

1 (11) Pathways for Emission Reductions

2 The Global Warming Solutions Act defines “mitigation” as the reduction of greenhouse gas
3 emissions caused by humans, as well as the preservation and enhancement of natural systems to
4 sequester and store carbon, in order to stabilize and reduce greenhouse gas emissions in the
5 atmosphere. The pathways included in this Chapter, when implemented, will constitute a
6 significant step in Vermont’s efforts to reduce emissions of greenhouse gases, and build upon
7 ongoing work to mitigate climate change.

8 The proposed pathways have been organized by the inventory sector in which the emissions
9 occur (emissions totals and percentages are from the most recent inventory, based on 2018 data):

- 10 - *Transportation* (39.7% of total emissions, 3.43 MMTCO₂e)
- 11 - *Buildings*, including residential and commercial fuel use, and emissions from natural gas
12 distribution (33.9% of total emissions, 2.93 MMTCO₂e)
- 13 - *Electricity* generation (2.1% of total emissions, 0.18 MMTCO₂e)
- 14 - *Agriculture* (15.8% of total emissions, 1.37 MMTCO₂e)
- 15 - *Other Non-energy emissions*, including Industrial Processes and Waste (8.5% of total
16 emissions, 0.73 MMTCO₂e)¹

17 Greenhouse gas emissions from the transportation sector have consistently been higher than any
18 other sector. The state has implemented law and policy aimed at requiring manufacturers to
19 deliver for sale cleaner vehicles to the market, and the legislature has authorized and funded
20 programs to incentivize the purchase and use of these vehicles in Vermont, as well as expand and
21 accelerate other transportation solutions the reduce reliance on the single occupancy vehicle. The
22 success of these policies and programs in driving innovation in the automobile industry to
23 produce cleaner technologies, coupled with the recent development of more robust state vehicle
24 purchase incentives and investments in electric vehicle charging stations has yielded a slow but
25 steady increase in electric vehicles in the Vermont fleet. As of January, 2021 there were 4,360
26 plug-in hybrid or battery electric vehicles registered in Vermont.² However, modeling shows that
27 our current rate of EV adoption and number of EVs on the road is not nearly enough to achieve

¹ The Vermont Greenhouse Gas Emissions Inventory Update and Forecast for 2018 has not been finalized as of the adopted date of the CAP. Emissions data is subject to change in the final Inventory for 2018.

² https://www.driveelectricvt.com/Media/Default/docs/maps/vt_ev_registration_trends.pdf

28 the reductions in this sector required by the GWSA. For example, we will need approximately
29 170,000 light-duty electric vehicles in the Vermont fleet to meet our 2030 reduction
30 requirements. The pathways and strategies in this sector represent a robust set of rules, programs,
31 and policies that will accelerate EV adoption through a variety of approaches aimed at sparking
32 market innovation and transformation in vehicle manufacturing, coordinating emission
33 reductions and investments at the regional level, designing more robust vehicle purchase
34 incentives that mitigate the high up-front costs of electric vehicles, creating more transportation
35 options and helping ensure these choices are accessible to all Vermonters, no matter their
36 income.

37 An essential component of the pathways to reduce emissions from the transportation sector is a
38 regional, market-based cap and invest program for transportation fuels. Vermont is a member of
39 the Transportation and Climate Initiative, along with 13 Northeast and mid-Atlantic states, and
40 has worked within this group to develop the Transportation and Climate Initiative Program (TCI-
41 P), which would cap emissions from transportation fuel in the region and invest funds from the
42 sale of carbon allowances to reduce emissions via the policies and programs put forward as
43 actions included in this CAP. As of the date of the adoption of this CAP, the future of the TCI-P
44 is uncertain, and it is not immediately clear how Vermont's adoption of the action to participate
45 in the TCI-P would be implemented without partnership from other states in the region. Absent
46 this clarity, the Council remains committed to this approach as a realistic and cost-effective way
47 to meet the emission reduction requirements in the GWSA, and includes in this plan the action to
48 join TCI-P when a viable regional market exists. Therefore, the Council maintains that there is
49 an immediate requirement for legislative action to authorize the generation and collection of
50 auction revenue from the sale of allowances in a transportation fuel cap and invest program,
51 whether its TCI-P or a comparable approach, and to determine of how revenue will be allocated
52 in accordance with the CAP and to ensure Vermonters' transition to the clean transportation and
53 energy future is equitable, just, and accessible to all. This action will ensure that Vermont is fully
54 prepared to expeditiously adopt and implement this type of critical program, or TCI-P, should it
55 be viable in the future. In the interim, the Council will continue to explore and identify actions
56 that can be taken to mitigate the gap in emissions reductions that would have been realized by
57 the implementation of TCI-P regionally and in Vermont. These actions will be incorporated into
58 future amendments to this CAP, and will meet the goals and requirements of the GWSA.

