IEA Hydrogen Annex XVIII
Task 18 - Integrated Systems Evaluation

Executive Committee Meeting

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Longitude 122 West, Inc.
Menlo Park, CA 94025 USA

Sponsored by U.S. Department of Energy
Task 18 Presentation Outline

• Review of Objectives and Structure
• Membership in Task 18
• Activities and Accomplishments
• Subtask A, information bases
• Subtask B, modeling and evaluations
• Milestones
• Phase 2 Description and Plans
• Matters Requiring Executive Committee Attention
Review of Task 18


• Annex 18 has two subtasks
  - Subtask A: Information / Database Development
  - Subtask B: Demonstration Project Evaluation

• Subtask Leaders
  - Subtask A: Jean Dubé, Services Mij, Inc., CANADA
  - Subtask B: Øystein Ulleberg, IFE, Norway

• Annex Schedule
  - Began 1 January, 2004; Phase 1 concludes 31 December, 2006
  - Phase 2 scheduled for 1 January, 2007 through 31 December, 2009
  - Experts meet two times per year, spring and fall, at demo sites

• Public website: www.port-h2.com/IEA-Annex-18/
Objectives of Task 18

• Objective 1) To develop information datasets and compiled summaries of integrated hydrogen system demonstrations and development plans. Focus is on determining patterns and the evolution of trends from lessons learned.

• Objective 2) To use modeling and analysis tools to evaluate hydrogen demonstration projects. Focus is also on lessons learned and providing design guidance for future projects.

• [Objective 3) To participate in Hydrogen Resources Study: “Where will the hydrogen come from?”]
### Current participants of Hydrogen Annex 18

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Natural Resources Canada</td>
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<tr>
<td>Japan</td>
<td>AIST Laboratory</td>
</tr>
<tr>
<td>Italy</td>
<td>ENEA</td>
</tr>
<tr>
<td>Iceland</td>
<td>Icelandic New Energy</td>
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<tr>
<td>France</td>
<td>CEA</td>
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<td>Joint Research Center</td>
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<tr>
<td>The Netherlands</td>
<td>ECN</td>
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<td>Norway</td>
<td>IFE</td>
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<td>Sweden</td>
<td>CarlBro</td>
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<td>United Kingdom</td>
<td>UK Consortium</td>
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<td>United States</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>Denmark</td>
<td>Gas Technology Center</td>
</tr>
</tbody>
</table>

Potential new members: Australia, Korea, New Zealand, Germany, Taiwan
Task 18 Activities during last 6 months

- The sixth Experts meeting was held in Glasgow, UK on 12-14 September. The meeting included a visit to the Hydrogen and Renewables Integration (HARI) project at the Beacon Farm in Loughborough, UK.
- Some experts also participated in a meeting of the Scottish Hydrogen Research Network at the University of Strathclyde.
- Some experts also visited the PURE project on the island of UNST.
- A presentation on Task 18 was made at a recent meeting of Task 19 (Safety) in Vancouver.
## Task 18 Expert Meetings

<table>
<thead>
<tr>
<th>Meeting Location</th>
<th>Meeting Dates</th>
<th>Meeting Host</th>
<th>Demonstration Site Visited</th>
<th>Demonstration System Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Las Vegas, Nevada, USA</td>
<td>March 2004</td>
<td>US Department of Energy</td>
<td>Las Vegas Energy Station</td>
<td>Natural gas reformer, stationary fuel cell, hydrogen refueling station, hydrogen vehicles</td>
</tr>
<tr>
<td>Madrid, Spain</td>
<td>September 2004</td>
<td>INTA</td>
<td>FIRST</td>
<td>Fuel cell innovative research system for telecommunication</td>
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<tr>
<td>Tokyo, Japan</td>
<td>March 2005</td>
<td>AIST and EAA</td>
<td>Takasago Thermal Engineering Co.</td>
<td>Integrated hydrogen load leveling system for buildings; regenerative fuel cell</td>
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<tr>
<td>Reykjavik, Iceland</td>
<td>September 2005</td>
<td>Icelandic New Energy</td>
<td>ECTOS refueling station and bus maintenance facility</td>
<td>Electrolyzer, compressor, storage, dispenser, fuel cell bus</td>
</tr>
<tr>
<td>Vancouver, Canada</td>
<td>March 2006</td>
<td>Natural Resources Canada</td>
<td>Pacific Spirit Station</td>
<td>Electrolyzer, high pressure compressor, storage, fuel cell cars</td>
</tr>
<tr>
<td>Glasgow, UK</td>
<td>September 2006</td>
<td>UK Consortium</td>
<td>HARI, PURE</td>
<td>Renewable electrolysis, storage, stationary and vehicle fuel cells</td>
</tr>
</tbody>
</table>
Experts Meeting in the UK

