January 17, 2018

Maine Department of Transportation
Environmental Office
ATTN: Judy Gates, Director
16 SHS, 24 Child St.
Augusta, Maine 04330

(Submitted by Email to: Judy.Gates@maine.gov)

Re: Sierra Club Comments on Proposed Maine Environmental Mitigation Plan Issued Pursuant to the Volkswagen 2.0 L Vehicle Partial Consent Decree, Appendix D

Dear Ms. Gates:

Sierra Club Maine appreciates this chance to comment on the Maine Department of Transportation’s (“MaineDOT”) Proposed Environmental Mitigation Plan¹ (the “Proposed Plan”) We encourage MaineDOT to focus on full electrification of Maine’s transportation system and protect Maine’s natural resources, while leading a transparent and accessible stakeholder process to determine best uses of the Environmental Mitigation Trust (“EMT”) funds. On behalf of the more than 18,000 members and supporters in Maine, we respectfully submit the following recommendations and comments.

As MaineDOT and the Proposed Plan recognize, the EMT presents our State with a unique opportunity to reduce NOx and other polluting vehicle emissions, to improve the health of all Maine residents, and to accelerate the transformation of our transportation sector. Our overarching aim is to ensure that MaineDOT invests the EMT funds in ways that are forward-looking, transformative, and cost-effective over vehicles’ useful lives, while meaningfully reducing NOx and other polluting emissions. Given those objectives, we believe several elements of the Proposed Plan are very positive, and offer recommendations to magnify the impact of the EMT funds.

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First. Sierra Club enthusiastically supports many parts of the Proposed Plan, including:

- Allocating the maximum allowable portion (15%) of the available EMT funds for investments in electric vehicle supply infrastructure (“EVSE”) for the charging of light-duty vehicles;
- Priority for projects that maximize public health benefits, considering the population that will experience improvements in air quality due to the project;
- Priority for projects in areas that receive a disproportionate quantity of air pollution from diesel fleets such as ports, rail yards, terminals, school depots/yards, and freight distribution areas;
- Priority for projects proposed by government and non-government entities with demonstrated experience and existing administrative and programmatic structure in place for implementing diesel emission reduction or offset projects;
- Priority for projects that impact designated Federal Class I areas: Acadia National Park, Roosevelt Campobello International Park, and Moosehorn Wilderness Area located within Moosehorn National Wildlife Refuge Area;
- Priority for projects with verified match (i.e., for projects that require a cost-share) or leveraged funding.

Second. we encourage MaineDOT to consider the following recommendations to maximize the impact of EMT funds:

- Emphasize long-term and systematic impacts of projects, especially the benefits of catalyzing the transition to zero emission vehicles (“ZEVs”) and full electrification, rather than prioritize immediate pollution reductions;
- Provide higher incentives for the adoption of electric vehicle technology relative to other alternatives within the priority multimodal transportation, Appendix D-2, and DERA categories;
- Prioritize investment in shore-to-ship power;
- Prioritize critical “long dwell time” locations for installation of Level 2 charging like multi-unit dwellings and workplaces, and partner with electric utilities to provide electricity service to sites where electric vehicle charging infrastructure will be installed.
Third, to assure that EMT funds have a purely positive impact, we encourage MaineDOT to consider adding stipulations that:

- Settlement funds should add to, not replace, existing clean transportation or environmental initiatives;
- Limit funds to projects that will introduce or extend dependence on methane gas, whether renewable or conventional.

I. Prioritize Full Electrification and Zero-Emission Technology

Sierra Club Maine recommends, first and foremost, that our state capitalize on this chance to show national leadership by prioritizing full electrification when allocating these funds. Doing so will benefit the State of Maine and powerfully contribute to environmental progress in many ways. First, in many of the sectors identified in MaineDOT’s draft proposal, such as drayage trucks and other port equipment, fully electric options are both the most environmentally friendly and cost-competitive over the life of the vehicle. Second, all investments in electrification not only lock in long-term emission benefits but contribute to falling prices of component technologies such as batteries and ultimately contribute to universal adoption of zero-emission transportation. Finally, electrification has significant ancillary benefits for local economies and jobs.

