



# Fact Sheet

California Environmental Protection Agency

 **Air Resources Board**

## 2007 Zero Emission Vehicle Technology Review

At the 2003 Zero Emission Vehicle (ZEV) Regulation hearings, the Air Resources Board (ARB or Board) adopted Resolution 03-4 directing staff to conduct a review of ZEV technologies and to advise the Board on the findings. To accomplish this, in June 2006 the ARB convened an Expert Review Panel that will investigate the status of ZEV technologies and will report this information to the Board.

The Expert Review Panel consists of Michael Walsh, who serves on the Executive Council of the Clean Air Initiative in Asia; Dr. Fritz Kalhammer, a consultant in energy and process technology with a focus on battery and fuel cell technology for electric and hybrid vehicles; Dr. Vernon Roan, a consultant and previous Director of the Fuel Cell Laboratory at the University of Florida; Dr. David Swan, a consultant specializing in the design and application of battery, fuel cell and hydrogen technology for automotive and aerospace; and Bruce Kopf, an automotive consultant in advanced technology implementation.

### ZEV Review Objective

The Expert Panel was directed to provide a thorough and accurate portrayal of the current status of sustainable zero emission vehicle technologies and the prospects for technology advancement in both the near-and long-term. The Panel was not to consider specific changes to the ARB ZEV Regulation.

Special emphasis is on timing and cost projections from the technology developers and automobile manufacturers. In particular, the following questions need to be answered:

- When will ZEV technologies achieve a level of maturity necessary for vehicle deployment at the following U.S. production levels:
  - 100's (demonstration),
  - 1,000's (pre-commercialization),
  - 10,000's (early commercialization), and
  - 100,000's (mass commercialization)
- What are the projected manufacturing costs at each of the above production levels?
- Does the deployment of ZEV technologies in Advanced Technology (AT) non-ZEVs accelerate the development and affordability of these components so that ZEVs can be deployed sooner? At what sales volumes do each of these AT "bridge" technology vehicles continue to provide significant improvement in the performance and affordability of components needed for ZEVs?

### Acquisition of Information

The Panel was asked to acquire information regarding the status of ZEV technologies for use in fuel cell vehicles, battery electric vehicles and advanced technology non-ZEVs including plug-in hybrids and hydrogen combustion engine vehicles. Specifically, they are looking at key technical issues, current and prospective

materials and manufacturing costs, emissions performance, and plans for evaluation, demonstration and commercialization of various technologies. Topics emphasized include:

- On-vehicle hydrogen storage technologies
- Automotive fuel cell technologies, including balance of plant components
- Batteries (both power and energy)
- Electric drive systems, and
- ZEV-appropriate vehicle platforms (“ground-up” vs. “conversion” ZEV design considerations)

## Site Visits

Information is being collected by soliciting responses to a confidential questionnaire that was developed by the Panelists, and through site visits and communications with all of the key sources, including the leading developers of the components as well as the major automobile manufacturers. Site visits include:

**US and European Automakers:** Ford, DaimlerChrysler, General Motors, BMW, Volkswagen

**Japanese Automakers:** Honda, Mitsubishi, Nissan, Toyota

**Japanese Battery Manufacturers:** Panasonic EV Energy (PEVE), Sanyo, Mitsubishi, Hitachi

**U.S. Battery Manufacturers:** Cobasys, JCI/Saft

**Canadian Battery Manufacturers:** Electrovaya

**European Battery Manufacturers:** Saft / Renault, ZEBRA / MES-DEA

**U.S. Fuel Cell Stack Manufacturers:** UTC

**Canadian Fuel Cell Stack Manufacturers:** Ballard

## Conclusions

As a supplement to the work of the Expert Review Panel, ARB is holding a 2 ½ day ZEV Technology Symposium on September 25 - 27, 2006 in Sacramento, CA. The Symposium will invite a variety of presentations from experts in the industry, and will provide an opportunity for public comment. More information on this event is found at: <http://www.arb.ca.gov/msprog/zevprog/symposium/symposium.htm>

Overall findings drawn from the Expert Panel’s report and the ZEV Symposium will be summarized in a staff report and presented to the Board in 2007. Regulatory changes, if any, will be considered only after staff has submitted the ZEV Technology Review staff report to the Board.

## For More Information

Please contact Tony Andreoni, Manager of the ZEV Implementation Section, at (916) 324-6021 or [tandreoni@arb.ca.gov](mailto:tandreoni@arb.ca.gov). To contact the ARB toll-free, call (800) END-SMOG (California only) or (800) 242-4450 (outside California).

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