

# 1 Chapter 12: Pathways for Adaptation and Building Resilience

## 2 in Communities and the Built Environment

3 There are a few common characteristics that define Vermont’s landscape, people, communities,  
4 and social fabric. These characteristics include the rural nature of communities, the changing of  
5 the four seasons, ample opportunities for nature-based recreation, and the independent  
6 unassuming grit of the people. Climate change challenges Vermont communities and poses a risk  
7 to the systems and landscape that are central to our lives in this beautiful place. Storms are  
8 becoming more severe, more frequent, and more complex with each passing year. The 4<sup>th</sup>  
9 National Climate Assessment identifies the adverse impacts of drought and heavy precipitation  
10 events on rural areas of Northeast United States and highlights rural communities. “With little  
11 redundancy in their infrastructure and, therefore, limited economic resilience, many rural  
12 communities have limited ability to cope with climate-related changes<sup>1</sup>.” Of the many natural  
13 hazards that impact Vermont, flooding poses the greatest risk to Vermont infrastructure and  
14 communities. According to the 3<sup>rd</sup> National Risk Assessment published by the First Street  
15 Foundation, Vermont has “26,565 residential properties, 7,030 miles of roads, 3,613 commercial  
16 properties, 273 infrastructure facilities, and 408 social facilities with operational flood risk  
17 today<sup>2</sup>.”

18 Each year, Vermonters experience life-altering impacts of climate-related events. Nationally  
19 there has been over a 400% increase in the number of billion-dollar declared disasters since the  
20 1980s<sup>3</sup>. Vermont is not immune to these impacts. During the period from 2010-2019 the  
21 President declared 17 Major Disasters occurred in Vermont which represents a significant  
22 increase over 2000-2009 in which there were 11, 1990-1999 in which there were 10, and 1980-

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<sup>1</sup> USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. <https://nca2018.globalchange.gov/chapter/10/>

<sup>2</sup> First Street Foundation. 2021. *The 3rd National Risk Assessment, Infrastructure on the Brink*. National Assessment, New York: First Street Foundation.

<sup>3</sup> (NCEI), NOAA National Centers for Environmental Information. 2021. *U.S. Billion-Dollar Weather and Climate Disasters (2021)*. <https://www.ncdc.noaa.gov/billions>.

23 1989 in which there were 2. These disasters include flooding, tornados, windstorms, ice and  
24 heavy snow, and tropical cyclones<sup>4</sup>.

25 In 2011 Vermont was catastrophically impacted by Tropical Storm Irene. 225 communities were  
26 damaged by the storm, which followed record precipitation earlier that year. The resulting 7-11  
27 inches of rainfall on the southern two-thirds of the state created one of the largest disasters in  
28 Vermont’s history. Overall “13 communities had been completely cut off. 3,500 homes and  
29 businesses were damaged, including 500 mobile homes. 20,000 acres of farmland were under  
30 water, 500 miles of states roadway and some 200 bridges were damaged across the state, while  
31 nearly 1,000 culverts had been washed away or damaged<sup>5</sup>.” Irene poignantly demonstrated the  
32 need for Vermont to change course in climate adaptation. In the last 10 years, federal hazard  
33 mitigation funds have been leveraged to acquire and demolish almost 150 flood-vulnerable  
34 properties, implemented almost 70 infrastructure improvement projects, and created or updated  
35 226 Local Hazard Mitigation Plans. The Emergency Relief and Assistance Fund statute, updated  
36 in 2014, incentivizes communities to increase their resilience to disasters through several actions  
37 that increase preparedness and break the cycle of disaster through hazard mitigation.

38 While these actions result in greater resilience to climate-related disasters, adaptation and  
39 resilience planning must also begin to incorporate an expanded paradigm about what it means to  
40 be truly resilient. While many strategies and actions in this section support continued efforts to  
41 increase resiliency to rain and flooding events, it also begins to expand the scope of work for  
42 understanding and preparing to be resilient to other changes to the climate, including higher  
43 average temperatures, extreme heat, and the ways in which new climate norms can have  
44 cascading effects on our health, key industries, and livelihoods.

45 This expanded paradigm for climate resiliency work should meet the Guiding Principles for Just  
46 Transition, which was developed per the mandate of the Global Warming Solutions Act. The  
47 guiding Principles for a Just Transition reflects a growing body of research that shows black,

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<sup>4</sup> US Federal Emergency Management Agency. n.d. *All Disaster Declarations*. Accessed 2021.  
[https://www.fema.gov/disaster/declarations?field\\_dv2\\_state\\_territory\\_tribal\\_value=VT&field\\_year\\_value=All&field\\_dv2\\_declaration\\_type\\_value=All&field\\_dv2\\_incident\\_type\\_target\\_id\\_selective=All&page=4](https://www.fema.gov/disaster/declarations?field_dv2_state_territory_tribal_value=VT&field_year_value=All&field_dv2_declaration_type_value=All&field_dv2_incident_type_target_id_selective=All&page=4).

<sup>5</sup> Montpelier: Vermont Irene Recovery Office. 2013. *Irene: Reflections on Weathering the Storm*. Legislative Report.

48 brown, indigenous, and low-income people and communities are disproportionately impacted by  
49 climate change, despite experiencing disproportionately fewer benefits and greater health, social  
50 and economic harms from the historic and ongoing industrial and economic growth that causes  
51 climate change. For example, the status quo is that residential flooding impacts are inversely  
52 correlated with socioeconomic status. To put a finer point on it, low-income Vermonters are  
53 more likely to live in flood prone locations and flood-vulnerable structures. Furthermore,  
54 projects to improve the situation are less easily accessed by Vermonters with lower incomes,  
55 renters, those in very rural communities, with limited e-connectivity, and/or with language  
56 and/or cultural barriers. To center equity and social justice in climate action planning, program  
57 design and outreach will need to explicitly be tailored to those with greatest vulnerability and  
58 least resources.

59 These pathways, strategies, and actions were drafted with the Principles for Just Transition in  
60 mind, however the full application of those principles to what is presented here, and direct  
61 engagement with frontline communities to inform these elements, remains to be done and will be  
62 done as the CAP continues to evolve. Furthermore, the Principles must apply to the entire  
63 GWSA lifecycle: the development of the CAP and its iterations, the development of legislation,  
64 the development of budgets, the promulgation of rules and regulations, and the execution and  
65 evaluation of programs. This section includes a Pathway and supporting strategies to increase  
66 capacity for building collective knowledge and collaborating on climate planning at the local,  
67 regional, and State levels. Strategies and Actions call upon infrastructure operators to assess  
68 climate threats, incorporate climate-resilient design standards, and strategically move critical  
69 infrastructure out of harm's way. If infrastructure projects are designed, evaluated, and  
70 constructed to meet these design standards rural communities will achieve the goal of sustaining  
71 critical services and lifelines with minimal disruption as a result of climate-related events in the  
72 future. Land-use policies must be modernized to recognize the increasing threat of climate events  
73 on developed structures with an overall goal of no or very limited new development in river  
74 corridors. And finally, acknowledging that access to safe, accessible, energy efficient and  
75 affordable housing is foundational to increasing both household and community resilience to  
76 climate change, this section of the plan proposes policy actions that will increase investment in  
77 housing availability and affordability by incentivizing new housing development, and  
78 remediating existing residential properties.

79 Vermont is experiencing climate-related events each year and those events are projected to  
80 increase in frequency, complexity, and severity. It is imperative to preserve and enhance  
81 Vermont’s way of life by adapting to threats posed by climate change now and building  
82 resilience for the storms that we will inevitably face in coming decades.

83 **PATHWAY 1: Increase capacity for climate resilience planning and**  
84 **implementation, and address inequities of under-resourced communities.**

85 Climate change caused by greenhouse gas emissions is already affecting every inhabited region  
86 across the globe, and Vermont will face impacts from the effects of global climate change that  
87 are no longer avoidable<sup>6</sup>. While emissions reductions are still critical to avoid the most severe  
88 and widespread impacts, Vermont must also dedicate attention and resources to preparing for the  
89 unavoidable impacts of climate change. Early action and strategic investment today that  
90 increases resiliency also reduces future costs associated with recovering from or adjusting to  
91 climate impacts.

92 Adapting and becoming resilient to the impacts of a warmer climate will require significant  
93 investment at the local, regional, and State level. This investment will need to support changes to  
94 the information and processes used to make decisions, as well as to our physical infrastructure  
95 and social safety nets. Climate action will require that we increase collective knowledge on  
96 climate change impacts and resiliency measures, and support collaborative decision-making  
97 processes among community, civic and professional networks of people that shape and have a  
98 say in how communities in Vermont serve their members. Improving physical infrastructure and  
99 supporting social networks both enable Vermont to adapt to climate impacts and increase  
100 resiliency in the face of climate change and will also need significant investment.

