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Policy Research Shop

Responding to Increasing EV Use in Vermont

Presentation to the Vermont Senate Committee on Transportation

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This report was written by undergraduate students at Dartmouth College under the direction of professors in the Rockefeller Center. Policy Research Shop (PRS) students produce non-partisan policy analyses and present their findings in a non-advocacy manner. The PRS is fully endowed by the Dartmouth Class of 1964 through a class gift in celebration of its 50th Anniversary given to the Center. This endowment ensures that the Policy Research Shop will continue to produce high-quality, non-partisan policy research for policymakers in New Hampshire and Vermont.





Problem Statement

- EV use is increasing in Vermont
- Revenue from state gas tax makes up a large share of Transportation Fund
- State EV network is developing rapidly and new federal funding will further accelerate development
- Proliferation of EVs raises the challenge of proper used battery disposal
- Each of these problems require attention from this committee



Replacing Gas Tax Revenue

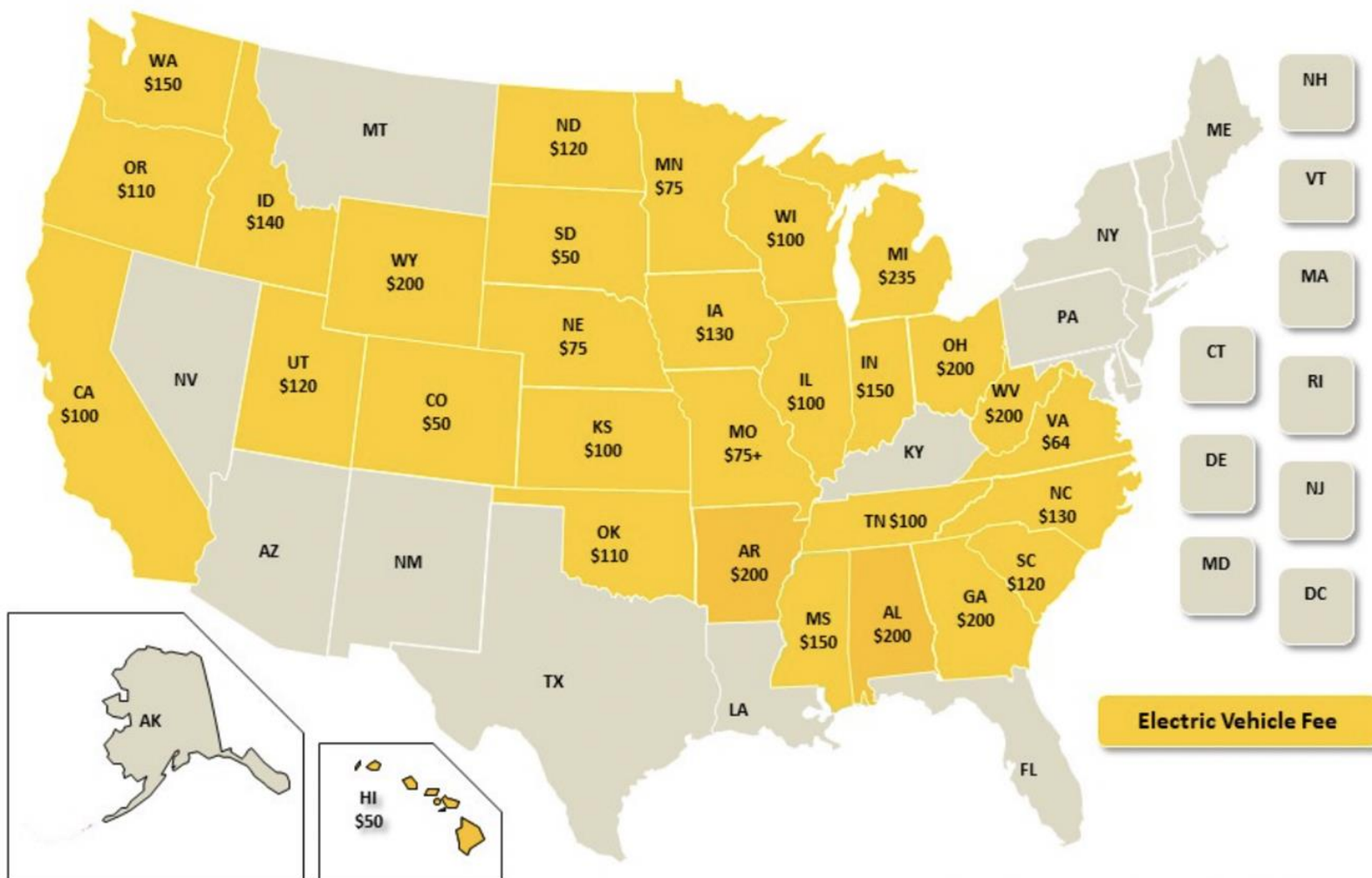
- Vermont faces increasing gas tax revenue loss
 - \$19 million in 2030 if CAP EV targets are achieved
 - Revenue accounts for almost $\frac{1}{3}$ of the transportation fund
- Most common methods currently:
 - Electric Vehicle Registration Fee (RF)
 - Road Usage Charge (RUC) Program
- State comparisons: Colorado, Utah, California
 - Colorado: EV RF
 - Utah: EV RF, small RUC program
 - California: EV RF, researching more complex RUC program