A. Fully Electric, Zero-Emission Alternatives are Market Ready and Cost-Effective

Sierra Club encourages Maine to prioritize electrification over alternative fuel options because in many cases it is not only the most environmentally responsible option, but also the most cost-effective. Electric buses are a prime example. In the analysis below, Sierra Club demonstrates how the lifetime costs of an electric bus in Maine is lower than both new diesel and CNG alternatives while offering the greatest reduction in NOx emissions on both an overall and per dollar invested basis. For other sectors identified in the draft Proposal, such as port equipment, similar analysis is not yet available, but electrification is expected to be similarly cost-effective based on reports of early-adopters.

Maine Transit Bus Lifetime Cost Analysis

Despite their greater purchase price, current analysis using Argonne National Laboratory’s AFLEET Model demonstrates that zero emission electric buses have a total cost of ownership 18% lower than new diesel buses. Maintenance costs for electric buses are between 70% and 79% lower than for compressed natural gas (CNG) and new diesel buses respectively, contributing to significant cost savings over the lifetime of a bus (15 years). Based on currently
reported data, each all-electric bus will save Maine’s transit agencies over $200,000 as compared to a new diesel bus purchase.

Moreover, as this electric bus technology continues to develop, all-electric bus up-front capital costs will continue to drop, whereas CNG and diesel bus capital cost trends are continually increasing. In addition, although reliable, current publicly available data on hybrid diesel-electric buses are lacking, a lifecycle analysis using data compiled by the California Air Resources Board in 2016 shows that hybrid diesel-electric buses have a total cost of ownership of $1,909,847, over $700,000 greater than an electric bus.

![Total Cost of Ownership - Maine Transit Buses](chart.png)

*Source: Argonne National Laboratory’s AFLEET Model (2017); fuel and electricity costs adjusted for Cumberland County, Maine.*

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The total cost of ownership is derived from Argonne National Laboratory’s AFLEET Model (2017). Fuel prices are adjusted for the Portland, Maine region. Model inputs are populated using averages of fuel economy and maintenance costs reported directly by transit agencies from the years 2014 to 2017.

Maintenance and fueling expenses typically account for a significant portion of transit bus’s lifetime costs. An investment in zero-emission vehicles will dramatically reduce this figure. As highlighted above, all-electric bus maintenance and repair costs are 79 and 70% lower than the maintenance and repair costs for new diesel and CNG respectively. Moreover, all-electric buses are fueled by regionally generated electricity, which has demonstrated far more reliable pricing as compared to diesel oil and natural gas. At the same time, electric vehicles are over 300% more efficient than either diesel or CNG, as expressed in the table above in terms of MPG-Diesel-Equivalent (MPGDE). Finally, as discussed below, reliance on regional generation benefits the local economy and promotes local jobs.

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3 Metrics derived from Argonne National Laboratory’s AFLEET Model (2017) and ZEB transit studies.
4 https://www.afdc.energy.gov/fuels/prices.html
Specific to the Volkswagen Settlement, agencies are instructed to demonstrate their anticipated NOx reductions as a result of their state’s environmental mitigation transportation investments. Many agencies are in search of the investment that results in the greatest NOx lb/$ ratio, but they are only considering the upfront purchase costs in these calculations. If the total lifetime costs are considered, the bus technology with the greatest NOx lb/$ ratio is a zero-emission bus.

*Electrification of Port Vehicles*

Sierra Club supports the draft proposal’s focus on port equipment, but again encourages the MaineDOT to prioritize electrification over alternative fuels. As discussed below, electrification of Maine’s transportation sector keeps money in state, and saves money through lower electricity
rates. Moreover, non-highway diesel engines account for ~11% of Maine’s total NOx emissions\(^5\) and have an outsize impact on economically disadvantaged communities.\(^6\)

Similar to transit buses, electrification of port vehicles also makes good economic sense. Although the cheaper upfront costs for new-diesel and alternate-fueled engines may be initially attractive, the more important costs for the State to consider are the lifetime costs of these vehicles. This is particularly true because the EMT funds will contribute to covering the upfront program costs to replace and repower engines, while subsequent fuel and maintenance costs will fall on the State, its residents, and its companies. Electrifying vehicles and equipment is a good investment since the lifetime costs are significantly cheaper than those of alternative-fueled vehicles and new diesel engines.