- 21 people attended, 16 countries
- Observer: Taiwan
- Guests from Australia and Algeria
- Attendees from Sgurr Energy and University of Strathclyde

Highlights
- Visit to HARI Project at Beacon Farm
- Guest lecture:
  - Dr. Dale Cruden, Scottish Hydrogen and Fuel Cell Alliance
- Subtask B working meeting
- Subtask A working meeting
- Visit to Unst
- Workshop: “The Hydrogen Highway? Getting from research and demonstration to growth industry.”
Major Accomplishments

- Task members are working very well as a team.
- Subtask A information base: new sections are being populated; dissemination plan completed; phase 1 final report drafted.
- Subtask B work plan: 5 demo project analyses completed; phase 1 final report in preparation.
- Annex 18 Phase 2 framework submitted to Executive Committee.
- Case studies: 1 completed, 1 new in progress.
- 2 abstracts submitted for NHA 2007, 1 for Canadian Hydrogen and Fuel Cell conference, 1 for EHEC:
  - "Analysis of the Italian Hydrogen House," by Stewart, Lutz and Chiesa
- Confirmed 2007 Spring meeting: Brunate, Italy.
Subtask A: Information Base Development

- National documents
- Demonstration progress
- Hydrogen resources
- Vendors / capabilities
- Infrastructure studies
- Codes and Standards
- Economic analysis
- HySociety database
- Links to others

Annex 18 website: Searchable portal
Subtask A: Information Base Development

- Task 18 (Private)
  - Public Site
  - Subtask B (Private)
  - Subtask A (Private)
    - Case Studies
    - External Links
    - National Documents (going public)
    - National Projects
    - National Organizations
    - HySociety Technology Database
    - Hydrogen Production (Resource Study)
**Subtask A – Information base development**

<table>
<thead>
<tr>
<th>Current Postings in Subtask A Information Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 postings on National Documents sub website:</td>
</tr>
<tr>
<td>- 118 Searchable summaries</td>
</tr>
<tr>
<td>- 24 IEA Case Studies in Word format</td>
</tr>
<tr>
<td>105 National Organizations</td>
</tr>
<tr>
<td>25 National Projects</td>
</tr>
<tr>
<td>Links to external databases and websites</td>
</tr>
</tbody>
</table>

This password accessible website contains 426 Megs of information, has received 3443 visits and 10,495 pages have been examined.

National Documents Sub-Website to go public December 31, 2006, through link on public website.
Subtask A – Information base development
Ongoing

- National documents:
  - Searchable summaries on public website
  - Data base to go public at the end of 2006

- Vendors / national capabilities data base

- Demonstration projects

- Links

- Future:
  - Model descriptions
  - Lessons from Subtasks
  - New Case Studies developed internally
Hydrogen Resource Study: Where will the hydrogen come from?

- Experts assisted in the preparation of a table that summarized process information for hydrogen production technologies
  - Ranges of values
  - Projections of future technologies
  - Database could be made available to HIA via Annex 18 website

- Status: Study not completed; Task 18 choosing not to continue
  - Similar to HyWays analysis
  - Significant work involved
  - Emphasis in Task 18 on other things
Subtask A – Work Plan

1. Final Draft and Final Internal Subtask A (Task 18) Report:
   1. Participants will provide comments to Draft before October 13, 2006.
   2. Final Subtask A Internal Report will be completed no later than November 17, 2006 and sent to the Operating Agent.

2. List of National Documents:
   3. Additional searchable summaries/documents will be posted on Website by Participants as discussed at Glasgow meeting to reach 100% of known documents.
   4. Participants will validate current information on the Document Website Country Library before Mid-November.
   5. Subtask A Coordinator will render Document Website publicly available on December 31, 2006.

3. List of National Organizations
   7. National Organizations Website will only be made public during the next Phase of Annex 18.

4. List of National Projects
   8. Subtask A Participants will populate website with List of National Projects using approved Format by Mid-November 2006.
   9. National Projects Website will only be made public during the next Phase of Annex 18.