101 **Strategies**

102 **1. Provide tools and resources to help communities assess climate**  
103 **vulnerabilities and create climate resiliency plans.**

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<sup>6</sup> IPCC 6<sup>TH</sup> Report, Summary for Policymakers. September, 2021.  
[https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_SPM.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf)

104 Extreme weather events and disasters are not new to Vermont. Resources have been developed  
105 and deployed to successfully recover from extreme weather events. However, climate change is  
106 expected to increase the severity and frequency of extreme weather events, including high winds,  
107 heavy rain, hail and sleet while also creating new climate norms that cause persistent and  
108 ongoing impacts to physical health, economic stability, and community vitality of Vermont. Our  
109 existing tools will need to be adapted to account for anticipated increases in frequency and  
110 severity of weather events, and new tools will be needed to identify and assess other climate  
111 change risks and vulnerabilities, particularly at the community scale. Tools for assessing climate  
112 change vulnerabilities and planning for resilience will help communities make the structural and  
113 investment changes needed to break the cycle of repetitive loss, speed post disaster recovery, and  
114 reduce long-term financial burden of disasters on communities, businesses, and individuals.  
115 Tools and resources for assessing climate vulnerabilities and planning for resilience should be  
116 developed in collaboration with EJ/under-represented communities, in acknowledgement that  
117 many of the tools used to inform policy decisions have historically caused harm to EJ  
118 communities.

119 **Actions**

- 120 a. Develop a climate planning toolkit to help towns assess vulnerabilities to climate change  
121 impacts, such as heat, air quality, drought, flooding, high winds, heavy rain, hail and  
122 sleet, and identify and prioritize actions to increase their resilience to climate change.  
123 Include newly developed tools, such as the vulnerability index, and existing tools, such as  
124 the AOT Repeat Flood Damage Inventory Tool, and the NOAA Climate Resilience  
125 Toolkit

<i>Preliminary Assessment of Strategy against Criteria</i>
<i>Impact:</i> Providing tools and information resources to assist with identifying, assessing and responding to climate change vulnerabilities enables climate change planning by helping to reduce the workload, particularly for under-resourced communities, and supporting a consistent and coordinated approach to climate change planning across the state. Providing tools and information resources is a first step towards impactful actions that improve resilience in communities across the State.

*Equity:* Tools for assessing vulnerability and plan adaptation actions should help the user of those tools understand the disproportionate impact that climate change has on frontline communities, particularly black and indigenous communities, identify who in their communities are likely to be most impacted by climate change, and provide guidelines, such as providing materials in the languages used by those most impacted, for engaging and consulting with impacted communities in completing vulnerability assessments and resiliency plans.

*Cost-effectiveness:* The investment needed to create and provide tools and resources to help communities identify, assess, and respond to climate change vulnerabilities is relatively low. It will require a one-time, upfront investment to update existing tools, create new ones, and develop a platform that makes them easily accessible to local and regional planners and community members. Some regular upkeep to keep tools relevant and up to date will also be required. Investment in tools to support climate planning can have a significant impact in reducing future costs by ensuring that vulnerabilities have been identified and actions to reduce them have been evaluated, identified, and leading to a high return on investment from climate actions.

*Co-Benefits:* Providing tools and information resources to support climate planning can improve all outcomes of climate work, including reducing emissions and sequestering atmospheric carbon, in addition to improving resilience. Other co-benefits include improving public health outcomes, reducing the health risks from climate change impacts, reducing financial losses from climate change impacts, improving economic stability, and protecting natural resources.

*Technical Feasibility:* Yes

126

127 **2. Establish permanent statewide funding and technical support for local and**  
128 **regional climate resilience planning and project implementation to enhance**  
129 **rural resilience to impacts of climate change.**

130 Adapting to the impacts of climate change, and planning for resilience needs to be supported and  
131 informed by the local knowledge within Vermont’s communities. Vermont’s eleven Regional  
132 Planning Commissions (RPCs) play a critical role in supporting the State’s 246 municipalities,  
133 especially those that are under-resourced. The RPCs ensure regional coordination and  
134 collaboration and help to advance State level goals and policy. The State can assist and  
135 collaborate with the Regional Planning Commissions and municipalities on climate planning by  
136 providing technical support and funding for the planning and implementation of projects that  
137 enhance community resilience to climate change impacts.

138 **Actions**

- 139 a. Increase funding to Regional Planning Commissions and local municipalities to support  
140 climate and energy planning and target funds to support towns with limited staff and  
141 marginalized populations that score high on the climate vulnerability index.
- 142 b. Create and fund one natural resource staff position at every Regional Planning  
143 Commissions to assist with implementation of climate policies and natural resources  
144 requirements such as Act 171 (forestry and habitat blocks). Use the Transportation  
145 Planning Initiative as a model to fund RPC natural resource staff and support trainings  
146 with ANR and other partners.
- 147 c. Increase and create a permanent state fund for design and implementation of local and  
148 regional climate adaptation and resilience projects.
- 149 d. Provide technical assistance to municipalities to assess the flood and erosion risks facing  
150 their drinking water and wastewater systems and identify potential mitigation  
151 improvements
- 152 e. Establish a state level individual assistance program to provide financial assistance to  
153 uninsured or underinsured households impacted by disasters not federally declared.  
154 Program should incorporate Community Action Agencies and supporting networks to  
155 ensure assistance is received expeditiously by those that need it most.

<i>Preliminary Assessment of <u>Strategy</u> against Criteria</i>
<i>Impact:</i> Resilience is unlikely to be achieved without human capital, funding, and technical support to begin building climate planning into current planning activities.

Human, monetary, and technical resources are needed to complete a local or regional vulnerability assessments, develop resiliency plans, and implement resilience projects and programs. A permanent funding source to support staff capacity, climate resilience planning, and project to reduce vulnerabilities and improve resiliency, would create a pipeline of projects that create resiliency in communities and across the State.

*Equity:* Increasing capacity to plan for and implement actions that improve resilience to climate change impacts should ensure that those who are most impacted by climate change experience contextual, procedural, corrective, and distributive equity in these investments. Due to historic and ongoing inequities, black, indigenous, and low-income communities, people of color, and persons with disabilities are often more vulnerable to climate change, and do not hold positions of power that make decisions on how and where climate action investments are made. These same segments of the population are repetitively impacted by disasters disproportionately. Community Action Agencies work with the most vulnerable people on a day-to-day basis and are therefore integral to ensuring assistance is provided post-disaster to the people who need it quickly.

The benefits of investments in projects and programs have not been born equally by frontline communities. In many cases projects and programs that result in benefits for some cause direct harm to frontline communities, for example by siting infrastructure in a way that burdens frontline communities with negative environmental consequences and limits or excludes them from receiving the benefits<sup>1</sup>. Funds for resilience projects and programs should require representation from those most impacted by climate change, and work towards correcting past inequity (e.g. lack of investment or representation in project and program development) while preventing the exacerbation of existing inequities (e.g. investment cannot lead to displacement). Increased staff capacity to support climate action planning must have the ability and expertise to integrate the principles of the Just Transitions recommendations into their local climate action planning work.



*Cost-effectiveness:* Investment will likely be needed for more than 10 years. However, upfront investment in planning to improve resiliency provides a net benefit<sup>7</sup>, and reduces the future costs associate with responding to climate impacts.

*Co-Benefits:* Increasing the capacity to do climate planning can improve all outcomes of climate work, including reducing emissions and sequestering atmospheric carbon, in addition to improving resilience. Other co-benefits include improving public health outcomes, reducing the health risks from climate change impacts, reducing financial losses from climate change impacts, improving economic stability, and protecting natural resources.

*Technical Feasibility:* Yes

156

157 **3. Expand cross-sector collaboration to align efforts, share best practices, and**  
158 **leverage resources to advance resilience and preparedness efforts statewide.**

159 To best meet the challenge of preparing Vermont’s communities, infrastructure, businesses and  
160 residents to be more resilient to the impacts of climate change, we need an “all-in” approach to  
161 sharing information on climate impacts, collaborating to identify solutions and opportunities, and  
162 aligning efforts towards resiliency goals. A diverse group of stakeholders and partners, including  
163 non-profits, community organizations, public entities, business, and industry is needed to engage  
164 in the work of planning for climate resilience. The diversity of perspectives, priorities, and lived  
165 experiences can help to ensure that assessments of climate impacts and vulnerabilities is  
166 comprehensive, solutions that have broad benefits and support can be quickly elevated, and  
167 resources can be effectively leveraged to make progress towards resiliency goals. Any forums in  
168 which collaboration on climate planning occurs should be designed with, and designed to be  
169 inclusive of and welcoming to those most impacted by climate change.

170 **Actions**

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<sup>7</sup> Research by the Global Center on Adaptation estimates that every dollar spent on adaptation results in between \$2 and \$10 of net benefits. [https://gca.org/wp-content/uploads/2019/09/GlobalCommission\\_Report\\_FINAL.pdf](https://gca.org/wp-content/uploads/2019/09/GlobalCommission_Report_FINAL.pdf)

- 171 a. Identify and develop new programs to address the full range of climate impacts,  
 172 especially those that impact important Vermont industries, including drought, less or  
 173 irregular snowfall, and shorter or irregular sugaring season.  
 174 b. Complete a Statewide climate change impact assessment for Vermont’s commercial  
 175 sector and natural resource based industries including but not limited to the ski, sugaring,  
 176 and logging industries.<sup>[OBJ]</sup>

<i>Preliminary Assessment of Strategy against Criteria</i>
<i>Impact:</i> Ongoing and collaborative work to assess and plan for the full range of climate impacts and vulnerabilities, across communities, business sectors and natural resources leads to better informed, resourced, and effective programs that improve Vermont’s resiliency to climate change impacts.
<i>Equity:</i> Cross sector collaborations should have the ability and expertise to integrate the principles of the Just Transitions recommendations into their collaborative processes. The validity of any of cross-sector collaborations for climate planning should consider the extent to which Just Transition principles were included in the collaborations, and are reflected in any outcomes of cross-sector collaborations.
<i>Cost-effectiveness:</i> Cross-sector collaboration is an enabling investment that ensures better return on investment of climate action by aligning stakeholders behind common information, goals and objectives, and leveraging private investment in climate action <sup>[OBJ]</sup> . S <sup>8</sup> investment in staff time and research and analysis support to organize and manage engagement with stakeholders over climate planning issues will be needed, and cross-sector collaboration will likely be needed for more than 10 years. However, upfront investment in planning to improve resiliency reduces the future costs associated with responding to climate impacts.
<i>Co-Benefits:</i> Supporting cross-sector collaboration in climate planning can improve all outcomes of climate work, including reducing emissions and sequestering atmospheric

<sup>8</sup> <https://openknowledge.worldbank.org/bitstream/handle/10986/35203/Enabling-Private-Investment-in-Climate-Adaptation-and-Resilience-Current-Status-Barriers-to-Investment-and-Blueprint-for-Action.pdf?sequence=5&isAllowed=y>

carbon, in addition to improving resilience. Other co-benefits include improving public health outcomes, reducing the health risks from climate change impacts, reducing financial losses from climate change impacts, improving economic stability, and protecting natural resources.

