

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 2017 data):

- 10 - *Transportation* (39.1% of total emissions, 3.39 MMTCO₂e)
- 11 - *Buildings*, including residential and commercial fuel use, and emissions from natural gas
12 distribution (31.3% of total emissions, 2.72 MMTCO₂e)
- 13 - *Electricity* generation (5.7% of total emissions, 0.49 MMTCO₂e)
- 14 - *Agriculture* (15.8% of total emissions, 1.37 MMTCO₂e)
- 15 - *Other Non-energy emissions*, including Industrial Processes and Waste (8% of total
16 emissions, 0.7 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. The success of these
21 policies and programs in driving innovation in the automobile industry to produce cleaner
22 technologies, coupled with the recent development of more robust state vehicle purchase
23 incentives and investments in electric vehicle charging stations has yielded a slow but steady
24 increase in electric vehicles in the Vermont fleet. As of January, 2021 there were 4,360 plug-in
25 hybrid or battery electric vehicles registered in Vermont.² However, modeling shows that our
26 current rate of EV adoption and number of EVs on the road is not nearly enough to achieve the
27 reductions in this sector required by the GWSA. For example, we will need approximately

¹ https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2017_Final.pdf

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

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

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

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

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

56 Greenhouse gas emissions from the electricity sector in Vermont have been variable over time,
57 but have been declining in recent years due to the adoption and implementation of the
58 Renewable Energy Standard (RES) and utility commitments. As a result, contributions of
59 greenhouse gas emissions from the electricity sector are currently low. However, because
60 pathways used to reduce emissions from other sectors will rely significantly on electrification, it
61 is important that the low emissions levels in this sector be maintained and improved upon, even
62 as the overall electricity load increases. This must be done while also keeping Vermont's electric
63 supply reliable and affordable. Increased reliance on electricity to meet transportation and
64 building heating needs also means ensuring resilient and adapted electric infrastructure, by
65 upgrading distribution and transmission infrastructure, increasing load management and
66 coordination capabilities, upgrading homes and businesses to enable the transition to electric
67 technologies, and making distributed energy resource programs and services widely and
68 equitably available to all Vermonters.

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

82 Pathways in the final sector, other non-energy related emissions, address work needed to reduce
83 greenhouse gas emissions from industrial processes and management of solid waste and
84 wastewater. This sector represents around 8% of total emissions statewide, but many of the
85 greenhouse gases emitted are gases other than CO₂ that have high global warming potential

86 (GWP) but are short-lived in the atmosphere. Because of the short atmospheric lifetimes of these
87 gases, prioritizing emission reductions from this sector is important for near term impacts.
88 Emissions reductions already made from the solid waste sector will further benefit from the
89 continued implementation of Vermont's Universal Recycling Law, and therefore have not been
90 prioritized in this Plan. Pathways related to the treatment of wastewater, the use of high GWP
91 refrigerants, and semiconductor manufacturing are, however, ripe for emission reductions in this
92 sector.

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