# Pathways for Mitigation

## Transportation – Summary Statement

Transportation – the movement of people and goods – is essential to the state's economy and Vermonter's quality of life. The state's rural character and low population density also means that Vermonters depend primarily on cars and trucks to get them where they need to go. Vermont's auto-reliant system is fueled almost singularly[1] with carbon-intensive gasoline and diesel, making transportation the largest source of climate pollution – equating to a full 40% of the state's greenhouse gas emissions. [2] The combination of our mostly rural nature, dispersed land use patterns and heavy reliance on fossil-fueled vehicles is a significant reason why Vermonters emit more greenhouse gasses per capita than any other state in New England. [3] This reality makes transforming the state's transportation system essential to meeting the emissions reduction requirements of the Global Warming Solutions Act. At the same time, creating a clean, efficient, multi-modal system will also have economic, environmental, equity and public health benefits.

Vermont's reliance on liquid fossil fuels is a significant drain on our economy. Vermonters collectively spend over $1 billion on fossil fuels for transportation. Approximately 77% of those dollars leave the state's economy every year.[4] In contrast, electricity purchases keep far more dollars in Vermont. Over 60% of every dollar spent on electricity stays here. [5] Moving to more

[1] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/The%20Vermont%20Transportation%20Energy%20Profile_2019_Final.pdf
[MJ2]https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2017_Final.pdf

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

[3] Page 11: https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_and_Forecast_1990-2016.pdf

[4] https://www.eanvt.org/wp-content/uploads/2021/06/EAN-APR2020-21_finalJune2.pdf

[5] EAN 2021 Progress Report: https://www.eanvt.org/wp-content/uploads/2021/06/EAN-APR2020-21_finalJune2.pdf

efficient, electric vehicles will keep more of the money we collectively spend on transportation in the state's economy and in Vermonters' pockets.[6]

The proportionally higher per capita income costs for lower income Vermonters and high price volatility in the current system also makes transportation a big equity issue.[7] Lower-income Vermonters spend a far greater proportion of their incomes on energy than upper income Vermonters. Transportation costs – primarily through owning, operating and maintaining a vehicle – equate to 45% of total energy expenditures for the average Vermont household. This reality places a disproportionate economic burden on lower income Vermonters. [8]

How the current system serves people equally – or does not –is another important equity issue. Many older Vermonters, youth, and people living with disabilities cannot drive, thus limiting their ability to access jobs, services and community amenities without a multi-modal, integrated transportation system. Research also highlights that the ownership of a vehicle is a significant job access and retention issue for lower income Vermonters.[9] This has long been true but also underscored in the COVID-19 pandemic, when many low-income, frontline workers continued to report in-person to work, often relying on costly, inefficient vehicles. Research has also found that "possession of a driver's license and a car was a stronger predictor of leaving public assistance than even a high school diploma," which speaks to the importance of vehicle access and ownership as an important justice issue.[10]

The economic disparities and equity issues embedded in rural Vermont's current transportation system also present opportunities. Equitably accelerating the adoption of more efficient, electric vehicles, expanding transportation choices and creating compact communities where Vermonters

[6] https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities_0.pdf

[7] https://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Legislative_Reports/2021%20Annual%20Energy%20Report%20Final.pdf

[8] https://www.efficiencyvermont.com/Media/Default/docs/white-papers/2019%20Vermont%20Energy%20Burden%20Report.pdf

[9] https://ljfo.vermont.gov/assets/Uploads/9bc271c390/Reach-Up-Annual-Report_FINAL_2020.01.15.pdf

[10] https://www.sierraclub.org/sites/www.sierraclub.org/files/sce-authors/u2196/Arrive%20Together%20Transportation%20Access%20and%20Equity%20in%20Wisconsin.pdf

can afford to live without a vehicle will have many benefits. Those benefits include collectively saving Vermonters hundreds of millions of dollars every year; significantly reducing the high energy burdens Vermonters currently carry; ensuring Vermonters of all incomes levels and demographics can access more clean, affordable transportation options; and – individually and collectively – improving public health outcomes by reducing exposure to the air pollutants caused by the burning of gasoline and diesel and expanding active modes of transportation. [11]

Together, the strategies identified below will not only improve health outcomes, but set Vermont on a course to dramatically reduce transportation-related carbon pollution and more equitably shift to a cleaner, more efficient, multi-modal transportation system. This is a two-pronged approach to make both vehicles and the transportation system more efficient by:

1. Replacing carbon intensive fuels (gas and diesel) with zero emission or low carbon fuels such as electricity (noting that for medium to heavy duty vehicles in particular, there may be a limited but important role for biofuels or hydrogen, especially in the near term).
2. Making both the vehicles and the transportation system more efficient; creating options for Vermonters to drive less or use alternatives to the single occupancy vehicle to get where they need to go, while also, importantly, increasing options for those who cannot drive.