*Technical Feasibility:* Yes

177

178 **4. Increase community participation in local governance and support civic**  
179 **engagement and citizen involvement.**

180 Regular and inclusive opportunities for meaningful citizen engagement can help to ensure that  
181 climate planning is informed by and responsive to a broader audience of Vermonters. Identifying  
182 existing channels for community engagement, coming prepared to listen instead of present or  
183 convince, and being clear about how feedback and ideas will be reflected in ongoing climate  
184 work can help to encourage broader participation in climate planning. Forums in which  
185 collaboration on climate planning occurs should be designed with, and designed to be inclusive  
186 of and welcoming to those most impacted by climate change.

187 **Actions**

- 188 a. Require remote meeting options, including a call-in option for all meetings of public  
189 bodies; allow fully virtual meetings of public bodies with guidelines similar to the state of  
190 emergency's; evaluate options for online collaboration in preparation for a meeting that  
191 can be done with transparency.

*Preliminary Assessment of Strategy against Criteria*

*Impact:* Providing remote meeting options for meetings of public bodies, where critical conversations happen and decisions are made, enables more equitable opportunities to participate, and can encourage participation from those who may not be comfortable or able to attend in person meetings.

<p><i>Equity:</i> Providing remote participation options for public meetings is a good foundation for providing more equitable opportunities for civic participation in governance. Additional tools and support will be needed to ensure public meetings are design and run so that participants have a similar experience in the meeting, regardless of the method of participation. In addition, equitable participation in governance requires equity in opportunities to engage beyond remote options for public meeting. For example, resources and information should be made available in languages other than English.</p>
<p><i>Cost-effectiveness:</i> Providing call in options is a low-cost action, that can be accomplished with the tools already used by most entities that run public meetings.</p>
<p><i>Co-Benefits:</i> Increasing the capacity to do climate work improves all outcomes and co-benefits of climate work.</p>
<p><i>Technical Feasibility:</i> Yes</p>

192

193 **PATHWAY 2: Proactively and strategically invest to enhance resilience in**  
 194 **transportation, communications, water/wastewater, and energy infrastructure**  
 195 **statewide.**

196 The strategies and actions supporting this pathway will improve the resilience of the State’s  
 197 transportation, electric, and water infrastructure systems to climate change threats. All three  
 198 sectors are considered critical infrastructure, which is defined in the Vermont Infrastructure  
 199 Protection and Resilience Plan as “...public and private sector systems and assets, whether  
 200 physical or virtual, that are so vital their incapacity or destruction would have a debilitating  
 201 effect on the security, economy, public health or safety, environment, or any combination of  
 202 these matters across any Federal, State, regional, territorial or local jurisdictions.” Another way  
 203 of describing criticality is that these infrastructure sectors are essential to supporting the  
 204 resilience of communities, which are the ultimate users of the services they provide. The  
 205 strategies and actions below do not specifically address other energy infrastructure, such as fuel  
 206 depots or natural gas distribution networks, that support thermal heat for buildings and fuel for  
 207 transportation or other uses. However, the resilience of other energy infrastructure to climate

208 change will improve due to the strategies and actions below to the extent their operation depends  
209 on electricity and the transportation system. General information on the three sectors is provided  
210 below. Additional work is required to develop actions specific to communications, which will  
211 require engaging with the private sector owners of those services and related infrastructure  
212 systems.

## 213 **Electric**

214 The electrical grid in Vermont includes Transmission, Sub-Transmission, and Distribution  
215 facilities that transmit and distribute energy into, out of, and throughout Vermont, both from  
216 larger generation resources and local distributed generation resources. Vermont's electric grid  
217 has become a bi-directional conduit for electrical energy that serves residential, commercial, and  
218 industrial customers throughout the state.

219 Vermont has 17 electric distribution utilities (one investor-owned, two cooperatives, and 14  
220 municipal electric utilities), with each having an exclusive service territory serving in total over  
221 648,000 Vermont residents throughout the state. All Vermont distribution utilities own electric  
222 distribution facilities, and some own transmission facilities. Vermont also has a statewide  
223 transmission operator, the Vermont Electric Power Company (VELCO). Vermont electric  
224 utilities are fully regulated vertically integrated, meaning they can own and operate generation  
225 facilities.

226 Vermont's grid serves the electric needs of its citizens, in that it is the "highway" for electricity  
227 to flow from generators to load to meet demand every hour of the year. The grid has and will  
228 continue to become more critical in terms of both safety in a less forgiving climate as well as a  
229 key ingredient of decarbonization as we transition our thermal and transportation sectors off  
230 fossil fuels, primarily to fuel-switching to electricity.

231 Vermont's grid has become increasingly susceptible to climate-change induced severe weather,  
232 mainly due to the rural nature of our landscape and our unique geography locally in the  
233 northeastern U.S. Threats to the grid include more frequent, stronger storms, high winds, ice, and  
234 heavy, wet snowstorms along with more frequent flooding from a large increase in extreme  
235 precipitation events. As Vermonters come to rely increasingly on electricity for heating and

236 transportation, doubling down on grid resilience to keep pace with a changing climate will be  
237 essential.

## 238 **Transportation**

239 Vermont's transportation system includes 14,174 miles of public roadways of which 2,700 miles  
240 are maintained and operated by the Vermont Agency of Transportation. The balance of the  
241 highway system is managed by Vermont's 251 municipalities. Non-highway infrastructure and  
242 services include seven regional public transit operators providing nearly 5-million rides annually,  
243 578 miles of active rail lines, 305 miles of which are owned by the state, and 16 public airports,  
244 10 of which are owned by the state. The Agency of Transportation oversees 140 miles of rail-  
245 banked rail-trails and municipalities provide and maintain many more miles of sidewalks,  
246 shared-use paths and other pedestrian and bicycle facilities.

247 The transportation system is critical to the state's economy and quality of life and is essential for  
248 emergency response. It provides access to jobs and mobility for the movement of goods and  
249 services that are essential to Vermont businesses, brings tourists and other visitors to the state,  
250 provides access for residents' daily activities, and delivers food and other products that  
251 Vermonters need for everyday living.

252 The transportation related actions listed below emphasize resilience to damage from flooding and  
253 fluvial erosion, climate change threats which are identified by the 2018 Vermont State Hazard  
254 Mitigation Plan as the highest-ranking hazard in the state. The transportation system is also  
255 challenged by other incremental climate change threats such as more frequent freeze and thaw  
256 cycles, increasing mixed precipitation events, and greater variations between high and low  
257 temperatures which reduce service life and affect on-going maintenance and operational  
258 activities like snow removal.

## 259 **Water**

260 Water infrastructure is a critical support for a climate resilient society. Traditional water  
261 infrastructure consists of drinking and wastewater treatment and collection/distribution systems  
262 and their related appurtenances. Green infrastructure consists of engineered systems in developed  
263 lands that endeavor to mimic natural hydrology functions, by attenuating and treating ever-

264 increasing stormwater flows, by using engineered wetlands to treat wastewater, and/or by using  
265 reclaimed water for landscape irrigation. Green stormwater infrastructure improves groundwater  
266 recharge, reduces flood scour, and limits sediment and nutrient pollution that kills fish in streams  
267 and rivers and produces harmful algal blooms in lakes and ponds. Green infrastructure also  
268 includes distributed or decentralized water supply and wastewater treatment infrastructure which  
269 can mitigate disruption of services by isolating climate-induced impacts. Natural infrastructure  
270 consists of existing or restored natural systems managed to provide for water storage and natural  
271 water purification, while promoting carbon storage. Human capital, in the form of a thriving  
272 environmental services sector is critical to the development, management, operation, and  
273 maintenance of all forms of water infrastructure, and must not be ignored as a key component of  
274 climate resilience.

275 Water infrastructure is regulated at the state level, and State agencies such as the Department of  
276 Environmental Conservation also provide significant financing and technical assistance  
277 resources. Municipalities and private entities are largely responsible for the operation,  
278 maintenance, and improvement of grey and green infrastructure, while non-profits typically  
279 administer the acquisition and restoration of natural infrastructure. Most natural and municipal  
280 infrastructure are publicly funded and financed with state, federal, or ratepayer dollars. The  
281 human capital necessary to support resilient water infrastructure cuts across the public, private,  
282 and non-profit sectors, and collectively should be considered a small but growing economic  
283 sector in its own right in Vermont.

