January 13, 2017

Hinrich Woebcken
President and CEO
Volkswagen Group of America
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Re: Suggestions for use of Appendix C Zero Emission Vehicle Investment Commitment

Dear Mr. Woebcken:

The Sierra Club appreciates the opportunity to comment on Volkswagen’s use of the $2 billion zero emission vehicle (“ZEV”) investment commitment. Constructing a comprehensive network of Electric Vehicle (“EV”) charging infrastructure should resolve some of the hurdles that have slowed EV adoption to date. If done right, investing in charging stations will reduce local air pollution, fill gaps in the current EV charging market, and help balance the electric grid. To accomplish these goals, we recommend that Volkswagen prioritize investments in areas with high smog (ozone) levels, in communities that are disproportionately impacted by air pollution, including low income, minority and disadvantaged communities, and in market segments that are underserved.

Across the country, transportation emits over 50% of ozone forming nitrogen oxides (“NOx”). One of the great harms from VW’s emissions cheating was that actual NOx emissions exceeded anticipated levels. Investing in EV infrastructure in past and present nonattainment and maintenance areas, and in upwind areas that contribute to those nonattainment and maintenance areas, can help ameliorate harmful ozone pollution in those regions. Electric vehicles have no tailpipe emissions, meaning that each mile travelled by an EV displaces a correlate amount of tailpipe NOx. In addition, early investments should be made in communities that have been positioning themselves to advance EVs and that can move forward quickly with VW investment to advance EV adoption, while not losing sight of long term, strategic planning for investment further out on VW’s 10-year investment horizon.

In terms of specific locations for siting charging infrastructure, we recommend that VW focus on investments that will address critical market gaps. These include areas along frequently trafficked highway corridors, and areas with long dwell times, but currently limited access to charging equipment, such as multi-unit dwellings and workplaces. VW should first focus on expanding the network of DC Fast Chargers along highway corridors. There are many gaps in the current fast charger network, making long distance travel with an electric vehicle difficult. DC Fast Chargers are expensive to install and the market has been slow to provide these services. VW has already committed to spend $2 billion over the next ten years, a portion of which would go a long way towards building out an expansive network of fast chargers. The company does not need to start from scratch here but instead can model its fast charger build out on what is already working. VW’s investments should follow the same principles as projects,
like the Department of Energy’s Electric Vehicle Charging Corridors, Tesla’s corridors, and the West Coast Green Highway, without duplicating their on-ground infrastructure.

Second, we recommend that VW build out Level 2 chargers at sites with long dwell times but which are not adequately served by the present market. These include multi-unit dwellings and workplaces, including in disadvantaged communities and communities of color. Using ZEV funds for projects at these locations would overcome the collective action problems that have hampered their construction.

It will be critical for VW to ensure that the charging infrastructure it invests in is appropriately equipped to manage the load of a growing EV fleet. At higher levels of EV adoption, the additional load placed on the grid by EVs, if not properly managed, could accentuate peak demand and unnecessarily increase pollution from power plants. If managed properly, however, EVs can provide important grid support services, facilitate the integration of renewable energy, and minimize increases of pollution from conventional power plants while also driving down tailpipe emissions and charging costs.

As VW invests in EV charging infrastructure, it should emphasize transparency, public education, and stakeholder engagement. Submissions and proposals should be publically available throughout the process. Transparency upon submission, approval, and beyond, will insure that VW’s investments foster a robust, competitive market for third party charging. Additionally, VW should emphasize investments that are additive, and not engage in behaviors that supplant existing or planned construction. Each of these suggestions is discussed in further detail below.

Addressing Pollution: Encouraging EVs in Areas That Have, or Significantly Contribute To, Regions With Impaired Air Quality

The ZEV Investment Commitment is designed to address the adverse environmental impacts from consumers’ purchases of Volkswagen vehicles with emission cheating software. Environmental factors should, therefore, inform where VW allocates ZEV funds. This software registered lower tailpipe emissions of nitrogen oxides than were actually occurring from thousands of VW Clean Diesel vehicles. Nitrogen oxides are precursors to other harmful pollutants like smog (ozone) and particulate matter.¹ Electrification of the transportation sector will completely eliminate tailpipe emissions, clean up our nation’s air, and reduce the adverse public health impacts of air pollution.