Electrification is a critical short-term priority. Electric vehicles are more energy efficient than gas powered vehicles – costing far less per mile than a gas-powered vehicle to own and operate over time.[12] For rural Vermont drivers, the economic benefits of an electric vehicle will also be significant. A recent study estimated that a typical rural driver can save approximately $1,500 every year by switching from a conventional gasoline car to a comparable electric vehicle, which is even more significant over the life of the vehicle [13]

Avoiding car trips, reducing car trip lengths and replacing car trips with clean and energy efficient transit, biking and walking options, carpool and rideshare programs and other non-vehicular strategies have economic, equity and public health benefits – while also having the

[11] https://www.healthvermont.gov/sites/default/files/documents/pdf/ENV_CH_Transportation-Health.pdf
[12] https://www.eanvt.org/wp-content/uploads/2021/06/EAN-APR2020-21_finalJune2.pdf
[13] https://www.ucsusa.org/about/news/rural-communities-could-benefit-most-electric-vehicles

potential to be important pollution reduction measures to achieve the 2050 requirements. These "vehicle miles traveled" reductions rely on compact community settlements and smart growth. This will require short- and long-term investments in key community infrastructure and affordable housing to create places where people want and can afford to live. More research is required to quantify, measure and better reflect the greenhouse gas emissions benefits of "transportation demand management" strategies but their value is clear, particularly related to equity and public health benefits.

When it comes to public health, the pollution associated with transportation disproportionately impacts disadvantaged communities, thus having unequal public health consequences and burdens – especially in places where there are high levels of traffic and congestion. Decades of advances in automobile emission control technologies have helped mitigate this, but communities located in or near high traffic areas still experience increased health risks due to emissions exposure to nitrogen oxides, sulfur dioxide, carbon monoxide, fine particulates, volatile organic compounds and ground-level ozone. Exposure to these pollutants results in many health effects, including cardiovascular impairment and disease and increased risk of cancer. In addition, they also result in environmental impacts such as acid rain and reduced visibility.[14]

Transitioning to a cleaner transportation system can have real public health benefits. A recent analysis by the American Lung Association found that residents in every region of the U.S. stand to benefit from the elimination of on-road traffic pollution and clean, renewable electric generation. It is estimated that, by 2050, a cleaner transportation system could net Vermont over $73 million in value from avoided premature deaths, asthma attacks and work days lost. [15]

The pathways and actions described below will help put Vermont on a path to significant climate progress, respond to the diverse needs and interests of Vermonters and achieve many co-benefits associated with their implementation. At a high level, the pathways include:

[14] https://www.ucsusa.org/sites/default/files/attach/2019/06/Inequitable-Exposure-to-Vehicle-Pollution-Northeast-Mid-Atlantic-Region.pdf

[15] https://www.lung.org/getmedia/99cc945c-47f2-4ba9-ba59-14c311ca332a/electric-vehicle-report.pdf

- Electrification of the light duty sector (autos, SUVs and light duty trucks) and the charging infrastructure to support an efficient, integrated electric vehicle network.
- Electrification and lowering the carbon intensity of fuels in the heavy duty sector (mid sized and heavy duty trucks and busses). This also includes the charging infrastructure to support the electrification of medium-to-heavy duty vehicles.
- Reduction of vehicle miles traveled through the creation and utilization of multi-model transportation options, such as transit, micro-transit, passenger rail, biking, walking, car and ridesharing etc. This includes the enabling environment – and infrastructure – to support it, which requires compact community settlements.

The transformation of our current transportation system will evolve over time and the process will be iterative, but it must happen swiftly to achieve Vermont's required greenhouse gas emissions reductions. This will also rely on continuing to better understand the realities facing Vermonters and, through that enhanced understanding, develop better public engagement strategies, programs and policies to reflect their diverse needs and interests. Success will also be incumbent upon helping Vermonters avoid prolonged reliance on fossil fuels. That means the vehicle point of sale, purchase or lease is a critical moment. Policies, programs and public engagement approaches should be designed to help people, communities and businesses avoid locking into high-emitting fossil fueled vehicles that will be on the road for a decade or more.

The partnership and participation of all Vermonters in this transformation is essential. We have a strong foundation today upon which to build to ensure we leave no one behind as we work towards the necessary reductions in greenhouse gas emissions; improve access to multi-modal transportation options; and leverage advances in technology in cost-effective, equitable ways.

## Pathway 1: Light Duty Electrification

The emissions benefits of switching from fossil fueled to electric powered vehicles are clear. Battery Electric vehicles (EVs) and Plug-in Hybrid light duty electric vehicles are well beyond the research and development stage, they are being manufactured across the globe and available for sale today in Vermont. Their deployment and use is supported by the state's current regulatory framework, federal leadership and the manufacturers' commitments. Vehicle types

that are more suitable for the Vermont climate and landscape, like light-duty trucks and all-wheel drive vehicles, are becoming more readily available. Electric vehicles are an attractive alternative because they provide a similar level of transportation convenience as conventional vehicles, with the caveat that public charging availability needs to continue to grow. While EVs often cost significantly less to own and maintain over the lifetime of the vehicles, purchase or lease incentives are an important tool to reduce the often higher upfront costs of EVs. Catalyzing the dramatic acceleration of EV deployment will require are-evaluation and expansion of purchase incentives and similar mechanisms to facilitate widespread adoption, especially among low- and moderate-income families.

## 1. Market-Driving Technology Forcing Regulatory Programs

Vermont first adopted California's Motor Vehicles Emission Standards, now known as Advanced Clean Cars (ACC), in the early 2000s pursuant to its authority under Section 177 of the Clean Air Act. The requirements of ACC are imposed directly on vehicle manufacturers and have pushed the industry to innovate and implement new technologies to meet the requirements of the rules and growing public demand. As these regulations are updated to require higher volumes of lower and no emitting vehicles be delivered to participating states, Vermont should amend its own rules to ensure the most stringent standards, identical to California's program, will apply to Vermont. Adoption of ACC II in Vermont will contribute to a broader acceleration of EV manufacturing and deployment as more manufacturers are required to embrace vehicle electrification and innovation, thereby ensuring a diversity of vehicle choices are available to Vermonters. The sooner more of this vehicle technology and types of vehicles are available on the market, the lower the upfront costs to consumers of EV ownership.

