

Attn.: California Environmental Protection Agency - Air Resources Board (ARB)
Topic: Public comments to the Volkswagen Settlement - California ZEV Investments

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Nel Hydrogen appreciates this opportunity to provide input to the ARB on the Volkswagen Settlement for California ZEV Investments.

Nel Hydrogen is a leading manufacturer of hydrogen production and fueling equipment, and is an active member of various organizations supporting the expansion of hydrogen for transport across California and the US, including the CaFCP, CHBC, FCHEA and H2USA.

We fully support the ARB's *"California's Initial Guiding Principles for VW ZEV Investments,"* as presented during the Public Workshop on Dec. 2, 2016. In particular, we concur with the ARB written comment: *"VW should be strongly encouraged to include hydrogen fueling investment."*

We have however noted that hydrogen, at present, has not been included by VW in the 1st cycle of their ZEV Investment Plan outline found at www.electrifyamerica.com.

Therefore, our comments outline critical elements relevant to hydrogen fueling infrastructure and bolster the argument for its inclusion in the 1st cycle of ZEV investments – which we urge the ARB and VW to consider in the ZEV Investment Plan approval process.

VW—through the Audi brand—has initiated steps that will contribute to the advancement of hydrogen fuel cells for transport. At the 2016 Detroit Auto Show, Audi showcased their fifth generation fuel cell technology with the *"h-tron Quattro Concept"*¹ – a Fuel Cell Electric Vehicle (FCEV) with a driving range of 370 miles: one of the highest ranges for a ZEV.

Earlier this year, VW also signed a contract for more than \$80 million with Ballard on accelerating fuel cell technology development. It was during this occasion that Dr. Petra Hackenberg-Wiedl, head of Fuel Cell Office Audi AG and Volkswagen Group, stated: *"We see our future as including electric powertrains, both battery and fuel cell vehicles."*²

Amongst car enthusiasts, the *"Audi Quattro technology"* is renowned for superior driving performance since its first showcase at the 1980 Geneva Motor Show. Its characteristics highlight critical aspects of ensuring successful widespread introduction of ZEVs in California and the US, namely *"vehicle brand/model and performance diversity."*

California's vehicle portfolio consists of myriad models, each of which tailor different sizes and performance metrics to meet a variety of consumer demands. For all ZEVs to achieve successful market penetration, a symmetrical vehicle portfolio must be offered to consumers. Comparable to the performance of Internal Combustion Engine (ICE) vehicles, FCEVs have characteristically long driving ranges and facilitate rapid fueling; whilst Battery Electric Vehicles (BEV) address smaller vehicle segments that require shorter driving ranges and longer charging times. A diverse portfolio approach that includes both BEVs and FCEVs will ultimately lead to greater ZEV market penetration.

¹ http://www.audi.com/en/innovation/futuredrive/h-tron_quattro.html

² <http://ballard.com/about-ballard/newsroom/news-releases/news09261601.aspx>

VW/Audi—given their brand and performance capabilities—addresses large vehicle consumer segments in California who will respond positively to the long range and fast fueling attributes of FCEVs, particularly if a brand such as VW/Audi offered such vehicles.

In fact, the importance of ZEV *“vehicle brand/model and performance diversity”* is already integrated into the *“California Zero Emission Vehicle Regulation”* that allocates ZEV credits according to market-relevant metrics, such as performance criteria on driving range and fueling time.

As highlighted in the ARB presentation from the Dec. 2, 2016 workshop, aims of the Volkswagen Settlement are to *“Support the growth of the ZEV Market,”* and to provide *“Increased availability of ZEV Infrastructure”* and *“Increased access to ZEVs across all Californians.”* These targets can be met through VW’s utilization of *“vehicle brand/model and performance diversity”* in tandem with supporting BEV and FCEV infrastructures, should both infrastructures be included in the ZEV investment from the 1st investment cycle.

Today, the California Energy Commission is actively supporting the deployment of ZEV infrastructure for both BEVs and FCEVs—in accordance with the *“vehicle brand/model and performance diversity”* under the *“California Zero Emission Vehicle Regulation,”* and is thus also indirectly aligned with the above aims of the Volkswagen Settlement.

