IEA HIA Task 29

Distributed and Community Hydrogen (DISCO-H2)

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Topics

- Introduction and Overview
- Accomplishments
  - √ Subtask 2
  - √ Subtask 3
  - √ Subtask 4
- Summary

Introduction and Overview

Goals and objectives:

- DISCO-H2 focuses on H2 applications in energy communities integrating hydrogen systems with electricity and other energy and mobility networks and distributed systems.
- As energy community it is intended a group of interacting people featuring shared geographical location and energy needs.
- Target size of Communities will be up to 1,000 people; total installed power capacity of the hydrogen energy technologies (both producing and consuming hydrogen) in the community should not exceed 500 kW.

Introduction and Overview

Subtasks (STs):

1.Management

2.Analysis and Selection

- 2.1 Community identification
- 2.2 Data Collection (in relation to economic, social-regulatory, environmental and technical areas)
- 2.3 Projects selection

3. (DISCO-H2) Model concept development

- 3.1 Selection of rural/island model
- 3.2 Selection of urban model
- 3.3 Selection of industrial/commercial model

4 (DISCO-H2) Concept replicability

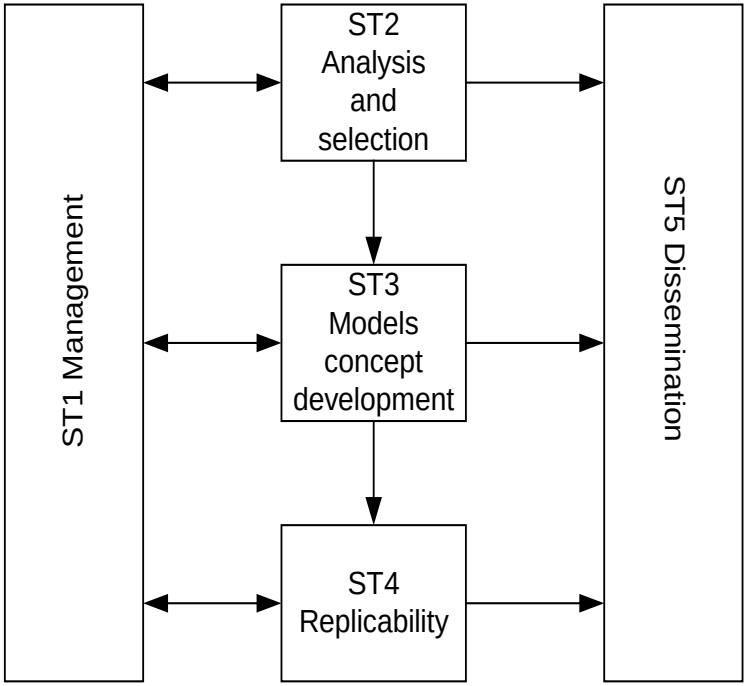
- 4.1 Market analysis
- 4.2 Risk analysis

5 Dissemination

- 5.1 Task results dissemination
- 5.2 Scientific community
- 5.3 Industrial sector
- 5.4 Regulating Authorities

Introduction and Overview

Task structure and original timetable



ID	Task Name	Year 1 (2011)				Year 2 (2012)				Year 3 (2013)				Year 4 (2014)				Year 5
		Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1
1	**ST1 Management**																		
2	Project manag. & reporting																		
3	**ST2 Analysis and Selection**																		
4	A2.1 Community identification																		
5	A2.2 Data collection																		
6	A2.3 Projects selection																		
7	M1 Target projects identification																		
8	**ST3 Model concept development**																		
9	A3.1 Selection of isaland model																		
10	A3.2 Selection of urban model																		
11	A3.3 Selection of industrial model																		
12	M2 Model definition																		
13	**ST4 Concept replicability**																		
14	A4.1 Market analusis																		
15	A4.2 Risk analysis																		
16	M3 Final task evaluation																		
17	**ST5 Dissemination**																		
18	A5.1 Task results dissemination																		
19	A5.2 Scientific community																		
20	A5.3 Industrial sector																		
21	A5.4 Regulating authorities																		

Task 29 started in 2011 and will be finished at the end of this year (2014).