## High (and consensus medium) Priority Actions

| **Lead Implementer: Agency of Natural Resources** | | |
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| **a.** | **Action Details**: Adopt California's Advanced Clean Cars II (ACC II) Regulations (amending Vermont's existing Low and Zero Emission Vehicle Regulations) beginning no later than Model Year 2026. ACC II includes, as proposed, a 100% ZEV sales requirement by 2035, more stringent criteria pollutant | **Impact** CAP modeling makes clear that vehicle electrification is one of highest pollution-reduction measures required to achieve the GWSA targets. CAP modeling indicates that approximately 170,000 EVs will need to be deployed by 2030 in order to achieve the state's |

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| | emissions standards, a robust vehicle durability standard, warranty provisions, battery state of health standardization, battery labeling, and availability of repair information to independent repair shops. | emissions reduction requirement. Amending Vermont's Low and Zero Emission Vehicle regulations will be the primary driver in delivering electric vehicles to dealerships in Vermont. This program will allow for a faster transition to electric vehicles through increased availability than what would have occurred without amendments to the current program. |
| | | **Equity** ACC II will build equity principals into compliance flexibility mechanisms for vehicle manufacturers. Increasing the availability and overall number of EVs generally will also help significantly drive down the cost of EVs over time and accelerate and expand the used EV market in Vermont, enabling increased consumer access to EVs. |
| | | **Cost-Effectiveness** Electrifying the light duty fleet will be a relatively cost-effective approach to reducing greenhouse gas emissions. The adoption of ACC II is a low-cost action and a critical component of electrifying the light-duty fleet in Vermont. |
| | **Timeline to Implement:** Rules adopted no later than December 31, 2022 | **Co-Benefits**<br>- Reduction in criteria air pollutants<br>- Lower vehicle maintenance and fuel costs<br>- Enhanced vehicle consumer protection measures |
| | | **Technical Feasibility** Yes |

## 2. Light Duty Electric Vehicle Purchase Incentives

Vermont launched a point-of-sale EV purchase incentive program in 2019, and authorization of funding in subsequent years has allowed the program to continue to date. The incentive is administered by Vermont Energy Investment Corporation's Drive Electric Vermont (DEV) program and helps to reduce the upfront costs associated with EV ownership. Additional

evaluation of the current program and consumer data research will inform necessary amendments to the current program in the form of incentive amounts, income eligibility, application to commercial and municipal fleets, and used EV purchases. Expanded and continued funding for upfront purchase incentives – with an important focus on helping lower-income, overburdened Vermonters to participate – will be critical to equitably increase EV adoption to the levels necessary to meet Vermont's greenhouse gas reduction requirements.

## High (and consensus medium) Priority Actions

<table>
<tr><td colspan="3">Lead Implementer: Legislature, Agency of Transportation</td></tr>
<tr><td rowspan="4">a.</td><td rowspan="3">Action Details: Expand and redesign Point of Sale Purchase Incentives for new and used Electric Vehicles and E-bikes. Specifically: determine the appropriate per vehicle incentive amount and dramatically increase number of incentives issued while cost-effectively driving uptake; apply incentives to used EV purchases, determine the dollar amounts and makeup of purchase incentive needed to achieve EV deployment and equity goals (if incentives are tiered, create income tiers instead of vehicle price tiers); expand eligibility for commercial and municipal fleet EV purchases.</td><td>Impact CAP modeling indicates that approximately 170,000 EVs will need to be deployed by 2030 in order to achieve the state's emissions reduction requirements. Incentivizing EV purchases will be critical towards meeting EV deployment requirements to achieve emissions reductions.</td></tr>
<tr><td>Equity The program will prioritize low and moderate-income families, as it does now. This goal and implementing program elements will be examined, adjusted and potentially increased as needed in the future to ensure broad, equitable access and participation.</td></tr>
<tr><td>Cost-Effectiveness Modeling shows that electrifying the light duty fleet is a cost-effective approach to reducing greenhouse gas emissions. Additional investigation will be required during program redevelopment to help determine the incentive amounts necessary to drive EV adoption at the rates required. Even with relatively high incentive amounts per vehicle, those costs will be gradually recouped by consumers through lower fuel and maintenance costs over time.</td></tr>
<tr><td>Timeline to Implement: Continue the current incentive funding authorized in the 2021 Transportation Bill (T-Bill), concurrently</td><td>Co-Benefits:<br>- Reduction in criteria air pollutants</td></tr>
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| | analyze its effectiveness, using consumer and other data to scale the program – and the income-tiered program benefits -- with consideration of the anticipated future need-based EV deployment and equity goals. Use this analysis to strategically expand investments in future T-Bills. | - Lower vehicle maintenance and fuel costs for consumers<br>- Keeps significantly more dollars spent on vehicle fuel in-state<br>- Improve access to cost-effective transportation for low-income families |
| | | **Technical Feasibility** Yes |
| **b.** | **Action Details:** Continue to fund and expand Replace Your Ride and Mileage Smart programs in future state budgets and T-Bills. Amend program eligibility and parameters as data and analysis requires. | **Impact** CAP modeling indicates that approximately 170,000 EVs will need to be deployed by 2030 in order to achieve the state's emissions reduction requirements. Although these programs are not limited to battery electric vehicle deployment, they are a helpful tool in facilitating adoption of more fuel-efficient vehicles while also furthering equity goals. |
| | | **Equity** These programs prioritize and/or limit eligibility to low-income individuals and families. These programs also improve access to more fuel-efficient vehicles for low-income families, helping to reduce household energy burdens. |
| | | **Cost-Effectiveness** Electrifying the light duty fleet is a relatively cost-effective approach to reducing greenhouse gas emissions. Additional investigation will be required during program review to help determine the incentive amounts necessary to drive EV or fuel-efficient vehicle adoption at the rates required. Even with relatively high incentive amounts per vehicle, those costs will be gradually recouped by consumers through lower fuel and/or maintenance costs over time. |
| | **Timeline to Implement:** Immediately | **Co-Benefits**<br>- Owning, operating and maintaining an EV costs less than a conventional vehicle and leads to savings on transportation, a significant household expense. |

