

IEAHIA NEWS

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THE IEA HIA TODAY

The IEA HIA R,D&D portfolio coalesced in 2010 to include critical efforts in analysis, infrastructure and distributed / community level use of hydrogen. The portfolio also features renewed interest in bioHydrogen and hydrogen safety. Each of these topics is the subject of a new or extended task listed below.



Task 21 - BioHydrogen was extended with a revised work program and a new Operating Agent, Dr. Michael Seibert of NREL, USA.

Task 28 - Large-Scale Hydrogen Delivery Infrastructure is led by Operating Agent Dr. Marcel Weeda of ECN, The Netherlands.

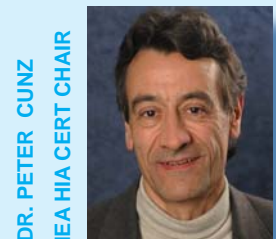
Task 29 - Distributed and Community Hydrogen (DISCO H2) kicks off with Dr. Federico Villatico of UNIDO ICHET as Operating Agent.



Task 30 - Analysis of Global Hydrogen Systems, two years in development, will develop HIA reports and datasets, and also collaborate with the IEA on the WEO and ETP. The Co-Operating Agents are Mr. Jochen Linszen from Jülich, Germany, and Dr. Susan Schoenung of Longitude 122, USA.



Task 31 - Safety continues the work of Task 19, which ended this year. Mr. William Hoagland of Element One, Inc. remains Operating Agent.



IEA HIA Welcomes Chairman of IEA Committee on Energy Research and Technology (CERT) to 63rd Executive Committee ExCo Meeting in Istanbul

The 63rd IEA HIA ExCo meeting at the Marmara Institute of Technology marked an important first-time event for the Agreement as the ExCo had the honor of welcoming Dr. Peter Cunz, Chairman of the IEA Committee on Energy Research and Technology (CERT). *See the Message from the Chair on page 15 for highlights of Dr. Cunz's comments.*

IEA HIA Outreach Engages New and Expanding Audiences

Recent IEA HIA Outreach events included a joint workshop with the Black Sea Economic Cooperation (BSEC) in Istanbul, a Congressional briefing in the U.S. Senate, as well as several presentations -- including a first-ever appearance at the World Energy Council Conference in Montreal. *See Presentation Alert on Page 2.*

Don't miss the Chairman's Message on Page 15! It includes key findings from the McKinsey study, notably the conclusion that there are no major breakthroughs needed to commercialize the hydrogen car. The IEA Blue Map Scenario identifies Hydrogen cars as a key technology to decrease CO₂ emissions. See DiploTech on page 13 for an update on Japan's plans to proceed with production of H₂ powered fuel cell vehicles by 2015.

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PRESENTATION ALERT

Highlights Of IEA HIA Outreach

The spring/summer 2010 - Spring 2011 IEA HIA outreach calendar was full indeed.

Among the outreach events was a **June Congressional briefing in the U.S. Senate** entitled *Global Hydrogen Landscape: Selected IEA HIA Member Programs and Initiatives*. Featured speakers at this briefing, the second IEA HIA congressional briefing were: Mr. Aksel Mortensgaard from Denmark (Danish Partnership for Hydrogen and Fuel Cells); Dr. Marc Steen from the Commission of the European Union; and Dr. Yongsug Tak from Inha University in Korea. To round out the picture from the perspective of our 20 other members, Ms. de Valladares gave a fourth presentation with highlights of their activities. The videos of all presentations may be found on the [IEA HIA Website](#). The [PowerPoint presentations](#) are also available.



DRS. AKSEL MORTENGAARD,
MARC STEEN, & YONGSUG TAK

With respect to conference appearances, the IEA HIA had a **dedicated track at the May World Hydrogen Energy Conference (WHEC 18 in Essen)**. The track included eight (8) presentations on thematically grouped tasks plus an overview lecture by Chairman Antonio G. García-Conde.

Formal presentation of the two **awards of the IEA HIA Project Prize** also took place in Essen, Germany at (WHEC 2010). For the Fundamental Research category, the winner was “Fundamental Safety Testing and Analysis of Hydrogen Storage Materials and Systems (H-25)”, a project of Task 22, Fundamental and Applied H₂ Storage Materials Development. For the Technology Demonstration category, the winner was the IOTHER Project, “Green Hydrogen from Wind and Solar Mobile Applications.” (For the full story on these projects, please see the April 2010 edition of the IEA HIA NEWS.)

In September, the IEA HIA gave its **first oral presentation at a World Energy Conference (WEC)**. The triennial energy conference was held in Montreal in 2010. IEA HIA Secretariat Manager, Ms. de Valladares, delivered the talk entitled “IEA HIA: Enhancing Prospects for Hydrogen in the Energy Mix.” As the sole dedicated hydrogen presentation at WEC, this was a very important opportunity for the entire hydrogen community. It was also the only presentation by an IEA Implementing Agreement on any subject.

The IEA HIA participated in the popular **October Fuel Cell Seminar** held in San Antonio, Texas, USA through a **presentation** made by Secretariat Manager Ms. de Valladares.

In November, the IEA HIA participated in a **UNIDO Workshop with the Black Sea Economic Cooperation (BSEC)** in Istanbul. Seven members, nine Operating Agents and the Secretariat contributed to the workshop entitled *Interactions on Scientific and Commercial Opportunities in the Field of Hydrogen Energy in the Black Sea Region*. Speaking on behalf of the IEA HIA was Co Vice-Chair, Dr. Steven Pearce of Solid Energy New Zealand. BSEC members and financial sector representatives, local and international, also participated in this workshop.