As mentioned above, we urge VW to prioritize investments that reduce pollution in communities with high levels of ambient ozone, or that contribute to those areas with high levels of ozone. Not only are areas still in maintenance and nonattainment for the 75 ppb ozone level, but given the significant adverse health impacts of even lower levels of ozone, the U.S. Environmental Protection Agency has set a new national ozone standard of 70 ppb.² Regions

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with high levels of ozone that are designated maintenance or nonattainment for either the 75 or 70 ppb standard, or regions that significantly contribute to maintenance or nonattainment areas, should be prioritized. These include but are not limited to the Mid-Atlantic and Northeast (one approximation of this area is the Ozone Transport Region), the West Coast, the Ohio River Valley (which is also a large contributor of air pollution to the East Coast), and many more individual metropolitan areas across the country outside of these larger regions. These include Charlotte, Atlanta, Houston, Sheboygan, Chicago, Detroit and Denver, to name a few.

Prioritizing areas that significantly contribute to air quality issues, will also help Volkswagen meet its commitment to use the ZEV fund to further environmental justice. Research undertaken by the Sierra Club demonstrates a direct association between communities of color and elevated levels of ozone. Notably, this trend persists across regions, states, and counties analyzed. Investing in ozone nonattainment and maintenance areas will yield greater environmental and health benefits for communities of color, the same communities that consistently bear the brunt of excessive pollution.

Notably there is overlap between highway corridors and higher levels of ozone. Many of these ozone non-attainment counties contain highway corridors that have been designated EV Signage Ready, such as I-95 in Connecticut, which runs through at least two non-attainment areas (Bridgeport-Stamford-Norwalk, CT and New Haven-Milford, CT), and I-25 in Colorado, which runs through at least two non-attainment areas (Denver-Aurora-Lakewood, CO and Fort Collins, CO). Transportation is often the greatest contributor to high levels of ozone, as demonstrated by ozone modeling. For example, an average of 17% of the modeled ozone pollution monitored in Hammonassett State Park in New Haven County, CT is attributable to vehicles’ tailpipe emissions -- with this vehicle contribution reaching as high as 33% of all ozone pollution measured in a single day.

**Addressing Market Gaps: Prioritizing Highway Corridors**

We also recommend that VW prioritize investments along highway corridors to promote access and improve consumer confidence. To date, commercial investment in EV charging has been largely confined to areas with predictably high rates of immediate usage. Private investors rely on fees generated from high use rates to support a rate of return on their investments. Volkswagen is, however, in a different position. The ZEV investment commitment is not meant to, and does not have to, drive immediate profits for VW, but to advance vehicle electrification.

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3 See 42 U.S.C. 7511c(a) (including in Ozone Transport region “Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia”).


Building highly visible infrastructure along highway corridors will facilitate that goal by reducing range anxiety, raising public awareness of EVs, and spurring electric vehicle adoption outside of densely populated urban areas. Importantly, VW does not have to start from scratch. Instead, the company should apply lessons learned during other efforts to build out charging infrastructure to guide its investments.

In constructing the West Coast Green Highway, states learned valuable lessons which should inform VW’s selection of highway charging locations. First, DC fast chargers can spur consumer investment in electric vehicles, even without initial high use rates, which follow later. Oregon is one of the nation’s leading EV states with more than 120 DC fast chargers and over 9,000 electric cars. But unlike many other states, Oregon has not implemented an aggressive incentive program for EV purchases. Instead, state measures to promote EVs have focused largely on constructing a robust, highly visible, network of DC Fast Chargers, and spreading its network beyond its population centers. One of the great benefits of DC Fast Charging is to reduce the isolation felt by EV users when travelling outside of urban areas. VW should not, therefore, limit its investments only to those areas with potentially high initial usages. Instead, it should focus on filling gaps in the existing highway network where commercial providers are unlikely to step in at this time.

VW could further refine these lessons to focus ZEV funds on connecting areas with already high levels of EV adoption. For example, Atlanta has one of the highest rates of EV adoption among the nation’s major metropolitan areas. But the highways connecting that region to other major cities and popular destinations are woefully lacking in DC Fast Chargers. Installing DC Fast Chargers along I-20 would allow greater EV travel to and from Augusta, along Highway 16 to and from Savannah, along I-75 to Chattanooga, Macon and Florida, and along I-85 to Greenville, Columbus and Montgomery. The large gaps in these networks may be discouraging further EV adoption both in and further from the state’s urban centers.