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| | | - Air quality benefits associated with retirement of old vehicle (Replace Your Ride only)<br>- Helps meet critical transportation needs of those in poverty (Mileage Smart) |
| | | **Technical Feasibility** Yes |
| **Lead Implementer: Legislature, Department of Motor Vehicles, Vermont Department of Taxes** | | |
| **c.** | **Action Details:** Design and implement a vehicle efficiency price adjustment that's linked to the "purchase and use" tax for new vehicles within a vehicle class. The program will help incentivize the purchase of more efficient new vehicles (electric vehicles in particular) and disincentivize purchase of less efficient vehicles The program should be designed to mitigate potential impacts to low-income purchasers and business and commercial users who require certain vehicles and where no cost-effective, comparable electric or clean vehicle options are available. Program development should consider and weigh how it complements current EV purchase incentive programs so as to avoid duplicative or unnecessary incentives. This program should be revenue neutral and revenues should go exclusively to rebates within the program. | **Impact** CAP modeling indicates that approximately 170,000 EVs will need to be deployed by 2030 in order to achieve the state's emissions reduction requirements. Although this vehicle price adjustment program would not be exclusive to EVs, adding an additional price signal to further incentivize the purchase of high efficiency or electric vehicles would help to speed the transition to EVs and more fuel-efficient vehicles in Vermont. |
| | | **Equity** The program is limited to new car purchases and can be designed to exempt certain income levels and purchasers who require a certain class of vehicle for business and commercial use for which there may be no cost-effective, comparable, available alternative. Also, higher income earning Vermonters are the primary purchasers of new vehicles. This program's singular focus on new vehicle purchases is intended to help address equity considerations. For Vermonters who require new vehicles for business use, it will be important to consider and potentially exempt any purchase for such purposes from the program. |
| | | **Cost-Effectiveness** Electrifying the light duty fleet is a relatively cost-effective approach to reducing greenhouse gas emissions. Additional investigation will be required during program development to help determine the amounts necessary to drive EV adoption at the rates required and not |

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| | | unnecessarily compete or duplicate other programs, such as EV purchase incentives. Even with relatively high price adjustment amounts per vehicle, those costs will be gradually recouped by consumers through lower fuel and maintenance costs over time. |
| | **Timeline to Implement:** Upon adoption of purchase and use price adjustment. | **Co-Benefits**<br>- Reduction in criteria air pollutants.<br>- Lower vehicle maintenance and fuel costs for consumers.<br>- Keeps dollars spent on fuel in-state. |
| | | **Technical Feasibility** Yes |

## 3. Public Investment in Electric Vehicle Supply Equipment (EVSE)

The Vermont Agency of Transportation has worked hard towards the goal of deploying a Level 3 (DCFC) charger within 30-miles of every Vermont resident, helping to lay an important foundation of EV infrastructure. However, there is much more to do to build an integrated, seamless system. A lack of availability of public charging remains recognized as a deterrent to consumers in making vehicle purchase choices. This is sometimes referred to as "range anxiety." While most charging occurs at home or at work, longer trips often require fast (DCFC) and reasonably priced charging adjacent to highway corridors and within walking distance of services – and those options need to increasingly be made available. Vermont is already leading the nation in its per-capita EVSE deployment efforts through the work of an existing inter-agency team but there is more to do to create a cohesive, strong, integrated charging network that serves both rural Vermont and Vermonters living in multi-family and more urban environments. State government's role in this effort should be to continue to lead EVSE deployment efforts, help municipalities, electric utilities, non-profits and the private sector determine the optimum location and type of EVSE, and financially support purchase and installation of EVSE until it becomes mainstream. In particular, expanding workplace, multi-family housing and rental unit charging and the infrastructure needed to support it (which often lack garages or parking adequate for at home charging) must also remain a significant priority. Efforts must include addressing these charging needs with the understanding that public/private partnerships and the role of the utilities in EVSE charging will complement and support greater deployment of and

benefits from expanding EVSE charging infrastructure across the state. Future discussions surrounding EV charging and rate design will also need to be informed by research and recommendations of the Interagency Task Group on Transportation User Fees, recognizing that transportation funding through gas tax revenues will decline as more drivers fuel their vehicles with electricity.

