Hydrogen Technical Advisory Panel

Presented by Dr. Alan Lloyd,
Past Chair, HTAP

1st Hydrogen and Fuel Cells Technical Advisory Committee (HTAC) Meeting

Crystal City, VA

October 2, 2006

Hydrogen Technical Advisory Panel (HTAP)

Established:
Spark M. Matsunaga Hydrogen Research, Development, and Demonstration Act of 1990, Public Law No.101-566.
Amended:
Hydrogen Future Act of 1996, Public Law No. 104-271.

Chartered by DOE on June 13, 1991

Superseded by the

Hydrogen and Fuel Cell Technical Advisory Committee (HTAC)

Overarching Goals 1992-2002

1. To raise the visibility of hydrogen as a key part of the nation's energy agenda.

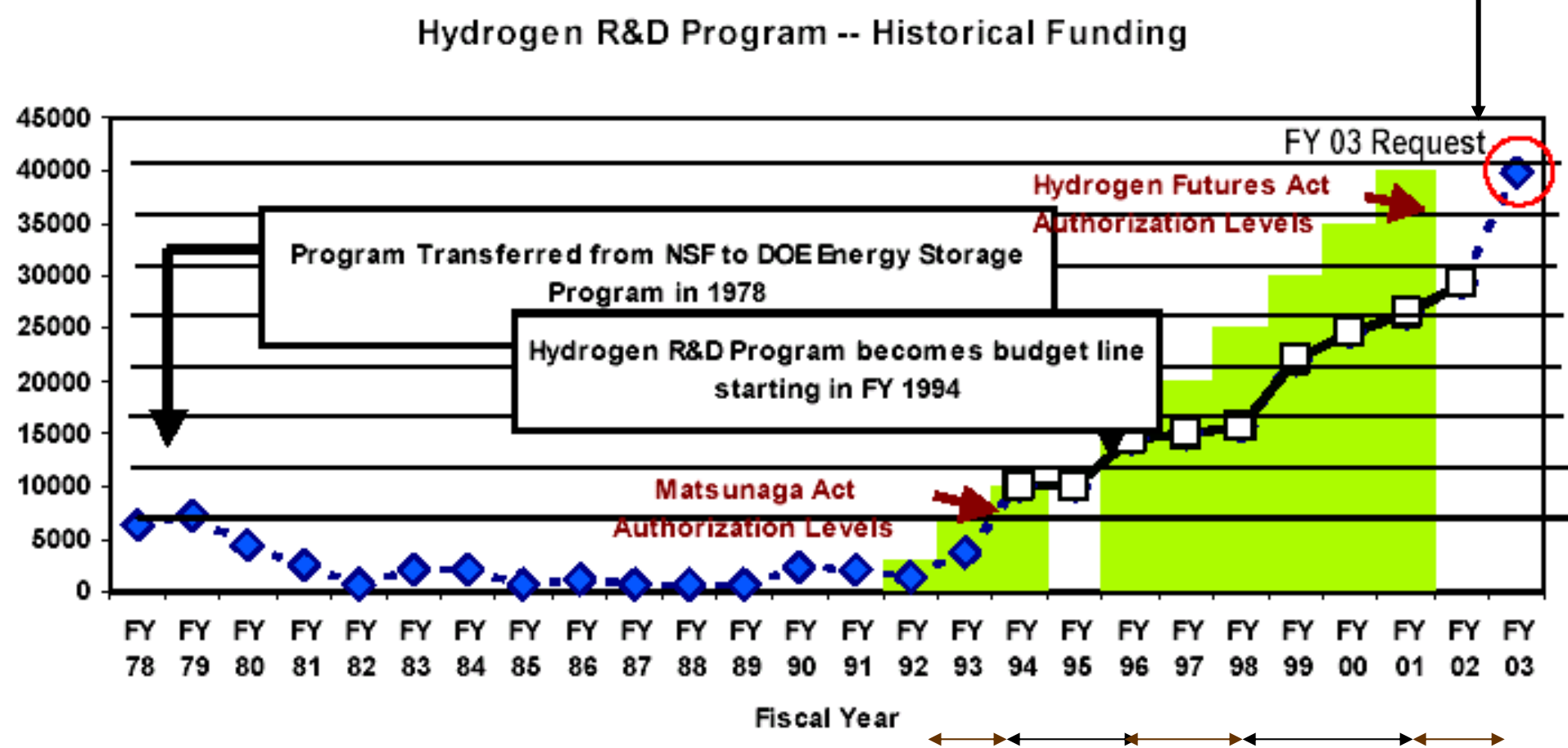
2. To advise DOE on the conduct of its hydrogen R&D activities