It would also benefit the market for VW to target interstate corridors that currently lack DC Fast Chargers. Absences along these routes serve to further isolate the EV adopter, limiting them to regional travel. For example, the absence of DC Fast Chargers along I-55 south of St. Louis would make travel to Memphis almost impossible with an EV. Similarly, the major East-West freeways connecting the Midwest to the Rocky Mountains are almost devoid of DC Fast Chargers. I-80, has almost no DC Fast Chargers between Chicago and Salt Lake City, and very few between Salt Lake and Sacramento. I-90, has no DC Fast Chargers as it travels across

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7 See Jeff Allen, Expanding the Fast Charging Network, EVS29 Symposium, June 19-22 2016 (detailing Oregon’s successful encouragement of EV sales by building a network of DC Fast chargers).
8 Id. at 3.
9 Id. at 1.
10 Id. at 3 (describing the state’s goal to “create enough ‘stepping stones’ so that EV drivers could travel major corridors and reach popular destinations around the state.”).
11 Id.
13 See PlugShare, EV Charging Station Map, https://www.plugshare.com/.
Wisconsin, Minnesota, South Dakota, Wyoming, Montana, and Idaho. VW should seek to fill these gaps.

Tesla has already begun to build chargers in these areas, but the Tesla Supercharger is incompatible with charging by most other EVs.\textsuperscript{14} Nonetheless, Tesla’s system of superchargers provides a valuable model for establishing DC Fast Charging corridors. Tesla’s focus on providing coast to coast coverage, and its reputation for investing in a comprehensive network of chargers, has helped establish it as a leader in the EV market.

It is also important that VW not focus exclusively on use rates when plotting its investments. DC Fast Chargers do not provide the primary charging service for most EVs. Rather, they function as a safety net, allowing greater confidence in EV reliability.\textsuperscript{15} Accordingly, the standard for DC Fast Charger buildout is to place charging stations every 40-80km, or approximately every 25-50 miles.\textsuperscript{16} As EV ranges increase and greater adoption occurs, building out a robust network of DC Fast Chargers will enable adopters to travel freely without range anxiety. These networks should also be extended beyond major highway corridors to allow travel along spurs to frequent destinations. Oregon’s EV buildout focused not only on electrifying I-5, the main north-south interstate that runs from the border with Mexico all the way to Baja California, but on electrifying spur roads connecting the state’s major urban areas to the frequently visited coastal Route 101.\textsuperscript{17}

VW should also be mindful of lessons learned when siting chargers in high-use areas. To avoid queueing multiple chargers should be sited at a single location.\textsuperscript{18} At these stations it may also be necessary to install multiple configurations of chargers. Because on-vehicle adapters are not uniform across models, multiple plugs may be required so that a station’s usefulness is not dependent on the model of EV being driven.\textsuperscript{19} For example, while Volkswagen’s E-Golf uses a J-1772 Combo port, Nissan and Toyota equip their EVs with CHAdeMO charge ports, and Tesla uses a separate proprietary design. To ensure that VW’s investments benefit all consumers, and to help expand the market for EVs, charger pods should be able to fuel EVs using either model. This is also an important step to ensure that the ZEV commitment does not favor one set of EV producers over the others.

Addressing Market Gaps: Investing in Multi-Unit Dwellings and Workplaces

To ensure that benefits from the ZEV Commitment are equitably distributed, we recommend that VW focus its deployment of Level 2 chargers at multi-unit dwellings and workplaces. At home charging is a virtual necessity for EV drivers.\textsuperscript{20} However, residents of multi-

\textsuperscript{14} Tesla, Supercharger, https://www.tesla.com/supercharger.
\textsuperscript{15} Jeff Allen, Expanding the Fast Charging Network, EVS29 Symposium, June 19-22 2016 at 4.
\textsuperscript{17} Jeff Allen, Expanding the Fast Charging Network, EVS29 Symposium, June 19-22 2016 at 1-2.
\textsuperscript{18} Id. at 6.
\textsuperscript{19} Id. at 6-7.
\textsuperscript{20} 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).
unit dwellings (MUDs) do not have access to, or ownership of, the private driveways, garages, and parking spaces where most at-home chargers are installed. Volkswagen can help overcome this market gap by making Level 2 Chargers available to MUDs. Providing these services, at little or no cost to the MUD owner, would expand the pool of potential EV customers beyond the current community.

Volkswagen should also emphasize installing Level 2 Chargers at workplaces and other areas with long dwell times. Providing access to electricity at workplaces reduces “range anxiety” and increases an EV’s value.\textsuperscript{21} For Plug in Hybrid Electric Vehicles, workplace charging can effectively double the number of all electric miles travelled by that car each day.\textsuperscript{22} Charges at workplaces can also be linked to on-site renewables. Factories and office buildings are increasingly integrating renewable energy through rooftop solar. Linking EV chargers directly to these sources would further decrease the grid impacts of EV charging.

