The International Energy Association (IEA) Hydrogen Implementing Agreement (HIA): Activity and Progress in a Global Collaborative R&D Portfolio

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1.0 Introduction

Created in 1977 and now in its Second Generation of Hydrogen R,D&D, the International Energy Agency (IEA) Hydrogen Implementing Agreement (HIA) is the oldest, largest international collaboration on hydrogen R,D&D. The HIA envisions a hydrogen future based on a clean, sustainable energy supply of global proportions that plays a key role in all sectors of the economy. The HIA mission is to accelerate hydrogen implementation and its widespread utilization.

The IEA HIA addresses many innovative, long-term pre-competitive R, D&D issues related to hydrogen production, storage, safety, integrated systems, analysis, economics and markets. A careful intellectual property policy safeguards the discovery process. The implementing agreement allows members to democratically determine their R,D&D portfolio and leverage precious R,D&D resources though an established technical network with a global reach. These features contribute to making IEA HIA membership a very attractive value proposition.

Through global cooperation in R,D&D, the IEA HIA (www.ieahia.org) is working to realize the energy future of an interdependent world. The IEA HIA's R&D cooperation provides an excellent model for successful international cooperation that will contribute to the sustainable supply and use of energy.

2.0 IEA HIA Fundamentals

The Implementing Agreement is a mechanism created by the International Energy Agency (IEA), which was founded in 1977 to carry out energy cooperation among member countries. The IEA devised the implementing agreement as a flexible vehicle for collaborative international R,D&D.[1] There are some 40 implementing agreements on a wide range of important energy topics. The IEA HIA is, of course, devoted to hydrogen.

As a leader and premier global resource on technical expertise in hydrogen R,D&D, the IEA HIA has undertaken 25 annexes or tasks on topics such as hydrogen production, storage, analysis of integrated systems, and related matters such as safety, conversion, economics and markets. The majority of the HIA's R&D portfolio has focused on longer term, pre-competitive R,D&D issues in hydrogen. Of the 25 annexes undertaken by the HIA, 18 are now complete. The

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HIA is also committed to outreach in support of both its core R&D activities and seminal issues related to regulation and infrastructure. As ever, the HIA welcomes collaboration and liaison with interested groups in public and private sectors.

3.0 Members

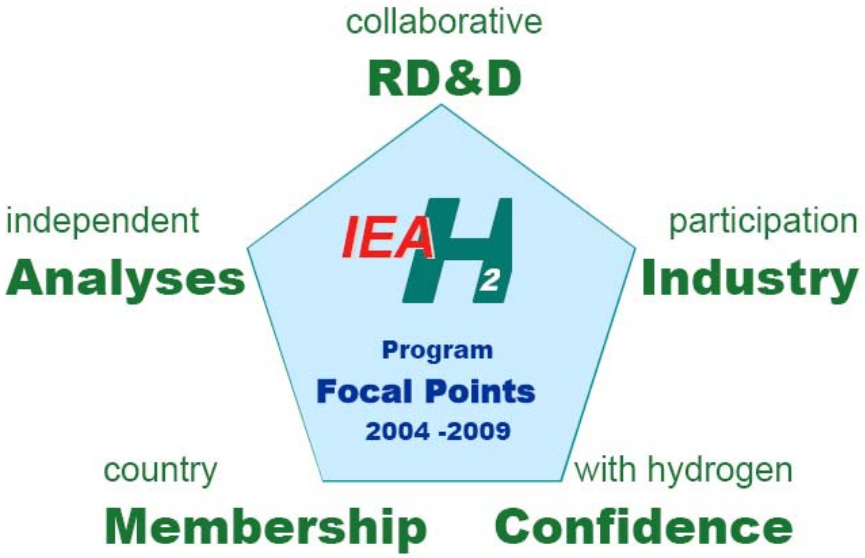
Currently, there are 22 IEA HIA members. The members are: Australia, Canada, Denmark, Finland, France, Germany, Greece, Japan, Iceland, Italy, Korea, Lithuania, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United Sates and the European Commission. Other countries have expressed interest in membership. With each new member, our capabilities grow.