DOE Designated Federal Officials:
1. Russ Eaton and
2. Neil Rossmeissl

Hydrogen Program Funding Summary

1979-1993 H2 program was part of Biofuels (Biomass). Emphasis Renewable Hydrogen.

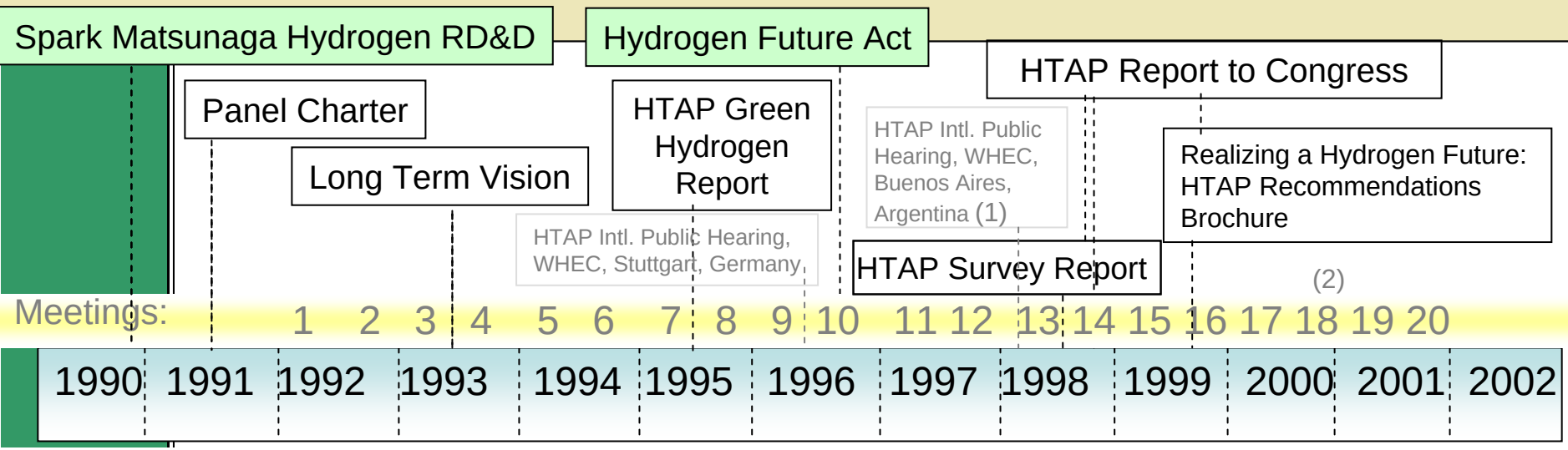
Hydrogen, Fuel Cells and Infrastructure RD&D Combine Energy and Water (Hydrogen) and Interior (FC) Appropriations Activities.



HTAP Chairs:

Burke — Takahashi — Lloyd — Nahmias — O'Sullivan

HTAP Timeline



Panel Structure

Chair: Birk
Committees:
- R&D
- Transportation
  - Air
  - Ground

Chair: Takahashi
Committees:
- demos
- commercialization requirements for hydrogen-fueled vehicles,
- hydrogen centers of excellence

Chair: Lloyd
Committees:
Detail objectives & strategies Green Report

Chair: Nahmias
Committees:
- Scenario Planning
- Fuel Choice
- Coordination

Chair: O'Sullivan
Committees:
- Safety
- Infrastructure
- Coordination

Spring meetings held in conjunction with major conferences (NHA or other) and Fall meetings usually in sites developing hydrogen energy. Examples:10: Denver, CO; 14: FSEC, Cocoa, FL; 16: CEC, Sacramento, CA; 18: SunLine Transit, Thousand Palms, CA; 20: Desert Research Inst., Reno, NV

(1). Bailey, C., Kamal, M., Lloyd, A.,C., Lynch, F., Nahmias, D. and Zaloch, R. "The United States Dept. of Energy's Hydrogen Program: Perspectives from the Hydrogen Technical Advisory Panel (HTAP)." XII World Hydrogen Energy Conference. Buenos Aires, Argentina, June 21-25, 1998.

