essential to ensure that clean energy does not entrench inequalities in wealth and power through adverse distributive effects, which may occur unless specific attention is paid to **who is funding** the transition towards the 100% RPS goal. Researchers have found that without explicit attention towards the distribution of costs and benefits of a clean energy transition, inequity arises (Welton and Eisen, 2018; Mormann, 2019).

2. Health - any positive or negative health effects?

This strategy may not have direct effects on the health of vulnerable populations, but could potentially offer positive co-benefits if attention is paid to the ability of vulnerable populations to access the benefits associated with a clean energy transition (e.g. improved air quality).

3. Accessibility - any improvements or reductions in access to services?

The strategy as presented here does not explicitly address access to funding and/or energy saving technologies that will be a part of the clean energy transition. To increase the equity of this strategy, and Maine's clean energy transition, barriers to access for vulnerable populations must be addressed, and potential solutions developed.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

The working group recognized that the distribution of benefits and burdens associated with clean energy policies is often greatly divergent depending on socioeconomic status (Welton and Eisen, 2018). Additionally we agree with their statement that "Existing programs focused on supporting rural and low-to-moderate income households, such as those offered through Efficiency Maine Trust, should continue to be made available and expanded as needed."

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Socially and demographically vulnerable populations are more likely to be affected by climate change due to an imbalance of power within the structures of government, and the provisions accessible to them. Ensuring that socially/demographically vulnerable populations are justly and adequately provided for in terms of their energy needs should be a key point of the

implementation of this strategy. Historically, these groups of people have been environmentally burdened, and this shift in Maine's energy economy offers an opportunity to ameliorate those harms. Addressing the energy needs of these vulnerable groups should be a top priority in moving towards meeting Maine's 100% RPS goal.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Those who end up living near the sites of renewable energy facilities are, in this case, geographically vulnerable. Communities in areas around the sites of renewable energy facilities often feel shut out of the decision making process surrounding the issue of siting. This is something that could be remedied with more inclusive engagement processes, beginning at the earliest stages of planning processes.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This strategy may impact vulnerable populations experiencing high energy burdens, especially low income people, people of color, and older people who have historically had decreased access to clean energy technologies.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Participation of vulnerable stakeholder groups should be a key element of this strategy, not only as it pertains to the siting of renewable energy resource projects, but also effective strategies for overcoming the barriers that limit the ability of vulnerable populations to benefit from the clean energy economy.

Strategy 2. Initiate a Power Sector Transformation Stakeholder Process managed by the Governor's Energy Office (GEO) in coordination with the Maine Public Utilities Commission (MPUC)to examine and provide recommendations regarding transformation and planning of Maine's electric sector to address and facilitate the recommendations of the Maine Climate Council (MCC)and achieve Maine's greenhouse gas reduction requirements.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

A power sector transformation has the potential to radically change Maine's economy. Transferring away from fossil fuels and towards clean power generation will require substantial upfront investment, but it is expected that this transition will also create economic benefits across the wealth spectrum in the future (Bloomberg NEF, 2019; Welton and Eisen, 2018). That being said, an inclusive and representative stakeholder engagement process is essential to ensuring that the economic benefits of Maine's power sector transition are equitably distributed across income levels. Engaging low income stakeholders from the beginning of the process can potentially have a positive impact on the overall equity of the power transformation process and is highly recommended as a strategy to promote procedural equity (gl) and inclusion (Welton and Eisen, 2018).

2. Health - any positive or negative health effects?

This strategy is not likely to have direct effects on the health of vulnerable populations, but it offers potentially positive co-benefits.

3. Accessibility - any improvements or reductions in access to services?

Although this strategy includes a strong focus on stakeholders, it is unclear whether vulnerable populations such as those experiencing energy poverty (gl) will be able to participate in ways that shape the decision-making process. Engaging with PUCs has historically been challenging for those aiming to promote the issues faced by low income consumers (Welton and Eisen, 2018; Kreiger, 1990). The proceedings have been described as "dense, technical, and time- and resource-intensive processes," creating conditions that are impenetrable for many advocates of accessible clean energy (Welton and Eisen, 2018). A useful example of how to proceed with inclusive and meaningful participation in this stakeholder engagement process may come from New York. New York State's grid modernization efforts included an extensive stakeholder outreach component, which was well received by participants and engendered policy decisions that thoughtfully incorporated power transformation and reduction of statewide energy poverty. "Through public hearing testimony of 100 predominantly low-income residents—totaling 600 transcribed pages—the Commission was able to capture a considerably deeper understanding of New Yorkers' lived experiences of energy poverty. The Commission explained that this understanding helped to fuel its decision to substantially expand New York's commitment to assisting low-income ratepayers, and to link more closely its proceedings related to clean energy and energy affordability," (Welton and Eisen, 2018: 52; Welton, 2017).

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy has potential to benefit financially vulnerable Maine people if low income populations are able to participate effectively in the stakeholder process and shape its outcomes. "Access to proceedings does not always translate into the ability to influence decision makers," and thus, it is ultimately the responsibility of the GEO and Maine PUC to ensure that they are adequately responsive to concerns of low income consumers, and those experiencing energy poverty (Welton and Eisen, 2018: 53).

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+

people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy may be most likely to impact socially/demographically vulnerable populations in instances where social/demographic vulnerability overlaps with financial vulnerability.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy may be most likely to impact geographically vulnerable populations in instances where geographic vulnerability overlaps with financial vulnerability.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This strategy could potentially have a particularly strong impact on those experiencing energy poverty.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

See Accessibility section above.

Strategy 3. Encourage the utilization of MPUC's long-term contracting authority to include highly efficient combined heat and power (CHP) production facilities.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Increased CHP production facilities in Maine could positively impact wealth of Maine people if the cost of heating and/or electricity is decreased for ratepayers. Additionally, CHP production facilities could supply jobs to Maine people. Welton and Eisen found that clean energy jobs are often not equitably distributed by gender or race, therefore Maine could be proactive in this regard, emphasizing the need for a diverse workforce in the clean energy sector (Welton and Eisen, 2018).

2. Health - any positive or negative health effects?

Increased CHP production facilities in Maine could positively impact health of vulnerable populations if the cost of heating and/or electricity is decreased substantially for low income for

ratepayers, allowing them to heat their houses to a more comfortable temperature more frequently. Increased thermal comfort has been shown to lead to improved health (Curl et al., 2015; Maidment et al., 2014).