284 All forms of water infrastructure are threatened by climate impacts, particularly flooding, and  
285 also drought. Public drinking water systems should be designed to accommodate climate change  
286 impacts, such as more droughts and more wet periods. Wellhead protection areas should take  
287 these swings into account and can be integrated into land conservation and recreation objectives.

288 During Irene, many municipal drinking and wastewater systems were disrupted or even lost due  
289 to the floods. While some of this infrastructure was restored, many systems, especially  
290 wastewater and stormwater systems, remain necessarily located in flood prone areas. In most  
291 municipalities served by public water systems and wastewater treatment facilities, the cost and  
292 complexity of moving water from source, to tap, to toilet, then treatment is minimized by the fact  
293 that water is typically pumped to a high location, then gravity-fed downhill from tanks and

294 standpipes to treatment. During flooding, upland drinking water reservoirs may experience  
295 undue water loading threatening the integrity of their dams, while wastewater treatment facilities  
296 or water supply wells located in floodplains may be adversely affected by inundation or erosion.  
297 During drought, drinking water supply systems are not able to keep pace with demand,  
298 necessitating reliance on lesser-quality sources, or even hauling of water by truck. One alarming  
299 manifestation of drought on public water supply is the diminishment of sufficient volumes of  
300 water to support fire suppression; a significant threat to towns.

## 301 **Strategies**

### 302 **1. Create a policy, planning and organizational foundation to support** 303 **effective investments in infrastructure resilience.**

304 A common theme for transportation, energy and water infrastructure is a need to better  
305 understand the threats and vulnerabilities caused by climate change, and how to use that  
306 information to guide decision-making and investments that improve resilience in an equitable  
307 and cost-efficient manner. State agencies would be the designated lead for almost all of these  
308 actions and most could be implemented within two years with adequate funding and dedication  
309 of staff resources. Although state agencies would lead most of these actions, they would have to  
310 be carried forward in collaboration with other stakeholders. Because these actions are laying the  
311 foundation for decision making, they provide an opportunity to incorporate equity from the start.

#### 312 **All Infrastructure Sectors**

- 313 a. Develop a vulnerability index methodology and tool for broad use by stakeholders to  
314 identify priority areas for investment. The index will account for the vulnerability  
315 communication, energy, transportation and water infrastructure in addition to  
316 socioeconomic and equity factors that affect community resilience.
- 317 b. Update or adopt as appropriate infrastructure planning and design standards to reflect  
318 impacts from a changing climate, such as more frequent extreme weather as well as an  
319 increasing range of high and low temperatures, freeze/thaw cycles, and mixed  
320 precipitation (harden, incorporate redundancies, maximize life span, reduce annual  
321 maintenance and operational costs. etc.)



322 **Electric**

- 323 c. Seek federal stimulus (ARPA), infrastructure bill, and other non-ratepayer funding to  
324 defray costs of utility resilience upgrades that exceed benefits to ratepayers, such as:
- 325 • Ubiquitous communications networks that enable full utilization and participation of  
326 distributed energy resources in an interactive grid.
  - 327 • Resiliency Zones: batteries installed at or near critical facilities, potentially paired  
328 with solar (and/or small wind) and with a microgrid /islanding where possible, to  
329 allow them to continue to operate in the event of extended disruptions to electric  
330 service.
  - 331 • Strategic upgrades to substations, distribution, and transmission capacity across the  
332 Vermont grid needed to enable the state’s renewable and electrification goals, after  
333 first exploring feasibility of any lower-cost options, e.g. flexible load management,  
334 curtailment, and storage.
  - 335 • Emerging non-wires technologies that address major challenges system resilience  
336 (e.g. long-duration outages).
- 337 d. Create a framework for identifying and evaluating climate resilience threats and impacts  
338 to energy systems serving rural communities.

339 **Transportation**

- 340 e. Complete the flood vulnerability assessment of all bridges, culverts and road segments on  
341 the state and town highway systems, identify and prioritize needed investments. This  
342 action includes completing the statewide expansion of the Transportation Resilience  
343 Planning Tool.
- 344 f. Complete a flood vulnerability assessment of state-owned rail infrastructure to identify  
345 and prioritize needed improvements
- 346 g. Incorporate GHG reduction goals and CAP strategies, and actions related to resilience in  
347 the VTrans transportation planning and project development process.

348 **Water**

- 349 h. Increase funding for floodplain restoration, including buy-out programs

- 350 i. Increase investment to municipalities to support reductions in inflow and infiltration into  
351 wastewater collection systems.
- 352 j. Examine the climate impacts of sludge and biosolids to determine if regional facilities  
353 can reduce utility costs and climate impacts. Support investment in strategically placed  
354 facilities for sludge and septage processing (much is currently trucked to  
355 Montpelier/Chittenden Co.)
- 356 k. Increase investment to municipalities to support reductions in inflow and infiltration into  
357 wastewater collection systems.
- 358 l. Increase efforts and funding towards pollution prevention programs at wastewater  
359 facilities to ensure that facilities protect available treatment capacity, which can focus  
360 development on already-served designated centers.
- 361 m. Understand source water vulnerabilities and invest in planning efforts to assist  
362 communities, especially those that are vulnerable for their long-term water supply needs.  
363 Revamp funding programs for source protection programs, increase funding for programs  
364 (include existing and new water sources) and conservation easements
- 365 n. Increase the number of public water systems and publicly owned wastewater treatment  
366 works implementing an asset management program. Expanding programs, funding  
367 opportunities, and incentives to develop and implement these programs.
- 368 o. Continue investments in traditional and green infrastructure to intercept, sink and treat  
369 stormwater.
- 370 p. Encourage adoption of low impact development regulations for municipal zoning,  
371 including low water usage landscaping practices and increased density outside of flood  
372 prone areas.

<i>Preliminary Assessment of <u>Strategy</u> against Criteria</i>
<i>Impact:</i> This strategy will have a significant positive impact by providing a foundation of information about climate change threats and vulnerabilities, and how to use that information to guide decision-making and investments in an equitable and cost-efficient manner.
<i>Equity:</i> This strategy is supported by actions that provide opportunities for the early involvement of marginalized communities in the process to identify climate changes threats to infrastructure, prioritizing needs, and identifying equitable solutions.

<i>Cost-effectiveness:</i> This strategy is highly cost effective because it will help guide the efficient allocation of resources.
<i>Co-Benefits:</i> This strategy will address both resilience and adaptation and to a lesser extent GHG reduction.
<i>Technical Feasibility:</i> Yes

373

374 **2. Public, private, and nonprofit entities should be prepared to respond and**  
 375 **recover quickly to disruptions caused by severe weather and other climate**  
 376 **change threats.**

377 Since it is not possible to eliminate all vulnerabilities in transportation, energy and water  
 378 infrastructure, the ability to respond quickly to major disruptions caused by climate change, such  
 379 as flooding events, will always be a critical component to providing resilient infrastructure.  
 380 There is only one high priority action included below due to the extensive experience of  
 381 Vermont Emergency Management and all the other state agencies, regional planning  
 382 commissions, municipalities, utilities, and others have in responding to and recovering from  
 383 disasters.

384 **All Infrastructure Sectors**

- 385 a. Strategically integrate planning and preparedness across disciplines and geographies  
 386 addressing the interdependencies of transportation, energy, communications, and other  
 387 systems.

<i>Preliminary Assessment of Strategy against Criteria</i>
<i>Impact:</i> This strategy and action have a significant positive impact because they will improve the ability to respond quickly and effectively to severe weather and other disasters and other disruptions.
<i>Equity:</i> Integrating planning and preparedness creates an opportunity to determine how equity can be incorporated into emergency response.
<i>Cost-effectiveness:</i> Highly cost effective because the potential benefits are significant while the cost to implement better coordination is relatively low.

*Co-Benefits:* Primarily focused on resilience.

*Technical Feasibility:* Yes

388

389 **3. Increase the resilience of critical infrastructure to severe weather and other**  
390 **climate change threats by reducing vulnerabilities of specific facilities.**

391 Implementation of the actions below would result in projects that improve the resilience of  
392 specific transportation, utility, or water infrastructure. Most of these actions could begin within a  
393 couple of years with sufficient funding and staff resources, would be on-going and would result  
394 in a steady pace of improvements over time.

395 **All Infrastructure Sectors**

396 a. Identify mission critical facilities in collaboration with local and regional planners,  
397 utilities and transportation providers to identify actions, procedures, or investments to  
398 mitigate the impact of extreme weather events to services provided by these facilities  
399 Examples of mission-critical facilities include designated emergency shelters, first  
400 responder facilities, hospitals and other medical facilities, key infrastructure such as  
401 water/wastewater pumping and treatment and sewer, key communications infrastructure  
402 such as fiber nodes, government offices, fuel suppliers, transportation hubs, supermarkets  
403 and other facilities municipalities identify as critical to serving communities during  
404 extreme weather events.

405 **Electric**

406 b. Replace aging electric and communication infrastructure with the most appropriate  
407 resilient alternative when cost effective. For example, during normal replacement  
408 schedules for aging and unreliable lines, evaluate and where cost effective and feasible,  
409 improve resilience by relocating lines underground or through other options.