(2). Chum, H.L. and Nahmias, D. (HTAP), Elam, C. and Gregoire-Padro, C. (NREL), Rossmeissl N. and Gronich, S. (DOE), Hydrogen Energy Research and Development Activities Across the United States Federal Government, HYFORUM 2000, Munich, Germany.

HTAP Members 1992-2002

Dr. James Birk, Chair 1992-1994, Electric Power Research Institute
Dr. Patrick Takahashi, Chair 1994-1996, University of Hawaii
Dr. Alan Lloyd, Chair 1996-1998, California Air Resources Board
Mr. David Nahmias, Chair 1998-2001, Air Products and Chemicals, Inc
Dr. John O'Sullivan, Chair 2001-2002, Electric Power Research Institute
Dr. Bernard Baker, Energy Research Corp.
Ms. Carol Bailey, ENRON
Dr. Addison Bain, NASA, retired
Dr. Helena Chum, National Renewable Energy Laboratory
Mr. Christopher Flavin, Worldwatch Institute
Mr. David Haberman, DCH Technology, Inc.
Mr. Michael Hainsselin, Praxair, Inc.
Dr. Henry Linden, Illinois Institute of Technology
Dr. Chung Liu, South Coast Air Quality Management District
Dr. Mounir Kamal, General Motors Corp., retired
Mr. Frank Lynch, Hydrogen Components, Inc.
Dr. James MacKenzie, World Resources Institute
Dr. Roberta Nichols, Ford Motor Company, retired
Dr. George Schmauch, Air Products and Chemicals, Inc., retired
Mr. Henry Wedaa, Chair Emeritus of South Coast Air Quality Managem
Dr. Mark S.Wrighton, Washington University
Dr. Robert Zalosh, Worcester Polytechnic Institute

HTAP 1st Vision

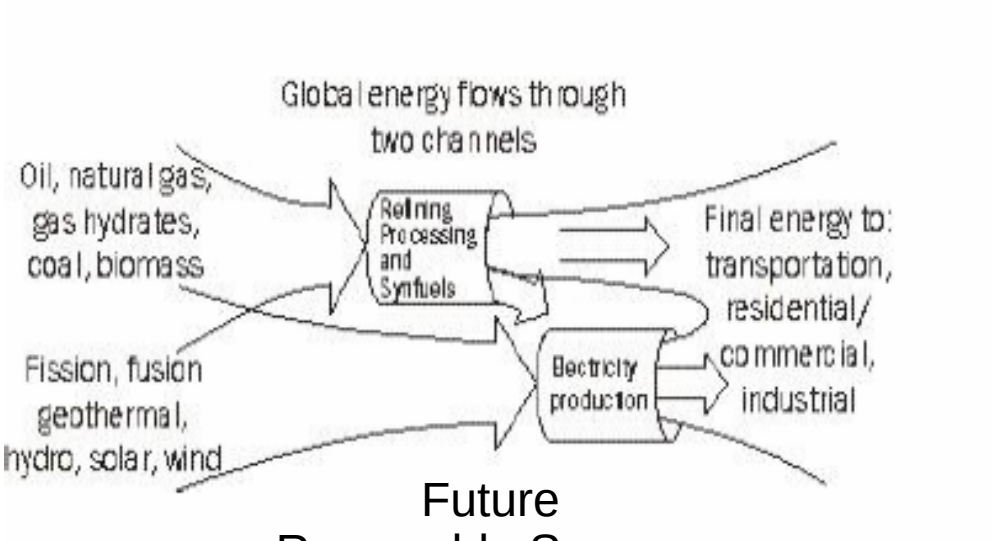
Hydrogen will join electricity in the 21st century as the primary energy carriers in the nation's sustainable energy future.