3. Accessibility - any improvements or reductions in access to services?

Increasing CHP production facilities in Maine is unlikely to directly impact access to services.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

Growth in the number of CHP units in Maine impacts financially vulnerable people only insofar as it has the potential to decrease the cost of heating and/or electricity. Ratepayers will have to generate the finances necessary to increase the number of CHP units in Maine, but this in and of itself is not an equity issue substantial enough to call into question the use of CHP as long as equity in financing the clean energy transition more broadly is explicitly addressed by the GOE and MPUC.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy seems most likely to impact socially/demographically vulnerable populations in those instances in which social/demographic vulnerability overlaps with financial vulnerability.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy seems likely to impact geographically vulnerable populations in two ways. Firstly, by preserving the rural manufacturing base, this strategy could financially assist geographically vulnerable populations. Second, potential emissions reductions in the industrial sector could have a positive health impact via reduced air pollution.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

No vulnerable stakeholder groups are likely to be directly impacted by this strategy, though those experiencing the effects of energy poverty may stand to benefit.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Maine should include stakeholders experiencing energy poverty in planning and implementation of all energy upgrades.

Strategy 4. Institute a Renewable Fuel Standard for all heating fuels, with incentives sufficient to drive rapid reductions in emissions from heating and process fuels (e.g., for industrial processes) used in Maine.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

If the RFS increases the price for heating fuel, those who already experience difficulty paying to heat their homes will be burdened by this strategy. A more explicit description of the point of compliance and distribution of costs is necessary to understand the equity implications of this strategy on the wealth of vulnerable populations.

2. Health - any positive or negative health effects?

This strategy seems unlikely to have direct effects on the health of vulnerable populations, but it could have positive co-benefits on health due to improved air quality.

3. Accessibility - any improvements or reductions in access to services?

While this strategy does not explicitly alter access to heating services, an increase in cost of heating fuel could potentially reduce access. More explicit detail about the distribution of costs is necessary to understand the implications of this strategy on access to heating by vulnerable populations.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy does not particularly impact financially vulnerable Maine people, but more information about cost is necessary to fully determine the effect on financially vulnerable populations. On the other hand, if proposed federal legislation led to the expanded use of renewable wood energy, this could potentially create increased rural employment in the forest products sector.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not particularly impact socially/demographically vulnerable Maine people, but more information about cost is necessary to fully determine its potential effects (e.g. due to the possibility of increased fuel costs) on socially/demographically vulnerable populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has potential to benefit geographically vulnerable populations. For example, projects for using methane to meet RFS standards are often located in rural areas, which could supply employment opportunities for residents. As mentioned above, this strategy could also lead to improvements in air quality in these regions.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This strategy could potentially impact more than one type of vulnerable population (e.g., rural residents living near proposed project sites and people experiencing fuel poverty).

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

During the development of the RFS, inclusive engagement processes will be needed to ensure that vulnerable communities (e.g. those experiencing fuel poverty) are not disproportionately burdened by this strategy.

Strategy 5. Develop and implement new financing options necessary to meet Maine's clean energy and emission reduction targets.

a. Create the mechanisms or entities necessary to finance Maine's energy system effectively, through and including energy end-uses, and authorize their initial capitalization.
    i. Maine Green Bank
    ii. Increased Revenue Bonding
b. Pursue further investigation of structural approaches to reducing clean energy infrastructure costs in Maine, including but not limited to:
    i. Consumer ownership and control of all, or the greater portion of, Maine's power delivery systems (e.g., as explored in 2019 LD 1646) to enable less-costly financing of related infrastructure, as well as to refocus planning and investment priorities; and
    ii. Establishment of a "Maine Power Authority "as a quasi-independent governmental entity to serve as the primary energy planning and financing authority in the state. This might take a form similar to the New York Power Authority, the Illinois Power Agency, the Maine Electrical Generation Authority proposed by Dr. Silkman, or something in between.
c. Investigate the potential of multi-state or national carbon pricing beyond the electric power sector. Economists generally believe that carbon pricing will be needed to address climate change; many also suggest that carbon prices need to increase over time and be accompanied by other complementary policies and measures. Maine already prices power sector carbon emissions through its participation in the Regional

Greenhouse Gas Initiative (RGGI) and returns the revenues back to participating states and consumers to invest in energy efficiency and for other state purposes. Carbon revenues can also be returned directly to consumers in the form of dividends. This carbon-price-and-dividend or investment approach could be expanded at the state or regional level to include other sectors and fuels sold and combusted in Maine, which could provide an important source of low-cost capital for financing clean energy. Carbon revenues should also be used to address any regressive distributional impacts to ensure that Maine's transition to clean energy is equitable. The institution of a carbon price in Maine alone could negatively impact the state's competitive advantage, so it may be necessary to condition the implementation of a carbon pricing policy on the adoption of a multi-state agreement, echoing the approach taken with power sector emissions (i.e., RGGI).

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

The options suggested in this strategy for developing and implementing new financing options for Maine's clean energy and emission reduction targets show creative and equity-first thinking on the part of the Energy Working Group. Ensuring that vulnerable people do not disproportionately bear the burden of financing Maine's transition towards clean energy should be top priority in choosing funding mechanisms. If Maine participates in a multi-state or national carbon pricing scheme, there is high potential for regressive distributive effects on low income Mainers (Cushing et al., 2016; Schmalensee and Stavins, 2017). The working group does point out that "Carbon revenues should also be used to address any regressive distributional impacts to ensure that Maine's transition to clean energy is equitable," but much more research regarding the equity outcomes carbon pricing in Maine would be necessary if this were to be a policy goal.

2. Health - any positive or negative health effects?

This strategy does not directly affect the health of Maine people.

3. Accessibility - any improvements or reductions in access to services?

A Maine Green Bank could improve the accessibility of clean energy technologies to low income Maine residents. No matter which funding implements are selected, provisions should be made to ensure that vulnerable communities are included in the energy transformation process (Welton and Eisen, 2018; Welton 2017; Sovacool and Dworkin, 2015).

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Funding Maine's clean energy transition should not disproportionately burden low income populations. This should be more explicitly addressed within discussion of funding mechanisms.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy seems most likely to impact socially/demographically vulnerable populations in those instances in which social/demographic vulnerability overlaps with financial vulnerability.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy seems most likely to impact geographically vulnerable populations in those instances in which geographic vulnerability overlaps with financial vulnerability.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

All vulnerable populations could be impacted by this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

The process of funding Maine's energy transition should be transparent, and should ensure that vulnerable stakeholders can effectively participate in the process and shape its outcomes.