410 **Transportation**

411 c. Create a transportation flood resilience funding program to meet the requirements and  
412 related funding that are anticipated to be part of the 2021 reauthorization of the federal  
413 transportation act.

414 **Water**

- 415 d. Expand public investment, particularly hazard mitigation funding to flood-proof or  
416 relocate drinking water and wastewater treatment infrastructure at significant risk of  
417 flooding, when flood damaged, or during end-of-life refurbishment.
- 418 e. Work with Vermont villages and property owners to relocate septic systems and public or  
419 private drinking water wells that are at risk due to floods.
- 420 f. Develop programs to achieve net zero energy drinking water and wastewater treatment  
421 facilities including microhydro, solar energy, heat exchange, building envelope; AND  
422 operational and technological efficiencies.
- 423 g. Improve road drainage around lakes / ponds to reduce stormwater runoff and erosion,  
424 especially on municipal roads.

<i>Preliminary Assessment of <u>Strategy</u> against Criteria</i>
<i>Impact:</i> This strategy will lead to incremental improvements in resilience at specific locations that will over time result in significant, real, and cumulative positive impacts on resilience.
<i>Equity:</i> Equity considerations need to be incorporated into the investments supported by this strategy.
<i>Cost-effectiveness:</i> The overall cost effectiveness is medium to high because the impact is significant while the cost to implement is medium to high.
<i>Co-Benefits:</i> The actions supporting this strategy will also support smart growth, improvements to non-auto modes of transportation which will help reduce GHG emissions, and water quality.
<i>Technical Feasibility:</i> Yes

425

426 **4. Increase the resilience of critical infrastructure to severe weather and other**  
427 **climate change threats by improving system efficiency, reliability and**  
428 **redundancies.**

429 While the actions in Strategy 3 focus on specific facilities, this strategy includes actions that seek  
430 to make systemwide improvement in resilience. Actions that lay the groundwork for systemwide  
431 improvements could happen within a couple of years leading to incremental improvements as  
432 specific initiatives are implemented.

433 **All Infrastructure Sectors**

- 434 a. Evaluate the risks and opportunities created by potential climate change in-migration to  
435 VT's critical infrastructure.

436 **Communications and Transportation Infrastructure**

- 437 b. Expand broadband to support remote work and tele-services to reduce the impact of  
438 travel disruptions.

439 **Electric**

- 440 c. Deploy foundational informational and operational technology statewide to enable and  
441 optimize storage and other distributed energy resources (e.g., GridLogic, Virtual Peaker,  
442 other emerging distributed energy resource management systems, in particular those that  
443 are open-source to various technologies and vendors)

444 **Transportation Infrastructure**

- 445 d. Update the 1995 Vermont State Highway Design Standards to create context sensitive,  
446 multi-modal projects that support smart growth per the Act 167 (2014) Sec 26 Report -  
447 VT State Standards Work Plan.
- 448 e. Increase infrastructure investment needed to for walking, biking and transit; support  
449 planning for regional bike corridors to improve safety and transportation options between  
450 community centers. Identify and eliminate barriers to development, including inequities  
451 resulting from match, maintenance and other requirements.

<i>Preliminary Assessment of <u>Strategy</u> against Criteria</i>
<i>Impact:</i> The impact of this strategy is high because it will lead to improvement in system-wide resilience. Also, because these are system-wide investments, they will reach all Vermonters.

<i>Equity:</i> Ensuring equity can be incorporated into the implementation of the actions.
<i>Cost-effectiveness:</i> The actions under this strategy have relatively low implementation costs but their resilience benefits are far reaching.
<i>Co-Benefits:</i> The resilience benefits of this strategy will also help reduce GHG emissions by supporting smart growth, sustainable transportation choices, and distributed energy sources.
<i>Technical Feasibility:</i> Yes

452

453 **PATHWAY 3: Support the reduction of municipal, school district, residential,**  
454 **university, and hospital fossil fuel use in rural areas through equitable best**  
455 **practices that address the unique challenges of rural communities.**

456 In the face of climate change, Vermont’s rural communities are posed with a set of unique  
457 challenges that highlight the need for targeted support and investment for communities and  
458 institutions. Rural communities have limited capacity to respond to climate change impacts, due  
459 in part to limitations in access to community resources<sup>9</sup>. Rural communities also frequently  
460 depend heavily on volunteers to meet community challenges, and often have limited locally  
461 available financial resources to help deal with the effects of climate change<sup>10</sup>. As Vermont plans  
462 for a reduction in fossil fuel use to meet its GHG mitigation requirements, specific policies and  
463 programs will be needed to assist rural communities in the transition to a carbon-free future.

464 Schools, universities, hospitals, businesses, and municipal organizations make up the main  
465 building blocks of Vermont’s rural communities. The size, scope, and variety of each one’s fossil  
466 fuel use varies across the state, as does each one’s capacity and willingness to reduce fossil fuel  
467 use; the same is true regarding residential energy use. Thermal energy use, or heat, in buildings  
468 currently accounts for 34 percent of Vermont’s greenhouse gas emissions, largely from burning  
469 fossil fuels: fuel oil, kerosene, natural gas, and propane. The transportation sector currently

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<sup>9</sup> USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. <https://nca2018.globalchange.gov/chapter/10/>

<sup>10</sup> USGCRP, 2014: Chapter 14: Rural Communities, Climate Change Impacts in the United States: The Third National Climate Assessment. [https://nca2014.globalchange.gov/downloads/low/NCA3\\_Full\\_Report\\_14\\_Rural\\_Communities\\_LowRes.pdf](https://nca2014.globalchange.gov/downloads/low/NCA3_Full_Report_14_Rural_Communities_LowRes.pdf)

470 accounts for 40 percent of Vermont’s GHG emissions<sup>11</sup>. Rural communities are often faced with  
471 a limited capacity at the municipal government level to take on new projects and programs.  
472 Coupled with the reality that rural communities rely heavily on single occupancy vehicles to  
473 access goods and services, and that the transportation sector makes up the largest portion of  
474 Vermont’s greenhouse gas emissions, special attention should be paid to how rural communities  
475 and institutions access programs and resources, financial and otherwise, that allow them to lower  
476 their greenhouse gas emissions.

477 Equipping Vermont’s rural communities with the appropriate support to reduce the use of fossil  
478 fuels will require significant support and investment. Tools are needed for municipalities and  
479 institutions to understand and educate on fossil fuel use and the economic benefits of  
480 electrification in their communities, while additional resources are needed to expand access to  
481 programs that focus on under resourced communities. Developing and supporting programs that  
482 give Vermont’s rural communities a leg up on the transition to a carbon-free future will create  
483 long lasting benefits for Vermont’s communities, Vermonter’s quality of life, and the ability of  
484 rural communities to adapt to the changes imposed by climate change.

## 485 **Strategies**

### 486 **1. Provide tools and resources to help assess data needs and establish best** 487 **practices for rural communities, businesses, and institutions to reduce fossil** 488 **fuel use.**

489 The reduction of fossil fuel use in the transportation, and buildings and thermal sectors will both  
490 increase a community’s ability to withstand the impacts of climate change, while also decreasing  
491 overall statewide greenhouse gas emissions, lowering the possibility of worsening climate  
492 impacts in the future. Additionally, and importantly, the transition to electric forms of  
493 transportation, heating, and cooling will also offer long term financial savings for communities.  
494 For communities to plan appropriately for decreasing fossil fuel use across sectors, data on

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<sup>11</sup> Vermont Agency of Natural Resources, Vermont Greenhouse Gas Emissions Inventory and Forecast (1990-2017), May 2021. [https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/Vermont\\_Greenhouse\\_Gas\\_Emissions\\_Inventory\\_Update\\_1990-2017\\_Final.pdf](https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2017_Final.pdf)



495 current fossil fuel use is needed at the municipal level to support planning and assessment of  
496 needs.

497 Initiatives to collect data for use at the municipal level have been undertaken in the past, some  
498 with the support of Regional Planning Commissions (RPCs). For example, in 2009 RPCs on a  
499 statewide effort used DOE American Recovery and Reinvestment Act (ARRA) funding to  
500 provide energy audits and management of energy efficient implement projects for municipal  
501 buildings. The Windham Regional Commission has continued this work by creating a guide for  
502 municipalities to use to weatherize their buildings<sup>12</sup>. Barriers to data access should continue to be  
503 identified as communities and institutions examine their fossil fuel use and plan for transitions to  
504 cleaner energy sources. In addition, best practices will need to be identified, such as the example  
505 provided above, to help guide communities on their transition away from fossil fuel use for  
506 heating and transportation. Initiatives such as the example provided will need to be expanded  
507 upon to provide equal access to data on energy use, and assistance to implement best practices on  
508 energy efficiency and electrification across communities.

## 509 **Actions**

- 510 a. Require the collection of fossil fuel usage data for municipal operations ~~at the municipal~~  
511 ~~level~~ for buildings, vehicle fleets, and utilities; identify data gaps and ways to collect that  
512 data for measuring change in fossil fuel use going forward.
- 513 b. Ensure data on fossil fuel usage at the municipal level is available and accessible in one  
514 location for municipal and public use.
- 515 c. Engage higher education institutions to actively participate in developing systems to  
516 gather, compile, update, extrapolate fossil fuel data and make that available to the public.
- 517 d. Identify, develop, and share best practices for reducing municipal, school district,  
518 residential, commercial, and industrial fossil fuel consumption. Identify and assess  
519 existing practices and note gaps.