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Source: TIAC, "State Electric Vehicle Fees," May 2021



EV Registration Fees

- **Insufficient**
 - Cover about $\frac{1}{3}$ of gas tax revenue in Utah and California
 - Colorado has pulled more than \$1 billion from general fund to support transportation costs in the last five years, even though EV fees were in effect since 2017
- **Potential for disincentive effects**
 - Research found that EV RF reduce zero-emission vehicle sales by 10% to 20% in the short-run in California (UC Davis)
 - Hybrid vehicles face double-taxation (state gas tax and registration fees, in some states)



Road Usage Charge (RUC)

- Advantages:
 - Better represents true cost of travel
 - Potential ability to influence driving habits
 - More similar to traditional gas tax than EV RF
- Long-term:
 - Potentially sustainable source of revenue if more enrolled
 - Could replace gas tax entirely



Road Usage Charge, Odometer Method

- Odometer method proposed in Vermont RUC study
- Advantages:
 - Lower administrative costs
 - Fewer security concerns
 - No third-party account managers necessary
- Potential concerns:
 - No ability to account for out-of-state driving
 - Requires detailed odometer record for each vehicle
 - RUC participants show preference for automated methods
 - over 75% in Colorado and California pilots
 - Manual methods may feel outdated and inefficient



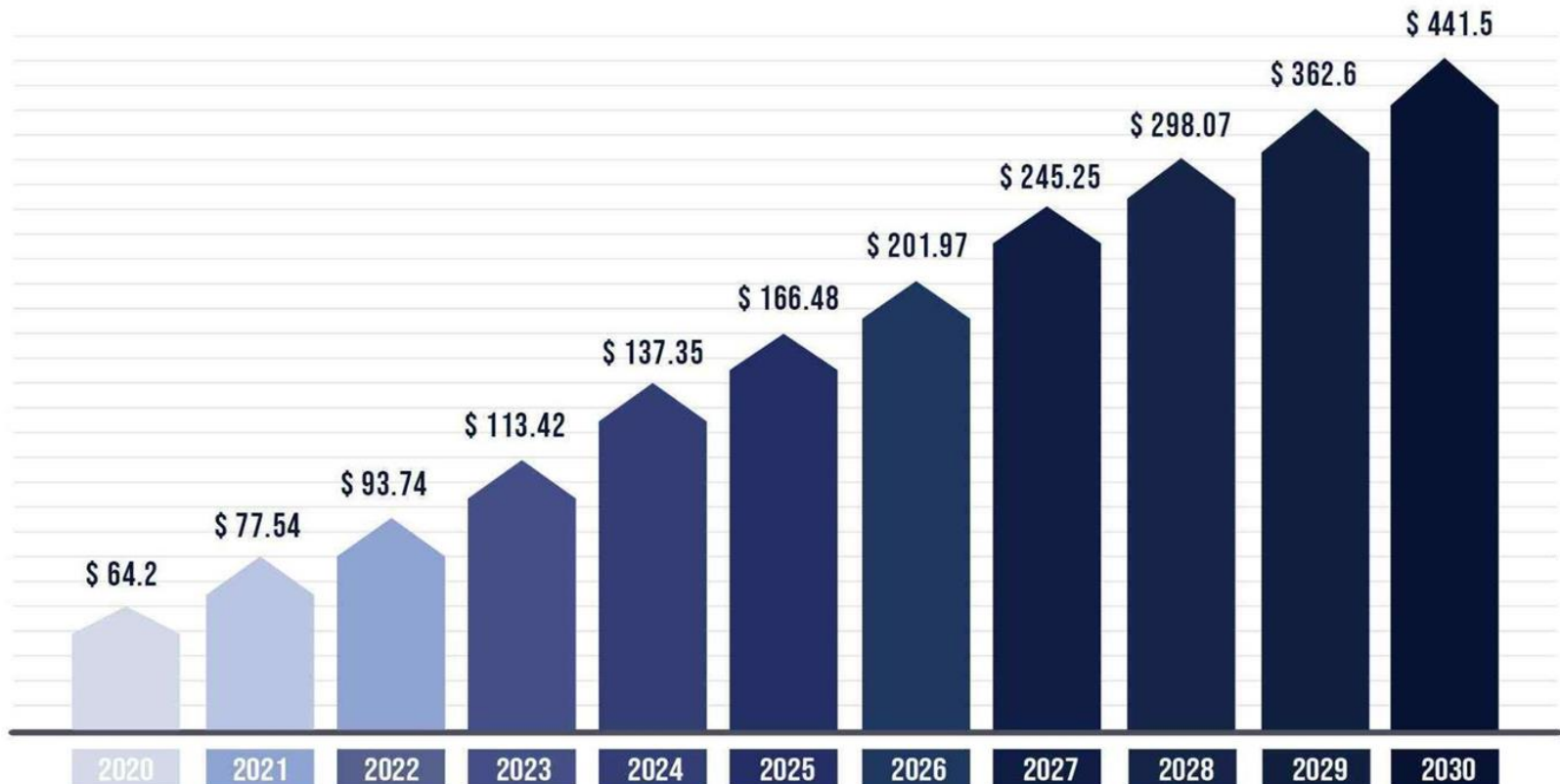
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AUTOMOTIVE TELEMATICS MARKET SIZE, 2020 TO 2030 (USD BILLION)





Road Usage Charge Considerations

- Rural drivers
 - Research suggests rural drivers pay less each year under a RUC program than with the traditional fuel-based system
 - More research, specific to Vermont rural drivers, needed
- Tourism
 - How, if at all, could Vermont account for out-of-state drivers on state roads?
- Collaboration with other states
 - RUC America is a mostly western-state coalition
 - Potential for New England/eastern-state coalition?

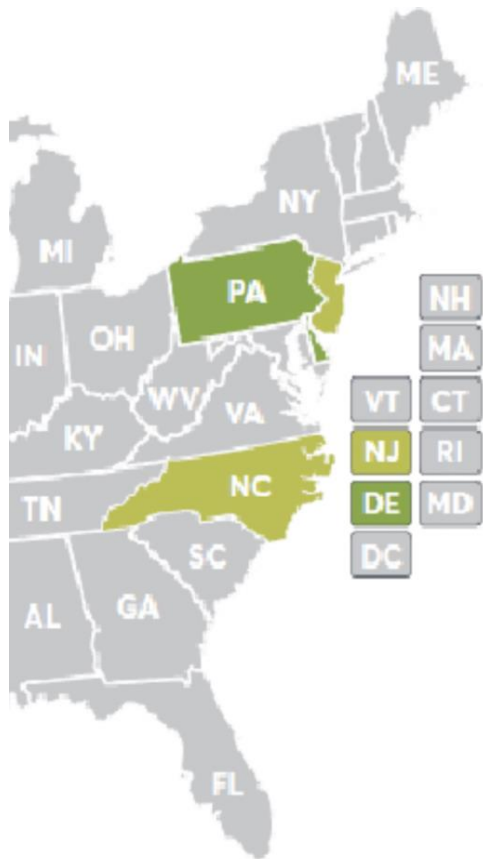


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2020



8 Pilots/Demonstrations **3** Planned Pilots **10** Research Only

2022





EV Charger Siting

- Vermont has around 300 public charging stations
- This number will soon increase due to National Electric Vehicle Infrastructure (NEVI) Funding from the Infrastructure Investment and Jobs Act
- When siting new charging stations, Vermont must contend with numerous challenges, namely:
 - Rurality, Grid Infrastructure, Equity, and Supply Chain Delays