Drayage trucks, the short-haul transport vehicles used to move cargo to and from ports and intermodal rail yards, are now available with clean, electric engines.\(^7\) Many existing drayage trucks are retired long-haul vehicles repurposed to serve shorter routes.\(^8\) Due to this practice, the drayage fleet is made up of old, outdated, high emitting vehicles. Indeed, EPA estimates that in 2011 50% of the national drayage fleet was made of pre-1997 models, and that the same category will still comprise 24% of the fleet in 2020.\(^9\) Drayage operators expect trucks to last an average of 10 years.\(^10\) Replacing these old models with all electric trucks will therefore deliver lasting reductions in NOx, PM and CO\(_2\).\(^11\)


\(^7\) Partial Consent Decree, Appendix D-2 p. 11.

\(^8\) EPA, National Port Strategy Assessment at 82, EPA-420-R-16-011 (September 2016).

\(^9\) National Port Strategy Assessment, supra note 8 at tbl. 5-6.


\(^11\) EPA’s emission standards for pre-2004 trucks allowed more than four grams of NOx/bhp-hr, a rate that has since been lowered to .2 g/bhp-hr. See U.S. EPA, Emission Standards Reference Guide, available at https://www.epa.gov/emission-standards-reference-guide (last visited Sep. 29, 2016).
Emission reductions from drayage trucks are largely dependent on the model year of the vehicle being replaced. However, as a general matter, one can expect to achieve between 840 and 1,105 lbs-per-year of NOx reductions by electrifying a single drayage vehicle. PM and CO₂ reductions are similarly significant: 21.7 lbs/year of PM and 12 tons of CO₂ reductions per year.

Electric drayage trucks are currently more expensive than traditional diesel models. However, electric drayage trucks have far lower fuel and maintenance costs than diesel vehicles—a more important consideration with respect to the EMT. Indeed, variable costs for all-electric drayage trucks are 50-85% lower than for their diesel counterparts. The owner of a diesel truck must regularly change oil, pass emissions tests, repair/replace brakes, and pay for diesel fuel. The owner of an electric truck can expect reduced or eliminated costs for each of these areas. TransPower estimates that the energy cost per mile of a diesel drayage truck is $1.49/mile while a TransPower electric drayage truck registers a per mile cost of only $0.23. Additionally, the cost of these zero emission vehicles is expected to dramatically decrease over the next fifteen years due to advances in battery production. As the capital requirements for drayage vehicles draw closer to equivalence, the economic benefits of electric trucks become even more pronounced.

These technologies have already been successfully demonstrated. In 2012, the Southern California Air Quality Management District engaged nine battery-electric trucks in a pilot project. SCAQMD has subsequently reinvested in 43 more electric drayage vehicles. Electric drayage trucks are available from Mack and TransPower.

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12 Mitigation funds are available to target trucks with model years between 1992 and 2006. If state regulations already require replacing vehicles with these model years, then the eligible class expands to include model year2007-2012 trucks. See Partial Consent Decree, Appendix D-2 p. 1.
13 National Port Strategy Assessment, supra note 8 at 43.
14 Id.
MaineDOT should also emphasize replacing diesel forklifts with all-electric models. Only forklifts with greater than 8,000 lbs. of lift capacity are eligible to receive funding.\textsuperscript{20} Though electric forklifts require a greater up-front capital investment they already represent a large portion of the forklift fleet.\textsuperscript{21} They also exhibit lower life-cycle costs when accounting for fuel, operation, and maintenance than their diesel powered alternatives. The Energy Policy Research Institute estimates that an electric forklift with an 8,000 lb. lift capacity costs roughly $37,500 less than a similar propane model and $48,000 less than a similar diesel model over a projected six-year lifespan.\textsuperscript{22} This is in spite of over $9,000 more in upfront capital cost.\textsuperscript{23} Again, the reasons for this significant economic advantage are a large decrease in fuel and maintenance costs associated with electrification. Additionally, an electric model can save up to 137,000 lbs. of CO\textsubscript{2} over its lifetime and entirely eliminate the local emission of carbon monoxide and toxics.\textsuperscript{24}

\textbf{B. Critical Importance of Early Adoption}

Sierra Club strongly urges Maine to take advantage of this opportunity to pursue electrification over alternative fuel sources even in cases where it is not immediately cost-effective. First, prioritizing zero-emission electrification over alternatives with higher immediate NOx/dollar returns still results in greater emissions reductions on an engine-to-engine basis \textit{in all emissions categories}. But as importantly, early adoption is critical to help drive down the cost of developing technologies to the tipping point where widespread adoption becomes economically inevitable.