BSEC, UNIDO - ICHET, IEA HIA WORKSHOP

IEA HIA Members

Australia

Canada

Commission of the European Union

Denmark

Finland

France

Germany

Greece

Iceland

Italy

Japan

Korea

Lithuania

The Netherlands

New Zealand

Norway

Spain

Sweden

Switzerland

Turkey

United Kingdom

United States

United Nations

Industrial

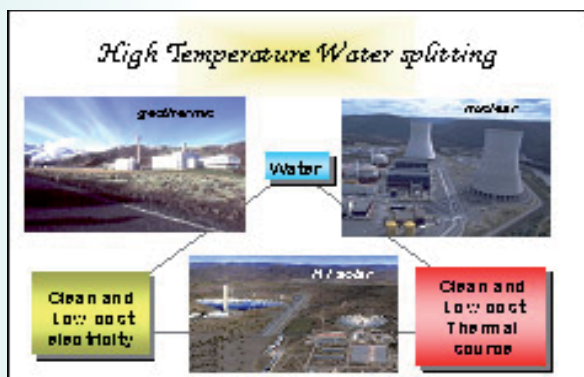
Development

Organization (UNIDO)

IEA HIA TECHNOLOGY SPOTLIGHT: TASK 25, HIGH TEMPERATURE PRODUCTION (HTP) OF HYDROGEN

Task 25 At a Glance

Imagine being able to produce massive quantities of zero-emission H₂ through use of high temperature processes (> 500 C) coupled with nuclear and solar heat sources – and you will grasp the vision of Task 25.



The overarching purposes of Task 25 are: 1) to enhance and create synergy between the different international research institutes and potential industrials involved in high temperature hydrogen production; and 2) to unite the nuclear and solar communities in a common task. This task supports exchange of existing knowledge on high temperature processes (HTPs) and development of expertise in global HTP assessment. Research focuses on innovative processes in three process families: steam electrolysis; thermochemical cycles (including pure and hybrid processes); and innovative direct water splitting. Existing processes are used in these analyses as reference points.

The specific objectives of Task 25 are:

- To identify and classify promising HTPs with no CO₂ emission
- To establish the state of the art and benchmark existing knowledge, programs, projects on HTPs
- To define a methodology for evaluation and comparison of HTPs
- To promote promising HTPs and propose an R&D strategy

Task 25 has four subtasks, which are described below:

Subtask A - Scientific, Technological Review and Analysis of Temperature Processes and the State of the Art (Subtask Leader Christian Sattler, DLR, Germany)

This subtask is performing a technical review of different processes utilizing the results of the European Project INNOHYP_CA to create a database that maps HTP process studies and development – including relevant papers, books and websites -- worldwide. It is also developing summary sheets describing the processes.

Subtask B - Development of a Methodology Approach and Integration of HTPs (Subtask Leader Alberto Giaconia, ENEA, Italy)



Task 25 Members

Denmark

France

Germany

Italy

Japan

Norway

Sweden

The Netherlands

Turkey

United States

Through rigorous analysis, Subtask B seeks to define the main criteria for integration of HTPs into the hydrogen chain, including the interface and primary energy source. This subtask is defining, testing and applying a multi-criteria assessment methodology to compare different HTPs. To do so, this effort first focused on validating tools designed to pilot technological choices that make it possible to meet the increasing demand on the hydrogen energy vector.

Subtask C - Establishment of Benchmarks, Recommendations for HTP R&D and Future Industrial Deployment (François Le Naour, CEA, France)

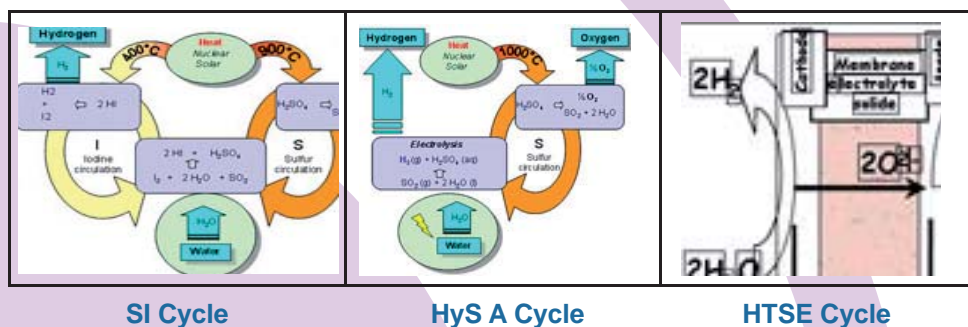
Based on the Subtask A review and industry input, Subtask C looks to identify the most promising technologies and recommendations in order to meet the needs of large future facilities and/or demonstration programs required for effective introduction of HTPs. The subtask's objective is to define demonstrators' needs ten years out, allowing validation of techno-economic evaluations and industrial demonstration of process feasibility.

Subtask D – Communication Actions: Coordination and Links with Other International Organizations; Dissemination of Information (Subtask Leader Sabine Poitou, CEA)

This subtask focuses on developing and ensuring coherence between Task 25 and other projects and groups. It also facilitates exchanges and communications on HTPs. Included are development of summary sheet descriptions of every process, as well as generic information sheets on solar or nuclear sources and techno-economic assessment.

Technology Made Simple

Task 25 deals with thermochemical cycles for water splitting with HT heat from nuclear and solar. High temperatures often imply an increased potential for high efficiencies, but also involve large capital investments to reach maximum efficiency. High temperature processes involve a decrease in ohmic resistance and use of heat rather than electricity. In practical terms, there is a need to identify the most suitable temperature for the optimum between efficiency and technology constraints. Today, nuclear power can be used to produce a massive quantity of hydrogen (>500 T/day) with significant safety constraints. In contrast, the challenge related to solar energy is the intermittency of the heat source. Task 25 is examining HTP relative to materials stability and reduction of costs.