4.0 Strategic Framework

The IEA HIA strategy is to facilitate, coordinate and maintain innovative research, development and demonstration activities through international cooperation and information exchange.

The IEA HIA is a task-shared agreement, meaning that the members share the actual work rather than the cost of executing the work. The R&D portfolio is developed on a democratic, bottom up basis by the Executive Committee. The governing body of the HIA, the Executive Committee, consists of member representatives. The annex or task is the basic unit of organization, followed by the sub-task. An Operating Agent manages each task and the actual work is performed by experts who are compensated directly by the members. The Secretariat manages the implementing agreement. The IEA HIA Secretariat office is located outside Washington, D.C. on the campus of the Federation of Societies of Experimental Biology (FASEB), which has produced over 120 Nobel laureates.

A summary of the IEA HIA's 2004-2009 Strategic Plan follows.[2] The 2004-2009 Five Year Plan has five focal points: collaborative R&D, independent analyses, industry participation, country membership and hydrogen with confidence. These are seen in Figure 1 below:



This five-year plan has specific goals in Science and Technology, Market Environment and Outreach, which appear below:

Science and Technology Goal: Advancement of Science via Pre-Commercial, Collaborative R&D in Hydrogen

- Production
- Storage
- Systems

Market Environment Goal: Assessment of Market Environment, including the non-Energy Sector, via

- Non-Energy and Industrial Processes
- Safety Foundation for Codes & Standards
- Infrastructure

Outreach Program Goal: Increasing Knowledge and Comfort with Hydrogen

- Membership and Participation
- Information and Dissemination
- Synchronization Worldwide

The HIA's core business is R&D, which relates directly to our Science and Technology goal. Our Market Environment goal supports related analysis and development of the necessary foundation for infrastructure. It is the collaboration of members and experts that enables all of the activities related to these two goals. Collaboration is also a feature of our third goal, Outreach. The HIA's Outreach goal is to increase understanding and comfort with use of hydrogen.

5.0 Overview of the IEA HIA Portfolio

The table below lists the number, name and term of each annex in the IEA HIA portfolio along with its category (completed, current and future). The recently completed Task 20, current annexes (tasks 18-25) and future tasks are then discussed briefly by category.

COMPLETED		
Task 1	Thermochemical Production	1977-1988
Task 2	High Temperature Reactors	1977-1979
Task 3	Assessment of Potential Future Markets	1977-1980
Task 4	Electrolytic Production	1979-1988
Task 5	Solid Oxide Water Electrolysis	1979-1983
Task 6	Photocatalytic Water Electrolysis	1979-1988
Task 7	Storage, Conversion and Safety	1983-1992
Task 8	Technical and Economic Assessment of Hydrogen	1986-1990
Task 9	Hydrogen Production	1988-1993
Task 10	Photoproduction of Hydrogen	1995-1998
Task 11	Integrated Systems	1995-1998
Task 12	Metal Hydrides for Hydrogen Storage	1995-2000
Task 13	Design and Optimization	1999-2001
Task 14	Photoelectrolytic Production	1999-2004
Task 15	Photobiological Production	1999-2004
Task 16	Hydrogen from Carbon-Containing Materials	2002-2005

Task 17	Solid and Liquid State Storage	2001-2006
CURRENT		
Task 18	Integrated Systems Evaluation	2004-2009
Task 19	Hydrogen Safety	2004-2007
Task 20	Hydrogen From Waterphotolysis	2004-2007 Closing
Task 21	Biohydrogen	2005-2008
Task 22	Fundamental and Applied Hydrogen Storage Materials Development	2006-2009
Task 23	Small-Scale Reformers for On-Site Hydrogen Supply (SSR for Hydrogen)	2006-2009
Task 24	Wind Energy and Hydrogen Integration	2006-2009
Task 25	High Temperature Production of Hydrogen	2007-2009
FUTURE		
	New Term Routes to Hydrogen Using Biomass as a Renewable Energy Source	In definition
	Large Scale Hydrogen Infrastructure and Mass Storage	In definition
	Advanced Materials in Waterphotolysis (successor to Task 20)	In definition

The IEA HIA prepares an Annual Report each year that contains an update on each annex. On completion, every annex must also prepare a final report.