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Natural and Working Lands

Strategy 1. Protect and conserve working and natural lands and waters through a dedicated, sustained funding source to support a robust forest products and agricultural economy, increase carbon storage opportunities, avoid future emissions, and enhance climate adaptation and resilience

Strategy 2. Create new and update existing financial incentives and support for private land management and infrastructure that supports climate mitigation and adaptation

Strategy 3. Provide technical assistance on natural climate solutions to landowners, land managers and agricultural producers

Strategy 4. Update and refocus state programs and policies to address climate mitigation and resilience

Strategy 5. Strengthen research and development, and monitoring of climate mitigation and adaptation practices

Resources and Recommended Reading

Strategy 1. Protect and conserve working and natural lands and waters through a dedicated, sustained funding source to support a robust forest products and agricultural economy, increase carbon storage opportunities, avoid future emissions, and enhance climate adaptation and resilience

a. Increase permanent protection of forest land and farmland (especially prime agricultural soils and soils of statewide significance) via conservation easements and fee acquisition
b. Conserve areas of high biodiversity value and areas that support land and water connectivity and ecosystem health, as informed by Beginning with Habitat Focal Areas and other conservation planning tools from Maine's natural resource agencies
c. Revise scoring criteria for state and federal land conservation funding sources (e.g. Maine Natural Resource Conservation Program, Land for Maine's Future Program, Forest Legacy Program, and Maine Outdoor Heritage Fund) to incorporate climate mitigation and resiliency goals into grant criteria and project selection

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy has potential to increase wealth for those who receive financial support to conserve land, biodiversity, and areas that support land and water connectivity and ecosystem health.

2. Health - any positive or negative health effects?

Conservation of natural and working lands provides potential health co-benefits to vulnerable populations through the provision of such ecosystem services as improved air and water quality.

3. Accessibility - any improvements or reductions in access to services?

This strategy can potentially expand accessibility to natural and working lands both in the short and long term via conservation easements. In making management decisions, efforts should be made to provide access to forest and farm land to vulnerable populations who have dealt with systemic barriers to access. Providing access to land to New Mainer farmers, as well as new farmers in general, and supporting existing low-income farmers would increase equity in Maine's food system. Conservation of forest, farm, and biodiverse land in Maine could have the potential co-benefit of maintaining jobs associated with forestry, agriculture, fisheries, and tourism.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

The direct impact of this strategy on low income populations depends in part on their ability to participate in the proposed incentive programs. Some of the proposed programs could

potentially have adverse indirect effects on low income populations if they result in increased property taxes or reduced municipal services.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Additional information is needed to ascertain whether and how these vulnerable communities might be affected by this strategy.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has the potential to positively impact rural populations by preventing farm and forestland conversion, thereby providing continued opportunity for agricultural and forestry use.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

This strategy impacts users of forest and farm land, as well as people who live near areas rich in biodiversity.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement, so that vulnerable populations can participate in decisions related to the future of natural and working lands.

Strategy 2. Create new and update existing financial incentives and support for private land management and infrastructure that supports climate mitigation and adaptation

a. Establish a stakeholder process to develop a voluntary, incentive-based Maine forest carbon program (practice and/or inventory based) for woodland owners of 10 to 5,000 acres, and forest practitioners, to increase carbon storage and encourage forest management while maintaining current timber harvest levels
b. Address land taxation policy through legislation introduced by the Governor to:
    i. Update the Open Space Current Use Taxation Program in a manner that incentivizes climate-friendly land management practices, makes it more attractive

to woodland owners, and enables landowners to move between Tree Growth and Open Space as land management objectives change

ii. Update Farmland Current Use Taxation Program in a manner that encourages broader use of the Program and incentivizes farmland management practices with climate mitigation and adaptation benefits

iii. Operationalize and fund the currently eligible but unused “wildlife habitat” criterion of the Farm and Open Space Tax Law (36 M.R.S. §1101-1121) to provide landowner financial incentives for conserving parcels with land and water resources of high biodiversity value, including species and habitats at risk of decline from climate change

iv. Maintain the Tree Growth Tax Law as an established program for landowners committed to active forest management

c. Provide funding to support the use of agricultural and forestry mitigation and adaptation practices; incentivize infrastructure and technology upgrades to support the adoption of those practices including on-farm renewable energy use and other strategies to reduce fossil-fuel usage

d. Reduce CO emissions from fossil fuels used for building heat/power by encouraging the consideration of installation of efficient modern wood heat/power technology in homes, businesses, schools, hospitals and other institutions

e. Encourage high quality on-the-ground performance by loggers, and facilitate the use of low-impact timber harvesting equipment

f. Increase funding to improve aquatic connectivity at private and publicly owned barriers (including dams and road-crossing infrastructure), using Stream Smart practices for freshwater bridges and culverts, Coast Wise practices for tidal crossings, and a temporary steel bridge cost share program for forestry operations (administered by the Maine Forest Service), thereby reducing flooding damage, supporting habitat functionality, and responding to seal level rise

g. Provide financial support to strengthen Maine’s food systems, so that more food can be produced and processed locally, distributed efficiently, and priced affordably

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A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Target populations associated with this strategy include forestland owners, agricultural landowners, loggers, etc. Further information is needed regarding the extent to which vulnerable populations are likely to benefit from these incentives and support programs.

2. Health - any positive or negative health effects?

Increasing access to farmers markets and Maine grown food to vulnerable populations could potentially benefit the health of vulnerable people, but simply increasing production does not ensure greater access. Specific actions should be taken to benefit vulnerable populations experiencing food insecurity, and those who cannot or do not have access to farmers markets.

3. Accessibility - any improvements or reductions in access to services?

Support for local food systems has the potential to reduce the adverse effects of food deserts that are disproportionately experienced by vulnerable populations.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

The direct impact of this strategy on low income populations depends in part on their ability to participate in the proposed incentive programs. Some of the proposed programs could potentially have adverse indirect effects on low income populations if they result in increased property taxes or reduced municipal services.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not appear to directly impact socially/demographically vulnerable Maine people, but further details are needed to ensure that they benefit from it.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Many of the elements of the proposed strategy are focused on rural regions, regions dependent on forestry and agriculture, and along waterways.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

Although the various elements of this strategy appear to have few adverse impacts on vulnerable populations, it will be important to conduct a refined equity assessment as specific incentives and policies are developed.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Extra efforts will likely be needed to ensure that the development and implementation of incentives is responsive to the concerns of vulnerable populations.

Strategy 3. Provide technical assistance on natural climate solutions to landowners, land managers and agricultural producers

a. Forestry Assistance: Add significant field forester capacity to the DACF's Maine Forest Service to support landowner and land practitioner adoption of carbon-friendly and

resilient forest management practices, through outreach, education, and technical assistance

b. Agricultural Assistance: Make natural climate solutions (such as soil health practices) a priority in federal and state agricultural programs, and increase technical service provider capacity to Soil & Water Conservation Districts, University of Maine Cooperative Extension, NRCS, and non-governmental organizations to assist producers in using known and emerging agricultural practices with mitigation and adaptation benefits
c. Natural Land Assistance: Increase technical service provider capacity to DIFW's Beginning with Habitat Program and DACF's Maine Natural Areas Program to support towns, land trusts, land managers, and landowners in their efforts to conserve native species and land and water resources vulnerable to climate change and to address climate-related threats such as invasive species

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A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Using carbon-friendly natural climate solutions could potentially increase the wealth of target populations (forest and agricultural landowners and land practitioners) over the long term. These practices are designed to increase resilience to climate change events, which will hopefully allow farmers and foresters to adapt more effectively to a changing climate.