59 Acceleration of electric vehicle adoption is a cost-effective, and necessary approach to achieving
60 emission reductions. The pathways also recognize that the importance of reducing Vehicle Miles
61 Traveled (VMT). More research and planning are required to understand and implement
62 strategies to help Vermonters reduce the number of miles they travel annually in single
63 occupancy vehicles. This research will need to be led by VTrans and coordinated with cross-
64 cutting efforts, such as improving the understanding of how land-use planning affect emissions
65 and the development of new or revised Smart Growth policies.

66 Many of Vermont’s residential and commercial building spaces are poorly insulated and heated
67 using carbon intense fossil fuels. Given the duration and intensity of Vermont’s cold-weather
68 seasons, it is not surprising then that this sector is the second highest emitter of greenhouse gases
69 in Vermont. Most homes were built before 1975, with a significant portion older than 1939³.
70 Pathways to reducing emissions in this sector are two-fold: improving thermal efficiency of
71 Vermont’s buildings through weatherization and related activities and switching heating sources
72 to lower carbon alternatives. These pathways need to be closely coordinated to achieve
73 maximum efficiency and to overcome the equity and cost challenges associated with the
74 necessary approaches. This work also incorporates an opportunity to keep more energy dollars
75 in-state by replacing fossil fuel use with electricity for heating needs while also employing an
76 increased workforce of weatherization and home heating technicians. Progress made, however,
77 must align with policies and programs that prioritize those who struggle with the costs associated
78 with housing and energy use.

79 Greenhouse gas emissions from the electricity sector in Vermont have been variable over time,
80 but have been declining in recent years due to the adoption and implementation of the
81 Renewable Energy Standard (RES) and utility commitments. As a result, contributions of
82 greenhouse gas emissions from the electricity sector are currently low. However, because
83 pathways used to reduce emissions from other sectors will rely significantly on electrification, it
84 is important that the low emissions levels in this sector be maintained and improved upon, even
85 as the overall electricity load increases. This must be done while also keeping Vermont’s electric
86 supply reliable and affordable. Increased reliance on electricity to meet transportation and

³ Vermont Housing Needs Assessment, Vermont Housing Finance Agency (“VHFA Housing Needs Assessment”), February 2020, p. 2.

87 building heating needs also means ensuring resilient and adapted electric infrastructure, by
88 upgrading distribution and transmission infrastructure, increasing load management and
89 coordination capabilities, upgrading homes and businesses to enable the transition to electric
90 technologies, and making distributed energy resource programs and services widely and
91 equitably available to all Vermonters.

92 While gross emissions from the agricultural sector in Vermont account for approximately 16% of
93 greenhouse gas emissions in the state, many Vermont farmers have already elevated climate
94 change mitigation as a goal in managing their agricultural enterprises. Emissions from
95 agriculture are technically a non-energy source of emissions, however reduction pathways are
96 discussed separately from the non-energy emissions sector for the purposes of this Plan.
97 Pathways in this sector include improving management practices, such as no-till or cover
98 cropping, to prevent emissions of carbon currently stored in soils into the atmosphere, while also
99 increasing the sequestration of carbon from the atmosphere through land use and management
100 decisions on farms. Maintaining and improving soil health as a climate change mitigation
101 strategy also has numerous co-benefits, such as resilience to extreme weather events and
102 improved water quality. In fact, there is an opportunity to leverage existing water quality
103 programming and funding to implement emission-reducing management tools, making pathways
104 in this sector uniquely cost-effective.

105 Pathways in the final sector, other non-energy related emissions, address work needed to reduce
106 greenhouse gas emissions from industrial processes and management of solid waste and
107 wastewater. This sector represents around 8% of total emissions statewide, but many of the
108 greenhouse gases emitted are gases other than CO₂ that have high global warming potential
109 (GWP) but are short-lived in the atmosphere. Because of the short atmospheric lifetimes of these
110 gases, prioritizing emission reductions from this sector is important for near term impacts.
111 Emissions reductions already made from the solid waste sector will further benefit from the
112 continued implementation of Vermont's Universal Recycling Law, and therefore have not been
113 prioritized in this Plan. Pathways related to the treatment of wastewater, the use of high GWP
114 refrigerants, and semiconductor manufacturing are, however, ripe for emission reductions in this
115 sector.

116 There is no single pathway or strategy that will ensure the necessary transitions required to
117 drastically reduce our emissions. Action will be taken on multiple fronts to reach the required
118 emission reductions in the GWSA. Most importantly, the policies, programs, and rules outlined
119 in each of the following sectors represent a coordinated approach to mitigating greenhouse gas
120 emissions, emphasizing approaches that are equitable and seek to ensure accessibility for all
121 Vermonters.