Introduction and Overview

Participants

- 8 countries + IEA and EU
- UNIDO-ICHET was closed.

Organisation	Deligate	Country
CRES - Centre for Renewable Energy Sources	Emmanuel Stamatakis	Greece
Areva Energy Storage	**Thomas Salles**	**France**
ALPHEA	**Aline Rastetter**	
Hydrogenics	Raymond Shmid	Canada
Proton Onsite	**Robert Friedland**	**USA**
Callaghan Innovation	**Alister Gardiner**	**New Zealand**
ITC – Canary Islands Institute of Technologies		Spain
Pure Energy	**Daniel Aklil**	**UK**
ITM Power	**Simon Bourne**	
EHA – European Hydrogen Association	**Marieke Reijalt**	**EU**
HIA - Hydrogen Implementing Agreement	**Mary-Rose de Valladares**	**IEA**
AIST - National Institute of Advanced Industrial Science and Technology	**Hiroshi Ito**	**Japan**
ICHET – International Centre for Hydrogen Energy Technologies	Federico Villatico	UNIDO

Introduction and Overview - Meetings

The biannual expert meeting has been held since the beginning of 2011.

2011

1st : 9-11 February at Istanbul, Turkey

2nd : 12-13 September at Edinburgh, UK

2012

1st : 2-3 June at Toronto, Canada (with WHEC2012)

2nd : 15-16 October at Brussels, Belgium

2013

1st : 13-14 June at Methil and Edinburgh, UK

2nd : 20-21 November at New York city, USA

2014

1st : 19-20 May at Ajaccio (Corsica island), France

Accomplishments

Subtask 2 - Analysis and Selection

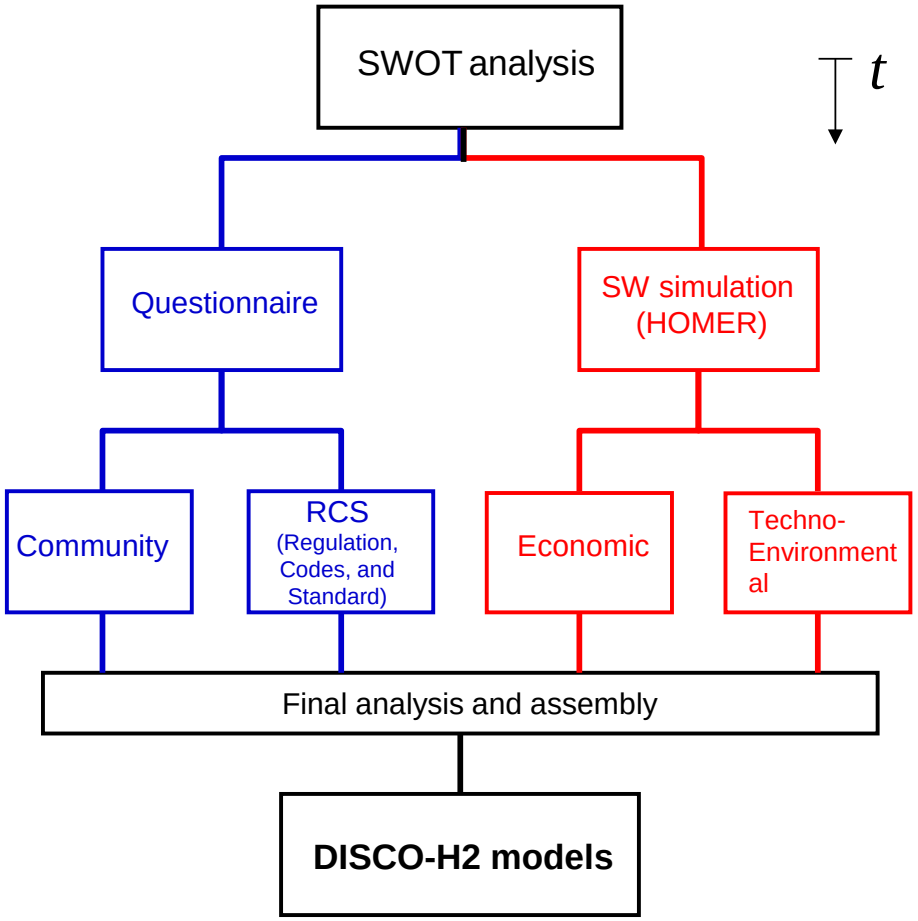
- A2.2 was surveyed community hydrogen system of over 50 all over the world.
- A2.3 performed eventually a selection in each category (Rural/island, Urban, and Industrial).