Many categories of electric vehicles, including those targeted in MaineDOT’s Proposed Plan will soon cross that threshold. Leadership by Maine and other states in their use of EMT funds can hasten that transition and the \textbf{tremendous} accompanying environmental gains. For example, California’s Air Resources Board (“CARB”), in formulating a strategy to accelerate broader

\textsuperscript{20} Partial Consent Decree, Appendix D-2 p. 7-8.
\textsuperscript{21} The current composition of the lift truck fleet is estimated at 60% electric, 40% combustion. Yale Materials Handling Corp., The Truth About Electric Lift Trucks (2010).
\textsuperscript{22} Electric Power Research Institute, Lift Truck Comparison with Capital Costs, http://et.epri.com/Calculators_LiftTruckComparison_with_cap2.html (last visited Sep. 30, 2016).
\textsuperscript{23} Id.
\textsuperscript{24} Id.
transportation electrification, called for a focus on “deploying zero-emission vehicles in heavier applications that are currently well-suited for broad market development, such as transit buses, airport shuttles, and last mile delivery [trucks]”\textsuperscript{25} in addition to continued electrification of light-duty passenger vehicles. CARB’s various technology assessments have also found that \textit{these categories are ripe for electrification}.\textsuperscript{26}

The pace of this transition impressive and encouraging from an environmental perspective, \textit{but it requires leadership and early adoption}. For example, another recent CARB study shows that every year the price premium falls for battery electric buses (“BEBs” in the chart below). Note that this is only purchase cost, \textit{not} lifetime costs, by which metric electric buses are already cheaper, as shown above. And every new bus bought will continue to shift the premium down. Using EMT funds to invest in electric buses now will place additional downward pressure on cost premiums and set the stage for future adoption.

\textsuperscript{25} CARB, “Revised Proposed 2016 State Strategy for the State Implementation Plan” at 83.
C. Indirect Economic Benefits of Electrification

Finally, Sierra Club recommends that MaineDOT prioritize full-electrification over alternative fuels because of indirect economic benefits to Maine. Foremost, increased electrification will decrease the cost of electricity for all Maine residents and increase the demand for local wind energy. At the same time, electrification can produce local jobs and keep a larger fraction of money spent on transportation fuel in-state.

Investment in electric transportation also places downward pressure on electricity rates. This benefits all utility customers, regardless of whether they own electric transportation vehicles. Electric vehicle charging will increase electricity sales, which if well-integrated into the electric

power system can dilute the fixed costs of electricity transmission and distribution and lower electricity rates for all utility customers.\textsuperscript{29}

Vehicles are used for transportation during only a small fraction of the day, and therefore an EV can be charged nearly any time. Maine’s electricity grid – from the poles and wires to the power plants – is designed for the heaviest electricity demands, which rarely occur. If vehicle charging is managed to occur during off-peak periods (primarily at night) this new load can be served by existing and often underutilized resources, such as wind, without proportionally increasing a utility’s costs. In turn, this can reduce the average cost of power for all utility customers. Maine is particularly well suited to capitalize on this effect, as wind accounts for more than $1/8$ of the state’s total net electricity generation (accounting for $3/5$ of the wind power capacity in New England).\textsuperscript{30} Analysis performed by the Pacific Northwest National Laboratory shows that large numbers of EVs charging during off-peak hours could significantly lower the marginal cost of energy.\textsuperscript{31} The same analysis found that there is sufficient spare generation capacity in the nation’s electric grid to power nearly the entire light-duty passenger fleet if vehicle load is integrated during off-peak hours and at lower power levels.\textsuperscript{32}

II. Shore-to-Ship Power

As another opportunity for EMT funds to accelerate electrification, Sierra Club recommends that MaineDOT consider the feasibility of shore-to-ship power at its commercial ports and major cruise ship ports-of-call. This technology eliminates the need for ships to self-produce electricity while in harbor, a requirement that is typically met by burning heavy bunker fuel in on-board auxiliary boilers. Components of such systems eligible for reimbursement are limited to cables, cable management systems, shore power coupler systems, distribution control systems, and


\textsuperscript{30} U.S. EIA, Maine State Energy Profile (Last Updated: June 15, 2017); U.S. EIA, Electric Power Monthly (February 2017), Table 1.14.B.


\textsuperscript{32} Id.
power distribution. EPA estimates average reductions in NOx emissions by 62.1 to 89.9% depending on ship type, PM2.5 emissions by 62.0 to 89.4%, and exhaust CO\textsubscript{2} emissions by 62.3 to 90.9%, when comparing shore vs. ship-based power generation. Shore power could potentially help address air and noise pollution near Acadia National Park, a Class I area identified by MaineDOT as a priority, which is currently grappling with impacts from the cruise industry.