Both energy carriers will ultimately come from renewable energy sources, although fossil fuels will provide a long-term transitional resource.

Future hydrogen suppliers will deliver a significant portion of America's energy for transportation and other applications. For these applications, hydrogen offers a non-polluting, inexhaustible, efficient, and potentially cost-effective energy system derived entirely from domestic energy sources.

Vision simplified

Hydrogen will join electricity in the 21st century as a prime energy carrier in the nation's sustainable energy future. Both electricity and hydrogen will ultimately be derived from renewable energy sources, although fossil fuels may serve as a transitional resource.



Future
Renewable Sources

1995 HTAP's *Green Hydrogen Report*

Calls for

- integrated program of basic research on hydrogen production, storage, and utilization; analytical studies on hydrogen use that incorporate life-cycle and environmental factors;
- an enhanced development program of components for the hydrogen infrastructure; and
- various project demonstrations.

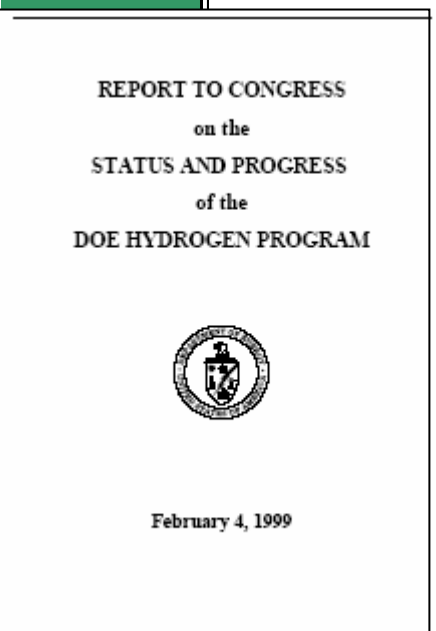
The plan emphasizes the need to

- transfer technology to the private sector to encourage the commercial introduction of hydrogen into the marketplace.

Concern was expressed that, across the board (and not only in hydrogen), the U.S. is losing international competitiveness and therefore, the creation of an industry-government partnership in the form of an authority or consortium might be necessary to facilitate swift progress.

1999 HTAP Report to Congress

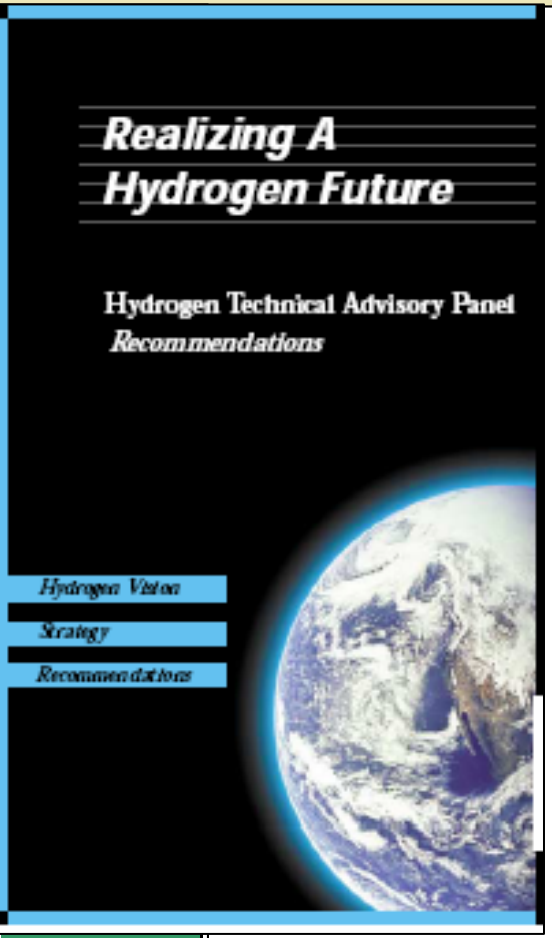
- Analysis of the Effectiveness of the DOE Hydrogen Program: A Report to Congress as Required by the Hydrogen Future Act (P.L. 101-566). Final Draft August 1998 . Washington, D.C.: U.S. Government Printing Office.
- Final Report: http://www.hydrogen.energy.gov/pdfs/bk28423.pdf