**Advancing a More Efficient Grid: Managing New Load**

VW can also take steps to ensure that the ZEV buildout does not exacerbate peak loads and regional air quality issues. As numerous studies make clear, EVs represent a new load segment that can be flexibly managed.\textsuperscript{23} If charging occurs during off-peak periods, additional load can be served by existing and often underutilized infrastructure.\textsuperscript{24} Volkswagen could encourage this behavior by pressing electricity providers to establish time of use (“TOU”) rates for EV charging—particularly at long dwell time sites. The Department of Energy’s EV Project, which has tracked the charging behavior of thousands of EVs since 2011, has shown that in areas with time-of-use (“TOU”) rates and effective utility education and outreach, the majority of EV charging occurs during off-peak hours.\textsuperscript{25} This was not the case in areas without TOU rates, where EV demand generally peaked in the early evening, exacerbating system-wide peak demand.\textsuperscript{26}

Ensuring that charging occurs during off-peak hours could also benefit non-EV users. Analysis performed by the Pacific Northwest National Laboratory shows that the marginal cost of electricity could be significantly lowered by a large fleet of EV’s conducting off-peak charging, and that standing assets are sufficient to meet the increased demand from such a shift.\textsuperscript{27} Other load management tools are also available and should be considered, particularly if TOU rates are not available. For example, VW could invest in charging technology that allows the electricity provider to control the distribution of electricity to EVs.\textsuperscript{28} By modulating electricity levels in real-time or switching off load completely through the use of advanced Electric Vehicle Support Equipment (“EVSE”) technology and enhanced utility metering, utilities can prevent EV charging...
from worsening peak distribution loads while still meeting EV drivers’ needs. Similarly, resource managers can shift EV load to facilitate the integration of variable generation from renewables. By increasing usage of standing assets, smoothing and shifting loads, and improving reliability, EV-charging can lower the marginal cost of electricity for all customers.

Finally, Volkswagen could pair EV chargers with on-site renewable generation and/or battery storage. Either of these strategies will decrease EV reliance on the electric grid. Moreover, such additions could allow EV users to receive the benefits of off-peak charging (i.e. low electric rates) during on-peak times. Pairing technologies in this way would thereby decrease time constraints on customers and in insulate the grid from greater peak demand.

However, a poorly integrated EV load can undermine these potential benefits. At high levels of EV penetration, unmanaged demand could strain the existing system, driving a need to add new generating resources as well as upgraded substations, distribution lines, and transformers. VW should avoid such results by taking the proactive measures discussed above.

Protecting Markets: Transparency, Education, and Stakeholder Engagement

Volkswagen should take steps to ensure that its ZEV Investment Commitment is administered in a transparent manner. VW’s investments will not fall upon a blank slate despite the large gaps in the EV charging market. There are a number of market players currently engaged in the EV charger buildout that may be impacted by the injection of the ZEV fund into their market. To prevent widespread disruption of a budding third party market, we urge that Volkswagen allow the interested public to engage in the proposal, approval, and implementation of projects. This should include not only making information available but also providing mechanism for stakeholder input to foster dialogue.

Sierra Club recommends that VW partner with experienced community education organizations and other stakeholders, including utilities, to increase awareness of EVs, the benefits of EVs, the growth in the EV industry and infrastructure, and to promote both EVs and the concept of off-peak charging. Doing so should increase the efficiency of outreach programs by leveraging existing organizational and educational networks. Public education programs should focus on providing information about increasingly competitive and advanced EVs and EV charging infrastructure, and the role played by EVs within the broader electric grid. Increasing public understanding of the benefits of thoughtful off-peak grid use can help mollify the impact of new EV adoption on the electric grid. Even without a TOU rate or other economic incentive to charge at off-peak hours, many EV adopters may modify their behavior if aware of the environmental impacts of their charging choices.

To the extent possible, as VW continues to make its investments, VW should consider how these investments could be structured to foster a competitive third party charging industry. This could be done, for example, by partnering with entities already in the field in certain instances.

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29 Id.
30 Regulatory Assistance Project, In the Drivers Seat: How Utilities and Consumers Can Benefit From the Shift to Electric Vehicles at 5, 13 (April 2015); CAISO, California Vehicle-Grid Integration (VGI) Roadmap: Enabling Vehicle-Based Grid Services at 5. (2014); CalTEA II at 68.
31 CalTEA II at 65.
32 See California Public Utilities Commission, Decision 95-11-035 (Utility Involvement in the Market for Low-Emission Vehicles); see generally CalTEA II.
The ZEV Investment Fund will inject unparalleled resources into the electric vehicle charging system. If properly conducted, the investments could jump-start the market for EVs nationwide. But the sheer scale of assets at play could also derail current efforts to expand electric vehicle charging if improperly distributed. We therefore urge VW to administer the program in line with the principles described above.

Sincerely,

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