Takeaway #1: Strong Influence of NEVI Requirements

- NEVI funding can only be used to meet strict locational and infrastructural requirements
- Requirement of four plugs at 50-mile intervals along designated corridors, even in low-traffic areas
- Funds can be used for alternative purposes only after designated corridors are “fully built-out”
- All states reviewed listed meeting NEVI requirements as an immediate priority



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State EV Charging Location Map ID	Route(s)	Location	Anticipated EV Network	Utility Territory	Status
1	I-89	St Albans	TBD	Green Mountain Power	To be constructed
2	I-89 / US 7	S Burlington	TBD	Green Mountain Power	To be constructed
3	I-89 / US 2	Berlin	TBD	Green Mountain Power	To be constructed
4	I-89	Randolph	Blink	Green Mountain Power	Potential exception for contracted installation
5	I-89 / I-91	White River Jct	TBD	Green Mountain Power	To be constructed
6	I-91	Derby	Blink	VT Electric Coop	Potential upgrade of current installation
7	I-91 / US 2	St Johnsbury	Blink	Green Mountain Power	Potential upgrade of current installation
8	I-91	Bradford	TBD	Green Mountain Power	To be constructed
9	I-91	Springfield	Blink	Green Mountain Power	Potential upgrade of current installation
10	I-91 / VT 9	Brattleboro	TBD	Green Mountain Power	To be constructed
11	US 7	Middlebury	TBD	Green Mountain Power	To be constructed
12	US 7	Rutland	Blink	Green Mountain Power	Potential upgrade of current installation
13	US 7	Manchester	TBD	Green Mountain Power	To be constructed
14	US 7 / VT 9	Bennington	TBD	Green Mountain Power	To be constructed
15	VT 9	Wilmington	TBD	Green Mountain Power	To be constructed

Left: Map of intended FY 2023 NEVI project locations

Above: Corresponding list of intended FY 2023 NEVI project locations

Source: Vermont NEVI Plan 2022



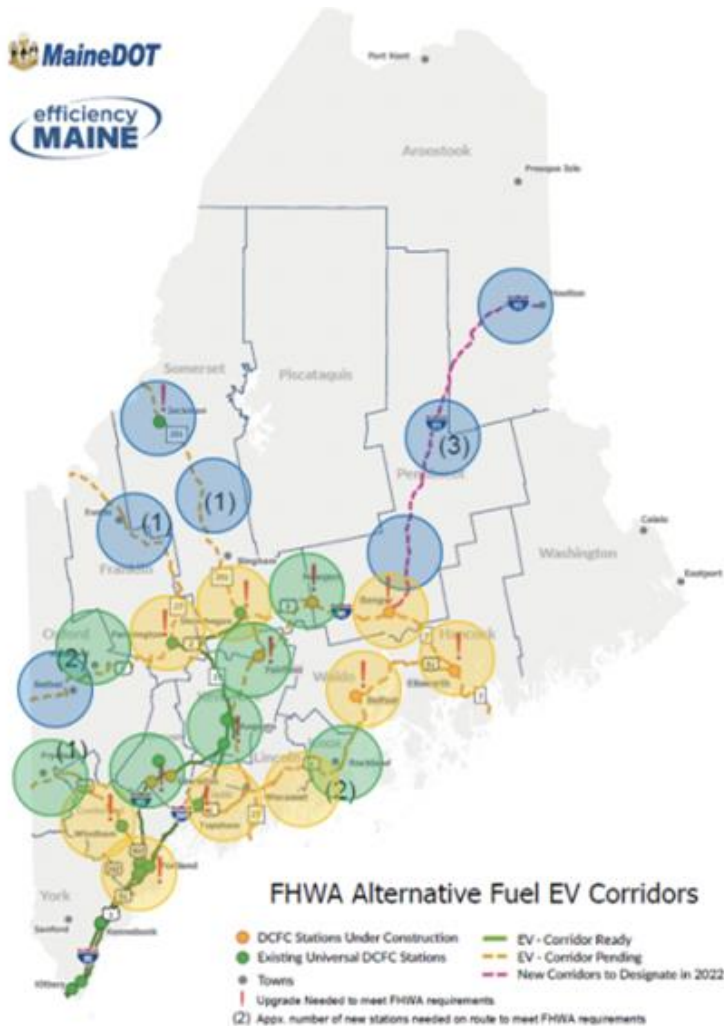
Takeaway #3: Federal Attention and Funding