5. Dissemination of Information
   10. Subtask A Coordinator will draft Public Final Subtask A Report and send it to Operating Agent by Mid-November 2006.
   11. Operating Agent will upload on Task 18 public website “Public Final Subtask A Report” when ready.
   12. Post on Task 18 Public website all public presentations made at WHEC Conference in Lyon.
Subtask B - Demonstration Project Evaluation

- Objective:
  - “…to gather data on hydrogen projects and exercise modeling and analysis capabilities to evaluate demonstration projects, or guide the design of them.”

- Member’s Responsibilities:
  - Work as a group to establish a list of desired data for each project
  - Bring to the group data from that country's project
  - Clarify with the data provider any limitations on data release or use
  - Make use of appropriate modeling & analysis tool for selected projects
  - Provide assessments & evaluations of the project based on the analysis results

- Expected Input from Members:
  - Project data
  - OR Analytical tools and/or expertise
  - OR both.

Goal:
Evaluate a minimum of three projects at a detailed level, plus others at a more general level. (6 projects selected, plus 5 Case Studies)
## Task 18 Project Portfolio - Phase 1

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

- RE/H₂ System Simulation Model Library

![Diagram of HYDROGEMS system with components such as electrolyzer, fuel cell, battery, diesel engine, photovoltaics, wind turbines, water electrolysis, fuel cells, H₂ gas storage, metal hydrides, batteries, compressors, and power conditioning.](www.hydrogems.no)
H₂ Fueling Station, Reykjavik

Objective: Test Fuel cell bus and operate prototype infrastructure and maintenance bay
Evaluation status: Data collection and analysis complete, emphasis on electrolyzer performance, optimization for future operation in progress

Alkaline electrolyzer (Norsk Hydro)  Citaro bus with Ballard fuel cell (3 Buses total)
Evaluation status: Data analysis complete, analysis for expanded operations in progress; emissions reductions verified
Pacific Spirit Station

- Located at the National Research Council’s Institute for Fuel Cell Innovation on the campus of the University of British Columbia
- Integral part of Canadian Hydrogen Highway
- Participants include:
  - General Hydrogen (storage and dispenser)
  - BOC (integrator and compressor)
  - Fuel Cells Canada
  - Natural Resources Canada
  - National Research Council
- Operational since Spring 2005
- Five Ford Focus fuel cell cars

Objective: To serve fuel cell vehicles and to increase awareness with public and investors
Evaluation status: Data gathering and evaluation in progress; modeling focused on compressor performance
Hydrogen and Renewables Integration (HARI) Project - UK

Evaluation status: Data analysis in progress, modeling tools implemented
Integrated $\text{H}_2$ System, Takasago, Japan

Evaluation status: Thermal design analysis complete; emphasis on metal hydride storage
“Hydrogen from the Sun”
House system in Brescia, Italy

Evaluation status: System in assembly; modeling will be done in Phase 2 by Experts at Sandia National Laboratories
Case Studies

- Case Studies of Integrated Hydrogen Systems were begun under Task 11, continued in parallel with Task 13, and have been sponsored directly by the HIA ExCo.
- Case Study work is now integrated into Task 18. Thomas Schucan is working directly with Subtask B members.
- Case Studies are posted on the IEA-HIA website, and the Task 18 website. Searchable summaries posted on the public website.
- Phase 1 completed case studies
  - California Fuel Cell Partnership (California)
  - Compressed hydrogen project (BC, Canada)
  - FIRST project (Madrid, Spain)
  - ECTOS (Reykjavik, Iceland)
  - HARI (Loughborough, UK)
- In progress:
  - French EPACOP fuel cell experiment
  - Denmark: H2 Logic - small truck
- Phase 2 will include new Case Studies developed internally by members
Task 18 Public Information Plan

• Final report and executive summary
• Annex 18 public website: white paper & links
  (This public website has received 425 visitors since its launch. 1297 pages had been accessed and 197 megabytes had been offloaded from the website.)
• Case studies and summaries
• Output from Subtask A activities: National Documents information base sub-website
• Output from Subtask B activities
  - Comparison of experience with refueling stations
  - Hydrogen modeling analysis
• Presentations and Publications
  - WHEC 2006
  - NHA, HFC, EHEC 2007
Effectiveness of Task Participation