Shore power further presents Maine with an opportunity to lead on electrification. Currently, the east coast lags behind the west in shore power installations. Investing in this technology would incentivize more of the Atlantic fleet to install compatible equipment, and more ports to invest in compatible infrastructure. Shore-to-ship power would also provide an opportunity for MaineDOT to partner with utilities and displace bunker fuel with locally generated energy.

III. MaineDOT should also emphasize “long dwell time” locations for installation of Level 2 charging and partner with the state’s electric utilities to stretch the investment in EVSE for light-duty vehicles.

As noted above, Sierra Club strongly supports the MaineDOT’s intention to allocate the maximum 15% allowable amount under the terms of the EMT for electric vehicle charging stations. Sierra Club has actively promoted EV development in Maine in the past, and will continue to support MaineDOT and other stakeholders to encourage increased vehicle electrification. Sierra Club endorses a two-pronged approach to support EV adoption, focused on providing would-be drivers access to critical charging infrastructure. To fully meet the needs of EV drivers, Sierra Club encourages MaineDOT to not only promote EVSE along travel corridors to enable extended travel but also to provide Level 1 or Level 2 charging in places where people naturally park for extended periods.

33 Partial Consent Decree, Appendix D-2, p. 5.
34 EPA, National Port Strategy Assessment, supra note 8 at 82.
37 Maine Proposed Plan at 16.
Therefore, Sierra Club strongly supports MaineDOT’s plan to dedicate a significant amount of this funding to the development of fast charging infrastructure along Electric Vehicle Corridors. Not only is fast charging critical to enable inter-city or distance travel, but consumer research indicates that a “lack of robust DC fast charging infrastructure is seriously inhibiting the value, utility, and sales potential” of EVs. But Sierra Club recommends that MaineDOT expand the scope of its proposed EVSE program to also include support for EVSE at “long dwell time” locations where cars are most often parked and where access to charging is critical for EV ownership—the home and the workplace. In particular, EMT money would be well spent on improving access to EV charging at multi-unit dwellings, where residents face unique challenges to the installation of EV charging.

Finally, Sierra Club also strongly supports the Proposed Plan’s emphasis on “leveraged resources” and encourages MaineDOT to partner with the State’s electric utilities in order to stretch the 15% allocation. In particular, Sierra Club recommends MaineDOT maximize station deployment by using EMT funds for charging station purchase and installation, while working with stakeholders and other agencies to allow the utilities to deliver power to the site or directly to stations. This approach would allow MaineDOT to reduce the incentive levels for corridor fast charging and better support use of the community or multi-unit dwelling fast charging program incentives. In many cases, the cost of installing supporting infrastructure and delivering power to charging stations is much higher than the cost of the charging station and its installation. DC fast charging stations, in particular, are more likely to require new or upgraded electrical service given the high power requirement and greater likelihood of installation at more remote sites.

38 Id.
40 National Research Council of the National Academies of Sciences, Overcoming Barriers to the Deployment of Plug-in Electric Vehicles, the National Academies Press at 9 (2015) (characterizing home charging as a “virtual necessity” for all EV drivers and describing the value of workplace charging).
42 Maine Proposed Plan at 16.
43 E.g., Joint Motion for Adoption of Settlement Agreement by Pacific Gas & Electric Company et al at 65, Case No. A.15-02-009 (filed March 21, 2016), California Public Utilities Commission; DOE, Costs Associated With Non-Residential Electric Vehicle Supply Equipment: Factors to consider in the implementation of electric vehicle charging stations at 17 (November 2015).
along highways. At minimum, “[i]t is important to work with the utility early in the process to minimize costs, optimize the electrical design, and eliminate scheduling bottlenecks.”

IV. Conclusion

Sierra Club Maine thanks MaineDOT for the opportunity to submit comments. We look forward to continued work with the Department and other stakeholders to support forward-looking, transformative, cost-effective use of the Volkswagen EMT in Maine that meaningfully reduce NOx and other polluting emissions from Colorado’s transportation sector.

Respectfully submitted,

Glen Brand
Chapter Director

44 DOE, Costs Associated With Non-Residential Electric Vehicle Supply Equipment: Factors to consider in the implementation of electric vehicle charging stations (November 2015).