2. Health - any positive or negative health effects?

This strategy does not appear to directly affect the health of vulnerable populations.

3. Accessibility - any improvements or reductions in access to services?

It is critical that this strategy be expanded to include explicit plans for equitable outreach and education during the implementation process. Historically, funding and assistance has been allocated to land owners and practitioners who are well educated and well connected, while excluding others who perhaps need the assistance more. Providing this explicit information about how technical assistance will be distributed to landowners and practitioners who have been historically excluded will increase the equity of this strategy.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

The impact of this strategy will depend in part on the degree to which low income populations can participate in these programs and benefit from this technical assistance.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Additional information is needed to ascertain whether and how these communities might be affected by this strategy.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy could be very beneficial to rural populations engaged in forestry and agriculture, as well as those living in proximity to native species and land and water resources vulnerable to climate change. Creating resilient working forest and farming communities through transitioning to low-carbon practices has the potential to benefit rural communities in both the short and long term.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Participants in forestry and agriculture (landowners and practitioners), as well as towns, land trusts, land managers, and landowners stewarding native species and land and water resources vulnerable to climate change are all impacted by this strategy. Further information is needed, however, regarding the extent to which vulnerable populations are likely to benefit from this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Engagement is central to this strategy. Effectively reaching those at whom this strategy is aimed will be crucial. Outreach efforts should seek to bring technical assistance to socially disadvantaged farmers, especially. When this strategy is implemented, monitoring and documentation strategies should be put into effect to ensure that socially disadvantaged and historically marginalized farmers, land managers, and landowners have been appropriately included.

Strategy 4. Update and refocus state programs and policies to address climate mitigation and resilience

a. Continue and enhance climate-friendly public land management practices
    i. Update DACF's Bureau of Parks & Lands Integrated Resource Policy (IRP) to incorporate current climate science and management priorities for enhancing landscape and species resiliency and mitigating climate change
    ii. Maintain support for, and consider expansion of, the state's Ecological Reserve System (ERS), and update ERS legislation and mandates to reflect new science on climate change threats, mitigation opportunities, and landscape resiliency
    iii. Incorporate principles of climate science and landscape resiliency when evaluating and prioritizing future land acquisitions by DACF and DIFW
b. Update existing policy and staffing needs to support comprehensive, accurate, and timely environmental review of land and water resources and permitting of projects under environmental regulations, thereby ensuring smart development, shoreland protection, and appropriate renewable energy project siting

c. Assess and improve state, regional and local land use planning efforts, policies and regulations to promote climate mitigation, resilience, and adaptation, as well as carbon storage
    i. Enhance existing and develop new land use planning tools and policies that encourage greater state coordination to reconcile competing land uses and promote efficiency, particularly with regard to environmental review
    ii. Prioritize the retention of valuable working and natural lands, especially prime agricultural soils and forest land, in balance with renewable energy development
d. Increase climate education related to forestry, agriculture and natural lands, through public school curricula, consumer awareness, and landowner information
e. Develop and enhance marketing programs for Maine forest products, in coordination with programs such as ForMaine, focused on climate-friendly bio-based wood market innovation including Cross Laminated Timber (CLT), cellulosic insulation, pyrolysis oil, nanocellulosic materials, advanced biofuels, and bioplastics. Issue an Executive Order to seek opportunities in State construction projects to use Mass Timber (including CLT) building technologies, and to encourage related manufacturing facilities to locate in Maine

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A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy does not directly affect the wealth of vulnerable populations, but may offer potential positive co-benefits if it helps strengthen the forest products sector.

2. Health - any positive or negative health effects?

This strategy does not appear to directly affect the health of vulnerable populations. .

3. Accessibility - any improvements or reductions in access to services?

This strategy is designed to increase the availability of climate planning tools, but does not appear to cause significant improvements or reductions in access to other services.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Efforts to strengthen the forest products sector could increase employment opportunities in working forest communities, where living wage jobs are scarce and unemployment is often high. This strategy should also consider what kinds of workforce training programs are needed to ensure that low income populations benefit from a revitalized forest products sector.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not particularly impact socially/demographically vulnerable populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Renewable energy projects (e.g. onshore and offshore wind, hydropower corridors) may be sited in regions that differentially affect rural and coastal communities that include vulnerable populations.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Many vulnerable stakeholder groups are often underrepresented in public participation processes (e.g. in conjunction with land use planning).

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Extra efforts will likely be needed to ensure that land use planning is responsive to the concerns of vulnerable populations.

Strategy 5. Strengthen research and development, and monitoring of climate mitigation and adaptation practices

a. Create a sustained source of funding for research on climate change and climate mitigation and adaptation strategies
    i. Conduct research in support of agriculture and forestry mitigation and adaptation practices
    ii. Promote research and monitoring to inform adaptive management practices designed to conserve climate-sensitive species and habitats
b. Establish the University of Maine as the coordinating hub for partnerships among academia, the private sector, and state government in Maine, for research on forestry, agriculture, and natural land-related climate concerns
c. Continue to invest in the University of Maine research facilities in their efforts to become a globally recognized hub for climate-friendly bio-based wood market innovation, including Cross Laminated Timber (CLT), cellulosic insulation, pyrolysis oil, nanocellulosic materials, advanced biofuels, and bioplastics
d. Promote research, development and planning efforts supporting the growth and stability of Maine food systems

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

As noted by the Working Group on page 38 of their report, “Applied research will [economically] benefit private landowners, land managers, and workers, and improve the economic viability and environmental resilience of working lands.” This in turn connotes a wealth benefit for all Mainers working in forestry, agriculture, outdoor recreation, and related industries. But there are many examples of vulnerable populations that have not benefited from such applied research. Further information is therefore needed regarding the extent to which vulnerable populations are likely to benefit from this strategy. For example, will there be programs to ensure that they are able to participate in an expanded bio-based wood economy?

2. Health - any positive or negative health effects?

This strategy does not appear to have a direct effect on the health of vulnerable populations.