## High (and consensus medium) Priority Actions

<table>
<tr><td colspan="3">Lead Implementer: Legislature; Interagency EVSE Working Group (ACCD, VTrans, ANR, VDH, PSD)</td></tr>
<tr><td rowspan="3">a.</td><td rowspan="3">Action Details: Continue to fund and support build-out of DCFC and Level 2 EVSE based on the EVSE Deployment Plan under development by Drive Electric Vermont pursuant to the Agency of Transportation’s Multipronged Vehicle Electrification Strategy and continue to coordinate regional efforts. Incorporate prioritization of multi-family and workplace charging and associated infrastructure availability into programs to be guided by equity principles and environmental justice mapping tools. Current funding includes VW Environmental Mitigation Trust and other funding available in the 2021 Transportation Bill. Available federal funding may be used as well as potential TCI-P revenue.</td><td>Impact CAP modeling indicates that approximately 170,000 EVs will need to be deployed by 2030 in order to achieve the state’s emissions reduction requirements. Charging infrastructure is a critical component in enabling EV adoption to increase consumer confidence and to reduce range anxiety. Dramatic increases in EV adoption rates will require significant additional buildout of public and workplace charging to enable the transition to electric vehicles.</td></tr>
<tr><td>Equity The state will work with local public and private partners to improve EVSE accessibility for multi-family properties, rental property dwellers, and Vermonters living in rural areas.</td></tr>
<tr><td>Cost-Effectiveness Electrifying the light duty fleet is a relatively cost-effective approach to reducing greenhouse gas emissions. Deployment of EVSE is a critical component of achieving these cost-effective reductions and installation of additional EVSE is a critical enabling factor in advancing electrification of the light-duty vehicle fleet.</td></tr>
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| | **Timeline to Implement:** Immediately. | **Co-Benefits**<br>- Cost of charging will be kept low through focus on home charging, especially multi-unit dwelling properties.<br>- Day time employee charging may be beneficial to electric load management.<br>- Enabling action for light-duty fleet electrification and associated air pollutant and health benefits.<br>- Utility load control benefits to balance and benefit the grid and ratepayers. |
| | | **Technical Feasibility** Yes |
| **Lead Implementer: Legislature; Public Utilities Commission** | | |
| **a.** | **Action Details:** Direct the PUC to consider and develop beneficial EV charging rates to incentivize EV adoption through lower fuel costs. Additional investigation and coordination with utilities is needed to inform the rate design and to ensure that the rate promotes and enables managed charging and the benefits a flexible EV load can bring to the grid. Discussion with utilities is also critical to inform the details of the rate itself and to incorporate lessons learned from existing EV specific rates. Further investigation into alternative demand charge designs for low utilization charging locations is necessary to help mitigate the barrier presented by demand charges to DCFC installations in low utilization rural areas for the near future. | **Impact** Implementing beneficial EV charging rates would be another financial incentive to help spur EV adoption. Setting EV specific charging rates that are lower than normal residential rates and based upon shared savings to incentivize EV adoption through even lower vehicle fuel costs as well as promote the ability of utilities to manage EV charging to lower the cost for all ratepayers. The flexibility that managed EV charging allows provides grid benefits that positively impact Vermont ratepayers. |
| | | **Equity** EV specific charging rates would be available to all Vermonters and, if based upon shared savings for load control, lower costs for all customers. Having this additional financial incentive to help reduce overall vehicle costs for the consumer would be another factor to help overcome the currently higher upfront cost of EVs and allow for greater access to the EV market for everyone. |

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| | | **Cost-Effectiveness** Adoption of a beneficial EV rate design would be another, and more enduring, financial incentive that would help to increase EV adoption and through shared savings and load control help achieve cost savings for participants and all ratepayers. |
| | **Timeline to Implement:** Upon issuance of PUC order. | **Co-Benefits**<br>- Promotes managed EV charging which provides load flexibility that benefits all Vermont ratepayers.<br>- Vehicle electrification reduces emissions of criteria air pollutants which has associated health benefits. |
| | | **Technical Feasibility** Yes |

## 4. Join the Transportation and Climate Initiative Program (TCI-P)

For over a decade, Vermont has been a member of the Transportation and Climate Initiative, a regional collaboration of 13 Northeast and Mid-Atlantic states and the District of Columbia that seeks to improve the transportation system, develop the clean energy economy and equitably reduce carbon emissions from the transportation sector. The TCI jurisdictions are: Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, and Virginia. In December 2020, Massachusetts, Connecticut, Rhode Island, and the District of Columbia announced that they will be the first jurisdictions to launch the Transportation & Climate Initiative Program (TCI-P), a multi-state cap and invest, market-based program that reduces air pollution while investing $300 million per year in cleaner transportation choices and healthier communities. It is important to note that the TCI-Program (TCI-P) is different than the Transportation and Climate Initiative (TCI). The TCI-P is the program which resulted from the 10+ year collaboration among the 13 Northeast and Mid-Atlantic states and would be the mechanism that would – through the cap – reduce approximately 26% of transportation climate pollution across participating jurisdictions by 2032 and raise approximately $20 million in annual revenue for Vermont. Vermont's participation in TCI-P – critically, paired with a

complementary legislative policy action to drive strategic investments, foster a more equitable process and ensure greater equity outcomes – is an important tool to reduce transportation emissions and raise needed revenues to investment in actions detailed in this Light-Duty Vehicle Electrification Pathway.

Federal infrastructure funds will soon become available to states for clean transportation investments. Rather than reducing the need for TCI-P, this federal spending will make TCI-P even more critical as a source of state or local matching funds (20% match required) for federal grant programs available through the Build Back Better Act.