*Preliminary Assessment of Strategy against Criteria*

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<sup>12</sup> <http://www.windhamregional.org/images/docs/publications/weatherizing-town-buildings.pdf>.

<p><i>Impact:</i> Data is needed in order to assess the impact that other measures have on GHG mitigation, fuel switching, and energy efficiency. Having a system in place to gather and track fossil fuel usage data at the municipal level, as well as best practices for municipalities to implement for reduction of fossil fuel use, are action that enables other actions that help Vermont reach its GHG mitigation requirements.</p>
<p><i>Equity:</i> To enhance equity of this strategy, traditionally underserved and impacted communities will be identified, and their input will be solicited on equitable practices for data collection, display of data, and accessibility of data. As this strategy is implemented, consideration should also be given to how this data is shared and explained to traditionally underserved and impacted communities, so the impact of data collection is clear. Implementation should ensure data gathering and explanation of data is translated into other languages, and that best practices are tailored to impacted communities.</p>
<p><i>Cost-effectiveness:</i> This strategy would likely have a moderate cost, meaning some of the actions needed for this strategy would need a new revenue source for a short-term period. Actions under this strategy do have an overall high impact, meaning this strategy results in an overall high ranking for cost-effectiveness. This strategy would help establish a baseline that would educate communities and reduce confusion around fossil fuel use. In the long term, this would save time and effort in planning initiatives and would further enable the work of future projects needed to decrease fossil fuel usage.</p>
<p><i>Co-Benefits:</i> Data collection at a municipal level would have broad co-benefits across GHG emission reduction and climate resilience and adaptation initiatives. By involving high education institutions in the collection of data, co-benefits across educational initiatives could be seen. In addition to data collection, establishing best practices for communities to reference could add to benefits in public health due to reduction of the use of fossil fuels. In addition, broad benefits for community planning projects could be realized due to easily accessible data.</p>
<p><i>Technical Feasibility:</i> Yes</p>

520

521 **2. Equitably expand access to programs that provide options to rural**  
522 **homeowners, landlords, municipalities, school districts, universities, and**  
523 **hospitals for weatherization, electrification, and utility upgrades.**

524 In addition to access to fossil fuel use data at the municipal level that allows for planning and the  
525 local level, existing programs that support weatherization, electrification, and utility upgrades  
526 will need to be expanded to provide equitable access to communities and institutions. Programs

527 that provide several options for weatherization, electrification, and utility upgrades to  
528 homeowners, renters, landlords, municipalities, school districts will be needed as Vermont works  
529 towards meeting its GHG reduction requirements. Especially in rural communities where access  
530 and knowledge of program may be more limited than in urban areas, an increased focus should  
531 be placed on education and access to local, regional, statewide, and federal programs that  
532 incentivize and promote a move away from fossil fuel use. Many of the actions listed below will  
533 require additional funding and third-party financing resources and represent a variety of  
534 stakeholder that will need to be engaged to implement these initiatives.

### 535 **Actions**

- 536 a. Ensure that there is broad and statewide public education and promotion of benefits,  
537 economic and otherwise, and opportunities for fossil fuel reduction.
- 538 b. Evaluate all existing state-funded programs for effectiveness, access, and equity and  
539 consider increased funding for weatherization, energy efficiency and electrification  
540 programs in order to expand access to all Vermonters, and to expand programs with zero  
541 up-front costs. Existing programs may include ~~the VEIC Property Assessment Clean~~  
542 ~~Energy (PACE) program~~<sup>13</sup>, Efficiency Vermont rebates, HEAT Squad - NeighborWorks  
543 of Western Vermont home energy audit program, and the Shared Equity program<sup>14</sup>. In  
544 addition, the private sector should be engaged to provide innovative third-party financing  
545 opportunities that are paid for over time by the customer.
- 546 c. Explore Commercial PACE (Property Assessment Clean Energy) program for municipalities and  
547 other programs to elevate, such as *bonding to support a statewide Tariffed On-Bill Finance Pilot*  
548 *and funding for a revolving loan fund for Public-Serving Institutions with retrofits. There may also*  
549 *be a need to continue providing the funding to support interest rate buydown (IRB) in EVT's*  
550 *Home Energy Loan and Business Energy Loan programs.*
- 551 d. Create new educational programs so existing energy efficiency, electrification, and utility  
552 upgrade programs may increase their public education and outreach.

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<sup>13</sup> <https://www.encyvermont.com/Media/Default/docs/services/efficiency-vermont-financing-PACE-eligible-measures-form.pdf>

<sup>14</sup> <https://vhcb.org/our-programs/housing/home-ownership>

- 553 e. The Public Service Department should ensure that all utilities provide similar  
554 opportunities for all customers (rebates, incentives) to encourage fossil fuel reduction,  
555 electrification, and energy savings.
- 556 f. Increase low-income weatherization through the State Weatherization Assistance  
557 Program including technical assistance to help households and landlords manage the  
558 process.
- 559 g. Entities that provide rebates for weatherization should stabilize rebate values year to year.
- 560 h. Expand workforce development programs such as the VT Training Program or the  
561 Department of Labor’s Workforce Education & Training Fund; cover costs for businesses  
562 to train in-house auditors/technicians. Pilot new programs in rural areas where workforce  
563 needed is greater.
- 564 i. Revise state building energy codes and standards to require a minimum 200 Amp service  
565 for new construction as electrification expands.
- 566 j. Provide funding to assist low-income homeowners to upgrade electric service to 200  
567 Amps. Electric utilities and renewable energy developers could provide new incentives  
568 and financing options through third-party financing mechanisms, on bill financing, RES  
569 Tier III incentives<sup>15</sup>, third-party power purchase agreements, and grants. All programs  
570 must include equal access to renters.
- 571 k. Implement a statewide program to support electrification of municipal fleet vehicles  
572 ensuring it is designed to allow equitable access and participation to municipalities  
573 regardless of tax base.
- 574 l. Support water and wastewater systems in conducting and implementing energy audits  
575 and recommendations for energy reduction and electrification.
- 576 m. Develop cost-effective programs to support renewable energy development on school and  
577 other municipal property, and evaluate and eliminate unnecessary statutory barriers  
578 related to capital financing and land purchase/lease.
- 579 n. Help individuals, municipalities, and businesses through the process of weatherization,  
580 energy efficiency and fuel switching upgrades by establishing and funding

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<sup>15</sup> <https://publicservice.vermont.gov/content/tier-iii-renewable-energy-standard#:~:text=Tier%20III%20%E2%80%93%20Energy%20Transformation&text=For%20Tier%20III%2C%20the%20RES,until%20reaching%2012%25%20in%202032.>

581 Weatherization and Efficiency Navigators at each Regional Planning Commission (RPC),  
 582 expanding the services currently available at CAP agencies and VEIC, and ensuring  
 583 coordination and a whole systems approach among the entities providing services. to .  
 584 o. Review and expand existing programs to support landlords in weatherizing rental  
 585 properties, including St. Johnsbury Rental Housing Improvement Program, and other  
 586 programs in counties and towns<sup>16</sup>.

<i>Preliminary Assessment of Strategy against Criteria</i>
<i>Impact:</i> The expansion of programs that provide weatherization, electrification, and utility benefits to communities and institutions will have a tremendous impact on Vermont’s overall ability to mitigate greenhouse gasses and be more resilient to climate change impacts. The actions under this strategy would impact broad change, reaching to town governments, institutions, businesses, and individuals.
<i>Equity:</i> While the programs referenced in the actions under this strategy are broad ranging, traditionally underserved and impacted communities must be identified, and their input solicited on the expansion and creation of these programs. These communities include smaller, less capable municipalities, low-income homeowners, renters, individuals without homes, and those who have high transportation burdens. Low-income and minority households tend to pay higher prices per unit of energy due to less efficient homes, so special attention should be paid to the expansion of existing programs and how benefits can be shared or targeted to help frontline and impacted communities.
<i>Cost-effectiveness:</i> Adding resources to strengthen existing and creation of new weatherization, electrification, and energy efficiency programs will require some up-front investment. However, due to the lifetime net cost decrease over time, the upfront investment will result in more affordable systems of energy for communities and institutions.
<i>Co-Benefits:</i> Increasing the capacity of existing weatherization, electrification, and utility upgrade programs will have long term benefits for not only reduction of GHG emissions, but co-benefits in resilience and adaptation. Increasing the capacity of weatherization programs would bring added health co-benefits due to the decreased cost of heating and cooling, reduction of pest infiltration, and measures to reduce excess moisture that impact respiratory health. Weatherization and energy efficiency programs have the potential to decrease the overall cost of fuel for households, which would have a significant impact on low-income and minority households who tend to pay higher prices for fuel. Switching to more efficient technologies has co-benefits for all those who pay energy bills - tax payers, business owners, institutional leaders,

<sup>16</sup> <https://accd.vermont.gov/housing/resources-rules/renters-landlords>

landlords, homeowners. Co-benefits also accrue to the economy: forest industry, contractors, utilities, energy businesses.

*Technical Feasibility: Yes*

587

588 **PATHWAY 4: Change Vermont's land-use policies so current and future land**  
589 **development will be adaptive and resilient to climate change impacts**

590 How Vermont chooses to use its land-based resources will have a significant impact on our  
591 ability to create and maintain resilient communities and natural resources. Vermont's current  
592 approach to land use planning is decentralized and relies on voluntary adoption and  
593 implementation of land use policy at the municipal and regional scale. The political and  
594 operational capacity to implement land use policies varies widely among municipalities and  
595 regions. This results in a patchwork of inconsistent local and regional land use policies to  
596 regulate and guide current and future land use.

