IEA Hydrogen Implementing Agreement Secretariat
Management Support for Sustainable International Cooperation

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M.R.S. Enterprises, LLC
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This presentation does not contain any proprietary or confidential information

Project SAP2
Overview
IEA HIA Secretariat Function

Timeline
- US commitment long-standing
- Support ongoing
- M.R.S. engaged FY04

Budget
- FY04 - $103,000
- FY05 - $107,000
- Voluntary Contractor Cost-Share- $57,000/yr

Other Funding
R&D costs of 200 experts, 175 FTEs, “task-shared” by member countries.
Overview - Barriers
IEA HIA Secretariat Function

DOE Hydrogen Program Management and Operations

- Cites value to US in cooperative partnerships and coordinated international hydrogen activities
- Acknowledges DOE’s leadership role in collaborative international activities via the IEA HIA
- Builds on sustainable HIA model with Secretarial initiative for an “International Partnership for a Hydrogen Economy”
Overview - Barriers

IEA HIA Secretariat and HIA R&D

- HIA's collaborative R&D, analysis and outreach portfolio contributes to removing full range of technical barriers in hydrogen
  - Production
  - Storage
  - Safety
  - System Analysis and Integration

- Secretariat management function essential to continued barrier reduction via HIA R&D
Overview - Barriers and Targets
Examples

DOE Program Plan Areas and HIA Tasks
Task 15 Photobiological
Task 16 H₂ from Carbon Containing Materials
Task 17 Storage
Task 18 Integrated Systems Analysis
Task 19 Safety
Task 20 H₂ Waterphotolysis

Example Technical Barriers and/or Technical Targets
- 50% molar yield of carbon conversion to H₂
- $1.50/gge total H₂ distributed H₂ production
- Reversible H₂ storage medium recoverable with 5wt% H₂ at @ 80°C
- Conflicts bet. domestic and int. codes & standards; lack of consistent modeling approaches; info and experience gap in tech validation
- Limited historical database; Proprietary data; Validation of historical data;
- Net solar to H₂ conversion efficiency of 10%
<table>
<thead>
<tr>
<th>Country</th>
<th>Member Country</th>
<th>Partners</th>
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<tbody>
<tr>
<td>Canada</td>
<td>Mr Nick Beck</td>
<td>Dr Stathis Peteves</td>
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<tr>
<td>European Commission</td>
<td>Dr John Wright</td>
<td>Mr Trygve Riis (Chairman)</td>
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<tr>
<td>Japan</td>
<td>Dr Koji Nakui</td>
<td>Dr Antonio Garcia-Conde</td>
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<tr>
<td>Italy</td>
<td>Dr Agostino Iacobazzi</td>
<td>Dr Gerhard Schriber</td>
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<tr>
<td>Iceland</td>
<td>Mr Agust Vatfells</td>
<td>United Kingdom</td>
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<td>Lithuania</td>
<td>Dr Jurgis Vilemas</td>
<td>Dr Ray Eaton</td>
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<tr>
<td>The Netherlands</td>
<td>Dr Henk Barten</td>
<td>Mr Patrick Davis</td>
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<td>France</td>
<td>Dr Paul Lucchese</td>
<td>Denmark</td>
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<td>Finland</td>
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<td>Mr Jan Jensen</td>
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<td>Australia</td>
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<td>Dr Seppo Hannus</td>
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IEA HIA Fundamentals

International Energy Agency (IEA)
Autonomous body within the Organization of Economic Cooperation and Development (OECD), founded in 1974 to carry out energy cooperation among member countries

IEA Implementing Agreement (IA)
A collaborative research and development (R&D) program

Annex / Task
Basic unit of organization; Next level is sub-task; Operating Agent manages Annex; Experts do work

Hydrogen Implementing Agreement (HIA)
Created in 1977 on task-shared, “bottom-up” basis; US a founding member
US supports HIA Secretariat and participates in all tasks
HIA Annexes Since 1977

Past Tasks
1. Thermochemical Production
2. High-Temperature Reactors
3. Potential Future Markets
4. Electrolytic Production
5. Solid Oxide Water Electrolysis
6. Photocatalytic Water Electrolysis
7. Storage, Conversion and Safety
8. Techno-Economic Assessment
9. Hydrogen Production
10. Photoproduction of Hydrogen
11. Integrated Systems
12. Metal-Hydride for H₂ Storage

Present Tasks
1. Design and Optimization of Integrated Systems
2. Photoelectrolytic Production
15. Photobiological Production
16. H₂ from Carbon-Containing Materials
17. Solid & Liquid State Storage Materials
18. Integrated Systems - II
19. Safety
20. Hydrogen from Waterphotolysis
Objectives