## High (and consensus medium) Priority Actions

<table>
<tr><th colspan="3">Lead Implementer: Agency of Natural Resources; Legislature</th></tr>
<tr><td rowspan="4">a.</td><td rowspan="3">Action Details: Vermont joins TCI-P as a participating jurisdiction through adoption of the TCI-P Model Rule. Regulated entities (Fuel suppliers) will need to purchase and surrender CO2 allowances equal to the amount of fuel that they deliver for sale in Vermont. Allowances will be purchased at auction and Vermont will have agency over how auction proceeds are spent, investing in actions that prioritize and benefit disadvantaged communities and reduce emissions.<br><br>The Legislature should enact a complementary policy that goes further to ensure equity outcomes (establish an expanded equity board, direct a minimum/significant investment in low income, rural, overburdened and underserved communities, e.g. 70%) and have funds go to transportation related or efficient transportation enabling investments. Consider a firewalled fund.</td><td>Impact TCI-P is an umbrella program, the proceeds of which will fund the actions in this Pathway and others in the CAP.</td></tr>
<tr><td>Equity The TCI-P MOU requires a 35 percent minimum investment in low income, overburdened communities and the creation of an Equity Advisory Body. To go further to ensure better process and equity outcomes, there is also a bill being drafted for introduction in the 2022 legislative session that will require a yearly review by a broad stakeholder group and substantially more TCI-P revenues directed to low income, rural, historically disadvantaged communities.</td></tr>
<tr><td>Cost-Effectiveness Revenue from TCI-P can be used to implement the actions outlined in this Pathway. Electrifying the fleet is a relatively cost-effective approach to reducing greenhouse gas emissions.</td></tr>
<tr><td>Timeline to Implement: Immediately.</td><td>Co-Benefits<br>- Emissions reductions achieved through a coordinated regional approach.</td></tr>
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| | | - Incentivizes regulated entities to lower carbon intensity of fuel delivered for sale.<br>- Improving public health outcomes. |
| | | **Technical Feasibility** Yes |

## 5. Educate drivers on benefits of electrification and other transportation options to reduce vehicle miles traveled (VMT)

A critical component of the transition to electric vehicles is to implement timely and targeted education about not only the environmental and public health benefits of driving an electric vehicle, but the difference in maintenance and fueling requirements, charging infrastructure utilization (at home and publicly accessible), cost savings, and how to reduce the need to use single-occupancy transportation options. Incorporating this information and training into student driver education courses, and making training available to already licensed drivers, will help drivers be more confident and prepared in their choice to purchase and drive an EV.

### High (and consensus medium) Priority Actions

| **Lead Implementer: Agency of Natural Resources, Department of Motor Vehicles, Legislature** | | |
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| **a.** | **Action Details:** Fund implementation and further enhancement of a unit within Vermont's driver education curriculum to educate student drivers about electric and high efficiency transportation options, as well as how to reduce VMT via use of other transportation options, as well as increase funding for EV education and buyer assistance support currently being offered by Drive Electric Vermont. | **Impact** CAP modeling indicates that approximately 170,000 EVs will need to be deployed by 2030 in order to achieve the state's emissions reduction requirement for 2030. Adequate and effective new and existing driver education will lead to increased uptake in EV deployment necessary to reduce emissions. |
| | | **Equity** Education opportunities will be made available at no cost and will be integrated into existing driver education requirements for ease of access. EV education, information and buyer assistance support – including via Drive Electric Vermont or otherwise – will be translated to ensure non-English speakers can access the information. |
| | | **Cost-Effectiveness** Because many education opportunities for driver |

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| | | training are already being deployed, an EV component of the existing curriculum could be added with minimal costs. The Drive Electric Vermont infrastructure and network also offers a solid foundation upon which to build. |
| | **Timeline to Implement:** Immediately. | **Co-Benefits**<br>- Reduction in criteria air pollutants.<br>- Lower vehicle maintenance and fuel costs for consumers.<br>- Keeps dollars spent on fuel in-state. |
| | | **Technical Feasibility** Yes |

## Pathway 2: Heavy Duty Electrification

Medium and heavy-duty trucks and buses contribute 14%of transportation emissions in Vermont. Reducing diesel emissions, such as particulate matter and nitrogen oxides has known health benefits. Medium and heavy-duty vehicle technology has been deployed internationally, and while there are challenges associated with replacing diesel power with electric, certain applications are being further developed and implemented. The purchase price of these vehicle types remains high compared to the upfront cost of conventional vehicles. Vermont has funded and implemented medium and heavy-duty electric vehicle pilot programs, including school and transit bus deployments and upcoming deployments of electric waste haulers, electric utility vehicles, and delivery vehicles. Vermont works closely with other states to coordinate a regional and national approach to deployment of medium and heavy-duty electric vehicles, as well as efforts to address excessive idling, research and development, and investigation of less carbon intensive and renewable fuels such biofuels. Note that this pathway includes not only deployment of electric vehicle technology, but also the development and future deployment of hydrogen fuel-cell vehicle technology, which is viewed as another fuel-switching pathway for medium and heavy-duty vehicles.

## 1. Market Driving, Technology-Forcing Regulatory Programs

Vermont's regulation of emissions from medium and heavy-duty vehicles has been limited compared to the regulation of light-duty vehicle emissions. Recent proposals and newly adopted regulatory programs from California have presented an opportunity to continue our coordination

with other states to reduce emissions from medium and heavy-duty vehicles. The rules outlined below encompass a comprehensive rule package to reduce greenhouse gas emissions through electrification and cleaner engine standards and increase efficiency and engineering of medium to heavy duty trucks to cause lower emissions of greenhouse gases and traditional air pollutants. The state should pursue available funding and use to mitigate the high upfront costs of medium and heavy-duty electric vehicles and hydrogen fuel-cell technology development.