- Expert team working well together. Subtask leaders are very effective.
- Input needed from all members for Phase 1 final reporting. Some more active than others.
- U.S. financial support for Operating Agent is critical.
Spin-off Benefits of Task 18 = Success

1. Optimization of hydrogen systems for the future.
2. Bilateral agreement / project between Norway and Japan on metal hydride storage and thermal control. “Wouldn’t have happened if we hadn’t held a meeting in Tokyo.”
3. Joint project on hydrogen powered ship demonstration is being developed between Iceland and Scotland. A direct result of our meeting in Glasgow.
4. Compressor modeling capability improved by IFE working together with Sandia personnel.
5. Spain: “Thanks to Spanish participation in Annex 18 of Hydrogen Implementing Agreement of IEA we have known other countries activities and initiatives in $\text{H}_2$ and FC and we have had access to technological and logistics problems happened in other countries facilities. Subtask B offers us an extraordinary opportunity to simulate one of our installations and learn about it.”
6. Hydrogems© and other modeling tools are becoming wide-spread among the groups.
7. Due to the success of Task 18, more countries are seeking to join the Task in Phase 2. We welcome them.
Milestones for Next 6 Months

- Complete project modeling documentation
- Complete input to databases and make public link to National Documents database
- Complete EPACOP and H2 Truck Case Studies
- Complete final internal reports
- Complete Phase 1 final management report
- Complete Phase 1 final external report
- Complete 2006 annual report
- Collect National Participation Commitment letters for Phase 2
- Prepare papers for 2007 conferences
- Make arrangements for Phase 2 kick-off meeting in Italy in March/April
### Task 18 Milestone Schedule

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<th>2004</th>
<th>2005</th>
<th>2006</th>
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<td><strong>Expert Meetings</strong></td>
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<td>Third demo evaluation</td>
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<td>Final summary report</td>
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</table>

Extend through 2009
Task 18 Phase 2 Structure

- Subtasks A and B continue
  - More analysis capability in Phase 2
- New Subtask C bridges existing elements
  - Lessons learned (case studies and demos)
  - Benchmark assessments
  - Trend analysis (database mining)
Task 18 Phase 2 Plans

Structure:

• 3-year extension: January 2007-December 2009
• Follow previous format of 2 expert meetings per year, meeting at demo sites
• Commitment required to Subtask A, information base development
• Continue information protection as in Phase 1

Commitment:

• National participation letters required before spring meeting, 2007
• Experts committed to 0.5 person-year/year plus travel to all meetings

Leadership:

• Operating Agent: Susan Schoenung, USA; confirmed
• Subtask A: Jean Dubé, Canada; request to continue
• Subtask B: Øystein Ulleberg, Norway; request to continue
• Subtask C: Shannon Miles, Canada; confirmed; co-lead Marcel Weeda, Netherlands, requested
## Task 18 Phase 2 Members

<table>
<thead>
<tr>
<th>Country</th>
<th>Current Members</th>
<th>Status</th>
</tr>
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<tbody>
<tr>
<td>Canada</td>
<td>Natural Resources Canada</td>
<td>Subtask C co-lead</td>
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<tr>
<td>Canada</td>
<td>Services Mij, Inc</td>
<td>Subtask A leader</td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Gas Technology Center</td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>Joint Research Center, Petten</td>
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</tr>
<tr>
<td>Commission</td>
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<tr>
<td>France</td>
<td>CEA, IFP, ADEME, ALPHEA</td>
<td></td>
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<tr>
<td>Iceland</td>
<td>Icelandic New Energy</td>
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<tr>
<td>Italy</td>
<td>ENEA, Catholic University</td>
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<tr>
<td>Japan</td>
<td>AIST, EENA</td>
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<td>Netherlands</td>
<td>ECN</td>
<td>Subtask C co-lead</td>
</tr>
<tr>
<td>Norway</td>
<td>IFE</td>
<td>Subtask B leader</td>
</tr>
<tr>
<td>Spain</td>
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<tr>
<td>Sweden</td>
<td>E.ON</td>
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<td>United Kingdom</td>
<td>Sgurr Energy / University of Strathclyde, UK Consortium</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>DOE</td>
<td>Operating Agent</td>
</tr>
<tr>
<td>United States</td>
<td>Sandia National Laboratories</td>
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</table>

