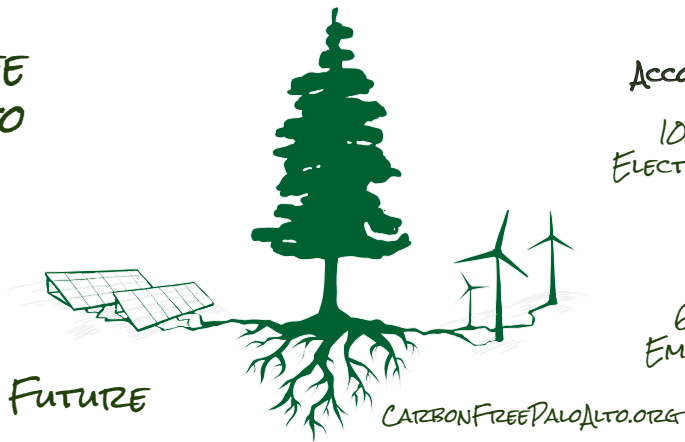


CARBON FREE PALO ALTO

DESIGNING
STRATEGIES
FOR THE
TRANSITION TO
A LOW-CARBON FUTURE



ACCOMPLISHED SO FAR:

100% CARBON-FREE
ELECTRICITY FOR ALL OF
PALO ALTO!

NEXT:

60% REDUCTION OF
EMISSIONS IN 10 YEARS

California Air Resources Board
Chair Mary D. Nichols
1001 "I" Street
Sacramento, CA 95814

November 16, 2016

Re: Comments on the Volkswagen Settlement, Appendix C

Dear Chair Nichols and Staff:

Carbon Free Palo Alto (CFPA) thanks you and your staff for the opportunity to comment on the Volkswagen (VW) Settlement, Consent Decree, Appendix C and the California Air Resources Board's (CARB) presentation slides from the public input workshop held on December 2, 2016.

Summary:

- 1) We support the proposed programs in Appendix C as only relates to battery electric vehicles
- 2) Settlement funding should not be wasted on hydrogen Fuel Cell vehicles.

Background:

We support the proposed programs in Appendix C as relates to battery electric vehicles.

CFPA was formed to help Palo Alto reach its aggressive goal of 80% carbon reduction by 2030. Car transportation is the largest single source of CO₂ emissions in our community and many others. Our city has converted to 100% carbon-free electricity in large part to support the switch away from fossil fuels to electricity for transportation and buildings. Many other cities in California also have a goal to provide 100% renewable electricity to their residents by 2030 or sooner. This means that all funding available from the Settlement can be productively used today to accelerate us along a proven route to zero emissions car transportation and a flexible renewable energy infrastructure.

Our city focuses exclusively on plug-in, battery electric technology as the best path to carbon-free car transportation for many reasons.

Battery electric vehicles are:

- Cost-effective automobile transportation solutions today – they offer lower lifetime cost of ownership than gasoline powered cars and can be charged in many existing locations
- Flexible and available in many forms, from plug-in hybrid to full battery electric, that cover the complete set of range and charge time requirements
- The lowest carbon and energy footprint, light duty vehicles
- True Zero Emission Vehicles, wells-to-wheels, wherever renewable energy is on-line
- Complementary to a flexible and resilient electrical energy infrastructure where renewable energy can be harnessed and building and transportation solutions can rapidly evolve

CFPA strongly recommends against funding hydrogen infrastructure programs with public money from the Settlement. Lack of infrastructure is often cited by industry groups as the only obstacle to the development of a fuel cell vehicle market. However *95% of hydrogen fuel comes from natural gas* and will remain so for the foreseeable future. In addition, public investment in the excessively expensive “fossil” hydrogen fueling network (\$2M per station) is highly speculative while vehicles are still expensive, unproven and largely unavailable.

There is no economical or energy-efficient way to produce hydrogen from carbon free, renewable energy. It simply takes too much energy (2 to 3 times as much) to generate hydrogen from water, compress it, distribute it and fuel a high pressure tank to power a fuel cell vehicle compared to just charging a battery electric vehicle from the grid. Moreover, producing hydrogen from water uses significant amounts of fresh water, a scarce resource in California.