## High (and consensus medium) Priority Actions

<table>
<tr><td colspan="3">Lead Implementer: Agency of Natural Resources</td></tr>
<tr><td rowspan="4">a.</td><td rowspan="3">Action Details: Adopt California Air Resources Board Advanced Clean Trucks Rule (an increasing percent ZEV sales requirement for manufacturers), Low NOx Omnibus Rule (includes a more stringent NOx emission standard and lengthened useful life and warranty), and Phase II GHG Rule for Truck Trailers beginning no later than Model Year 2025. Fund incentives for medium and heavy-duty electric fleet purchases.</td><td>Impact CAP modeling indicates that approximately 50,000 medium and heavy-duty EVs will need to be deployed by 2030 in order to achieve the state’s emissions reduction requirement for 2030.</td></tr>
<tr><td>Equity Reductions in these emissions through electrification would benefit communities that are disproportionately impacted by poor air quality related to transportation emissions.</td></tr>
<tr><td>Cost-Effectiveness This is a technology forcing regulation, and therefore the costs of compliance directly impacts manufacturers of MHD vehicles. Also, because manufacturers do not receive compliance credit for a vehicle until it is placed in service, manufacturers will need to support dealers and fleets in Vermont to make purchase and operation of these vehicles feasible in order to meet their compliance obligation.</td></tr>
<tr><td>Timeline to Implement Immediately.</td><td>Co-Benefits<ul><li>Reduction in criteria air pollutants.</li><li>Lower vehicle maintenance and fuel costs for owners and operators.</li><li>Keeps more dollars spent on fuel in-state.</li></ul></td></tr>
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| | | |
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| | | **Technical Feasibility** Yes |

## 2. Electrify medium and heavy-duty vehicle auxiliary systems

Many medium and heavy-duty vehicles in Vermont are equipped with auxiliary systems that run off of the combustion engine power, and therefore increase the vehicle's emissions when they are in operation. While fully electric options for some of these specialty vehicles are becoming available on the market, retrofitting existing vehicles that still have a long remaining useful life to electric auxiliary systems will be an important step towards meeting our emissions reduction requirements in the short term and while the medium and heavy-duty electrification transformation takes place.

## High (and consensus medium) Priority Actions

| **Lead Implementer: Legislature, Agency of Natural Resources** | | |
|---|---|---|
| **a.** | **Action Details** Fund programs that incentivize electric auxiliary systems, such as (but not limited to) hybrid-electric bucket trucks and electric transport refrigeration units and programs that incentivize installation of electrified parking spaces in truck loading/unloading zones. | **Impact** CAP modeling indicates that approximately 50,000 medium and heavy-duty EVs will need to be deployed by 2030 in order to achieve the state's emissions reduction requirements. Electrifying vehicle auxiliary systems can be a bridge towards electrification while conventional vehicles are still being used, but with electric auxiliary power. |
| | | **Equity** Reductions in these emissions through electrification would benefit communities that are disproportionately impacted by poor air quality. |
| | | **Cost-Effectiveness** While the upfront cost of fully electric medium and heavy-duty vehicles will be a barrier to early adoption, mitigating emissions from auxiliary power systems can be a cost-effective way to achieve emissions reductions while the transition to fully electric vehicles in this sector occurs. |
| | **Timeline to Implement** Immediately. | **Co-Benefits**<br>- Reduction in criteria air pollutants<br>- Lower vehicle maintenance and fuel costs for owners/operators |

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| | | - Keeps dollars spent on fuel in-state |
| | | **Technical Feasibility** Yes |

## 3. Join the Transportation and Climate Initiative Program (TCI-P)

For a detailed description of this Strategy, please see Pathway 1: Light Duty Electrification, Strategy (4), above. Vermont's participation in TCI-P -- critically, paired with a complementary policy to drive strategic investments, foster a more equitable process and ensure greater equity outcomes – is an important tool to reduce transportation emissions and raise needed revenues to investment in actions detailed in this Heavy-Duty Vehicle Electrification Pathway.

## High (and consensus medium) Priority Actions

| **Lead Implementer: Agency of Natural Resources; Legislature** | | |
|---|---|---|
| **a.** | **Action Details:** See Action Details in Pathway 1, Strategy 4. | **Impact** See Impacts from Pathway 1, Strategy 4. |
| | | **Equity** See Equity from Pathway 1, Strategy 4. |
| | | **Cost-Effectiveness** See Cost-effectiveness from Pathway 1, Strategy 4. |
| | **Timeline to Implement:** Immediately. | **Co-Benefits**<br>- See Co-benefits from Pathway 1, Strategy 4. |
| | | **Technical Feasibility** Yes |

# Pathway 3 Reduction in Vehicle Miles Traveled (VMT)

While the quantitative emissions reductions benefits of reducing VMT requires additional modeling, it can be assumed that reducing the number and length of car trips is possible by growing state and local investment in transit, micro-transit, rail, bike and pedestrian infrastructure, and other transportation services beyond the single occupancy vehicle will have a beneficial impact on emissions. These transportation modes also have known public health, equity and other co-benefits. Increasing the use of these modes is contingent on several factors including service that mimics the convenience of driving, and is safe, reliable, and feasible for

users who cannot drive, including people living with a disability. Use of these modes tends to be most feasible in urban and village areas where the land use density is adequate and is less feasible in dispersed rural contexts. Long term reduction of transportation emissions is also contingent on the commitment at the local, regional and state levels of supporting the state's smart growth land use goals through infrastructure investment.

## 1. Increase state, regional and local capacity to plan for VMT reduction and implement sustainable transportation strategies.