Tech Talk



François Le Naour, was born in 1956 in Orsay, France which is close to Paris. He grew up in the Paris area near the nuclear research center of Saclay, where his parents were working on nuclear

materials. That is surely the origin of his passion for materials research. At the university level he attended the Ecole Centrale de Lyon, one of the best-known French engineering schools outside Paris. There he received his engineering degree in 1980. He continued his formation by preparing a doctoral thesis at the French Institute for Nuclear Energy (CEA) in Grenoble. In 1984, Dr. Le Naour obtained his Ph.D. as a Materials Engineer graduate at the Electrochemical and Electrometallurgy Engineers School.

To launch his career as an engineer scientist, Dr. Le Naour returned to Saclay to join the team that his parents had left to enjoy a well deserved retirement. As a “second generation” member of this team, he first researched the effects of irradiation on cladding material for fast breeder nuclear reactors. He began his own family in 1986 when he married Veronique, whom he had met in Grenoble. They have two daughters, Audrey who was born in 1987 and Nathalie who was born in 1989. Apart from work and family, Dr. Le Naour is a dedicated gardener specializing in flowers. A man of varied skills, he is also an avid “do it yourself-er” (a real handyman or “bricoleur”!).

From 1989 to 1998, Dr. Le Naour managed the “material behavior research group.” As a French expert on material embrittlement analysis, he contributed his expertise to the international team that assessed the bottom of the vessel at the Three Mile Island reactor. He was also regularly called to French reactor incidents, where he was responsible for identifying the origin of the observed defects. For this work, he relied on a network of experts and laboratories specializing in the manufacture of materials, welding, mechanical and corrosion studies in order to analyze damage assumptions and

(Tech Talk continued)

experiments. He enjoyed this networking experience and subsequently joined the “Materials Business Group” in 1999 in order to coordinate projects of broader scope. There, he managed projects of increasing importance in the field of materials before ultimately taking the lead in the Materials & Processes Department. In this capacity he managed more than one hundred people, honing his leadership approach by emphasizing the importance of teamwork in pursuit of a common goal. This experience was highly enriching and rewarding, so much so that Dr. Le Naour hopes to return one day to this type of responsibility.

After his early university studies, Dr. Le Naour was taken with the energy field because it united the technical perspectives of science and engineering with the civic and social perspectives on the environment and public policy. The year 2004 was a turning point in his career since he left the field of materials to engage in the new CEA program on New Technologies for Energy. He joined Paul Luchese as part of the management team for this new program intended to facilitate the activities on the “Production of Hydrogen.” In this new role, he coordinated the European project INNOHYP CA from 2005 to 2007. This project established the state of the art on the international high-temperature processes for hydrogen production and proposed a roadmap for R & D on these processes to the European Commission. Concurrently, he also managed many industrial, national and European projects, mainly on High Temperature Steam Electrolysis. Since early 2010 he has been Deputy Head of Department “Biomass and hydrogen” in charge of strategy and programs.

Following development of the European project INNOHYP CA, Dr. Le Naour promoted the creation of an IEA HIA annex with the main experts involved in this European project. Unable to organize a national coordination on the hydrogen production theme given his other responsibilities, he delegated development of



Task 25 on high temperature hydrogen production processes to another expert from CEA, Gilles Rodriguez. Soon after successfully establishing this task, Mr. Rodriguez, originally an expert in the chemistry of

Significant Outcomes**The big picture:**

A first cycle of evaluation has closed on three (3) main processes (SI, HyS and HTSE), improving the knowledge base for strategic analysis from the standpoint of pure techno economic analysis.

The completion of the Multi Criteria Analysis and the results it produced validated use of this methodology in establishing a (criteria dependent) order of merit between the different processes (depending on the set of criteria). A separate, simplified visualization analysis appears to confirm these results.

And some specifics:**Subtask A - Scientific, Technological Review and Analysis of Temperature Processes and the State of the Art**

- Review of different processes utilizing INNOHYP projects complete. France and the U.S. advocate use of HTSE and have stopped research in the IS process. No decision has yet been made about HyS.
- Addition of important countries to the database
- International policy report underway to develop R,D&D strategy for supporting HTP deployment

Subtask B – Benchmarking of Calculation and Methodology


- In order to confirm the homogeneity of different methods, a benchmark calculation has been performed on cost investment for four simple scenarios
- An outranking method called Electre was adapted and validated as a common, global Multi-Criteria Analysis methodology for process investment. Eight criteria were applied to fourteen processes from which trends emerged relative to: 1) which process appears first; 2) which other processes appear next; and 3) which processes never appear. For innovative HTPs, the order of merit for our data relative to four (4) different scenarios (different sets of criteria) is:

Instant Profitability	Realistic Profitability	Safe & Competitive	Sustainable Competitiveness
HyS nuclear	HTSE nuclear HyS nuclear	CuCl solar HTSE solar HyS solar CdO solar	HTSE solar HyS solar CuCl solar CdO solar FeOx solar

ORDER OF MERIT FOR INNOVATIVE HTPS IN FOUR (4) SCENARIOS



New ranking w/o the energy resource availability



Same order between the criteria but stronger weights and wider gaps between the criteria

	Criteria	Rank	Weight (%)
Short term scenario	Economic competitiveness	1	50
	Maturity	2	37.5
	Toxicity	4	12.5
Long term scenario	Toxicity	1	41.5
	Economic competitiveness	1	41.5
	Maturity	2	17

	Criteria	Rank	Weight (%)
Short term scenario	Efficiency	1	33.5
	Complexity	2	26.5
	Maturity	3	20
	Toxicity	4	10
Long term scenario	Maximum process temperature	4	10
	Efficiency	1	33
	Toxicity	2	23.5
	Complexity	2	23.5
Maximum process temperature	Maximum process temperature	3	10
	Maturity	3	10
	Maturity	3	10