5.1 Completed Tasks

5.1.1 Task 20 Hydrogen from Waterphotolysis (Operating Agent Dr. Andreas Luzzi)

Tasks 20 closed in December, 2007. The final report is expected to be released shortly, pending Executive Committee approval. IEA HIA Task 20 was the world's best address for expertise in photoelectrochemical (PEC) watersplitting. At inception, Task 20 collaborators numbered 23 expert R&D groups from eight (8) countries. Over the life of the task, the research attracted the cooperation of other international expert groups and countries interested in materials development and systems design issues related to PEC water-splitting.

IEA HIA's international teams have been investigating solar-to-hydrogen production since 1979. Task 14, immediate predecessor to Task 20, published encouraging findings from its R&D on photoelectolytic technology. This dedicated international effort laid the groundwork for Task 20. The development of early-stage PEC demonstration devices as received particular attention by Task 20 members over the first years of the task. However, as the task concludes, most Task 20 experts have slowed or suspended efforts in PEC device development pending solutions to the core PEC challenge of developing a stable and well-performing photoelectrode material.

The basic concept is simple and exciting: photoelectrochemical (PEC) cells can decompose water into hydrogen and oxygen upon solar illumination. PEC cells employ photoelectrodes that are immersed in an aqueous electrolyte or, if preferred, directly into water (sea water included!) Technically, PEC cells could be described as integrated or monolithic photovoltaics/electrolysis devices.

While straightforward in concept, the materials challenge requisite to development of efficient PEC technology is significant. There is, however, global fascination with the wizardry of the PEC cell and the use of the sun to split water. It conjures the image of Merlin the Magician. It also offers the future promise of clean, sustainable hydrogen production at a very large-scale. This prospect has captured the imagination and talent of researchers around the world.

Photon conversion efficiency and durability are considered the main measures of Task 20 success. Key objectives include:

- Advancement of photoelectrode materials science, especially as to low-cost materials and corrosion challenges
- Development of engineering challenges with a focus on thin-film deposition as well as powder techniques and system integration
- Demonstration of the leading concepts

The following are among the significant outcomes of Task 20:

- Maturing PEC water-splitting tandem concepts

- Pioneered Fe_2O_3 (Hematite) as very promising, abundant, low and environmentally benign photoanode material.
- Continuously evolving understanding of fundamental material science "knowhow" related to PEC needs
- The 2007 formation of two highly coordinated photoelectrode materials development focus groups, one in the US and the other in Europe. Development and submission of two multi-year R&D proposals to the US DoE and EU 7th Framework Program.
- An interactive web-based platform to better manage and exchange PEC materials knowhow related to PEC needs

In addition, PEC work on tungsten trioxide led to novel, highly sensitive, reliable and low-cost pollution control sensors for the automobile industry.

5.2 Current Tasks

Presently, there are seven tasks in the HIA current portfolio.

5.2.1 Task 18 – Integrated Systems Evaluation (Operating Agent – Dr. Susan Schoenung)

The overall goal of Task 18 is to provide information about hydrogen integration into society around the world. There are two subtasks: A) Information Development; and B) Demonstration Project Evaluation. Approved in late 2003 for a three-year term, Task 18 consists of 13 member countries. Task 18 was recently extended through 2009 and it is anticipated that two more countries will join for phase two.

During the first three years, this annex had two major subtasks: Subtask A – Information Base Development; and Subtask B – Demonstration Project Evaluation. In addition, Task 18 has overseen the preparation of case studies by Thomas Schucan. Completed case studies are posted on the HIA website www.ieahia.org and the Annex 18 public website www.port-h2.com/IEA-Annex-18/

The second phase of Task 18 will include a new subtask. Subtask C will focus on synthesis and learning to bridge the experience of Subtasks A and B and provide Lessons Learned, Benchmark Assessments and Trend Analysis.