- Manage orderly and efficient conduct of HIA to support realization of HIA mission and DOE Hydrogen Program to advance hydrogen economy
- Support appropriate and effective expansion of the HIA R&D, analysis and outreach program
- Promote growth in HIA membership and industry participation
- Cooperate with other international hydrogen R&D ventures, notably the IPHE
- Enhance HIA leadership position in international hydrogen RD&D ventures
- Foster HIA’s standing as a premier global resource for technical expertise in hydrogen R&D
Approach

In support of HIA mission & DOE Hydrogen Program Objectives
and under direction of HIA Executive Committee

- **Manage HIA Operations**
  - Strategic planning for R&D, analysis and outreach portfolio
  - Finance and accounting
  - Administration
  - Conferences, meetings and event planning

- **Manage HIA Personnel**
  - Employees and consultants, both professional and administrative

- **Manage Communication and Outreach program**
  - Internal HIA communications and IEA liaison
  - External communications and cooperation ([www.ieahia.org](http://www.ieahia.org))
  - Media Engagement
  - Representation to relevant organizations and groups
HIA Secretariat
Accomplishments-Progress-Results

Operations

- Membership recruiting - Current total 17 members:
  - 4 new members
  - 1 returning member
  - 8 potential country members in pipeline to join HIA
- Formal IEA approval for new five year term of operation 2004-2009 and Strategic Plan
  - Features plans for HIA growth and expanded collaboration
- Two Executive Committee meetings per year
- HIA R&D, Analysis and Outreach Portfolio and Work plan
  - 3 new tasks (18, 19, 20) approved
  - approval of 4th task imminent
  - 2 tasks in project definition phase and others in decision pipeline
HIA Secretariat
Accomplishments-Progress-Results

Outreach and Communications

- HIA featured speaker at 10 major international conferences
- 12 media articles on HIA
- 4 major presentations and 2 posters now planned
- New corporate identity (logo, etc) developed
- HIA website [www.ieahia.org](http://www.ieahia.org) now under reconstruction
- Published HIA Annual Report

Personnel

- Managed Secretariat’s administrative and professional resources

HIA’s success acknowledged as a sustainable vehicle for collaborative R&D that offers a global model for international cooperation
1) provides an introduction to the complex, interconnected issues associated with the development of a hydrogen infrastructure and the adoption of hydrogen as the “future fuel”

2) conveys the attractive fundamentals of the hydrogen energy proposition

3) highlights important HIA contributions to the advancement of hydrogen science and technology

Available for downloading at http://www.ieahia.org/iea_publications.html
Task-15: Photobiological Hydrogen Production
Technical Accomplishments-Progress-Results

May 1999 – June 2004

☑ Completed – will evolve into Task-21
☑ Various process-development-scale photo-bioreactor systems being tested
☑ Comprehensive global database established on hydrogen-producing microorganisms
☑ Hydrogen production from a green algae demonstrated
☑ Two breakthroughs
  ☐ Accessory genes for photoproduction of $\text{H}_2$ in Chlamydomonas Reinhardtii identified
  ☐ STA7 and starch metabolism play important roles in this process
Gen-Mutated Algae Cultures for Hydrogen Production


DOE Program Review 2005
Task-16: H₂ from Carbon-Containing Materials
Technical Accomplishments-Progress-Results

April 2002 – December 2005

- Completed concept study of **large-scale integrated hydrogen production project** for power production with decarbonization
- Comprehensive status and R&D challenges report on **hydrogen production from biomass** complete; Resource, technology and market analysis for biomass feedstock underway
- Review of **small-scale stationary reformers** for hydrogen production from fossil fuels with CUTE update
- Three subtasks:
  - Osaka Gas won engineering excellence award from ENAA for reformer work under Subtask C
“Small-scale” Natural Gas Reformer

Mahler
Task-17: Liquid & Solid Hydrogen Storage
Technical Accomplishments-Progress-Results

June 2001 – May 2006

- **Global database** created http://hydpark/ca.sandia.gov
- R&D on catalyzed sodium aluminum hydrides led to identification of hydride capable of **4 wt% reversible hydrogen @ 120°C**
- Metal hydride storage material with **5 wt% @ 150°C** confirmed
- Joint R&D on **14 metal hydride, 12 combined hydride/carbon and 6 carbon projects**
Hydriding Mechanisms

