

Sunday Afternoon, October 14, 2007

The Industrial Physics Forum 2007: The Energy Challenge

Room: 602/603 - Session IPF-SuA

Automotive Energy

Moderator: J. Hobbs, American Institute of Physics

3:00pm **IPF-SuA1 Technology, Economics, and Policy of Hydrogen and Fuel Cells**, *D. Dresselhaus*, Massachusetts Institute of Technology
INVITED

The history of alternative transportation fuels is largely a history of failures. None has overcome the institutional, financial, and technological inertia of gasoline and diesel. Only ethanol made from corn is gaining market share in the US - thanks to large federal and state subsidies and a federal mandate. What are the prospects of alternative low-carbon fuels, especially biofuels, electricity and hydrogen? Is California's low carbon fuel standard a model for orchestrating the transition to alternative fuels? Is hydrogen different? Might hydrogen and fuel cells succeed on a grand scale, where others have not? If so, how might this unfold? What role do hybrid vehicles play in this process? This presentation will address the technology, economics, and policy of hydrogen and fuel cells, and will explore possible and likely outcomes.

3:40pm **IPF-SuA3 Frontiers, Opportunities and Challenges for a Hydrogen Economy**, *J.A. Turner*, National Renewable Energy Laboratory
INVITED

Energy is one of the most important issues facing our world today; in fact, in today's society energy is as important as food and water. Humankind finds itself faced the challenge of how to continue to power society, particularly in the face of the rapidly growing economies of emerging nations like India and China, and yet answer questions of sustainability, energy security, geopolitics and global environment. One of the major issues facing America and most other countries in the world is how to supply a transportation fuel, an energy carrier to replace gasoline. Hydrogen as an energy carrier, primarily derived from water, can address issues of sustainability, environmental emissions and energy security. The "Hydrogen Economy" then is the production of hydrogen, its distribution and utilization as an energy carrier. While the vision of a hydrogen economy has been around for over 130 years, the most recent push to use hydrogen as an energy carrier came as part of a US Presidential Initiative, announced in the 2003 State of the Union Address. It is important that we consider hydrogen in tandem with other technologies as an alternative to the once-abundant hydrocarbon resources on which our society depends. This talk will introduce sustainable energy systems, including fuel cell technology and discuss the vision, the barriers and possible pathways for the production and implementation of hydrogen into the energy infrastructure.

4:20pm **IPF-SuA5 The (Re) Electrification of the Automobile**, *M.A. Tamor*, Ford Research and Advanced Engineering
INVITED

It is easily forgotten that a century ago electric vehicles had a dominant market share over steam and internal combustion automobiles. While quiet, clean and reliable, the EV was challenged by range and performance limitations, and eventually done in by the electric self-starter one of the first electrified features! Driven in large part by the quest for improved fuel efficiency and emissions - and accelerated by design opportunities and attractive customer features - the re-electrification of motor vehicle is now progressing rapidly. Electrified functions range from the mundane, such as power steering and engine coolant pumps, through a spectrum of hybrid powertrain concepts and on to a resurgent interest in all-electric vehicles. Each incremental function and additional load increases the demand for efficient and cost-effective energy storage and is driving new, sometimes divergent, battery requirements. The hybrid electric vehicles available today are all what might be called "power hybrids" that have been optimized to achieve impressive fuel efficiency with minimum battery energy capacity - and so minimum battery weight and cost. Driven by commercialization of HEVs, rapid progress on batteries and power electronic systems paves the way to two revolutions in the motor vehicles: First, is the proposal to shift a significant fraction of propulsion energy from petroleum fuel to electricity by "plugging in." The "plug-in" HEV is an "energy hybrid" that by definition requires a much larger battery, and creates a new connection that allows motor vehicles to exploit the efficiency and diversity of the electric grid. While not overwhelmingly attractive in the present economy of still-cheap oil and fossil fuel-generated electricity, the plug-in hybrid could

prove critical to closing the gap between a limited supply of renewable fuel and ever-growing transportation needs. Second, with no rigid connections between the various powertrain elements, the series HEV - "power" or "energy" - enables re-engineering of the motor vehicle including its shape, structure, materials and manufacturing. In short, the re-electrification of the automobile is enabled by progress in battery technology, but itself may enable revolutions in the nature and the economics of personal transportation.

5:00pm **IPF-SuA7 General Motors' Perspective on New Transportation Technologies**, *J. Bereisa*, General Motors Corporation
INVITED

Will review the rationale behind and the progress made in fuel cell cars and the hydrogen economy and specifically highlight technical progress achieved in fuel cell vehicles, remaining challenges and issues related to creating the hydrogen refueling infrastructure.

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