Subtask A – Information Base Development

Task 18 Subtask A announces release of its Phase I (2004-2006) final report entitled *Information Base Development.* The overall goal of Task 18 is to provide information about hydrogen integration into society around the world. The objective of Task 18 Subtask A is to provide the hydrogen community with data and analysis in the form of inventory databases and/or compiled summaries that address the developing use of hydrogen. This report describes the scope of work, products and accomplishments in Phase I. Subtask A created a public website 2004 to disseminate information about its activities. The URL for this website is http://www.port-h2.com/IEA-Annex-18/. The hydrogen community

and interested public will be very pleased to learn that as of the completion of Phase I on December 31, 2006, this website now contains an extensive "National document information base" which consists of over 250 formational reports and proceedings, including 150 searchable summaries, from fifteen member countries. In addition, as of December 31, 2007, the public website now also hosts other Subtask A products featuring:

- 305 National Organizations
- 60 National Projects
- 35 Links to external databases and websites, along with access to the HySociety database.

This resource has logged 1,000s of visitors to date. It is expected to function as an essential hydrogen research tool and greatly facilitate understanding of hydrogen conditions worldwide.

Subtask B – System Studies – Optimization for the Future
Subtask B seeks to use modeling and analysis tools to evaluate hydrogen demonstration projects or guide their design and assessment, thereby facilitating validation of models and assumptions. Task 18 is pleased to announce release of its Subtask B final report entitled *Demonstration Project Evaluations*. Subtask B evaluated hydrogen-based power system and hydrogen refueling system demonstration projects in Task 18 member countries. This report describes the scope of work in Phase 1 (2004-2006) of Subtask B and conveys the conclusions of its evaluations for:

- Modeling and detailed analysis of five (5) demonstrations that included technical simulations
- Analysis of three (3) demonstrations in less detail
- Case studies of eight (8) demonstrations, three of which were analyzed in detail.

The report also provides general conclusions in the areas of system evaluations, data monitoring, modeling tools, system design, control systems and cost-benefit analysis. It is available for downloading free-of-charge at http://www.ieahia.org/pdfs/finalreports/18subtaskB/Task18_SubtaskB_Final_ISBN.pdf

The table below lists the complete Subtask B project portfolio (present and future) which is comprised of two major categories: H_2 refueling stations and Integrated RE/ H_2-energy systems. Over half of all projects are renewables based; the remainder are fossil fuel based.

Project Portfolio under Evaluation in Subtask B

Country	Projects	Location	Modeling focus	Evaluation status
Refueling Stations				
Sweden	Hydrogen filling station (grid/electrolysis)	Malmö	System sizing	complete
Iceland	Hydrogen filling station (grid/electrolysis)	Reykjavik	Electrolyzer performance	complete
Canada	Hydrogen filling station (grid/electrolysis)	Vancouver	Compressor performance	In progress
Grid-connected or stand-alone power systems				
Spain	PV/MH-telecom showcase (RE)	Madrid	Storage sizing	done
Japan	Regenerative PEM FC-power system (grid)	Aichi	Storage thermal control	complete
UK	RE/H2-project	Loughborough	Economic performance	In progress
Italy	Hydrogen from the Sun	Brescia	System efficiency	Phase 2
Combined fuel and electricity generation				
USA	Hydrogen energy/refuelling station (NG)	Las Vegas	System performance	done
USA	Hydrogen power park (RE)	DTE or HI	Compressor and storage optimization	Phase 2
Infrastructure demonstrations				
Denmark	Natural gas / hydrogen pipeline, boiler	Copenhagen	Economics	In negotiation
Residential heat and power				
France	Building fuel cell evaluation	5 sites	Fuel cell / system performance	Case Study

On the basis of the modeling and evaluation work, the following additions or improvements have been planned for the H_2-refueling stations projects:

1. Expanded service scenario, to 100-200 buses (Malmö)
2. Expanded service, to level electrolyzer load and include more vehicles (Reykjavik)
3. Compressor / dispenser component optimization; model improvement (Vancouver)

Subtask B modeling and evaluation also resulted in optimization activities for the following Integrated RE/ H_2-energy systems:

1. Metal hydride storage thermal system optimization (Japan)
2. Techno-economic system design study with optimized dispatch operation (HARI, UK)
3.