Rural/Island		
#1	Lolland CHP	Denmark
#2	Myrte	France
Urban		
#3	Residential CHP	Japan
#4	Octagon	USA
Industrial/commercial		
#5	FedEx Forklift	USA
#6	Hydrogen Office	UK

Accomplishments

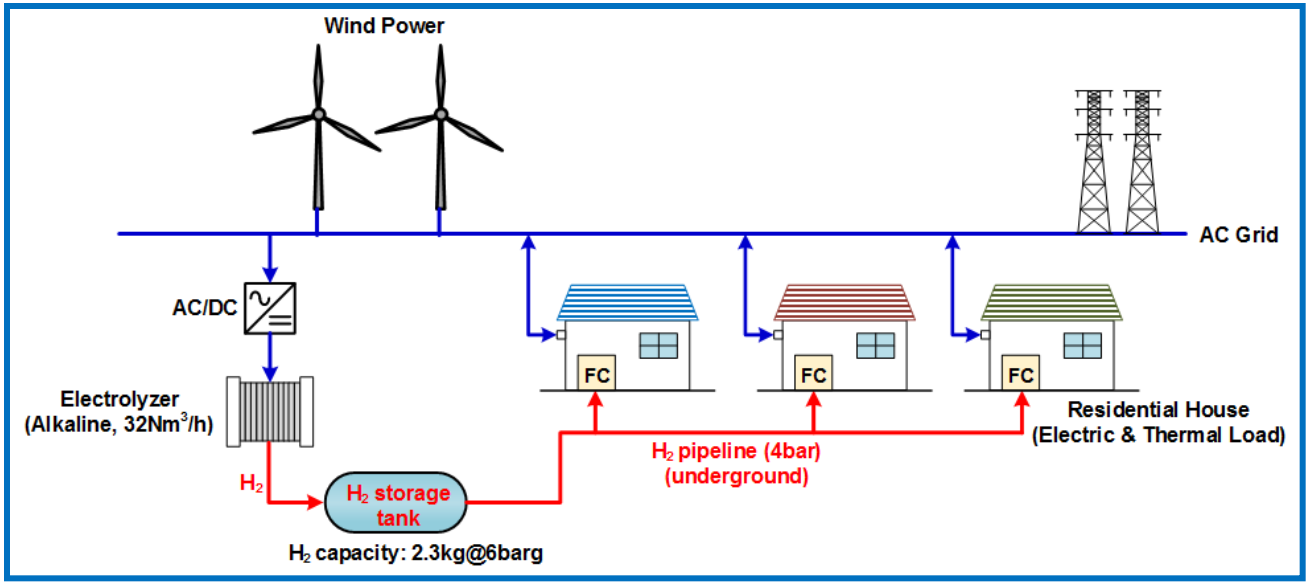
Subtask 3 - Model concept development

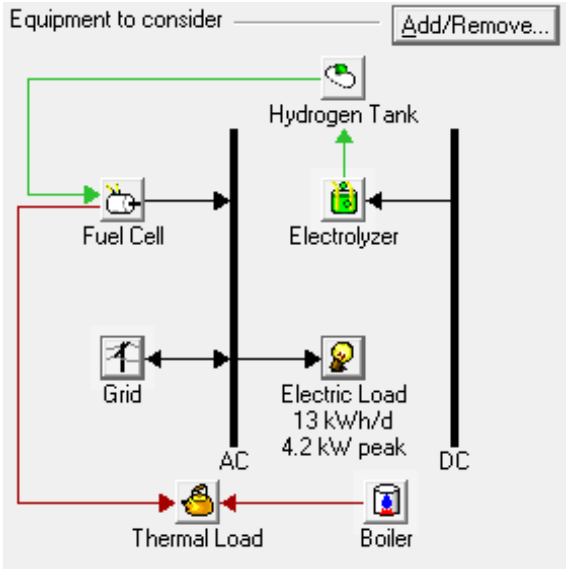
- Subtask 3 has carried out the software (HOMER) analysis on selected 6 projects in order to evaluate each system from the aspects of "techno-environment" and "economy".
- Subtask 3 also investigate each system from the aspects of "regulatory" and "community". For that the questionnaires were delivered to each project director.
- Summarizing the outcome from these hour aspects, DISCO-H2 model will be established in each category (Rural/island, Urban, and Industrial).