L. Schlapbach
Task-18: Integrated Hydrogen Systems
Technical Accomplishments-Progress-Results

January 2004 – January 2009

- Anticipates development of comprehensive information datasets and summary compilation of integrated hydrogen demonstration systems and development plans
- Utilizes Modeling and use of previously developed analysis tools to evaluate hydrogen demonstration projects
- Project selection and assessment: 8 demonstration projects selected; 2 evaluations complete; 6 underway
- “Hydrogen Resources Study” underway with broad participation
- New case study approach for other demonstration projects
Fuel Cell Innovative Remote System For Telecommunication

**FIRST**

Data acquisition of FIRST project showcase 1

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DOE Program Review 2005
Task-19: Safety
Technical Accomplishments-Progress-Results

October 2004 – October 2009

- Approved October 2004
- **Subtask 1**: Survey of Quantitative Risk Assessment (QRA) methodologies and testing methodologies **underway**
- **Subtask 2**: Establishment of testing equipment to evaluate the effects of equipment, product and/or system failures under a range of **real-life scenarios**, environments or mitigation measures
- **Subtask 3**: Development of targeted information packages for stakeholder groups
E.g.: High-Pressure Hydrogen Gas Tank Testing

- Bonfire test
- Grenade test
- Drop test
- Gunfire test
- Hydraulic burst test
Task-20: Hydrogen from Waterphotolysis
Technical Accomplishments-Progress-Results

October 2004 – June 2008

- Launched October 2004: countries, 35 research groups, experts
- Continuation and expansion of Task-14 (up to 14 countries and 35 research groups)
- Aim: Net solar-to-hydrogen conversion efficiency of 10%
- Objectives: Intensification of international collaboration, advancement of PEC materials science, development of engineering solutions, demonstration of leading concepts, promotion of photolysis of water
Photoelectrochemical (PEC) Tandem Cell

IEA H₂ Program Focal Points 2004 - 2009

- Collaborative RD&D
- Independent Analyses
- Industry Participation
- Country Membership
- Confidence with hydrogen
The Future
HIA Goals 2004-2009

Science & Technology Goal
Advancement of Science via Pre-Commercial Collaborative RD&D
- Hydrogen Production
- Hydrogen Storage
- Hydrogen Systems

Market Environment Goal
Assessment of Market Environment, including Non-Energy Sector
- Non-Energy and Industrial Processes
- Foundation for Codes & Standard
- Infrastructure

Outreach Program Goal
Increasing Knowledge and Comfort with Hydrogen
- Membership and Participation
- Information Dissemination
- Synchronization worldwide
Future Plans for Annexes & Activities

- Internal IEA cooperation – e.g. with Advanced Fuel Cells IA
- External collaboration – e.g. with IPHE
- High-temperature processes: Electrolysis, thermochemistry
- Low-temperature processes: Including electrolysis and wind
- Compressed gas assessment
- Hydrogen storage (focus on liquid & advanced solid state storage concepts)
- Industrial uses of hydrogen with non-energy focus
- Infrastructure for stationary applications
- Hydrogen economics
- Expanded outreach with newsletter on revamped website
Publications and Presentations
Secretariat Supported and/or Delivered

Publications

- 25th Anniversary Report: In Pursuit of the Future
- End of Term Report and Five-Year Plan
- HIA Annual Reports
- Final management Report Task 14
- 200 expert publications
- Opportunities Assessment Report: Gaps & Priorities in Hydrogen R&D
- Papers for inclusion in conference proceedings
- Press releases on HIA news
- Member only publications – Semi-Annual Reports and presentations
- Secretariat and media articles

Presentations

FY2004
- German Hydrogen Energy Conference
- U.S. National Hydrogen Association Conference
- Windsor Workshop Panel Discussion
- World Hydrogen Energy Conference 15 – Presentation and poster
- Task 16 Subtask C presentation
- World Renewable Energy Conference (WREC)

FY2005
- Fuel Cell Seminar
- Gaps and Priorities in Hydrogen R&D to IEA Hydrogen Coordinating Group
- Renewable Hydrogen at IEA REWP Meeting
- IPHE Storage Conference (Co-sponsor)
- International Hydrogen Energy Congress & Exhibition
- World Hydrogen Technologies Conference
- European Hydrogen Energy Conference/Exhibition
HIA Secretariat:
Enhances HIA Investment Value for DOE

Provides a neutral international profile
- Knowledgeable, reliable, unbiased
- Global reach (government, academia, industry)

Leverages resources through task-sharing
- Focus includes science & technology, market analyses and outreach
- Portfolio includes shorter term and long-term, pre-competitive activities

Offers sustainable model for management of international R&D cooperation