5.2.2 Task 19 – Hydrogen Safety (Operating Agent – Mr. William Hoagland)
Hydrogen safety is recognized as a critical issue for the coming hydrogen economy, one that cross cuts all R&D, infrastructure and market considerations. Task 19 has been extended to 2009. The goals of the Hydrogen Safety Task are: to survey and analyze effective risk management techniques, testing methodologies and test data; to contribute to the development of fundamental knowledge on hydrogen related to hydrogen safety; and to develop targeted information products that will facilitate the accelerated adoption of hydrogen systems. The three subtasks are:

Subtask A Risk Management

A1. - Survey of existing risk assessment methodologies for relevant case studies, including development of a best practice for ignition probability modeling

A2 - Comparative risk assessment of hydrogen systems with hydrocarbon fuel systems

A3. - Probabilistic risk and consequence analysis

Subtask B Testing and Experimental Program

Subtask C Information Dissemination

This three part safety annex reports progress on Subtask A, Risk Management, which will produce a public report that surveys Quantitative Risk Assessment (QRA) methodologies on hydrogen safety. The report is intended for use by industry professionals and is expected to be published in spring 2008. A comparative analysis of risk assessment methodologies used will also be completed in October 2007 and made publicly available after internal review.

Results of the Subtask B Testing and Experimental Program, now underway, will be compiled in the private Hydrogen Testing and Experimental Database (HYTEX) beginning in 2007. In addition, an inventory of planned or existing testing and experimental projects and facilities will be collected in a dedicated public database whose working title is HY PRO (Hydrogen performed, ongoing or planned projects). That database is expected to be active early spring 2008.

For Subtask C, Information Dissemination, the following hydrogen safety stakeholder groups have been identified: permitting officials; insurance providers; system developers; equipment manufacturers; and early adopters of technology.

5.2.3 Photobiological Production of Hydrogen (Operating Agent - Dr. Jun Miyake)
The successor task to Annex 15, Task 20 - Photobiological Production of Hydrogen, has four subtasks. The subtasks are listed below with their associated goals.

Subtask A BioHydrogen Systems. This subtask will focus on:

i. Metabolism, genetics and thermodynamics of H_2 producing bacteria to identify critical genes, pathways and regulatory components for high yield H_2 production
ii. Genetic and physiological interventions to maximum H_2 production – identification of bacteria and conditions that allow for high H_2 productions rates
iii. For fermentations, demonstrate H_2 production from organic substrates under conditions that produce high amounts of H_2

The goal of this subtask is to increase the achievable H_2 production from substrates above the currently achievable yields of 3-4 moles H_2/mole of glucose.

Subtask B Basic Studies for BioHydrogen Production. This subtask will focus on:

i. Genetics and metabolism of H_2 production of synthetic microbes
ii. Physiology and cultivations of photosynthetic microbes to maximize H_2 production from water or organic wastes
iii. Photosynthesis – overcoming limited factors

The goal of Subtask B is to demonstrate potentially practical processes for conversion of water or organic substrates to H_2 with solar energy.

Subtask C Bio-inspired systems. Subtask C will focus on:

i. Enzyme systems for hydrogen production
ii. Bio-inspired systems for hydrogen production
iii. Biological fuel cells - coupling enzymes and even whole organisms to electrodes

The subtask C goal is to identify promising applications of enzymes and biologically inspired processes for hydrogen production and fuel cell use.

Subtask D Overall Analysis. Subtask D will focus on:

i. Effects of BioHydrogen on social systems and human life
ii. Analysis of unstable factors and risks of BioHydrogen
iii. Economic and social conditions to realize BioHydrogen

This task now has 11 HIA members and continues to grow, a witness to the considerable and growing global interest in biohydrogen.

5.2.4 Task 22 - Fundamental and Applied Hydrogen Storage Materials Development (Operating Agent – Dr. Bjørn C. Hauback)

Task 22 was approved by the Executive Committee and began operations on December 1, 2006. The previous storage annex, Task 17- Solid & Liquid State Hydrogen Storage Materials, made significant progress toward realization of solutions for hydrogen storage, but further efforts are needed to meet international goals. As liquid and compressed gas storage options cannot achieve these goals,

solid materials become the preferred storage medium. Task 22 will research the new solid storage materials and solutions needed to meet this challenge.