Fuel cell vehicles that use “*fossil*” hydrogen from natural gas generate the same amount of emissions as today’s efficient hybrid vehicles with limited scope for improvement given the technical limitations. They should therefore not qualify as “Zero Emissions Vehicles” (ZEV) for the purpose of directing Settlement funds. Further, promoting hydrogen vehicles as a viable near or medium term, low/no carbon transportation solution confuses consumers entering the market looking for a low or zero emissions vehicle.

The following table developed by Carbon Free Palo Alto shows that the EV market is already significant and accelerating while the Hydrogen Fuel Cell market remains just a projection. As such, it is highly unlikely that Fuel Cells will play a significant role in reducing transportation emissions.

California Count	Electric Vehicles	Hydrogen Fuel Cell Vehicles
Models for Sale*	20+	2
2016	~250,000	<500
2019	~600,000	~13,500
2022	~1,200,000	~43,600
Cost	\$29k-Leaf	\$57k-Mirai
Fuel \$/yr**	\$450	\$1,250
Energy/yr** Tank to Wheel	4.5 MWh	7.6 MWh
Energy/yr*** Well to Wheel	6.5 MWh	33-40 MWh

* 20 EV models sold in all leading CA cities in 2016. November, 2016 ICCT report. FCV models for sale in 2016: Toyota Mirai, 8 dealers, Toyota website; Hyundai Tucson, lease only, near H2 stations, Hyundai website.

** Tank to Wheel based on 15,000 miles/yr base, Leaf: \$0.10/kWh, 3.3 miles/kWh; Mirai, \$5.5/kg H2, 2 miles/kWh; https://www.fueleconomy.gov/feg/fcv_sbs.shtml

*** Well to Wheel based on renewable energy + electrolysis, <http://phys.org/news/2006-12-hydrogen-economy-doesnt.html>

Hydrogen fuel-cell transportation still needs “four miracles”. Energy Secretary Stephen Chu’s comments from 2009 are, in essence, still true today; for hydrogen to work, “four miracles” need to happen:

- 1) There needs to be an efficient and low-cost way to produce hydrogen
- 2) There needs to be a safe, high-density method of storing hydrogen in automobiles.
- 3) An infrastructure for distributing hydrogen has to be built so that fuel-cell vehicles would have ample refueling options; and
- 4) We need to improve the capacity of the fuel-cell systems themselves

Chu concluded that achieving all four big breakthroughs would be unlikely. “Saints only need three miracles,” he added.¹

CARB responded to Secretary Chu at the time as follows:

All promising low-carbon non-petroleum transportation options, including hydrogen fuel cell vehicles, battery electric vehicles, and advanced liquid biofuels in combustion engines, face significant technical, resource, and market challenges. Hydrogen and fuel cells show great potential and have met or exceeded nearly all of the technical milestones set out by US DOE. Several major automakers are pursuing early market testing with consumers beginning this year and are expected to ramp up production to nearly 50,000 vehicles in California by 2017. Ultimately the market will decide which technologies are the winners, but given the critical importance to our long term climate and energy security goals, the best approach is to pursue and invest in a portfolio of the most promising options.

Industry projections for the fuel cell vehicle market are continually rolled back. Likewise, the present CARB projections roll back the forecast above five more years to 47,000 Fuel Cells by 2022. Other technical and economic statements regarding fuel cell vehicles contained the response have likewise failed to materialize. This lack of progress combined with the accelerating EV market strongly suggests that the market has already decided that hydrogen cars are not a winning technology for the foreseeable future. A recent Stanford study comparing the longer term scenarios of hydrogen vs battery electric based transportation also conclude that investing in the path toward hydrogen cars would not be a sound investment.²

The envisaged hydrogen car market has outsized infrastructure cost, untested products and no clear economic or environmental value. Any public investment and promotion of hydrogen stations will likely be seen as wasted on a “white elephant”.



Bruce A. Hodge
CFPA Founder and Chair

CC:

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Notes:

¹ Paraphrased from: <https://www.technologyreview.com/s/413475/q-a-steven-chu/>

² *Battery cars a better choice for reducing emissions than fuel cell cars.* Stanford Precourt Institute for Energy. Nov. 14, 2016. <https://energy.stanford.edu/news/battery-cars-better-choice-reducing-emissions-fuel-cell-cars>