597 These inconsistencies compromise the ability of the State to implement land use policy that also  
598 meets climate goals, and raises equity and environmental justice concerns. Municipalities and  
599 regions with the most political and operational capacity can direct land use policy to be formed  
600 in a way that does not share the burdens and benefits of land use decisions that meet Statewide  
601 community needs. If an adaptation and resilience strategy or action is deemed essential, it is  
602 necessary for the state to give objective consideration to what level of government has the ability  
603 and capacity for actual implementation in a timely manner, and what partnerships are necessary  
604 for effective execution.

605 **Strategies**

606 **1. Increase investment in the infrastructure (sewer, water, stormwater,**  
607 **sidewalks, bike lanes, EV charging, broadband, energy supply) needed to**  
608 **support communities that are more resilient to climate disruptions, equitable,**  
609 **resource efficient, and protects the adaptive capacity of natural resources.**

610 Investment in infrastructure is essential to make our existing communities more resilient to  
611 climate change hazards, including precipitation events that are forecast to become more frequent  
612 and intense. Many of Vermont's villages and downtowns were settled in locations to harness  
613 water power, which also puts them at risk for flooding and, in some cases, fluvial erosion. Many  
614 of the actions recommended here address the well documented risks of flooding and impact to  
615 our water supply and management systems. Additional work will be needed to identify other  
616 climate risks, and the infrastructure investments that can make communities more resilient to  
617 them. For example, as we better understand localized risks and vulnerabilities of our power  
618 distribution systems, additional recommendations for investing in infrastructure that can improve  
619 a community's resilience in the event of power outages will need to be developed. tMunicipal  
620 plans and bylaws are important regulatory tools to reduce vulnerabilities, particularly to flooding,  
621 but it is the presence of foundational infrastructure that will make climate resilient and adaptive  
622 settlement actually possible.

## 623 **Actions**

- 624 a. Revise stormwater permitting as needed to ensure green infrastructure is primary in  
625 design considerations.
- 626 b. Increase investment in stormwater and green infrastructure, including separating  
627 combined wastewater and storm water systems, to protect public health and water quality.
- 628 c. Complete a Climate Readiness assessments of drinking water, stormwater, and  
629 wastewater infrastructure. (This is an EPA tool that looks at all climate impacts  
630 including, fires, droughts, flooding, etc.).
- 631 d. Examine regionalization efforts and sharing of resources for all water utilities.
- 632 e. Invest in enhancing water sources in vulnerable communities to enhance resilience to  
633 long-term drought.
- 634 f. Increase investment to municipalities for new and expanded water and wastewater  
635 facilities to support reductions in inflow and infiltration into wastewater collection  
636 systems.

*Preliminary Assessment of Strategy against Criteria*

<p><i>Impact:</i> Investing in infrastructure than minimizes disruption to climate events improves community-wide resilience to climate change impacts.</p>
<p><i>Equity:</i> Investment in infrastructure should ensure that those most impacted by climate change experience contextual, procedural, corrective, and distributive equity in the implementation of infrastructure investments to address climate change. Due to historic inequities black, indigenous, and low-income communities, people of color, and persons with disabilities are often more vulnerable to climate change. While infrastructure investments can improve resilience, some infrastructure investments have historically caused harm to these communities by siting infrastructure in a way that burdens them with negative environmental consequences and limits or excludes them from receiving the benefits<sup>1</sup>. Infrastructure projects should include the voices of those most impacted by climate change, and work towards correcting past inequity (e.g. lack of investment or representation in infrastructure development) while preventing the exacerbation of existing inequities (e.g. investment cannot lead to displacement).</p>
<p><i>Cost-effectiveness:</i> The investment needed to add or improve infrastructure to support community resilience is likely high, however may be offset by avoided future costs associated with climate impacts. More research and analysis is needed to quantify the cost/savings of investment in infrastructure that improves resilience.</p>
<p><i>Co-Benefits:</i> Many of the infrastructure investments needed to increase resiliency also provide immediate health, economic, and environmental benefits. For example, investment in broadband improves resilience to climate impacts by allowing for better connectivity among community members when physical connectivity is not possible due to road closures. However, it also can improve the economic vitality and social connectivity of a community under non-climate event conditions.</p>
<p><i>Technical Feasibility:</i> Yes</p>

637

638 **2. Develop permanent private and public funding sources to flood-proof,**  
639 **elevate and purchase commercial and residential properties, as well as**



640 **conserve and restore ecosystem services upstream to protect our people,**  
641 **property, environment, and economy from flooding.**

642 Nationally, the FEMA Hazard Mitigation grant programs provide \$7 in avoided costs for every  
643 \$1 invested; however, some communities, particularly rural communities, have not been able to  
644 make use of this funding due to the administrative burden of managing a FEMA award, the lack  
645 of a sustainable funding source to provide the required 25% non-federal funding match, and  
646 limitations within program eligibility. A permanent State funding program for flood hazard  
647 mitigation would enable communities use of federal funds by providing a source of funding for  
648 the required 25% match and funding for the purchase of both structures and easements to  
649 conserve natural areas that are not eligible for federal funding.

## 650 **Actions**

- 651 a. Establish a dedicated, comprehensive state level program with funding to strategically  
652 purchase or match funding for hazard-prone properties, easements to conserve river  
653 corridors, floodplains, forests, and wetlands to reduce overall flood risk and enhance  
654 flood storage statewide.
- 655 b. Expand the eligibility criteria and increase funding for VHCB's conservation and buyout  
656 program, to address any flood-vulnerable structures.
- 657 c. Fund ERAF for non-federal disasters in towns that have adopted floodplain and/or river  
658 corridor bylaws and to support the 25% non-federal match for buyouts and develop  
659 criteria for distribution when funding is limited.

<i>Preliminary Assessment of <u>Strategy</u> against Criteria</i>
<i>Impact:</i> Flooding is a key, known impact that is likely to increase as storms become more frequent and intense in Vermont. Reducing vulnerability to flooding will have a significant impact on individual community members, and the community at large to be resilient to, and recover from flooding events.
<i>Equity:</i> Due to historic inequities black, indigenous, and low-income communities, people of color, and persons with disabilities are often more vulnerable to climate change impacts, such as flooding. Disbursement of these permanent funding sources to mitigate

vulnerability to flooding must ensure that those most impacted by climate change, and especially those also impacted by historic inequity receive the benefits of these funding sources.

*Cost-effectiveness:* The investment needed is likely high, however offset by avoided future costs associated with climate impacts, and the cost of remediating, especially for repetitive flood damages. Hazard mitigation grant provide a \$7 return on investment for every \$1 spent.

*Co-Benefits:* Reducing vulnerability to flooding by flood proofing, buying out high and repetitive risk properties, and improving the natural adaptive capacity of river ecosystems also provides public health benefits by reducing the risk of soil and water contamination, reducing exposure to contaminated flood waters.<sup>17</sup>

*Technical Feasibility:* Yes

660

661 **PATHWAY 5: Ensure that all people have access to safe, accessible, energy**  
662 **efficient, and affordable housing**

663 A home is a basic human need. It provides a foundation for household health and safety,  
664 security, well-being, and prosperity. People that have access to safe, accessible, energy efficient  
665 and affordable housing are more resilient to climate change impacts compared to people who are  
666 unhoused or living in unsafe, isolated, unaffordable or inefficient housing.

667 Today, too many Vermonters, 24% - nearly a quarter - over 150,000 people, are spending more  
668 than 30% of their income on housing. Vermont's housing stock is also old and energy inefficient,  
669 which contributes to the high number of substandard housing units, adds to the cost burden by  
670 increasing the cost of heating and cooling and increases resident health risks. Non-white  
671 households are more heavily burdened by housing challenges. About half of non-white

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<sup>17</sup> <https://www.cdc.gov/healthywater/emergency/extreme-weather/floods-standingwater.html>

672 households experience a housing problem, while one third of white households face housing  
673 problems<sup>18</sup>.

674 Meeting current and future housing needs of residents, businesses, and communities requires  
675 immediate action. Yet it's clear that we also need to change the status quo for housing and  
676 carefully consider how, where and for whom housing is rehabilitated and built, to ensure  
677 equitable, safe and affordable housing that enables resilience to climate change. Locating in  
678 compact walkable centers can also improve resiliency and reduce household costs. Additional  
679 housing actions related to the siting of new housing in compact walkable centers can be found in  
680 Chapter 15, Compact Settlement.

681 While housing insecurity has been a longstanding issue in Vermont, increased migration due to  
682 the coronavirus pandemic exacerbated the housing crisis, causing dramatic increases in housing  
683 competition and prices<sup>19</sup>. This gives us valuable insights into how the housing market  
684 could be affected by climate migration, and presents an opportunity to proactively plan for  
685 housing rehabilitation and development that can meet the demand for housing while improving  
686 the resilience of the people living in it.

687 The housing crisis and the climate crisis are inextricably linked, and Vermont must work through  
688 the tension between expediency and thoughtful planning, all while aligning investments and  
689 regulation to increase the availability of and access to fair, safe, and affordable housing.