There are three primary annex targets. The first target focuses on development of reversible or regenerative hydrogen storage media that meet international goals for hydrogen storage. The second target entails pursuit of fundamental and engineering understanding of hydrogen storage by various hydrogen storage media that have the capability of meeting the first target. The last target is the development of hydrogen storage materials and systems for use in stationary applications.

As the annex begins, 17 IEA HIA countries are expected to participate in some 50 projects. Project types include**:** experimental; engineering; theoretical; modelling (scientific or engineering); and safety aspects of hydrogen storage materials. The following classes of H-storage media will be researched**:** Reversible metal hydrides; regenerative hydrogen storage materials; chemical hydrides; nanoporous materials; and rechargeable organic liquids and solids.

5.2.5 Task 23 - Small-scale Reformers for On-Site Hydrogen Supply (SSR for Hydrogen) (0perating Agent – Dr. Ingrid Schjølberg)

Created on the basis of findings and recommendations of the recently completed Task 16, Task 23 will focus on development of reformer technologies and distributed on-site hydrogen supply systems based on reforming. This annex has three subtasks:

Subtask A: Harmonized Industrialization
Subtask B: Sustainability and Renewable Sources
Subtask C: Market Studies

Industry participants from eight member countries (Denmark, France, Germany, Netherlands, Norway, Sweden, the United Kingdom and the United States) have been identified.

5.2.6 Task 24 Wind Energy and Hydrogen Integration (Operating Agents: Dr. Luis Correas and Mr. Fernando Carpintero)

The new annex proposes an international collaborative midterm R&D program among entities belonging to the whole wind-to-H_2 production chain, as well as the wind-to-profit chain including: project financiers, engineering and contractors, market regulators, grid operators and distribution companies. Task 24 was approved by the Executive Committee in November 2006. Four subtasks are planned:

Subtask A - State of the Art
Subtask B - Needed Improvements and System Integration
Subtask C – Business Concept Development

Subtask D - Applications with Emphasis on Wind Energy Management

Dr. Luis Correas and Mr. Fernando Carpintero will share the Operating Agent role sequentially, with Dr. Correas performing the management function for the first two years.

5.2.7 Task 25 High Temperature Production of Hydrogen from Nuclear and Solar (Operating Agent: Mr. Gilles Rodriguez)

The purpose of this annex is to support production of massive quantities of zero emission hydrogen through identification of high temperature processes coupled with nuclear and solar heat sources. The main objectives are to share existing knowledge on high temperature production (HTP) worldwide and to develop objective global expertise on HTP assessment for Hydrogen Production Road Mapping purposes.

The annex proposal recognizes the growing need for hydrogen in the current refinery market, as well as the anticipated market for hydrogen as an energy carrier, and for transportation needs. The justification for selection of nuclear and solar for hydrogen production is based on well-to-wheel analysis of contribution to CO_2 abatement. This annex will consider high temperature electrolysis, thermochemical cycles (pure or hybrid), and innovative processes. Four subtasks are proposed:

Subtask A - State of the Art
Subtask B - Methodology Approach of HTPs
Subtask C - HTP R&D and Future Industrial Deployment;
Subtask D – Dissemination of Information. Mr. Rodriguez encourages balancing nuclear and solar research.

5.3 Future Tasks: "In Definition"

5.3.1 New Term Routes to Hydrogen Using Biomass as a Renewable Energy Source (Task Organizer Ms. Elisabet Fjermestad-Hagen)

The Task 16 Subtask B successor annex has received preliminary approval. Final approval awaits clarification of the Operating Agent. A scope of work has been developed with the following four subtasks and objectives:

Subtask A - Co-gasification of Biomass with Fossil Fuels. The subtask will identify and evaluate the most attractive and realistic process pathways towards a large-scale demonstration of biomass co-gasification with fossil fuels.
Subtask B - Near Term Stand-alone Biomass Gasification
Subtask C - Hydrogen market facilitation. The subtask is based on distributed processing of biomass to new tradable intermediates
Subtask D – Roadmap. This subtask contemplates development and verification of a plan.

