Joint Energy Committee
Testimony from Jennifer Wallace-Brodeur, Director of Transportation Efficiency, VEIC
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I am the transportation efficiency director at the Vermont Energy Investment Corporation. Before starting, I'd like to clarify that I work for and am here representing VEIC, not Efficiency Vermont. Efficiency Vermont is one of several programs under the VEIC umbrella. I am part of the Consulting Division for VEIC, which advances market leading strategies for energy efficiency, renewables, and transportation for clients across the country and internationally.

Our transportation consulting work is focused on reducing the environmental and economic impact of energy use in the transportation sector. We do this by advancing the market for electric vehicles – both cars and heavy duty vehicles, such as electric school buses and transit buses. We also work to advance solutions that reduce vehicle miles traveled by providing more transportation options and services for people who lack transportation.

Today, I'm going to focus my comments on the overall need to reduce transportation sector emissions, transportation electrification as a key strategy to reduce emissions, how VEIC is working in this area, and the VW Settlement as an immediate opportunity to start electrifying the transportation sector.

Transportation Sector Emissions
The good news is that as a country and state we've been making progress towards reducing emissions from the electric sector. The bad news – we haven't made any progress in reducing emissions from the transportation sector. In 2016, for the first time, transportation sector carbon emissions nationally exceeded those from the electric power sector[i]. Here in Vermont, the transportation sector consumes more energy than any other sector (34% of total energy use in Vermont[ii]). And the transportation sector is largest source of carbon emissions in Vermont. (56% of emissions come from transportation sector[iii]). It's time that we have a focused, comprehensive effort to address the transportation sector to reduce harmful emissions and provide more options for all Vermonters to access jobs, schools, goods, services and community life.

Transportation Electrification
Here in Vermont we've set climate and energy goals both in statute and in the Comprehensive Energy Plan. In order to meet these goals, we must look to renewable sources of energy to power the transportation sector. Specifically, to meet the 2025 Comprehensive Energy Plan goal of 10% renewably powered transportation would require about 45,000 EVs – a major increase from the current total of about 2,000. There is no way we will come close to meeting this goal if we continue with business as usual.

Vermont utilities have invested significantly in renewable energy and as a result Vermont's electricity is among the cleanest in the nation and is continually becoming cleaner. In the first part of this millennium, CO2 emissions rates from the electric sector decreased by 39% in New York and by 28% in New England[iv]. Robust clean energy policies in Northeast states such as Renewable Portfolio Standards, Greenhouse Gas emission targets and participation in the Regional Greenhouse Gas Initiative (RGGI) support continued reductions in GHG emissions. Cleaner electricity means greater benefits from electric transportation - reducing emissions and transitioning away from fossil fuels.

Beyond addressing climate change, Vermonters can benefit in multiple ways from a transition to electric vehicles.

Air pollutants from conventional gasoline vehicles harm human health, especially in areas of high traffic. The American Lung Association estimates that in 2015, Vermont spent $347 million in health and climate costs due to tailpipe emissions from gasoline and diesel-powered vehicles. Shifting to electric vehicles could reduce this by more than 90%.

While these environmental and health goals are laudable and important, it's also essential that we acknowledge how transportation impacts family budget, access to jobs and quality of life.

Electric vehicles can save us all money, as ratepayers, as taxpayers and as consumers. Almost 80% of the cost of a gallon of diesel immediately leaves the local economy[v]. Vermonters collectively spent over $1 billion on transportation energy in 2015[vi]. Driving on electricity could cut this cost by 65%, to about $350 million, with more of the electricity dollars staying local to Vermont. Auto ownership is high in Vermont. While it's essential to invest in public transportation and other options to reduce single occupancy driving, we also need to recognize that these options are challenging to deploy in rural areas.

The majority of Vermonters will continue to use personal vehicles to meet their mobility and access needs for the foreseeable future. As a result, low income Vermonters often have disproportionate transportation burdens due to costs of owning and fueling vehicles in our rural landscape. According to analysis conducted by the VEIC transportation group for Efficiency Vermont, transportation accounts for more than half of the energy spending in Vermont households[vii].

As ratepayers, EVs can be a strategy to maximize efficiency of our electric system through programs that encourage charging at periods of low demand and to avoid charging during peak events. As taxpayers, electric school and transit buses can reduce overall transportation operating costs with lower cost fuel and maintenance.

VEIC Electric Vehicle Work: Personal Vehicles, Public Transportation, School Buses

VEIC's transportation work has focused primarily on electric vehicles and strategies to overcome barriers to EV adoption and accelerate the transition to cleaner vehicles. Since 2012, we have coordinated the Drive Electric Vermont program, which is a stakeholder-driven initiative to increase consumer adoption of electric vehicles. VEIC coordinates marketing programs and infrastructure development support. We also administered two statewide consumer incentive programs, which include a dealer training and incentive program. This coordinated effort has resulted in Vermont leading the nation in per capita EV registration and deployment of public charging stations. The US Department of Energy's EV Everywhere program recognized DEV as a model for other states and regions working to advance EV adoption and created a case study on the program in 2016.

Electric Transit

VEIC's Transportation Efficiency team also has experience purchasing electric vehicles and working with electric transit vendors through vehicle demonstrations in Massachusetts and Vermont. In 2016, we prepared an alternative fuel assessment for Martha's Vineyard Transit Authority (VTA) to determine the best fuel technology for the system and are now providing technical assistance as the agency transitions to an all-electric fleet. As part of this assignment, we developed a request for proposal for an electric vehicle vendor, evaluated responses, and led procurement of their first electric vehicles.