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(Tech Talk continued)

sodium, was recalled to the Generation IV program to work on CEA's behalf



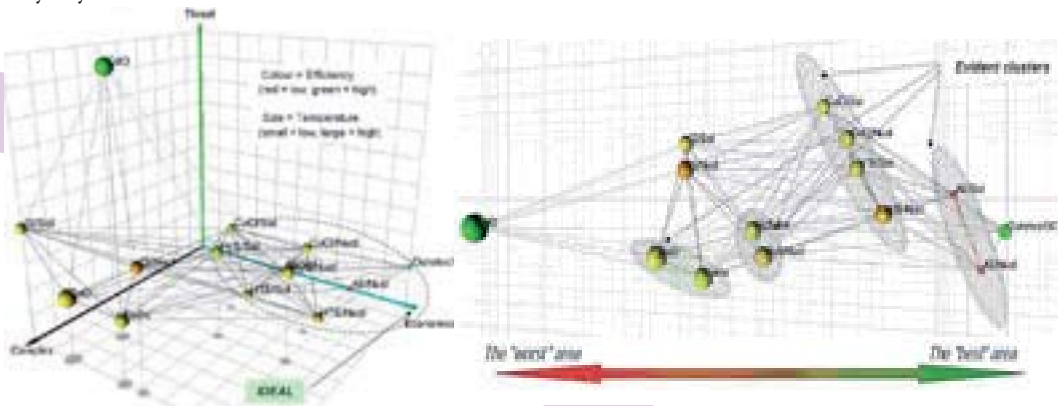
on recovery in the sodium fast breeder reactor. He was replaced by Sabine Poitou,

also of CEA Cadarache, who spent two productive years as Operating Agent of Task 25. During those two years, Dr. Le Naour participated in all meetings to provide the strategic vision of the CEA and France in the field. Thus, following a refocusing of hydrogen related activities in Grenoble, he was well-equipped to assume the role of Operating Agent when Ms. Poitou was called away to other duties.

As he reflects on the anticipated 2011 completion of Task 25 and prospects for future activities in this field of long-term research interest, Dr. Le Naour stresses the role of industry. The nuclear industry is already huge and the solar industry is growing. While industry involvement has already been vital to IEA HIA and other research efforts, there is a critical need to increase industry presence in this research field, including successor efforts at the IEA HIA.

Over the course of his career, the energy field has had enduring appeal for Dr. Le Naour. Looking to a clean energy future, his advice to young people is to refrain from rigid evaluation of energy technology on the basis of ideology, and to remain open to new possibilities for innovation and advancement in the energy domain.

Dr. Gasik of Finland has proposed a new, visualization approach to analysis of the same data and criteria. Application of this approach appears to confirm the results obtained via the Multi-Criteria Analysis. The main results with the same data provide the following rank order with no discernible difference between nuclear and solar: Alkaline electrolysis, HTSE, CuCl cycle and HyS cycle.



Subtask D – Communication Actions: Coordination and Links with Other International Organizations; Dissemination of Information

Twelve (12) process description and two general brochures are now available. *See the list on page 2.*

Spin-Off Benefits

- Growing industry cooperation with the public R&D sector
- Possible new task aimed at building and sharing new modeling tools on a sub-systems model database



TASK INK

Hydrogen Production

Closing Acts



IEA HIA Portfolio

PAST

Task 1 1977-1988

Thermochemical Production

Task 2 1977-1979

High Temperature Reactors

Task 3 1977-1980

Assessment of Potential Future Markets

Task 4 1979-1988

Electrolytic Production

Task 5 1979-1983

Solid Oxide Water Electrolysis

Task 6 1979-1988

Photocatalytic Water Electrolysis

Task 7 1983-1992

Storage, Conversion, and Safety

Task 21 – BioHydrogen

Operating Agent Dr. Jun Miyake

Dr. Jun Miyake made his final presentation at the 62nd ExCo in Essen, Germany where Chairman García-Conde commended him for the progress under his leadership over the past five years. This task has been extended under the same number but with new management. See the Task 21 discussion under Current Acts in hydrogen production.

Task 23 – Small Scale Reformers for On-Site Hydrogen Supply (SSR for H₂)

Operating Agent Dr. Ingrid Schjøberg

Task 23 will conclude in 2011. All three subtasks are engaged in preparation of their final reports for Industrial Harmonization, Sustainability and Renewable Sources, and Market Studies. On-site hydrogen production is an important stepping stone in early market development in both domestic and transport applications. Task 23 seeks a harmonized approach to reformer design that supports suppliers and end-users in future technology development. To this end it will produce a market guide to facilitate infrastructure development and generate a decision base for the end-user.

Task 24 – Wind Energy and Hydrogen Integration

Operating Agents Dr. Luis Correas and Dr. Ismael Aso

Task 24 will conclude in 2011. Subtask leaders are now preparing final reports for the four subtasks: Subtask A – State of the Art; Subtask B – Necessary Improvements and System Integration, Technology Development on Main Equipment and System Integration Concepts; Subtask C – Business Concept Development; Subtask D – Applications Emphasis on Wind Energy Management. The 2011 meetings are scheduled for France and Spain, to be hosted, respectively, by CEA and CENER.

The IOTHER (Infraestructura Tecnológico del Hidrógeno y Energías Renovables) Project, a project of IEA HIA Task 24, was awarded the IEA HIA Project Prize for Technology Demonstration at the May 2010 World Hydrogen Energy Conference (WHEC) in Essen, Germany.

Task 25 – High Temperature Production of Hydrogen

Operating Agent Dr. Francois Le Naour

Task 25 will conclude in 2011. It is featured in this issue's IEA HIA Technology Spotlight. Please see this article to learn about high temperature production of massive quantities of hydrogen from solar and nuclear sources. Tech Talk, the companion to Technology Spotlight, profiles Task 25 Operating Agent Dr. François Le Naour.

Task 27 – High Temperature Production of Hydrogen

Operating Agent Dr. Jan Erik Hanssen and Ms. Berrin Bay Engin

Task 27 is now preparing its final reports in anticipation of closing (this phase of work) in 2011.