5.3.2 Large Scale Hydrogen Infrastructure and Mass Storage (Task Organizer: Mr. Frank Denys)
The objective of the task is to establish international consensus on the academic techniques and industrial practices required to implement hydrogen pipeline distribution system with mass bulk storage. The starting point will be information about the existing infrastructure consisting of industrial hydrogen distribution systems and pipelines. The following six subtasks are anticipated:

Subtask 1 – Exisitng Infrastructure
Subtask 2 – Pipelines
Subtask 3 – Mass Storage
Subtask 4 – System Modeling
Subtask 5 – Economic Modeling
Subtask 6 – Knowledge Dissemination

5.3.3 Hydrogen From Waterphotolysis (Task Organizer Dr. Eric Miller)
Proposed as the successor to Task 20, the new task will focus on advanced materials for PEC watersplitting to the exclusion of PEC devices. Four subtasks are planned: materials theory; synthesis, characterization; and information coordination/database.

Outreach and Collaboration

The HIA's Outreach goal is to increase understanding and comfort with use of hydrogen. Three objectives are associated with this goal: 1) increasing membership and participation; 2) information dissemination; and 3) synchronization worldwide. So, relative to membership, the HIA now numbers 22 members and continues to grow. HIA expert participation has grown commensurately. Industry participation was particular focus for Task 16 – Hydrogen from Carbon Containing Materials. Industry participation continues to be a focus for Task 23 – Small Scale Reformers for On Site Hydrogen supply and Task 19 – Safety, both of which address important issues of common interest to industry.

The IEA HIA has actively participated in the G8 Gleneagles Plan of Action inspired Network of Expertise in Energy Technology (NEET). NEET has produced a series of workshops in the so-called "Plus Five" nations of Brazil, China, India, Russia and South Africa aimed at building awareness of and participation in IEA implementing agreement activities.

The second objective is information dissemination. The HIA has made a concerted effort to make oral and poster presentations that provide an overview of the implementing agreement and details on our work portfolio.

The first two outreach objectives contribute directly to the third objective, which is worldwide synchronization of hydrogen information. To this end, cooperation

among HIA members and HIA's coordination with the greater IEA – its other implementing agreements and committees – has been very valuable.

The IEA HIA is pleased to announce that it has entered into a Memorandum of Understanding (MOU) with the International Partnership for a Hydrogen Economy (IPHE) that addresses cooperation between the two groups. The first area of collaboration will be Task 22 on Hydrogen Storage, which is subject of Annex 1, the first area of cooperation under the new MOU. The Russian Federation has formally expressed interest in joining the IEA HIA and participating in Task 22 under the framework of this MOU.

In general, the IEA HIA looks forward to increased cooperation with the greater energy community.

6.0 The IEA HIA Value Proposition: A Model R, D&D Collaboration for an Interdependent World

Today, the IEA HIA is the premier global resource for technical expertise in hydrogen R, D&D. Enabled by a collaborative framework, a careful intellectual property policy, an established network of researchers and a neutral international profile, the implementing agreement has made significant achievements and advances toward a hydrogen energy future. This energy future promises abundant, clean energy benefits to an interdependent world. At the same time, the IEA HIA also offers its members a solid value proposition, leveraging their resources in hydrogen R, D&D and increasing the return on their investment as the IEA HIA grows in membership and productivity. Through its Secretariat, Executive Committee and Operating Agents, the IEA HIA would be pleased to share more information with the greater energy community about this implementing agreement, a sustainable model for collaborative R, D&D in an interdependent world.

[1] For more information about the IEA and its implementing agreements, visit www.iea.org

[2] The HIA's Five Year Plan: 2004-2009 was approved by the HIA Executive Committee on April 1, 2004 and subsequently approved by IEA Committee on Energy Research and Technology in Paris. The next Five Year Plan will cover the period 2010-2015.