3. Accessibility - any improvements or reductions in access to services?

Depending on how it is conducted and disseminated, additional research may lead to an increase in available information regarding low carbon practices for forestry and agriculture. But it will also be important to identify other factors that limit access to important information and services.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy may not have a direct positive effect on financially vulnerable populations, but they could potentially benefit if it enhances employment opportunities in the forest products industry and strengthens rural economies.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy does not appear to have a direct impact on socially/demographically vulnerable populations.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has the potential to benefit rural populations engaged in forestry and agriculture, as well as those whose lives and livelihoods depend on land and water resources vulnerable to climate change. Increased information, and updated mitigation and adaptation strategies could potentially benefit these geographically vulnerable populations.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Many different vulnerable populations could potentially be impacted by this strategy.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Extra efforts will likely be needed to ensure that research, development and monitoring programs are responsive to the concerns of vulnerable populations. For example, these populations should have a say in defining research needs and research agendas.

Resources and Recommended Reading

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Public Health

Strategy 1: Improve Public Health Behavior Related to Climate Impacts Through Investments in Public Health Monitoring and Education

Strategy 2: Conduct Public Education About Climate Change Health Effects and Resources

Strategy 3: Improve Health Systems' Capacity to Mitigate & Adapt to Climate Change

Resources and Recommended Reading

Strategy 1. Improve Public Health Behavior Related to Climate Impacts Through Investments in Public Health Monitoring and Education

a. Direct the Department of Environmental Protection (DEP) to implement air allergen, particulate matter, and ozone monitoring in all Maine counties
b. Direct DEP to invest in freshwater harmful algal bloom (HAB) monitoring, including modeling in big lakes/public water supplies
c. Direct the Maine Center for Disease Control and Prevention (Maine CDC) to invest in additional monitoring systems, including: Vector-borne disease monitoring (especially ticks and mosquitoes), Browntail moths
d. Direct the Department of Marine Resources (DMR) to invest in additional monitoring activities, including: HAB monitoring, Vibrio monitoring

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A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy can potentially improve the wealth of some vulnerable populations. For example, those whose incomes come from work outdoors (such as in fishing, forestry, and farming) are more at risk for income loss due to health effects of the diseases likely to increase with climate change. More monitoring is likely to be especially important for those whose outside livelihoods could put their health at greater risk under predicted climate changes.

2. Health - any positive or negative health effects?

This strategy can potentially improve the health of some vulnerable populations. For example, negative health effects from climate impacts can be reduced through the proposed strategies. Additional monitoring systems, including of vector-borne diseases that are increasing with higher temperatures, have been shown to be cost effective. The University of Maine has been a leader in research on the growing impacts of vector-borne diseases and faculty can be tapped for assistance. The costs of such monitoring systems are not large when built into ongoing practices. Ozone monitoring and similar practices are important for those with respiratory and other health problems, particularly those associated with aging.

3. Accessibility - any improvements or reductions in access to services?

Ensuring accessibility to the monitoring information will be very important. Careful attention needs to be paid to the implementation of the proposed accessibility strategies to ensure that they are fair and equitable.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

The planned heightened monitoring strategy, if thoroughly implemented, has the potential to be helpful to low income populations in the farming, fishing, and forestry industries.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy of greater monitoring is likely to positively impact those with social/demographic vulnerabilities to the extent that the monitoring results are made readily available and in a form that is accessible to those with limited English proficiency or who face other barriers to accessing information crucial to their health.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy is likely to be important to those with geographical vulnerabilities. For example, those who live in seasonally dependent areas whose livelihood might be affected both directly and indirectly by the expected public health impacts. Those who work in the tourism industry might find their livelihoods affected, as might migrant workers, farm workers, forestry workers, and others with outdoor occupations.

C. Participation and Inclusion

1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

This important strategy will impact many stakeholder groups and publics. These include those who work in farming, forestry, and fishing as well as those who work in the many outdoor tourism industries in Maine. Organizations that represent these groups will be important to reach and involve.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It is important to tap the many groups that are playing roles throughout the state in creatively reaching and involving others and doing so through many different media. Higher education could be tapped (through communication programs, cooperative extension, and the like) in assisting to develop innovative approaches.

Strategy 2. Conduct Public Education About Climate Change Health Effects and Resources

a. We recommend investing in Maine CDC's and Maine DEP's public education efforts for these topics:
    - Air quality alerts
    - High heat and cold warnings (e.g., a central place where public can look to for strategies to protect their health)
    - Harmful Algal Blooms (HABs) and how to adapt
    - Vector-borne diseases and how to combat
    - Water testing education (especially during floods)
    - Health advisories
    - Reframing "Heat Pumps" as "Heat/Cold Pumps"
    - Health effects of wood smoke. According to the U.S. Environmental Protection Agency (EPA), "The biggest health threat from smoke is from fine particles, also called fine particulate matter or PM2.5.

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Investing in public education efforts on these topics is extremely important and is likely to result in benefits to vulnerable populations at relatively low cost. Tapping into the existing public education infrastructure but with this added information is likely to be very productive. Involving the many groups that already share information and could simply add this information can be very cost-effective. In Lowell, MA, for example, information about health impacts was easily added to 'English as a Second Language' sessions, etc. as a way to reach people who are important to reach.

2. Health - any positive or negative health effects?

This approach has great promise for producing positive health effects. Few negative effects are likely if this approach is fully implemented.

3. Accessibility - any improvements or reductions in access to services?

This approach has the potential of increasing knowledge of risks that could serve to increase interest among key groups in accessing services.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This strategy has great potential, if done effectively, to impact low income populations. Findings ways to ensure that the information is readily accessible to all is important. Considerable considerations should be given to where people obtain their information and how to use those outlets in effective ways. In Lowell, MA, for example, immigrant communities were found to access information from different sources (local grocery stores, temples, radio stations in their languages, moms who ran neighborhood day care centers) than did some other groups. Involving these mediators was very effective in getting information out about environmental health issues.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

As noted above, it is very important not to assume that generic information will reach everyone who needs to be reached. The information needs to be customized so that the uptake happens. In Lowell, Massachusetts, EPA wanted to warn new immigrants not to fish in the contaminated Merrimack River. The EPA announcements were in English and used fish terms that new immigrants did not know. By working in partnership it was possible to create materials in different languages (and that worked for those who were not able to read) that focused on safe fishing in ways that assisted in learning. The same can be done with climate change information.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy is important for all of Maine. Different strategies will be needed but climate change impacts on air, water, and soil that are being discussed are important to a great or lesser extent throughout Maine.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

Many organizations can be tapped to get the word out in effective ways. Groups can be involved in designing the outreach, the content, and the discussions. Many groups stand ready throughout the state and can be involved.

2. Is participation by vulnerable members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Involvement has started and more would be helpful and is quite possible. Certain groups are known for their effectiveness in being trusted resources for others. There are those who can provide ideas about these groups and which might be available for what purpose.