Subtask A – Processes for Co-gasification findings include:

- H₂ can be usefully produced by co-gasification with coal at 20 –30 wt% biomass in conventional gasifiers
- The most promising technological option is to use entrained flow gasifiers able to produce H₂-rich syngas with a low tar content
- Milling biomass to 0.3 mm particle size can cost up to 1/10 of energy input
- Torrefaction of biomass reduces the power need for milling by about 80%

Subtask B – Biomass Tradable Intermediates findings on the use of biomass with fossil fuel include:

- BTG/BTL is constructing a 10 MWth plant at Hengelo in the eastern Netherlands
- Co-processing pyrolysis oil with natural gas will be integrated into Akzo chemical plant
- A potential breakthrough for industrial use of pyro liquids could open this market
- There are nine plants producing hydrogen with a total production capacity of 15.6 million Nm³ hydrogen per day

Subtask D – Roadmapping, will build on the findings of Subtasks A-C to develop a roadmap for use at industrial scale that creates and evaluates a reference plant as a hypothetical reference case.

Current Acts**Task 21 – BioHydrogen**

Operating Agent Dr. Michael Seibert

Task 21 was extended at the 62nd ExCo meeting held May 2010 in Essen, Germany. The new Operating Agent is Dr. Michael Seibert from the U.S. Department of Energy's National Renewable Energy Laboratory (NREL). Dr. Seibert established and continues to lead the NREL BioHydrogen program.

The extended task will have a three year term with a two year option renewal option and have five subtasks, listed below with their subtask leaders:

- Subtask A – Bio-inspired systems (Dr. Peter Lindblad);
- Subtask B – Dark BioHydrogen Fermentation Systems (Dr. Patrick Hallenback);
- Subtask C – Basic Studies for Light-Driven BioHydrogen Production (Dr. Marc Rousset);
- Subtask D – Biological Electrochemical Systems (Dr. Alan Guwy);
- Subtask E – Overall Analysis (Dr. Jun Miyake).

In addition, to ensure efficiency and effectiveness of the task and facilitate the work of the sub-task Leaders and Operating Agent, Regional Coordinators have been selected. Their role is to provide BioHydrogen intelligence and to foster increased cooperation on a geographic basis.

The first two formal meetings of the extended task were held in North Cyprus in September 2010 and in Singapore in March 2011.

Task 8 1986-1990**Technical and Economic Assessment of Hydrogen****Task 9 1988-1993****Hydrogen Production****Task 10 1995-1998****Photoproduction of Hydrogen****Task 11 1995-1998****Integrated Systems****Task 12 1995-2000****Metal Hydrides for Hydrogen Storage****Task 13 1999-2001****Design and Optimization****Task 14 1999-2004****Photoelectrolytic Production****Task 15 1999-2004****Photobiological Production****Task 16 2002-2005****Hydrogen from Carbon Containing Materials**

Task 17 2001-2006 **Solids and Liquid State Storage**

Task 18 2004-2009 **Integrated Systems Evaluation**

Task 19 2004-2010 **Hydrogen Safety**

Task 20 2004-2007 **Hydrogen from Waterphotolysis**

CURRENT

Task 21 2005-2010 **Biohydrogen**

Task 22 2007-2012 **Fundamental and Applied H₂ Storage Materials Development**

Task 23 2007-2011 **Small-Scale Reformers for On-site Hydrogen Supply (SSR for H₂)**

Task 24 2007-2010 **Wind Energy and Hydrogen Integration**

Task 26 – WaterPhotolysis

Operating Agent Dr. Eric L. Miller

Task 26 is also slated to close in 2011 but an extension of the current work is highly likely. Recent Task 26 progress includes:

- Significant advances in construction of the IEA-HIA SharePoint Site
- Launching of the DOE Solar Fuels Initiative Hub represents an important milestone in PEC research
- The most important recent for the past six months were the technical advances realized through implementation of the annex's R&D methodologies. Noteworthy results include:
 - Laboratory benchmark NREL High-performance GaInP/GaAs tandem PEC cell demonstrates technological feasibility of PEC H₂ production (recently improved from 12.4% to >18% STH)
 - Initiation of a Benchmark Validation Project
 - Demonstration of CGSe₂ Photostability and Nano-photocatalysts
 - New Benchmark in Iron Oxide from Europe; new advances in Bilayer Oxides in S. Korea
 - Demonstration of multijunction devices in Japan and Breakthroughs in WO₃ surface activation in Japan

Hydrogen Storage

Current Acts

Task 22 – Fundamental and Applied Hydrogen Storage Materials Development

Operating Agent Dr. Bjørn C. Hauback

Most recently, Task 22 met in Perth, Australia. In September the task will meet in Copenhagen, Denmark. With 17 participating countries, 47 projects and 50 experts, Task 22 addresses both fundamental and applied hydrogen storage development.

Task 22 Project H-25, Fundamental Safety Testing and Analysis of Hydrogen Storage Materials and Systems, was awarded the IEA HIA Project Prize for Fundamental Research at the May 2010 World Hydrogen Energy Conference (WHEC) in Essen, Germany. In an effort to better understand the safety of solid materials used for hydrogen storage, the winning project encompasses risk assessment, thermodynamics and chemical kinetics of materials, as well as risk mitigation and prototype systems.

Integrated Systems

Closing Acts

Task 23 – Small Scale Reformers for On-Site Hydrogen Supply (SSR for H₂)

Operating Agent Dr. Ingrid Schjøberg

Task 23 falls into several R,D&D portfolios. Please see this issue's Task 23 update under Production.

Opening Acts

Task 29 – Distributed and Community Hydrogen (DISCO H2)

Operating Agent Dr. Federico Villatico

Task 29 follows on Task 18 – Evaluation of Integrated Systems. Approved at the 63rd ExCo meeting at the Marmara Research Institute in Istanbul, Turkey, Task 29 held its kick-off meeting in early 2011 at the headquarters of the United Nations Industrial Development Organization International Centre for Hydrogen Energy Technologies (UNIDO ICHET), also located in Istanbul, Turkey. The task is focusing on hydrogen applications in energy communities and distributed systems involving stationary applications and also looking at potential benefits for transportation. The scope of distributed and community hydrogen encompasses:

- Island, rural and urban communities
- Off-grid or communities connected and interacting with smart grids
- Industrial distributed H₂ applications

Apart from management, Task 29 will have four subtasks: Analysis and Selection (to identify six projects for analysis); Model Concept Development; Concept Replicability; and Dissemination.