Further, investments in hydrogen fueling infrastructure offer additional paths toward meeting other provisions outlined in the *“Consent Decree”*: *“The ZEV investments required by this Consent Decree are intended to address the adverse environmental impacts arising from consumers’ purchases of the 2.0 Liter Subject Vehicles.”* This implies that the overall aim of the California ZEV Investments is to offset negative environmental impacts as much as possible for the given and agreed investment scope under the *“Consent Decree.”* In this regard, investing in a combination of fueling infrastructures for both BEVs and FCEVs is a crucial component to reducing and offsetting environmental impacts.

A portfolio of BEVs and FCEVs throughout California can serve to balance renewables generation and the electrical grid. According to the California Independent System Operator (CAISO)³, the continual increase in renewable electricity generation will be challenging for the California grid—as illustrated by the well-known *“Duck Curve”*. However, hydrogen can be connected directly to solar power and be produced during daytime, thereby reducing risks of curtailment. Similarly, BEVs can charge at home during night, which is when the amount of wind-generated electricity fed into the grid is typically higher. Therefore, the complementary combination of BEV and FCEV infrastructures will incorporate higher shares of renewables to the grid whilst enabling zero emission transport.

By focusing on BEV infrastructure exclusively in the ZEV Investment Plan—as currently proposed by VW—higher emissions could potentially be generated than if the Investment Plan proposed a portfolio approach. If a California ZEV fleet is overwhelmingly or exclusively comprised of BEVs, recharging the fleet would require a substantial increase in fossil fuel-supported power production during nighttime hours, since solar-generated power would not be available. Such an approach might be in conflict with the aim of the Consent Decree to offset *“adverse environmental impacts”* generated from diesel fuel combustion.

³ https://www.aiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

In this regard, it is also highly relevant that VW not only include hydrogen fueling stations in their ZEV Investment Plan, but to also include the supporting renewable-based hydrogen production infrastructure.

Further, the inclusion of hydrogen fueling infrastructure in the VW ZEV Investment Plan will not only offset “*adverse environmental impacts*,” but also provides a relevant and sustainable business case to stakeholders.

Currently, VW proposes to install 300+ fast chargers in 15 US metropolitan areas in their ZEV Investment Plan outline. One 150kW DC fast charger can support 10 vehicles in 12 hours (if 50% of the time is used for charging), but will only provide consumers with an 80% charge in about 40 minutes. However, a single hydrogen fueling station with a 150kW grid connection and two fueling hoses can fuel over 100 vehicles in 12 hours (if 30% of the time is used for fueling), and provides consumers with a 100% fill in under 5 minutes.

Thus, only 30 hydrogen fueling stations are necessary to service the same number of vehicles as 300 fast chargers, whilst offering consumers superior convenience with regard to rapid fueling time. On a daily basis, a hydrogen fueling station will also achieve a \$ revenue of 3-4 times higher than that of a DC fast charger due to the faster fueling time (more vehicles served) and higher fuel price justified by the convenience offered to consumers.

A balanced investment approach (during all investment cycles) that ensures infrastructure capacity to serve similar numbers of BEVs and FCEVs would therefore be highly beneficial to both the business case and to offsetting “*adverse environmental impacts*” from diesel.

Therefore, we strongly encourage:

- The ARB to include hydrogen infrastructure (for both renewable fuel production and fueling) in the 1st investment cycle as one of the criteria for the California approval of the ZEV Investment Plan, justified by the aim of ensuring greater ZEV market penetration by “*vehicle brand/model and performance diversity*” and to offset “*adverse environmental impacts*” to the highest extent possible; and
- VW to reconsider the relevant market and business opportunities that the inclusion of hydrogen infrastructure in their ZEV Investment Plan would provide for both their return-on-investment and in supporting ongoing VW/Audi efforts to offer FCEVs and compelling technologies such as “*h-tron Quattro*” to consumers.

Nel Hydrogen thanks the ARB for their time and for their vigilant efforts to support California’s clean air goals and guide this ZEV Investment Plan.

Best regards

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