REPORT TO CONGRESS
on the
STATUS AND PROGRESS
of the
DOE HYDROGEN PROGRAM

February 4, 1999

- Input to the report provided by the Survey Report - findings of HTAP survey of individuals involved or interested in hydrogen (1998)
- Summarized in the Brochure “Realizing a Hydrogen Future: HTAP Recommendations, 1999 http://www.hydrogen.energy.gov/pdfs/brochure.pdf

HTAP Recommendations Summary - 1



Coordination Committee Product

The Panel commends the DOE for —

- devising a balanced strategy for a hydrogen future;
- supporting the mix of technologies being researched and validated;
- making significant progress in these technologies; and
- coordinating hydrogen-related activities within DOE and with other federal agencies.

The Panel recommends strengthening DOE efforts in—

R&D and Technology, by:

- continuing support of a well-balanced portfolio (especially in core R&D) — to ensure realization of the vision and to retain critical capabilities and resources.

Coordination and Outreach, by:

- continuing high-level coordination of hydrogen-related activities across agencies (including DOE, NASA, DOT, DOD, NIST, and other agencies) — to leverage resources, establish a shared knowledge base, and accelerate reaching a hydrogen-powered future.

HTAP Recommendations Summary –2

The Panel recommends strengthening DOE efforts in—

Legislation and Funding, by:

• extending the Hydrogen Future Act beyond 2001, for five additional years with yearly funding increases — to enable the nation to move more rapidly toward its hydrogen future;

• providing multiyear funding and minimizing funding discontinuities

— to increase efficiencies in advancing the technologies and in implementing the Program; and

• supporting hydrogen as an option in federal alternative fueled vehicle programs

— to give this important fuel-cell option, which promises significant societal benefits, the impetus it needs to make a sufficient impact.

Fuel Choice Committee Impact

Roberta Nichols, Chair of Fuel Choice Committee, led the preparation of the White Paper comparing direct hydrogen and on-board reforming efforts. (1999)

The Committee argued that both industry and government were providing substantially greater support for onboard fuel processing than to direct hydrogen. The portfolio needed to be more balanced. Direct hydrogen vehicles have significantly greater long-term societal benefits.

DOE made a NO GO decision for onboard reforming activities in 2004

HTAP Scenario Planning Activities

- Three qualitative scenarios, structured around rate of technological change and dominant social values, are used to explore possible futures for hydrogen and R&D strategies that are robust across scenarios.
- Committee meetings and experts discussions guided the preparation of conference papers.

Ohi, J., *Hydrogen Energy Futures: Scenario Planning by the US DOE Hydrogen Technical advisory Panel,* 14th World Hydrogen Energy Conference, Montreal (2001).

HTAP Scenario Planning Cited

ELSEVIER

Energy Policy 34 (2006) 1236 -1250

ENERGY POLICY

www.elsevier.com/locate/enpol

Forecasts, scenarios, visions, backcasts and roadmaps to the hydrogen economy: A review of the hydrogen futures literature

William McDowall*, Malcolm Eames

Policy Studies Institute, 50 Hanson Street, London, W1W6UP, UK

Cited in recent major international Journal Review Article

DOE Acted on the Majority of HTAP Recommendations

Recommendation 2001	DOE Implementation 2002-2006
Increase intra DOE and Interagency coordination	Hydrogen Program Matrix Group and Interagency Task Force established
Vision/Scenarios and Plans	Posture Plan, MYTP, Presidential Initiative, IPHE
Programmatic Oversight	
Include HTAP members in Annual Merit Peer Review (done)	HTAC (biennial), NAS(five years), Annual Merit Peer Review, special Technical Advisory Groups
Fuel Choice HTAC White Paper overemphasis of DOE on onboard reforming relative to direct hydrogen	On-board reforming go-no go decision was no-go for on-board reforming of passenger vehicles
Infrastructure	Hydrogen Delivery Program Element
Safety, Codes and Standards	Safety, Codes and Standards Program Element
Education and Outreach Emphasis	Education Program Element