## High (and consensus medium) Priority Actions

<table>
<tr><td colspan="3">Lead Implementer: Legislature, Vermont Agency of Transportation, regional and local partners</td></tr>
<tr><td>a.</td><td>Action Details: Require VTrans to create a State Sustainable Transportation Implementation Plan, including:<ul><li>The GHG reduction cost effectiveness of Smart Growth strategies which could reduce VMT in the Vermont context and how that compares to other GHG reduction strategies which Vermont could deploy.</li><li>Understanding and quantifying the effect of Smart Growth on VMT in Vermont</li><li>Establishing of State VMT targets</li><li>The level of investment across modes needed to contribute towards long & short-term emissions, equity and other goals. This could include funding to grow existing programs & increase availability and use of transit, micro-transit and other transportation choices.</li><li>Continuing to fund and provide technical assistance to RPCs and municipalities through the Transportation Planning Initiative. In addition to the current program's priorities, transportation sustainability will be incorporated as a goal within Regional Transportation Plans and Municipal Plans and in order for evaluation and inclusion of affordable</li></ul></td><td>Impact VMT The state currently lacks information regarding how land use affects transportation emissions and the transportation investment necessary to reduce emissions by shortening trips, reducing single occupancy vehicle trips and increasing transit options and other services, and the associated infrastructure. More research and better metrics will be required. It is possible and the State should seek to quantify, measure and adjust programs and policies to realize potentially essential pollution reduction benefits needed to achieve 2050 emissions reduction requirements.<br><br>Equity Transit and other services and modes that replace vehicle trips are essential to the those that can't afford to own or operate a vehicle.<br><br>Cost-Effectiveness VMT reduction measures are relatively cost-ineffective compared to other transportation emission reduction pathways in contrast to vehicle electrification, but the long-term growth of non-single occupancy vehicle transportation and the associated land use patterns will result in numerous</td></tr>
</table>

| | | |
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| | and effective methos of reducing GHG emissions from transportation such as expanding transit service, building bike and pedestrian facilities, locating EV charging equipment and more.<br>The *State Plan* shall evaluate and incorporate if founds to be feasible, affordable, and effective at reducing GHG emissions:<br>- Free fares for users of public transit. Encourage Public Transit Provider Boards of Directors to continue to offer fare-free transit to all public transit users following the conclusion of the SFY22 fare free programming funded by the Legislature.<br>- A multi-year plan to increase the availability and use of transit and micro-transit, based on industry recommended deployment standards for route deployment, to achieve a more robust, integrated public transportation system following the conclusion of the SFY22 fare free programming funded by the Legislature.<br>- Expanding and improving Amtrak/rail and inter-city bus service<br>- Actions to enhance the delivery of the State's Complete Streets legislation, maintain and expand transportation trails, and continue to advance the implementation of the 2021 Bicycle & Pedestrian Strategic Plan and other bike/ped funding programs. | economic, social and environmental benefits and potentially significant essential pollution reduction benefits over time. |
| | **Timeline to Implement:** Immediately | **Co-Benefits**<br>• Increased equity in transportation options.<br>• Improved public health outcomes from active transportation.<br>• Air quality and other environmental benefits<br><br>**Technical Feasibility** Yes |

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## Pathway 4 Lower the carbon intensity of fuels

While Vermont is working to electrify vehicles to achieve emission reduction requirements, combustion vehicles and equipment, especially in the heavy-duty vehicle sector, will remain on and off Vermont roads for years to come. Production and deployment of combustion vehicles is likely to continue until at least 2035 for the light duty sector and may continue for additional years for heavy duty vehicles and equipment. Many heavy-duty vehicles have long "useful" lives, meaning they could continue to be operated for decades after electrification options are available and feasible. Therefore, increasing efficiency of combustion vehicles and equipment, and lowering the carbon intensity of the fuels that these vehicles use, remains a critical component of the State's near-term strategy to reduce emissions in the transportation sector. Lower carbon fuels, like biofuels, could play an important role, especially in the near-term, to reduce emissions from combustion vehicle use while developments and additional deployments of medium to heavy duty electric vehicles are made.

## 1. Join the Transportation and Climate Initiative Program

For a detailed description of this Strategy, please see Pathway 1: Light Duty Electrification, Strategy (4), above. TCI-P requires fuel suppliers that deliver gasoline and diesel fuel for final sale in Vermont to purchase carbon allowances available for sale at auction and surrender those credits equal to the emissions from the fuel delivered for sale. The number of allowances available for sale on the regional market is capped, and reduced over time, to achieve regional emission reductions. One way for a fuel supplier to reduce their compliance obligation is to supply lower carbon intense fuels for sale in participating jurisdictions.

## High (and consensus medium) Priority Actions

<table>
<tr><td colspan="3">Lead Implementer: Agency of Natural Resources; Legislature</td></tr>
<tr><td rowspan="4">a.</td><td rowspan="3">Action Details: See Action Details for Pathway 1, Strategy 4.</td><td>Impact See Impacts details for Pathway 1, Strategy 4.</td></tr>
<tr><td>Equity See Equity details for Pathway 1, Strategy 4.</td></tr>
<tr><td>Cost-Effectiveness See Cost-effectiveness for Pathway 1, Strategy 4.</td></tr>
<tr><td>Timeline to Implement: Immediately.</td><td>Co-Benefits</td></tr>
</table>

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|---|---|---|
| | | - See Co-benefits for Pathway 1, Strategy 4. |
| | | **Technical Feasibility** Yes |

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