Strategy 3. Improve Health Systems' Capacity to Mitigate & Adapt to Climate Change

a. Mitigation: Incentivize the achievement of carbon neutrality within 6 years by Maine's four major health systems (MaineHealth, Central Maine Medical Center, Northern Light Health and MaineGeneral).
b. Mitigation: Encourage hospitals' Community Health Needs Assessment (CHNA) community benefits investments to align with broader state health priorities, including climate goals and associated endeavors. This would entail partnerships between health systems, Maine CDC and non-governmental stakeholders.
c. Incentivize preparedness planning and implementation for Maine's four major health systems (MaineHealth, Central Maine Medical Center, Northern Light Health and MaineGeneral; the 11 independent, and much smaller, hospitals would have more time to adopt similar planning and implementation directives).

A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy could potentially have some adverse, indirect effects on vulnerable populations. To minimize this possibility, it is important to ensure that the viability of the healthcare systems is not affected by steps that must be taken to reduce the degree to which the healthcare systems are contributing to greenhouse gasses. The plans as outlined are intended to move in that direction without at the same time increasing costs for health consumers. This is an especially difficult challenge (as noted below) because of the challenges that the health systems (especially those in Maine's rural areas) are experiencing. Some rural health care centers are closing and facing increasing challenges. They are likely not to see reducing their carbon

footprint as a priority in terms of meeting the diverse needs of their patients and so involvement of key leaders and groups will be important.

2. Health - any positive or negative health effects?

The health impacts for individual consumers would not be immediate but the effects on the reduction of state's greenhouse gas emissions is likely to be significant.

3. Accessibility - any improvements or reductions in access to services?

Please see analysis on B1. The points are also relevant here.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

This issue of health systems cannot be easily separated from transportation issues and contributions to climate change. In rural areas of Maine, patients often have to travel by personal vehicle to get to health care sites. As health practices and hospitals close this need to travel greater distances is likely to increase. This issue of accessibility is important to consider in terms of impacts on greenhouse gases.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

The plans described in the strategy, to the extent that they do not decrease the availability or accessibility of health care centers, are likely not to negatively impact people with social and demographic vulnerabilities.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers, coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

As noted above, small rural health care facilities need to receive special consideration in decisions about this strategy. Patients often have to travel further to reach such facilities and some of the rural systems are facing significant financial challenges.

C. Participation and Inclusion
1. Who? — Who/what vulnerable stakeholder groups/publics are impacted by this strategy?

It is important that not just the health care providers be involved in the discussions but also that different patient communities (e.g., those who are elders, live in rural areas, tribal communities) are included. Involvement of diverse groups is important and will call for careful attention to how people gather, share information, and respond to information.

2. Is participation by members of vulnerable stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to continue to increase the involvement of vulnerable stakeholder groups in the discussions and in providing feedback. Many organizations and meta-organizations can provide ideas for who to most efficiently reach the diverse groups who can contribute in significant ways to this discussion.

Resources and Recommended Reading

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Transportation

Strategy 1. Expand Electrification of Vehicles

a. Develop a statewide plan for expanding, coordinating, and distributing investment in EV infrastructure.
b. Equitably expand EV and plug-in hybrid incentives and grants. Support E-bike incentives for individual purchase and for bikeshare.
c. Advance the deployment of EVs, including medium- and heavy-duty trucks, by ensuring that operation costs are low and electrification benefits are maximized through a package of utility/Public Utility Commission (PUC)-focused legislation.
d. Establish Statewide ZEV/EV adoption targets for public fleets.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

This strategy has the potential to positively affect wealth for those who can afford to purchase an EV though the upfront cost is high. It should be noted that Efficiency Maine has higher EV rebates for low income purchasers and other states have rebates for used EVs, which could be incorporated in Maine. No matter what the policy intervention, EVs and E-bikes remain expensive at the present moment. Over the long term, owning an EV reduces a household's transport burden. Currently, the distribution of EVs is inequitable. A 2016 study found that the top 20% of earners have received 90% of all EV related tax credits since 2006 (Borenstein and Davis, 2016). "Direct subsidies for new vehicles are generally claimed by those with higher incomes for a number of reasons. First, because wealthy people are more likely to purchase new vehicles, subsidies for new car purchases (EV or not) will tend to benefit the wealthy. Additionally, electric vehicles tend to have lower ranges than gasoline vehicles, making them less attractive as a household's first vehicle. Households that purchase electric vehicles are therefore more likely to be able to afford several vehicles, rather than just one. Finally, because many electric vehicles are expensive compared to gasoline vehicles, they tend to be purchased by wealthier individuals. These factors have the combined effect of making policies that subsidize the purchase of electric vehicles particularly regressive," (Bosworth and Patty, 2017: 13).

California has taken steps to mitigate this problem. The state's "Clean Vehicle Rebate Project" "ties rebate amounts to the purchaser's income and precludes those with incomes over $150,000 from participation. In a different vein, other California energy providers issue rebates for used as well as new electric vehicles, to make these vehicles more accessible to a broader range of residents," (Welton and Eisen, 2018: 38).

2. Health - any positive or negative health effects?

Transportation is the greatest source of emissions in Maine so has the most room for improvement. EVs are expected to be the most effective way to reduce emissions in the sector, therefore offers significant opportunities for improving air quality, especially in urban and more populated areas where residents are in close proximity to roadways. There are significant potential health co-benefits associated with expansion of EVs as reduced air pollution increases health. "On average, communities of color in the Northeast and Mid-Atlantic breath 66 percent more air pollution from vehicles than white residents. The average concentrations of exposures for Latino residents are 75 percent higher, and for Asian American residents they are 73 percent higher than they are for white residents. Exposures for African American residents are 61

percent higher than for white residents, (Pinto de Moura and Reichmuth, 2019: 2). Reducing air pollution from vehicles would benefit all Maine people and specifically communities of color.

3. Accessibility - any improvements or reductions in access to services?

Despite financial incentives of various types (rebate, upfront payment, tax incentive) the cost of EVs remains prohibitively high for most people. A study of uptake of Ultra Low Emission Vehicles in the UK found that "most private EV owners are currently middle-aged, male, well-educated, affluent, and live in urban areas with households containing two or more cars and with the ability to charge at home," and additionally stated that these demographics are unlikely to change in the near term (Brook Lyndhurst Ltd, 2015, 17). As with many types of incentive, "Unless the funding scheme foresees provisions for vulnerable people, 'first-come-first-served' will occur resulting in a more intense uptake by the more affluent, more educated, more informed, more socially connected, thus increasing inequalities," (Camprubí et al., 2016: 310). Thus, financial incentive programs must be explicitly targeted at those who need financial assistance **most.** Additionally, even when financial incentives are provided, EVs may remain too costly for many households to access.