- Attention towards securing key metals and minerals
- Key Legislation
 - Inflation Reduction Act
 - Infrastructure Investment and Jobs Act
- Key Federal Actors
 - Department of Energy
 - Department of Transportation
- Vermont could wait to follow federal legislation and guidance as opposed to being a first adopter



Takeaway #2: Benefits to Staggered Development of Rural Sites

- NEVI requirements apply, even in low-traffic areas
- Chargers in low-traffic areas are not predicted to be profitable within the next decade
- Building four-plug stations in rural areas is often inefficient and impractical
- Maine and Colorado plan to install rural chargers through a “staggered approach”
- Vermont may want to consider a similar strategy



Initial Buildout of AFC Stage 1: Years 1-5 (NEVI Period)

- Low traffic sites
- Medium traffic sites
- High traffic sites

Fig. 6 In the initial stage, DCFC sites are sized based on the amount of traffic they receive. High traffic sites are built to the full NEVI scope in the beginning while lower traffic sites are initially built with a smaller number of plugs and/or with power sharing to allow for a lower maximum kW per site. In all cases, the electrical service is sized to accommodate an upgrade to the full NEVI scope (min. 600kW per site) in the later stages of buildout.



Takeaway #3: Areas for State Action on EV Charger Installation

- The current grant system creates some space challenges for installers
- Vermont lacks a uniform system of infrastructure reporting and electrical fees for EV chargers
- Local governments and businesses are often hesitant to accept new charging stations



Takeaway #4: Necessity of Developing At-Home Charging

- It is five times more expensive to charge at public stations than at home
- Low-income Vermonters are less likely to have access to at-home charging
- Thus, the mere presence of public chargers in a community does not facilitate equal access
- To ensure equitable access to charging, Vermont can prioritize allocating funds for at-home charging



EV Battery Disposal

- Average Vermont citizen drives roughly 12,000 miles annually; a 200,000 mile battery would last 17 years
- Projected to be a major issues in the 2030s
- Three ways of processing: re-use, repurposing, and recycling
 - Re-use: Re-using old batteries in new EVs
 - Repurposing: Using old batteries for non-EV applications
 - Recycling: Extracting usable materials from old batteries
- Several US companies involved in battery processing
 - Contain valuable metals such as lithium and cobalt



Takeaway #1: Identifying Parties Responsible for EV Battery Waste

- A universal focus of state task forces, particularly the Californian Lithium-ion Car Battery Recycling Advisory Group Final Report
- ‘Extended Producer Liability’ is primary solution
 - Designates responsible party for every step of battery’s life
- Vermont’s ‘Primary Battery Stewardship Law’ as a model for Extended Producer Liability



Lithium-Ion Car Battery Responsibility Timeline

Battery Warranty Period:
Auto
Manufacturers

Battery Replacement:
- Core Exchange
(Dealerships, Repair
Shops, Collision
Shops)

Vehicle End-of-Life:
Dismantler
(w/Auto Manufacturer
Complete Vehicle “Back-
stop”)

*Note: Re-furbished batteries
placed back into a vehicle would
follow this process*

Non-vehicle Secondary Use:
Non-vehicle secondary use
Owner Responsible unless
stated otherwise in a contract



Takeaway #2: Lack of EV Battery Waste Processing In-State

- No in-state capacity
- Closest EV battery processing capacity in Worcester, Massachusetts (Ascend Elements) and Rochester, New York (Li-cycle)
- Transportation costs make up 40-60% of costs
- Federal funds available for in-state programs through Infrastructure Investment and Jobs Act



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Thank You for Your Time