H2 Integration In Existing Infrastructure

Closing Acts

Task 23 – Small-Scale Reformers for On-Site Hydrogen Supply (SSR for H₂)

Operating Agent, Dr. Ingrid Schjøberg

Task 23 falls into several R,D&D portfolios. Please see this issue's Task 23 update under Production.

Current Acts

Task 28 – Large Scale Hydrogen Delivery Infrastructure

Operating Agent Dr. Marcel Weeda

Task 28 received final approval at the 62nd ExCo meeting in May 2010 in Essen, Germany. This is a modeling effort whose focus is on infrastructure for mass markets in Transport (Liquefaction, Storage, Trucks and Pipelines) and Delivery (Fueling stations and local grids). The work is structured in three subtasks: Roll-out Scenarios – definition of large-scale, views and orders of magnitude for Fuel Cell Electric Vehicle roll-out; Comparison of hydrogen refueling stations (central and on-site generation) given requirements for large-scale activity; and Analysis of hydrogen delivery routes.

Task 28 meetings in 2011 are scheduled for Vancouver, Canada and Berlin, Germany.

CURRENT - Continued

Task 25 2007-2011

High Temperature Production of Hydrogen

Task 26 2008-2011

WaterPhotolysis

Task 27 2008-2011

Near-Term Market Routes to Hydrogen by Co-Utilization of Biomass as a Renewable Energy Source with Fossil Fuels

Task 28 2010-2013

Large Scale Hydrogen Delivery Infrastructure

Task 29 2010-20

Distributed and Community Hydrogen

Task 30 2010-20

Global Hydrogen Systems Analysis

Task 31 2010-2013

Hydrogen Safety

THEME:
ANALYSIS THAT
POSITIONS
HYDROGEN

Analyses That Position Hydrogen

Opening Acts

Task 30 - Global Hydrogen Systems Analysis

Operating Agent Mr. Jochen Linssen and Dr. Susan Schoenung

One of the key themes of the IEA HIA 2009-2015 Strategic Plan is the “Analytic Imperative.” Approved at the 62nd ExCo meeting in Essen, the new analysis task evolved from the IEA HIA Analysis Committee and Task 18 – Evaluation of Integrated Systems as well as this overarching imperative. The task goal is to perform comprehensive analysis to enable informed decisions that lead to sustainable clean energy systems including hydrogen. The specific objectives are:

- To build systems analysis expertise within the IEA HIA
- To prepare detailed analytical studies that answer questions with respect to supply, demand, emissions and costs
- To collaborate with IEA headquarters analysis efforts toward mutual goals
- Task 30 has three subtasks:
 - Subtask A: Detailed analyses of global hydrogen resources. (Dr. Susan Schoenung of Longitude 122, sponsored by US DOE)
 - Subtask B: Updating and Harmonizing the database of hydrogen technologies. (Mr. Jochen Linssen of Forschungszentrum Julich, Germany)
 - Subtask C: Collaboration with IEA analytics (Paris). (Ms. Kari Espegren of Institute for Energy Technology, Norway)

THEME:
H₂ AWARENESS,
UNDERSTANDING
& ACCEPTANCE

H₂ Awareness, Understanding And Acceptance

Closing Acts

Task 19 - Safety

Operating Agent William Hoagland

Phase 2 of Task 19 closed in 2010. The closure process was somewhat delayed due to cancellation of the April 2010 experts meeting as a result of the spectacular Icelandic volcanic eruption. All planned task products for the first phase of the collaboration have been completed. They are listed below and can be found at <http://ieahia.org/page.php?s=d&p=documents&t=task&id=19>:

- Risk Assessment Methodologies Survey
- Review and Analysis of Risk Assessment Studies
- Knowledge Gaps White Paper

The Executive Committee endorsed the concept of two End of Term Workshops for Task 19, one to be held in Paris and the other in North America.

Opening Acts

Task 31 – Hydrogen Safety

Operating Agent William Hoagland

The ExCo approved Task 31, the new safety task, at the 63rd meeting in Istanbul, Turkey for the period November 2010 through October 2013. Task 31 will continue the work undertaken in Task 19 over a six years period. Task 31 objectives are:

- To develop testing methodologies around which collaborative testing programs can be conducted
- To collect information on the effects of component or system failures of hydrogen systems
- To use the results obtained to develop targeted information packages for selected hydrogen energy stakeholder groups

The four Task 31 subtasks are listed below with their subtask leaders:

- Subtask A – Physical Effects Knowledge Gaps (Pierre Bénard, UQTR)
- Subtask B – Hydrogen Storage Systems and Materials Compatibility (John Khalil, UTRC)
- Subtask C – Early markets: risk identification and hazard analysis (Andrei Tchouvelev, AVT)
- Subtask D – Knowledge analysis, dissemination and use (Steven Weiner, PNNL)



DIPLOTECH

The minority Australian Government elected 21 August 2010, recognizes that reducing GHG emissions by 2020 will require a price on carbon. The Government remains committed to a 5-25% reduction in emissions by 2020 and has established a multi-party parliamentary Climate Change Committee. CSIRO commissioned a study “A Technology Roadmap for **Australia’s** Hydrogen Delivery Infrastructure,” completed in 2010. The newly-formed Australian Association for Hydrogen Energy was officially launched in Sydney on 3 September and will be holding its first Annual General Meeting and annual AAHE Hydrogen Workshop on 11 November.