### New Members

<table>
<thead>
<tr>
<th>Country</th>
<th>New Members</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>HART</td>
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</tr>
<tr>
<td>Belgium</td>
<td>MINECO</td>
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<tr>
<td>Germany</td>
<td>Linde</td>
<td>Pending HIA membership</td>
</tr>
<tr>
<td>Korea</td>
<td>KIER</td>
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<tr>
<td>New Zealand</td>
<td>Solid Energy</td>
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<tr>
<td>Singapore</td>
<td>TBD</td>
<td>invited</td>
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<tr>
<td>Switzerland</td>
<td>Swiss Federal Energy Agency</td>
<td>invited</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Institute of Nuclear Energy</td>
<td>Pending HIA membership</td>
</tr>
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</table>
Task 18 Phase 2 - Subtask A: Information Bases

Subtask A (Private)
- National Organizations
- National Documents (going public)
- National Projects
- National Organizations
- HySociety Technology Database
- Hydrogen Production (Resource Study)
- New information bases proposed

Subtask B (Private)

Subtask C (initially private)

Case Studies
External Links
Public Site

Task 18 (Private)

New information bases proposed
# Task 18 Phase 2 Subtask B
Project Portfolio - Preliminary

<table>
<thead>
<tr>
<th>Country</th>
<th>Projects</th>
<th>Location</th>
<th>Modeling focus</th>
<th>Evaluation status</th>
</tr>
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<tbody>
<tr>
<td><strong>Refueling Stations</strong></td>
<td></td>
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<tr>
<td>Germany</td>
<td>Refueling station</td>
<td>Munich or Berlin</td>
<td>Station sizing and economics</td>
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<td><strong>Grid-connected or stand-alone power systems</strong></td>
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<td>Italy</td>
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<td>Brescia</td>
<td>System efficiency</td>
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<td>Spain</td>
<td>RES2H2 (Desalination plant with renewable power and electrolyzer)</td>
<td>Canary Islands</td>
<td>Performance analysis</td>
<td>Phase 2</td>
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<td>New Zealand</td>
<td>Renewable hydrogen at remote site with pipeline</td>
<td>Totara Valley</td>
<td>Renewables integration, infrastructure</td>
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<td>Australia</td>
<td>HART SAPS project</td>
<td>Cape Barren Is.</td>
<td>Stand alone power system</td>
<td>Ideal for Phase 2</td>
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<td></td>
<td></td>
<td>(Tasmania)</td>
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<td><strong>Combined fuel and electricity generation</strong></td>
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<td>DTE or HI</td>
<td>System efficiency, performance, economics</td>
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<td>Rotterdam</td>
<td>Thermal performance</td>
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<td>HyTrec - integrated system</td>
<td>Trondheim</td>
<td>Optimization</td>
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<td>UK</td>
<td>PURE</td>
<td>Unst</td>
<td>Performance, economics</td>
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<td>Canada</td>
<td>Renewable hydrogen stand-alone island power</td>
<td>Prince Edward Island</td>
<td>Performance</td>
<td>suggested</td>
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</table>
RES2H2 - Spanish Project
Hawaii Power Park

- Wind, Biomass, Solar, Geothermal
- Hydrogen Production
- Fuel Cell
- Distributed Electric Generation
- Hydrogen Storage
- Fuel Cell Buses & Cars
PURE Project, Unst, UK
HyTrec Center, Norway
Totara Valley, New Zealand
Cape Barren Island, Australia
(Tasmania)

Wind power and diesel are used to generate electricity, which is then used to electrolyze water into hydrogen and oxygen. The hydrogen is stored in tanks for later use. The oxygen can be used for other processes, such as desalination. The process of electrolysis also produces carbon dioxide and other pollutants, which are vented to the atmosphere.
"Data and analyses deemed to be confidential and used during the course of Subtask B will be held confidential by the members of Subtask B for two years after the end of the Annex, unless all parties agree to an earlier release of data. Summary reports of the evaluations and conclusions will be delivered to the Executive Committee and the Annex and the national participant groups as they are completed, and will be held confidential by the member countries of the Executive Committee and the Annex and members of the national participant groups, unless or until all parties agree to make them publicly available or for two years after the end of Subtask B, whichever occurs first. The national participant group consists of the national project participants in the demo study and shall be agreed by the Subtask B members."
Subtask C will support the needs of existing hydrogen demonstrations while facilitating:

- specific lessons learned from the analysis of hydrogen systems; especially for future demonstration or fully implemented systems
- the identification and selection of system types requiring further modelling (Subtask B), such that the modeling tools are useful for future design or evaluation
- the development of specific information bases similar to those already being implemented in Subtask A; examples are specific data bases for electrolysers or metal hydride storage.

