

Status and Prospects for Zero Emissions Vehicles Technology

Independent Expert Panel

Michael P. Walsh, Chairman

Dr. Fritz R. Kalhammer

Bruce M. Kopf

Dr. Vernon P. Roan

Dr. David H. Swan

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Objectives and Scope of Work

- Provide an assessment of the technical and cost status and prospects of the main technologies currently under development and the potential of integrated vehicles for Zero Emissions Vehicles (ZEVs) and near ZEVs, including
 - Battery Electric Vehicles (BEV)
 - Fuel Cell Vehicles (FCEV)
 - Hybrid Vehicles (HEV)
 - Plug In Hybrid Vehicles (PHEV)
 - Hydrogen Combustion Engine Vehicles (H2ICE)
- Tasks
 - Acquisition of Information (Worldwide, All Key Players)
 - Meetings, Questionnaires, Follow Up Questions
 - Critical Assessment of Information



Panel Members and Points of Focus

	Team Chair	ZEV Technology Vehicle Integration	Fuel Cell Stack & Components	On Vehicle Hydrogen Storage	Energy Batteries	Other Topics
Michael Walsh	X					
Vernon Roan			X	Subgroup Lead		X
Fritz Kalhammer					Subgroup Lead	X
Bruce Kopf		Subgroup Lead	X	X		X
David Swan			Subgroup Lead	X	X	X

ZEV Technology Vehicle Integration

Bruce M. Kopf

- Obtained technical and cost data, as well as analysis and opinions, from 10 major Original Equipment automotive Manufactures (OEMs)
- Considered both Zero Emissions Vehicles (ZEVs) and Advanced Technology Vehicles (ATVs)
- Investigated and considered:
 - Present status of vehicle integration and remaining major issues
 - Mass market customer acceptance
 - Potential for future deployment of commercially available vehicles
 - Degree of synergy of ATV technology with ZEV technology



Vehicle Energy Storage Systems

Dr. Fritz R. Kalhammer

- Scope
 - Timeframe: technology fully developed within a decade
 - Battery manufacturers/developers (“worldwide”)
 - Batteries with potential for HEVs, FPBEVs and PHEVs
 - Focus: NiMH and Li Ion (ZEBRA; Li-Sulfur)
- Issues
 - Key battery technology issues and study focus: cost, life, safety (Li Ion), and energy density (FPBEVs)
 - Main challenge for the study: obtaining good data for battery cost, calendar life (for Li Ion batteries)



Vehicle Hydrogen Storage Systems

Dr. Vernon P. Roan

Scope

- Candidate Technologies
 - Compressed Hydrogen Gas Storage
 - Liquid Hydrogen Storage
 - Hydrogen Storage in Solids
 - Hydrogen Stored in Liquids

Issues

- System Requirements
 - DOE Targets
 - Input from Industry and other Sources
- Current Status of Technologies
- Outlook for Selected Technologies



Vehicle Fuel Cell System

Dr. David H. Swan

- Scope
 - Fuel cell systems for propulsion and auxiliary power
 - Complete system (hydrogen to net electricity)
- Issues
 - Performance
 - Net efficiency and system specific power
 - Operational characteristics (start up, response time, etc.)
 - Life
 - Durability of fuel cell system for life of chassis
 - Operation and storage in cold or hot ambient conditions
 - Cost
 - Basic materials for electrode membrane assemblies
 - Fuel cell stack components and construction
 - Balance of plant (complexity)
 - Time frame to reach technical viability for commercialization

Where Do Things Stand?

- Work is Largely Completed
 - Preliminary Presentation to ARB Staff
 - Draft Report Provided to ARB Staff
 - Final Report Will be Given to ARB Within a Week
- Presentation to Full Board is Being Prepared



Thank You!