The fuel cell buses used in Vancouver, **Canada**, remain in service. Another fueling station has been opened in Saskatoon, Saskatchewan. The station uses byproduct hydrogen from ERCO Worldwide’s Saskatoon chemical production plant, an industrial chlor alkali plant. The station will fuel a fleet of seven hydrogen trucks.

The first roadmap on the hydrogen economy and infrastructure in **Finland** has been drafted. There are plans to build hydrogen refueling infrastructure in several locations. The family owned Woikoski company (<http://www.woikoski.fi/default.asp?viewID=3069>) has taken a lead in this activity. Tekes Fuel Cell Programme launched a major demonstration project -- Demo 2013 -- to demonstrate the results of the FC Programme in the Port of Helsinki in 2013. The target is to show all kinds of applications in action in the harbor area including: a power plant, back-up power, material handling equipment such as forklifts and straddle carrier, and a hydrogen fueling station.



In **Germany** the new hydrogen station in Hurth provides the final link in a 600 mile highway from Munich to Amsterdam. Germany's NOW GmbH (National Organization of H₂ and Fuel Cells) has created H2 Mobility – an industrial alliance of several auto manufacturers and energy industry partners that aims for roll out with serial production starting in 2015. There were 1900 participants at the World Hydrogen Energy Conference (WHEC), a successful conference that afforded a major role for the IEA HIA.

In **Greece**, interest in renewable energy is expected to be translated into wind parks. The budget for hydrogen and fuel cells is on the order of 3 million €/year.

Last June, the National Action Plan for renewable energies in **Italy** was released. It calls for a 20% reduction in use of fossil fuels by 2020. An agreement has been reached with the Economic Development Ministry to provide 25 M € for research activities devoted to the national electric system. Relative to hydrogen and fuel cells, an effort is underway to stimulate implementation activities at two levels: the first, top-down from the ministerial level, and the second, bottom-up from the Italian H₂ Association, universities and research organizations. Meanwhile, meaningful initiatives and projects are underway, including an industrial innovation project for sustainable mobility.

Japan plans for commercialization of Hydrogen Powered Fuel Cell Electric Vehicles (FCEV) beginning in 2015. In a recent demonstration drive, three Toyota Highlanders (a Sports Utility Vehicle) completed a long-distance (1,100 km or 637 mile) drive with two refuelings, a total consumption of 28 kg of hydrogen and average fuel efficiency of 118.4km/kg.

As of August 2010 Seoul can claim a second hydrogen station. This one is located in the heart of Korea's capital city. This is the 10th hydrogen station in **Korea**. The number of fuel cell power plants is increasing as well. Nineteen (19) fuel cell plants produce 32MW of electricity at 14 different locations.

Lithuania is outfitting its Hydrogen Energy Technologies Centre with state-of-the-art equipment. The Research Council of Lithuania expects to finance a hydrogen storage project, one of the 50 research projects funded in a tough round of competition involving many fields. The Lithuanian national science program is funding "Future Energy" as well as a hydrogen storage project.

New Zealand will value carbon at 12.50/ton NZD of CO₂ equivalent. The four government planning priorities are: developed resources; security and affordable energy; efficient energy; and environmental responsibility.

In **Norway**, Hynor had a call for tender this year for supplying the buses and the refilling station to the bus project in Oslo. The buses will be delivered by Van Hool and will be equipped with Siemens electric motors and fuel cells from Ballard. Air Liquide Norway AS has been chosen to deliver the filling station to the HyNor Oslo Bus project. The H₂ production will occur at the station via two electrolyzers from Hydrogenics; the station will have a production capacity of 250 kg H₂/day (350 bar). The H₂ Moves Scandinavia project will also build a filling station in Oslo in 2011 where 17 cars will be demonstrated.

In **Spain**, a new hydrogen fueling station has opened in the Walqa Technological Park inside the Foundation for Development of New Hydrogen Technologies in Aragón. In October 2010 the first ton of CO₂ was captured at the new pilot CO₂ capture and hydrogen production plant Puertollano. The Spanish EMUASA (Aguas de Murcia) is participating in a BIOCELL project to demonstrate the techno-economic feasibility of energy production from biogas via PEMFC and SOFC fuel cells adapted to wastewater treatment plants.

Switzerland reports that it has a new Master Plan for Innovation (<http://www.cleantech.admin.ch/cleantech/index.html?lang=en>). A new hydrogen project with potential for industrial applications is exploring hydrogen storage with formic acid. Photoelectrochemical (PEC) activities at the Ecole Polytechnique de Lausanne (Grätzel Group) were highlighted in June 2010 Nature: "Significant improvements could be achieved in the nanostructuring of hematite photoanodes for photoelectrochemical (PEC) water splitting, which resulted in the highest water splitting photocurrents for oxide-based photonanodes reached so far."

Maria van der Hoeven from **The Netherlands**, a former Dutch Minister and Member of Parliament, has been selected as the next IEA Executive Director effective September 2011.



**MR. ENVER KHAN &
MS. MARY ROSE
DE VALLADARES**

The TUBITAK Marmara Research Center graciously hosted the 63rd ExCo meeting. Besides renewable energy, coal and biomass are Turkey's most widespread indigenous energy sources. Therefore, development of know-how on clean utilization of coal and biomass is of great importance. Since 72% of the world's proven gas reserves are located in the regions surrounding **Turkey**, Turkey is nowadays widely called 'The Energy Bridge between the East and the West'. Hydrogen is an important alternative fuel for Turkey whether it comes from renewable sources such as solar or wind power or is produced in a clean way via coal/biomass gasification or natural gas reforming

UNIDO ICHET was also a host of the 63rd ExCo meeting. After the ExCo meeting, Secretariat Manager Mary-Rose de Valladares visited Mr. Enver Khan at **UNIDO** headquarters in Vienna. There she had the opportunity to thank Mr. Khan for his proactive participation in the IEA HIA. The UNIDO/IEA HIA cooperation is off to a great start, in large part to his efforts. She also met with key members of the UNIDO team who shared their perspective on energy and industrial development among their members and stakeholders. **UNIDO ICHET**, UNIDO's representative to the IEA HIA, is sponsoring the Operating Agent for Task 29 – Community and Distributed Hydrogen (DISCO H₂).