Additionally in 2017, VEIC in partnership with BED, GMT, Advance Transit, UVM and VTrans conducted an electric transit bus pilot project. For this six-week pilot, VEIC teamed with Build Your Dream Motors (BYD) to evaluate cold weather vehicle performance, fuel costs, and build acceptance for the technology among transit stakeholders. We have worked with both VTA and VTrans on successful Low and No Emission Vehicle applications in 2017 and will be assisting with their electric bus purchases. In 2016, we conducted a cost-benefit analysis and state of the technology report on battery electric buses for VTrans. Through these projects we have gained deep understanding of electric transit bus technology, charging infrastructure and deployment challenges, and we have built strong relationships with electric transit bus manufacturers.

Electric transit bus technology is mature and the market is growing rapidly. As of 2016, all the major transit vehicle manufacturers are producing electric transit buses. This includes the primary manufacturers of diesel vehicles (Gillig, New Flyer and Nova Bus) plus three manufacturers who entered the market specifically to make electric transit buses (Proterra, Build Your Dreams (BYD) and Complete Coach Works).

There are two types of electric buses:

- Short range buses can recharge in 8-10 minutes with a fast charger 500 kW; they have smaller battery packs and range is 50-70 miles
- Longer range buses have larger battery packs, 150-200 mi range and can charge in 4-6 hours, 80 kW draw

Several large transit agencies – LA Metro and King County Metro in Seattle have announced their intention to go 100% electric and there are some smaller agencies, like Antelope Valley Transit Authority that are in the process of going 100% electric. Here in Vermont, VTrans won a $480,000 grant from the Federal Transit Administration Low and No Emission Vehicle program this year to purchase 2 electric transit buses for Green Mountain Transit. By the way, this program gives out about $55M/year to purchase low or no emission buses. This year the program received over $500M in requests.

Electric School Buses

VEIC's transportation team includes leading national experts on electric school buses. Since 2015, we have been under contract with the MA Department of Energy Resources to manage an electric school bus demonstration project in 3 school districts (Amherst, Cambridge, Concord). This is the first deployment of ready-built Type C (the typical yellow school bus) electric buses in the United States. Also first buses deployed in a cold weather state. VEIC's role has included selecting school to participate in the pilot, developing RFP to select and purchase buses, working with Lion Bus (vehicle manufacturer) and schools to get vehicles on the road and to trouble shoot, and evaluate vehicle performance. VEIC is leveraging work in MA to build awareness about electric school bus technology by hosting workshops with education, utility, government and NGO stakeholders across the country (Northeast, OH, MI, FL, OR). We held a Vermont workshop this summer in White River Junction, attended by several school districts who are interested in this technology.

There are obvious benefits to electric school buses with the most important being children's health and reduced exposure to diesel emissions. Additional switching from diesel to electric power can reduce a vehicles CO2 emissions by 71%[viii] and can reduce fueling costs by over 40%.

While electric school bus technology is proven, market deployment is more nascent than for transit buses. VEIC estimates that currently there are only 26 electric school buses on the road in the United

States, with another 63 expected by the end of this year. Lion Bus, based outside Montreal is the only manufacturer of ready-built Type C buses. TransTech in New York makes smaller Type A electric buses.

The most significant barrier to both electric transit and school bus deployment is the upfront cost.

School buses are 3-4 times the cost of diesel buses:
~ $250k vs. $75k (Type A)
~ $325k vs. $100k (Type C)

There is a 70% premium for electric transit buses, although the major manufacturers believe costs will come down significantly in the coming years and transit buses will make up the differential in the upfront cost through lower operating costs over the lifetime of the vehicle.

~ $750k vs. $450k for diesel

Additional costs for infrastructure (includes installation)
~ $25-40k for depot charging
~ $480k for fast or inductive charging

Immediate Opportunities to Catalyze Transportation Electrification
Vermont is poised to receive $18.7M from the Volkswagen Settlement and these funds could be the catalyst towards electrifying transit and school buses – both of which are eligible mitigation activities. We believe the settlement should be used to not only meet the required NOx reductions but also help advance our other climate, energy and health goals by using 100% of the proceeds for electric technology. In addition, we recommend using the full allowable allocation for EV charging, which is 15% of the total settlement.

[i] DOE, EIA May 2016 Monthly Energy Review
[ii] http://www.eia.gov/state/?sid=VT
[iii] http://www.eia.gov/environment/emissions/state/analysis/pdf/stateanalysis.pdf
[iv] NYISO and ISO-NE
[v] https://www.eia.gov/petroleum/gasdiesel/
[vi] https://www.eia.gov/state/seds/sep_fuel/html/pdf/fuel_pr_pa.pdf
[vii] https://www.efficiencyvermont.com/Media/Default/docs/white-papers/efficiency-vermont-mapping-energy-burden-vermont-white-paper.pdf
[viii] VEIC calculation: based on fuel efficiency of an eLion (1.4 kw per mile) compared to the fuel efficiency of a diesel bus (6 miles per gallon). Assumed 22.38 lb. of CO2 from a gallon of diesel - https://www.eia.gov/tools/faqs/faq.php?id=307&t=11. Assumed 0.72 lb of CO2 from on kW - https://www.iso-ne.com/static-assets/documents/2016/01/2014_emissions_report.pdf