Another equity issue related to the ownership of EVs is the presence or absence of at home charging capabilities and related issues of access to public charging infrastructure. People who can charge at home will achieve convenience parity (with a gas powered vehicle) but people who cannot charge at home will have to deal with the considerable inconvenience of waiting to charge at public stations, at work, or in route to a destination (Dixon et al., 2020).

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Sovacool et al. report that "There is even the potential for the poor to provide financial support for the affluent…most adopters of EVs...have been new car purchasers, with high educational levels and incomes, who reside in urban areas…By contrast, lower income households tend to purchase cheaper and less-efficient vehicle models. This means they could end up paying to subsidize EVs without being able to benefit from the lower running costs." (500) Incentive programs, therefore, should be structured in such a way that low-income individuals are not subsidizing the purchase of EVs for wealthy individuals.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

The health co-benefits of this strategy will potentially benefit people of color, people with ongoing health concerns, and older people since they tend to be highly negatively impacted by poor air quality (Pinto de Moura and Reichmuth, 2019; Simoni et al., 2015).

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

The limited range of EVs presents a risk to those who live in rural or remote areas far from charging locations and necessary services (Sovacool et al., 2019). On the other hand, rural people in Maine drive farther distances, so the potential for meaningful fuel savings is greater (if the purchase price hurdle can be overcome) leaving more money in the owner's pocket for other important expenses.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

Many stakeholder groups and publics would potentially be impacted by this strategy.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Outreach and engagement regarding EV and E-bike incentives should be provided in many languages and should be accessible to socially and demographically vulnerable groups.

Strategy 2. Reduce the Emissions of Maine's Internal Combustion Engines

a. Encourage Freight Companies to Voluntarily Participate in EPA SmartWay Program
b. Expand Alternative Fuels
c. Increase Vehicle Fuel Economy
d. Conduct ongoing public education and marketing regarding the above fuel economy programs and strategies

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Increasing vehicle fuel economy increases wealth by saving money on gas -- this is true across the economic spectrum. Public education and marketing regarding fuel economy programs and strategies may increase wealth of those who participate in the programs. In addition to benefits from fuel economy, producing alternative fuels (e.g. biofuels) in Maine can create new economic opportunities.

2. Health - any positive or negative health effects?

The strategy could have positive health benefits if, by reducing fuel consumption, it reduces air pollution (e.g. ground-level ozone, PM2.5, etc.)

3. Accessibility - any improvements or reductions in access to services?

If vehicle prices increase due to increases in fuel efficiency, this could limit the ability of vulnerable populations to benefit from this strategy.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

In the short term, increased efficiency standards will benefit those who can afford to purchase vehicles with better fuel economy (Chase and Maples, 2014). Lower income people tend to drive older, less fuel efficient cars (Baker et al., 2011). In the longer term, increased availability of more efficient vehicles in the used car market will allow low income people to access the benefits of driving a more efficient car.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy is likely to impact all communities and stakeholders. One challenge will be to ensure that vulnerable populations share in the strategy's potential benefits.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Rural car drivers could potentially benefit from this strategy as a result of a lowering in cost of driving through fuel saving, and the effect on fuel efficiency for their typically longer journeys would have stronger benefits than for those making shorter trips. Another factor to consider is that rural drivers may be more likely to rely on 4-wheel drive vehicles (e.g. light-duty trucks) to cope with winter driving conditions; such vehicles typically have lower fuel efficiency.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

This approach is likely to impact all communities and stakeholders. The challenge will be to ensure that the approach is operationalized to reach those who are hard to reach and to do so in effective ways so that they can act on the information.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

Public education and marketing regarding fuel economy programs and strategies should be inclusive of those for whom driving creates a financial burden.

Strategy 3. Reduce Vehicle Miles Traveled

a. Support Development in Priority Areas
b. Expand Public Transportation
c. Expand Telework and Teleservice Opportunities
d. Expand GO MAINE's Multimodal Support Services for Mainers and Workplaces
e. Increase Rail Freight Service and Efficiency
f. Conduct Public Education and Marketing Regarding VMT Reduction Efforts

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Reducing vehicle miles traveled in a personal vehicle could reduce a household's transport burden, thereby positively impacting wealth.

2. Health - any positive or negative health effects?

This strategy has potential to benefit the health of Maine people through encouraging walking and biking as alternatives to driving. There is the potential to expand healthcare services (through telehealth) for vulnerable populations. Positive co-benefits could occur through improved air quality via a reduction in number of vehicles on the road.

3. Accessibility - any improvements or reductions in access to services?

As the working group has expressed, expansion of public transportation, telework and teleservice opportunities and GO MAINE's services seek to increase accessibility to transportation services, increase the accessibility of rides to members of the population without access to cars, or offer an alternative to transportation by staying home. In general, outside of Maine and especially in rural areas, issues of sparse schedules, lack of trust, lack of reliability, and lack of access to booking/scheduling technology have all barriers to accessing public transportation and rideshare services (Teubner and Flath, 2015). The successful implementation of this strategy via an improved GO MAINE and improved public transportation network seeking to solve these issues has the strong possibility to increase access to rides in the long term.

Access to reliable broadband is an issue in Maine, and therefore, as the working group has expressed, increasing access to the internet must be a priority in order to expand telework and teleservice opportunities. The planned strategy does include a focus on the importance of expanding broadband.

B. Types of vulnerable populations
1. Financial vulnerabilities — How does this strategy impact low income populations?

Low income Maine people can potentially benefit from the expansion of public transportation networks and the GO MAINE program as it can reduce the cost of commuting substantially through shared cost ridesharing (Coulombel et al., 2019), and could reduce a household's transportation burden.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Expansion of public transportation would benefit younger people, women and ethnic groups who are greatest users of public transportation (Lucas and Pangbourne, 2014). People with disabilities would not specifically benefit from this strategy because it only addresses expansion of services rather than physical accessibility (Lucas and Pangbourne, 2014).

GO MAINE's trip planning feature allows walk and bike commuters to request a "buddy" to accompany them on their trip. While this may increase the likelihood that commuters chose active transport over a personal vehicle, there are very few if any trips that actually list a number of "buddies" to choose from on the website. Older people stand to benefit from the expansion of public transportation and GO MAINE's services, but in order for this to happen, GO MAINE will need to expand its platform beyond just a webpage to increase accessibility.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Geographically vulnerable populations are currently disadvantaged with regards to access to public transportation and GO MAINE's current reach and offerings. The impact of this strategy would be to assist geographically vulnerable Maine people by offering them better connectivity to the GOMAINE and public transportation network. Additionally, increasing internet connectivity in rural parts of the state, as suggested by the working group, would greatly improve equity in rural areas.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

Users of public transportation, and ridesharing services like GO MAINE are impacted by this strategy.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to ensure that vulnerable populations can easily participate in the design and implementation of various elements of this strategy, and to provide feedback on what is working and what needs to be improved. For example, outreach and engagement should be multilingual. Careful attention should also be given to building in a consistent way to obtain feedback and strengthen the approach based on that feedback.