Conclusions

- HTAP helped the DOE Hydrogen Program increase its visibility and reach a balanced RD&D program, with emphasis on systems analysis including life cycle, and fundamental elements of infrastructure, safety, codes, standards, outreach and education.
- HTAC will have significantly enhanced responsibility for a four-fold increased funding program that includes hydrogen and fuel cells. The scope of the new program is National, Presidential, and International.
- Aspects of HTAP's responsibilities appear to have been transferred by the 2005 Matsunaga Act to the External Review by the National Academy of Sciences on Program Priorities, Technical Milestones, and Evaluation of Progress toward meeting the milestones.

Chair Nahmias Report in 2001

Coordination

The HTAP Report to Congress recommended the need for substantial improvement in coordination between the Hydrogen Program and other areas of the DOE and other Federal agencies.

Visions/Scenarios/Plans

Work in progress that needs to continue to help guide the DOE Program

Programmatic Oversight

In the report HTAP made two recommendations to increase oversight of the Hydrogen Program outside of the HTAP meetings. First, to add a program-level review back into the annual R&D review meetings and second, to have representatives of HTAP participate in periodic management meetings of the Hydrogen Program. …

Fuel Choice

During an HTAP spring 1999 meeting, we formed the Fuel Choice Committee under Roberta Nichols to help address the issue of direct hydrogen versus other fuels for fuel cell vehicles. DOE was spending more on onboard fuel processors using gasoline or methanol than on direct hydrogen, and industry strongly favored the fuel processor approach -- despite the fact that direct hydrogen provides greater long-term societal benefits.

Later that spring, the Fuel Choice Committee published a brief white paper urging more balanced DOE funding for direct hydrogen and onboard fuel processors. We were planning on following that up with a far more comprehensive white paper, based on holding workshops – when events favorable to direct hydrogen overtook us. Industry and DOE were beginning to take a more serious look at direct hydrogen, and the California Fuel Cell Partnership was formed with a strong focus on direct hydrogen.

We switched gears and redirected our focus to *technical, safety, and infrastructure* issues relating to hydrogen fueling of direct hydrogen fuel cell vehicles – in an effort to reduce the existing barriers. We call this effort the "Blueprint for Hydrogen Fuel Infrastructure Development," for which two workshops have been held to date.

Education and Outreach

Over the years, there has been an ebb and flow of interest in education and outreach from the Hydrogen Program. In 1995 the Program undertook a strong industry outreach effort, but it was short-lived. The report encouraged the Program to reinvigorate its industry outreach effort.

The Report to Congress suggested that some validation projects offer the opportunity for public outreach, and that a public outreach plan be a part of such projects. I continue to advocate that suggestion.

Getting Hydrogen on the National Energy Agenda

At the fall 2000 HTAP meeting, DOE encouraged HTAP to do more to get hydrogen more squarely on the nation's energy agenda. As I stated earlier, it has been the goal of every HTAP chairman to do so – but our effectiveness has been partial. Moreover, the successful reauthorization of the Hydrogen Future Act will help maintain hydrogen's legislative visibility.

http://www.hydrogenassociation.org/advocate/ad62htap.htm

HTAP Meetings and International Expertise

- World Energy Network Program (WE-NET) presented by K. Okano in 1999
  - "International Clean Energy Network Using Hydrogen Conversion (WE-NET) Project" started in 1993 under a comission from the New Energy and Industrial Technology Development Organization (NEDO). The research intends to clarify the partnership with other countries concerned and international exchange of technical information in order to develop a true international joint project.
- Hyforum organizers announced the 2000 conference at this HTAP meeting and invited a presentation from HTAP and DOE.
- IEA Activities Reported highlighted in 1998
- HTAP convened international public meetings in several international conferences to collect information and assess of hydrogen activities that informed Reports to Congress and inventory activities of the DOE program.