



27 March 2008

Memo

To
California Air Resources Board

From
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Sub: EPRI Position on PHEV Cost Premium re: ZEV ISOR dated Feb 8, 2008

On behalf of EPRI, I would like to specify that recently published Zero Emission Vehicles (ZEV) Initial Statement of Reasons (ISOR) document dated 8 February 2008 erroneously cites EPRI research report # 1006892 titled 'Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options for Compact Sedan and Sport Utility Vehicles' in section 6.4 on pages 33-34 and in Table 6-1, while discussing cost impact of Plug-in Hybrid Vehicles. The specific paragraphs that are not supported by EPRI research are,

“6.4 Plug-in Hybrid Electric Vehicle

Staff has relied on a report by EPRI entitled “Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options for Compact Sedan and Sport Utility Vehicles”⁹ to estimate the average incremental cost for Enhanced AT PZEVs vehicles produced in low volumes.

Table 6.1 presents the incremental cost estimates for each vehicle technology.

Table 6.1: Incremental Vehicle Cost Estimates

Vehicle Type	2012 to 2014	2015 to 2017
ZEVs		
Fuel Cell Vehicle: Type IV	\$300,000	\$150,000
Fuel Cell Vehicle: Type III	\$250,000	\$125,000
Battery Vehicle: Type II	\$80,000 to \$120,000	\$40,000 to \$60,000
Battery Vehicle: Type I.5	\$40,000 to \$80,000	\$20,000 to \$40,000
Battery Vehicle: Type I	\$35,000 to \$65,000	\$15,000 to \$35,000
AT PZEVs		
Plug-in Hybrid Electric Vehicle	\$25,000	\$12,500

The estimates for the various vehicle types are subject to great uncertainty associated with projecting future costs for evolving technology. As such, though the direction of the cost impact of the proposed amendments is clear, the magnitude of the savings is much more difficult to assess.”

This assertion about PHEV cost premium is inconsistent with EPRI's 2001-2002 research contained in the referenced report #1006892 from EPRI, as follows:

1. **Cost or Price?** ZEV ISOR does not indicate what a 'cost premium' means – whether this is the cost to the OEM, cost to customer or cost to society. The report discusses differences between 'Retail Price Equivalent' values, which are in reference to what the retail customer will be expected to pay if auto OEMs were to have a positive business case.

In the case of ZEV ISOR, information on 'incremental cost estimates' in Table 6.1 is used for 'cost of compliance' in section 6.5. This implies the presented numbers indicate cost to OEMs to comply with ZEV mandate. Thus, it appears that ZEV ISOR, in Table 6.1, is showing what it would **cost** the OEMs to put the PHEVs for sale. Therefore, the numbers shown in ZEV ISOR and the numbers referenced in EPRI document cited, differ by the profit margin, which is assumed to be 16.3%, *assuming that the costs are referenced with the same vehicle type (car/van/SUV etc), same model years, same annual volumes, none of which line up.*

2. **Annual Sales Volumes:** Costs of advanced technology vehicles such as plug-in hybrids are highly sensitive to volumes due to both scale economies and learning curve effects, with the per-unit cost lowered as a function of manufacturing volume. The cited EPRI document therefore chose to analyze these costs assuming that these vehicles will be in mass production by the years cited (2010 and thereafter), with **annual volumes of 100,000.**

ZEV ISOR document dated 2/8/2008 specifically indicates the cost premium of these vehicles at much lower volumes (5000-15,000 vehicles per Table 5.1) while citing the EPRI study. Furthermore, the Table 6.1 indicates 'incremental cost estimates' of PHEVs in two timeframes: 2012-2014 and 2015-2017, which were not specifically analyzed by the cited EPRI study. **Since EPRI study did not examine the cost or price of PHEVs at these low volumes or in these timeframes,** it cannot be cited as a reference for the numbers included in Table 6.1.

3. **Gross Numbers Comparison:** The following table summarizes the ranges of **incremental Retail Price Equivalent** numbers that were the outputs of EPRI study (Section 2.6.1.2, Fig. 2-13 through 2-15, pages 2-17 through 2-21) cited here:

Table 1: Incremental Retail Price Equivalent for PHEVs over
Conventional Vehicles¹

2010 Model Year, 100,000 Vehicles/year, 2001 Dollars

	Compact Car	Midsize SUV	Large SUV
PHEV20	\$4500-\$6100	\$6400-\$8500	\$6000-\$8500
PHEV60	\$8100-\$10,300	\$10,100-\$13,100	\$11,000-\$14,500

As is evident from the above, the numbers presented in Table 6.1 in ZEV ISOR document do not line up, nor do the referenced parameters (production year, annual volume or vehicle class) with the EPRI document # 1006892 it purportedly references.

Recommendation:

EPRI recommends that the citation and reference to the afore-mentioned EPRI report #1006892 be deleted based on the analysis presented in this document. Any questions relative to the clarification of the facts presented here be directed to Dr. Mark Duvall at EPRI.

¹ “Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options for Compact Sedan and Sport Utility Vehicles”, EPRI, Palo Alto, CA: 2002. 1006892.”