Basic Research for the Hydrogen Economy

Basic Research Needs for the Hydrogen Economy

Mildred Dresselhaus, MIT

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Biomimetic Production of Hydrogen

Devens Gust, Arizona State University
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Hydrogen Generation by Solar Photolysis of Water

Augustin McEvoy, EPFL Lausanne, Switzerland
with Michael Graetzel

George Crabtree, Argonne National Laboratory, Chair

The Hydrogen Vision

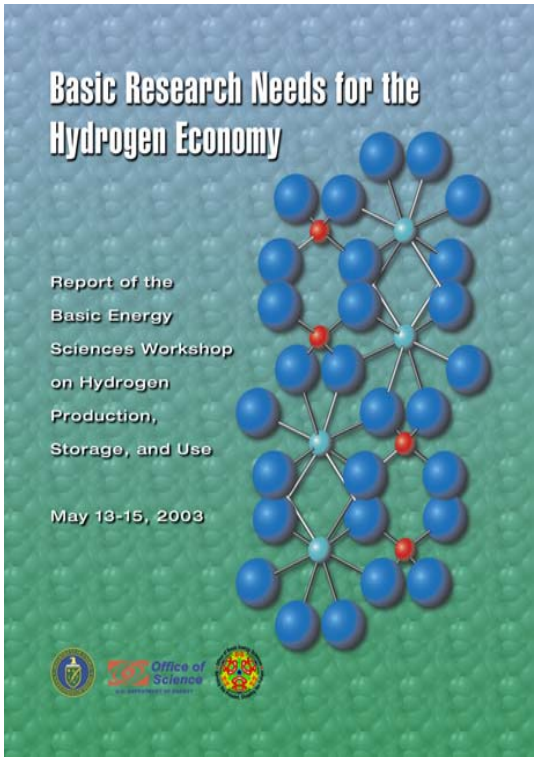
Abundant energy for future needs

Secure supply independent of geopolitics

Free of greenhouse gases

Free of pollution

Hydrogen Studies



Basic Energy Sciences
Department of Energy

July 2003/February 2004

http://www.sc.doe.gov/bes/hydrogen.pdf

THE HYDROGEN ECONOMY: OPPORTUNITIES, COSTS, BARRIERS AND R&D NEEDS

Committee on Alternatives and Strategies for Future Hydrogen Production and Use

Board on Energy and Environmental Systems
Division on Engineering and Physical Sciences

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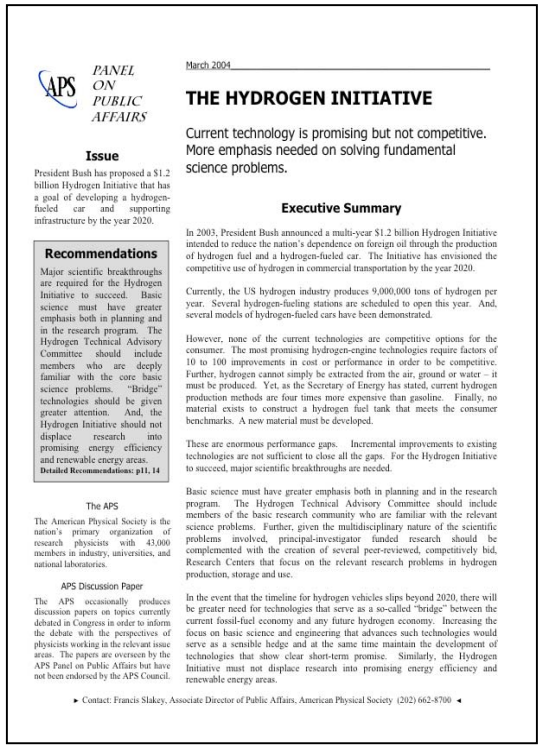

APS PANEL ON PUBLIC AFFAIRS

March 2004

THE HYDROGEN INITIATIVE

Current technology is promising but not competitive. More emphasis needed on solving fundamental science problems.

Issue

President Bush has proposed a $1.2 billion Hydrogen Initiative that has a goal of developing a hydrogen-fueled car and supporting infrastructure by the year 2020.

Recommendations

Major scientific breakthroughs are required for the Hydrogen Initiative to succeed. Basic science must have greater emphasis both in planning and in the research program. The Hydrogen Technical Advisory Committee should include members who are deeply familiar with the core basic science problems. "Bridge" technologies should be given greater attention. And, the Hydrogen Initiative should not displace research into promising energy efficiency and renewable energy areas.
Detailed Recommendations: p11, 14

The APS

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APS Discussion Paper

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Executive Summary

In 2003, President Bush announced a multi-year $1.2 billion Hydrogen Initiative intended to reduce the nation's dependence on foreign oil through the production of hydrogen fuel and a hydrogen-fueled car. The Initiative has envisioned the competitive use of hydrogen in commercial transportation by the year 2020.

Currently, the US hydrogen industry produces 9,000,000 tons of hydrogen per year. Several hydrogen-fueling stations are scheduled to open this year. And, several models of hydrogen-fueled cars have been demonstrated.

However, none of the current technologies are competitive options for the consumer. The most promising hydrogen-engine technologies require factors of 10 to 100 improvements in cost or performance in order to be competitive. Further, hydrogen cannot simply be extracted from the air, ground or water – it must be produced. Yet, as the Secretary of Energy has stated, current hydrogen production methods are four times more expensive than gasoline. Finally, no material exists to construct a hydrogen fuel tank that meets the consumer benchmarks. A new material must be developed.

These are enormous performance gaps. Incremental improvements to existing technologies are not sufficient to close all the gaps. For the Hydrogen Initiative to succeed, major scientific breakthroughs are needed.

Basic science must have greater emphasis both in planning and in the research program. The Hydrogen Technical Advisory Committee should include members of the basic research community who are familiar with the relevant science problems. Further, given the multidisciplinary nature of the scientific problems involved, principal-investigator funded research should be complemented with the creation of several peer-reviewed, competitively bid, Research Centers that focus on the relevant research problems in hydrogen production, storage and use.

In the event that the timeline for hydrogen vehicles slips beyond 2020, there will be greater need for technologies that serve as a so-called "bridge" between the current fossil-fuel economy and any future hydrogen economy. Increasing the focus on basic science and engineering that advances such technologies would serve as a sensible hedge and at the same time maintain the development of technologies that show clear short-term promise. Similarly, the Hydrogen Initiative must not displace research into promising energy efficiency and renewable energy areas.

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American Physical Society
Panel on Public Affairs

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http://www.aps.org/public_affairs/index.cfm

Hydrogen Studies

universal finding:

the hydrogen economy requires breakthrough basic research on the interaction of hydrogen with materials

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