## 690 **1. Update state and local land-use governance, regulations, practices, and** 691 **investments to eliminate barriers to housing development**

692 Vermont's Planning and Development Act is one of the State's key tools for influencing where  
693 and how much housing is built. Its housing policies were last update in 2003<sup>20</sup> and do not reflect  
694 the significant shifts in household composition and needs over the last 20 years. Today, 69%<sup>21</sup> of

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<sup>18</sup> The U.S. Department of Housing and Urban Development estimates the number of households with housing problems by identifying households that experience one or more of the following issues; lacking kitchen facilities, lacking complete plumbing, overcrowding, cost burdened.

[https://www.vhfa.org/documents/publications/vt\\_hna\\_2020\\_report.pdf](https://www.vhfa.org/documents/publications/vt_hna_2020_report.pdf)

<sup>19</sup> According to VHFA data, the median Vermont primary home sold for \$259,900 during the first six months of 2021, compared to \$245,000 throughout 2020, a six percent increase.

<https://www.housingdata.org/profile/homeownership-costs/primary-home-sales-ytd>

<sup>20</sup> <http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2004/acts/ACT115.htm>

<sup>21</sup> <https://www.housingdata.org/profile/population-household/household-size>

695 Vermont’s households are one- or two-person households with diverse needs and preferences.  
696 83% % of Vermont’s rental supply is privately owned and an estimated 6,960 of these units are  
697 substandard .<sup>22</sup> Legislation and funding to expand our understanding of the current housing stock  
698 and update the land use and housing provisions will support state, regional, and local planners'  
699 work to create housing that meets peoples’ needs and is safe, affordable and allows them to be  
700 more resilient to climate change impacts. Successful state planning reforms have moved at the  
701 speed of trust through organized and resourced statewide conversations. For Vermont to be a  
702 place where people of all backgrounds can live in a safe and affordable home, state, regional, and  
703 local land use leaders must consider the structures that prevent or welcome diverse, resilient  
704 homes and neighborhoods.

## 705 **Actions**

- 706 a. Increase manufactured housing tax credits to replace older and inefficient manufactured  
707 homes.
- 708 b. Expand the existing program to relocate mobile home park homes and residents outside  
709 of flood vulnerable locations.
- 710 c. Create a rental registry and inspection program to locate all of Vermont's rental housing  
711 and improve their quality and safety.
- 712 d. Expand pilot program to train a network of local builders in the design and building of  
713 small and mid-sized and accessory dwelling units (mother-in-law apartments) and fund  
714 homes starts within communities planning and investing in development-ready  
715 infrastructure, building development partnerships, and updating zoning bylaws to  
716 welcome new homes.
- 717 e. Convene a statewide conversation on the Vermont Municipal and Regional Planning and  
718 Development Act’s (24 VSA, Chapter 117) provisions on land use and housing to outline  
719 amendments and strategies that will expand housing choice, opportunity, and improve  
720 community resilience.

*Preliminary Assessment of Strategy against Criteria*

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<sup>22</sup> [https://vhfa.org/sites/default/files/publications/vt\\_hna\\_2020\\_report.pdf](https://vhfa.org/sites/default/files/publications/vt_hna_2020_report.pdf)

<p><i>Impact:</i> Comprehensive action to remove regulatory barriers and ensure adequate resources can have a significant, cumulative impact on increasing housing projects that increase the availability of safe and affordable housing.</p>
<p><i>Equity:</i> Any changes to land use governance, regulations and practices need to ensure that those most impacted by housing insecurity experience contextual, procedural, corrective, and distributive equity in the implementation of this strategy. Due to historic inequities black, indigenous, and low-income communities, people of color, and persons with disabilities are often more housing insecure. Governance structures, regulations and procedures have explicitly prevented black and indigenous communities and people from accessing affordable and safe housing choices. Changes to governance, regulations and procedures should include the voices of those most impacted by housing insecurity, and work towards correcting inequity in access to housing choices.</p>
<p><i>Cost-effectiveness:</i> This strategy is highly cost-effective, requiring minimal investment to achieve an increase in housing rehabilitation and development over the status quo.</p>
<p><i>Co-Benefits:</i> Co-benefits of updating state and local land-use governance, regulations and practices include improved efficiency in government operations, improved customer service experience for constituents, and better collaborative relationships between stakeholders involved in governance and regulatory processes.</p>
<p><i>Technical Feasibility:</i> Yes</p>

721

722 **2. Increase investments in the preservation and development of both private-**  
723 **market and nonprofit-owned affordable housing.**

724 A recent pilot initiative to remediate vacant, blighted, and unsafe housing units<sup>23</sup> has highlighted  
725 untapped opportunities to revitalize existing and develop new housing by using innovative  
726 funding models to create homes. The pilot provided \$30,000 grants to private property owners  
727 who contributed at least 10% to the home remediation costs, and succeeded in bringing

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<sup>23</sup> According to VHFA, approximately 83% of Vermont’s rental supply is privately owned and an estimated 6,960 of these unites are substandard or vacant.

728 approximately 250 rental homes in existing buildings back online, and with affordability  
729 provisions in place. Future legislation should continue to allocate funding for innovative housing  
730 investments in both rental and owner-occupied housing stock that leverage private initiative and  
731 non-profit innovation.

732 Vermont benefits from a robust network of non-profit housing developers that are committed to  
733 addressing affordability needs in perpetuity. They have often been on the leading edge of  
734 housing development choices that reduce total homeownership costs by meeting high energy  
735 efficiency standards and creating new housing units in locations that reduce driving distance and  
736 travel costs by being closer to jobs and services. These commitments tend to increase cost per  
737 unit when compared to units developed in Greenfields where land and permitting cost are less.  
738 Funding support is needed to ensure these organizations can continue to build housing that also  
739 achieves Vermont’s climate goals.

740 **Actions**

- 741 a. Continue to fund housing investments that leverage private initiative and funding to cost-  
742 effectively create housing units under models like the Re-Housing Recovery Program  
743 funding and the proposed Vermont Housing Investment Program.
- 744 b. Create programs to assist prospective homebuyers to purchase and make improvements  
745 to homes that are energy inefficient and otherwise in need of immediate investment.
- 746 c. Increase support for mission-driven, non-profit housing developers to maintain their  
747 ability to produce high-quality, energy- and location-efficient housing.

<i>Preliminary Assessment of <u>Strategy</u> against Criteria</i>
<i>Impact:</i> Providing direct investment is a significant incentive that enables more housing projects, especially more affordable housing projects, than what would be supported by the private housing market alone.
<i>Equity:</i> Investment in housing should ensure that those most impacted by housing insecurity experience contextual, procedural, corrective, and distributive equity in the implementation of investments to increase housing. Investments in housing has not provided equitable access to housing choice, and the wealth generating benefits of

homeownership. Housing projects should include the voices of those most impacted by housing insecurity, and work towards correcting past inequity (e.g. lack of equitable access to housing choice) while preventing the exacerbation of existing inequities (e.g. investment cannot lead to displacement).
<i>Cost-effectiveness:</i> Public investment that leverages private funds to rehabilitate and build new housing is a highly cost-effective strategy.
<i>Co-Benefits:</i> Access to affordable housing can also improve health outcomes, increase community and civic engagement, and support healthy local economies. Preservation of existing housing can reduce the use of natural resources to create needed housing.
<i>Technical Feasibility:</i> Yes

748

749 **3. Increase access to fair and affordable housing for Vermonters who are**  
750 **housing instable.**

751 People and families who spend more than 30 percent of their income on housing are considered  
752 to be cost burdened, and at risk of facing housing insecurity. Over 24% of Vermont’s households  
753 and more than half of all renters are cost burdened or severely cost burdened<sup>24</sup>. Housing  
754 insecurity disproportionately affects BIPOC communities, older Vermonters, and those living on  
755 low incomes. As rents continue to rise due to increased migration and a tightening supply, more  
756 Vermonters are experiencing homelessness. After many years of thoughtful collaboration  
757 between housing providers, advocacy groups, and lawmakers, the legislature has allocated an  
758 unprecedented \$195 million (Act 74 of 2021) to increase housing stability and prevent future  
759 increases in homelessness. However, finding lasting solutions to Vermont’s housing challenges  
760 requires a sustained effort. For Vermont to be place that welcomes people of all backgrounds, we  
761 must find ways house everyone who needs a home, increase our commitment to racial justice,  
762 and remove discriminatory housing barriers.

763 **Actions**

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<sup>24</sup> <https://www.housingdata.org/profile/income-employment/cost-burden>

- 764 a. Implement the recommendations of the Analysis of Impediments to Fair Housing.
- 765 b. Increase funding for community-based homelessness prevention and rapid re-housing.

<i>Preliminary Assessment of Strategy against Criteria</i>
<i>Impact:</i> This strategy has significant impact on the pathway, ensuring that people are able to access, and do not face barriers to accessing housing that is available.
<i>Equity:</i> Housing insecurity disproportionately affects BIPOC communities, older Vermonters, and those living on low incomes. Those most impacted by housing insecurity experience contextual, procedural, corrective, and distributive equity in the implementation of this strategy.
<i>Cost-effectiveness:</i> Strategies to prevent homelessness and increase access to stable, affordable housing are more cost effective than strategies that provide emergency or transitional housing.
<i>Co-Benefits:</i> Access to stable and affordable housing can improve health outcomes, increase community and civic engagement, and support healthy local economies.
<i>Technical Feasibility:</i> Yes

766