Dr. Carole Read reported that the **U.S.** is now investigating hydrogen sorbents that operate at ambient temperature and moderate pressure as they addresses a critical research need for multiple applications. The U.S. has invested significant resources in training middle and high school teachers, sponsoring student competitions and events, and fostering university projects. Recognizing the urgent need for analysis, the U.S. is sponsoring a Co-Operating Agent for Task 30 Global Hydrogen Systems Analysis. A new "Green Community" initiative is also underway to promote the goals of energy efficiency and renewable energy, as well as green building design, "smart growth" mixed use development, and alternative and/or energy efficient transportation. The \$137 million hydrogen and fuel cell budget request for 2011 is still pending final Congressional action. The next DOE Annual Review took place 9-13 May 2011.



DR. ANDREJ ZEMAN

In Vienna, Ms. de Valladares also met with Dr. Andrej Zeman of the International Atomic Energy Agency (**IAEA**) and several of his colleagues about fostering formal cooperation around our mutual interests in hydrogen R,D&D. Dr. Zeman and the IEA HIA – here we must thank Task 22 Operating Agent Bjorn Hauback -- have already cooperated on technical meetings related to Application of Nuclear Methods to Material Studies for Fuel Cell and Hydrogen Cycle Technologies.



MESSAGE FROM THE CHAIR

Dr. Peter H. Cunz, Chairman of the IEA Committee on Energy Research and Technology (CERT), attended the 63rd meeting of the IEA HIA Executive Committee (ExCo) 10-12 November in Istanbul, Turkey. Dr. Cunz's attendance was a real milestone for the Agreement and the ExCo was very pleased to have the opportunity to host the CERT Chair. His participation afforded a "teachable moment" that allowed the IEA HIA ExCo and the CERT Chair to exchange views on matters of importance.

I would like to say a few words about the CERT for those who may not fully understand its role. Established in 1975, the CERT is the highest non-ministerial body at the IEA, positioned just below the Governing Board. The CERT is charged with "optimizing international collaborative RD&D and deployment." Its vision affirms that "technology will have a decisive impact" on future energy systems. Keenly aware that global conditions have changed profoundly in the recent past, the CERT directs its contributions in science and technology to mitigation of global energy related CO₂ emissions through advanced technology.

IEAHIA NEWS



The IEA HIA News is published twice a year by the International Energy Agency Hydrogen Implementing Agreement (IEA HIA), whose vision for a hydrogen future is based on a clean, sustainable energy supply that plays a key role in all sectors of the economy.

Chairman

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Dr. Cunz articulated the CERT's role in fostering a sense of solidarity among scientists and engineers. He affirmed the need to strengthen the scientific community by promoting RD&D collaboration; increasing visibility and outreach; and enhancing funding for demonstration and pilot plants. He underscored the CERT message about the value of science, saying that "...knowledge increases the more you make use of it." The IEA HIA looks forward to future cooperation with CERT on the increase and dissemination of scientific knowledge in pursuit of our goals. Dr. Cunz is surely welcome at future meetings!

Speaking of increasing knowledge through continued use, I am happy to report some good news on prospects for hydrogen and fuel cell technology. This good news comes from *A portfolio of power-trains for Europe: a fact-based analysis – The role of Battery Electric Vehicles, Plug-In Hybrids and Fuel Cell Electric Vehicles*, the report prepared by McKinsey and Company for an industry consortium under the auspices of the European Fuel Cells and Hydrogen Joint Undertaking and NOW GmbH (http://www.now-gmbh.de/uploads/media/Power_trains_for_Europe.pdf.)

The conclusions and recommendations of this timely report, which are based on industry data, reflect the collective view of the consortium. The report concludes that the fuel cell electric vehicle (FCEV) is technologically ready for commercial scale-up and essential to development of a sustainable transport system by 2050. Moreover, in a CO₂ constrained world, FCEVs have clear benefits for the 50% of consumers in all market segments who prefer larger cars and drive longer distances. Large cars are in fact responsible for 70% of CO₂ emission. Furthermore, over the coming decades, costs for a hydrogen distribution and retail infrastructure comprise 5% of the overall cost of FCEVS (€1,000-2,000). This 5% cost for developing the hydrogen infrastructure is comparable to costs for rolling out a charging infrastructure for Battery Electric Vehicles (BEV) and Plug-in Hybrid Vehicles (PHEV) (before addition of the significant costs for upgrades in power distribution networks!) The study demonstrates that FCEVs make commercial sense, justifying development of a dedicated hydrogen infrastructure for the mass FCEV markets.

And more on mass markets – Dr. Federico Villatico, Operating Agent for the newly approved Task 29 - Distributed and Community Hydrogen (DISCO H₂) is supported by the United Nations Industrial Development Organization (UNIDO) through its IEA HIA ExCo representative, UNIDO ICHET (International Centre for Hydrogen Energy Technologies). Energy and environment are one of UNIDO's three thematic priorities. With 173 member states, UNIDO plays a specialized role in promoting sustainable and inclusive industrial development for a huge segment of the global population/marketplace. The IEA HIA appreciates UNIDO's support in launching the new task. In particular, we would like to acknowledge Mr. Enver Khan, whose vision and enthusiasm enabled UNIDO's active participation in the Agreement. We anticipate that Task 29 will develop replicable models for distributed and community hydrogen in stationary, transportation and industrial sectors that can be effectively disseminated and widely utilized in UNIDO member states in the near future. Onward to these and other very real markets for hydrogen technologies!



MR. ENVER KHAN

Sincerely,

Antonio G. García-Conde

Antonio G. García-Conde