Subtask C will include the following activities:

- the development of a methodology for the evaluation of integrated hydrogen energy systems
- the use of the methodology retained to assess all hydrogen energy systems submitted by participants in this subtask and make recommendations regarding:
  - further optimization using modelling of proposed systems (subtask B), and / or
  - information compilation, analysis and dissemination (subtask A)
- the development of lessons learned based on the hydrogen energy systems’ evaluations, and
- the monitoring of progress or trend analysis of hydrogen system implementation.
Task 18 Work Programme

Our initial approach is to continue to work in a way similar to Phase 1. That is, we will hold two expert meetings per year, located at sites that are under evaluation in Subtask B. We have found these site visits extremely useful, as the designers, engineers, operators and sponsors are often available to answer the many questions we have about the projects.

However, we may also find it useful for individual subtasks to hold separate meetings to make their work more efficient.

We anticipate that work in Subtask C will, among other things, concentrate on analysing and synthesizing information from the Case Studies.

The hydrogen resources study could continue to be supported under Subtask A, or as a separate activity.
Task 18 Deliverables

All reports required by the Hydrogen Implementing Agreement will be provided:
- Two semi-annual reports and presentations per year
- One annual report per year
- Final report

In addition:
- Summary reports on each demonstration system evaluated
- A comparison of integrated hydrogen power systems (companion to the comparison of refuelling station experience)
- Subtask C synthesis reports on lessons learned and trend analysis
- Publications, as appropriate
- Postings on the public website, as appropriate
## Task 18 Milestone Schedule

<table>
<thead>
<tr>
<th>Subtask</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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<td><strong>Expert Meetings</strong></td>
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<td>Update of info bases</td>
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<td>Final summary report</td>
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<td><strong>Subtask C</strong></td>
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<td>Synthesis reports</td>
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Task 18 Phase 2 Meetings

Preliminary Schedule

• Spring 2007: Brescia, Italy (include Subtask C kick-off)
• Fall 2007: Canary Islands, Spain (Oct 25-26 proposed)
• 2008: Hawaii
• 2008: New Zealand, possibly in connection with ExCo meeting in Australia
• Future: joint Malmö, Sweden / Copenhagen, Denmark
• Future: Munich or Berlin fueling station (pending German membership)
Relationship to Other Activities

Task 18
Evaluation of Integrated Systems

Small Reformers Biomass
(Task 16 follow-on)

Modeling and analysis

Database

Wind Integration
(New Task)

Safety
(Task 19)

IPHE
Matters Requiring Executive Committee Attention

1. Approve Phase 2 of Annex 18; approve Operating Agent and Subtask leaders.
2. Indicate commitment to join Annex 18, Phase 2. (Sign and return National Participation Commitment Letters)
3. Comment on future of Hydrogen Resources study.
4. Define relationship with IPHE, if any, for Annex 18, Phase 2.
Back-up Slides
Significant Outcomes of Subtask A
Information Bases

Sub-task A provides data and analysis to the hydrogen community in the form of inventory databases and compiled summaries. The information is being used to perform trend analysis and formulate lessons learned. Among the databases are:

1. More than 200 National Documents (roadmaps, strategies, etc.), all of them searchable. This database will go public on Dec. 31, 2006.
2. An inventory of National Capabilities for the participating countries
3. Descriptions of National Projects
4. Hydrogen production technologies data base
5. Links to HySociety and other data bases
6. Case studies
Significant Outcomes of Subtask B
System Studies - Optimization for the Future

I. H₂-refueling stations
   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 study; model improvement (Vancouver)

II. Integrated RE/ H₂-energy systems
    1. Metal hydride storage optimization (Japan)
    2. Techno-economic system design study with optimized dispatch operation (HARI, UK)
    3. Future (Italy, US, Mahgreb-Europe)
Task 18 / Wind Task

Subtask A
Information Bases

Subtask A
Data gathering / state of the art

Subtask B
Modeling and Analysis

Subtask B
Analysis

Subtask C
Integrated systems / Lessons learned

Subtask C
Business Concepts

Subtask D
Wind energy management