Strategy 4. Adapt Maine's Infrastructure Critical to the State

a. Conduct a statewide Infrastructure Vulnerability Assessment

b. Develop and maintenance database (or improve an existing database) to enable the Maine DOT and municipalities to track the frequency of events that require a specific asset to be closed, along with the associated costs, including time and materials, associated with the maintenance response to that asset.
c. To encourage the implementation of resilient upgrades, design guidance and standards should be adopted and updated, respectively.
d. To further increase the resiliency of state infrastructure, the physical materials used to construct the infrastructure should be investigated to determine if they can be made more durable to withstand the changing environment.

A. Social impacts

1. Wealth - any significant changes that would affect wealth of target populations/participants?

Increasing infrastructure resilience should enhance ongoing connectivity within the state, which should in turn strengthen the economy. Additionally, there is potential for avoided costs associated with damage to infrastructure due to disaster. Resilient infrastructure would ensure continued functioning during and after a disaster, mitigating potential spending on repair. Additional information is needed to ascertain whether and how this strategy might affect the wealth of vulnerable communities.

2. Health - any positive or negative health effects?

Increasing infrastructure resilience has the potential to enhance access to health care for many vulnerable populations. More resilient infrastructure that can withstand the impacts extreme weather events will ensure access to health care services during critical times, both during and after extreme weather events.

3. Accessibility - any improvements or reductions in access to services?

This strategy has great potential to increase accessibility to essential services. Conducting a vulnerability assessment will show weak points and increase the likelihood that Maine people living and working in vulnerable areas, such as coastal zones and floodplains, have access to key services. In order to increase equity, the vulnerability assessment should take into consideration the social and demographic vulnerability of communities in surveyed areas. Special attention should be paid to areas where vulnerable infrastructure and vulnerable populations coexist.

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Financially vulnerable populations are generally less able to cope with social and economic disruptions, including those involving infrastructure. Thus, one of the potential impacts of this strategy would be a decrease in social and economic disruptions due to infrastructure impairment or failure. This in turn would reduce risk to vulnerable populations who often have a harder path to recovery from economic crisis.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+

people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

This strategy is likely to positively impact a wide variety of socially/demographically vulnerable communities and stakeholders.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

This strategy has potential to greatly benefit those living in proximity to rivers and coastal areas. Critical public infrastructure constructed to support coastal communities is vulnerable to the effects of increased coastal flooding, thus adaptation is critical. Increased flooding in non-coastal areas will also increase with climate change (Fernandez et al., 2020), making all floodplain areas vulnerable and in need of adaptive infrastructure.

C. Participation and Inclusion
1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

In terms of equity impacts, all people who live in areas where infrastructure is vulnerable to the effects of climate change are impacted by this strategy.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement, so that vulnerable populations can participate in decisions related to infrastructure resilience.

Strategy 5. Explore Mechanisms to Fund Transportation Needs and Facilitate Emission Reduction

a. Blue Ribbon Commission to recommend transportation funding solutions report
b. Fuel tax increase
c. Transportation and Climate Initiative: Implement a cap, trade and invest system placed on fuel suppliers
d. Charge a fee for Vehicle Miles Traveled, weight and/or emissions from a vehicle
e. Implement an excise tax based on vehicle emissions and/or weight

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A. Social impacts
1. Wealth - any significant changes that would affect wealth of target populations/participants?

Funding transportation needs will impact wealth if the funding is secured through a tax or fee. The working group acknowledges that while there are equity concerns regarding increased cost to drivers, there is a possibility for increased equity through redistribution of collected funds. There is potential for increasing equitable access to more expensive technologies through the

redistribution of these funds, and this is something the climate council should seriously consider in their deliberations regarding funding. The overall equity outcome of these potential taxes and fees depends crucially on if and how the tax revenue is redistributed. Fuel taxes and fees for Vehicle Miles Traveled are both regressive, and have been shown to have large disparities between income groups and ethnic groups (Robitaille et al., 2011), but depending on how the funds are distributed they may be more or less regressive over time. Funding public transportation, and using revenue to fund incentive programs for EVs specifically for low income people are two examples of the ways in which the revenue from a tax or fee could be used to increase equity.

2. Health - any positive or negative health effects?

To the extent that these taxes or fees lead to reduced VMT and/or increased fuel efficiency, this strategy could create health co-benefits by increasing air quality.

3. Accessibility - any improvements or reductions in access to services?

If this strategy increases travel costs, it could make it harder for vulnerable populations to access some services (e.g. travel to rural hospitals).

B. Types of vulnerable populations

1. Financial vulnerabilities — How does this strategy impact low income populations?

Lower income people tend to drive older vehicles, vehicles that have lower average fuel economies, and a higher percentage of light duty pickup trucks and sport utility vehicles, which also have lower fuel efficiency (Baker et al., 2011).) Increased fuel taxes would therefore disproportionately negatively impact low income households at the outset, but there is potential for the revenue from the taxes to be equitably redistributed in a way that creates opportunities for low income Maine people to access green technologies, and expanded public transportation.

2. Social/Demographic vulnerabilities — How does this strategy impact people of color, older people, youth, people with limited English proficiency, formerly incarcerated people, LGBTQ+ people, recent immigrants and undocumented people, homeless people, people with disabilities, and/or people with ongoing health concerns?

Robitaille et al. show that fuel taxes and VMT fees have differing effects ethnic groups, by age, and by income, but this information is not Maine specific, though the study does have some information regarding Maine. Generally, fuel taxes and VMT fees disproportionately burden people of color, and low income people. This information could provide a focus for discussion of how to best redistribute the funds collected through a potential fuel tax or VMT fee.

3. Geographic vulnerabilities — How does this strategy impact rural populations, those living in proximity to rivers or coastal waters, those dependent on natural resources, and/or those living in seasonally dependent areas?

Residents of remote, low income areas generally have longer commutes and depend on their cars for commuting more than do those who live in suburban or urban areas (Steinsland et al., 2018). This being the case, both an increase in fuel tax, or a VMT fee would disproportionately affect those living in rural areas.

C. Participation and Inclusion

1. Who? — Who/what stakeholder groups/publics are impacted by this strategy?

All drivers in Maine are affected by this strategy. It could also affect those using public transportation.

2. Is participation by members of stakeholder groups adequate and meaningful? How will these stakeholders/publics be integrated not only into the process of providing feedback, but beyond that, the process of determining how this strategy will be implemented? Will there be ongoing engagement?

It will be very important to create inclusive processes of stakeholder engagement, so that vulnerable populations can participate in decisions related to transportation costs and emissions reduction programs.

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