Accomplishments

Subtask 3 - Model concept development
HOMER analysis example on Lolland CHP





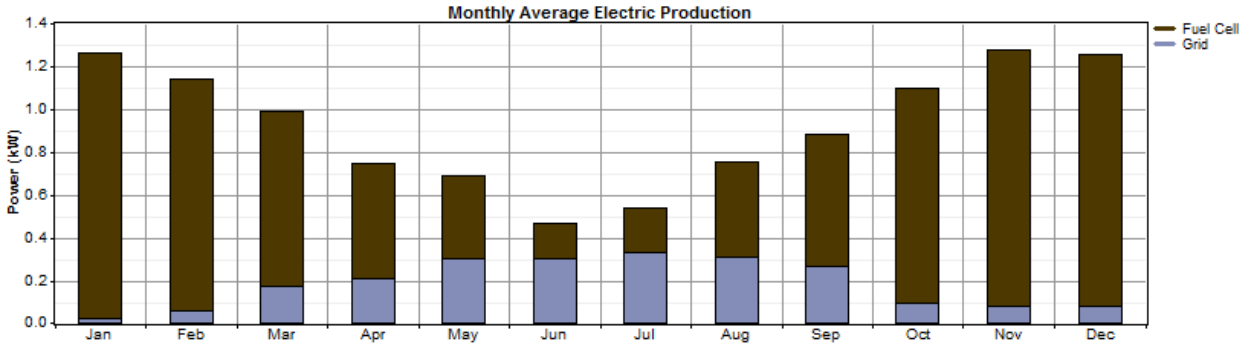
System configuration in HOMER

Accomplishments

Subtask 3 - Model concept development
HOMER analysis example on Lolland CHP

FC operating hours per year: 5,732 hrs/year

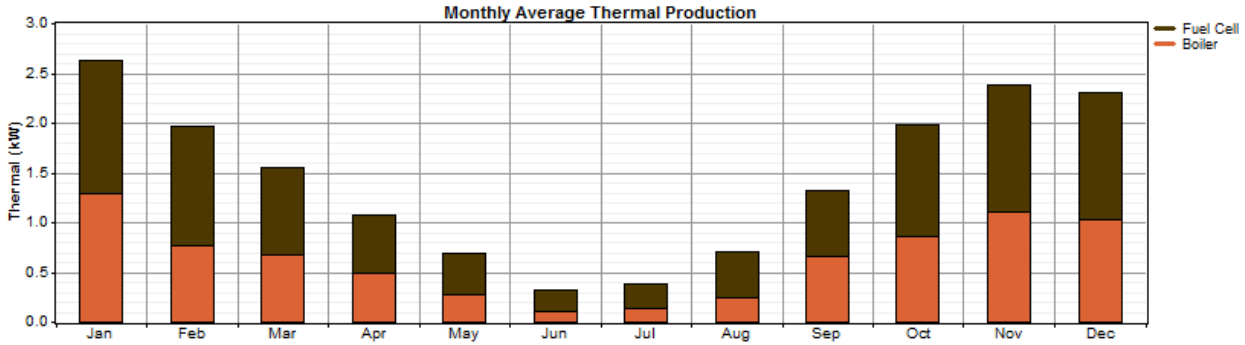
Electrical Share of FC: 67.2%



Production	kWh/yr	%
Fuel Cell	6,469	80
Grid purchases	1,629	20
Total	8,099	100

Consumption	kWh/yr	%
AC primary load	4,964	61
Grid sales	3,134	39
Total	8,098	100

Thermal Share of FC: 55.8%



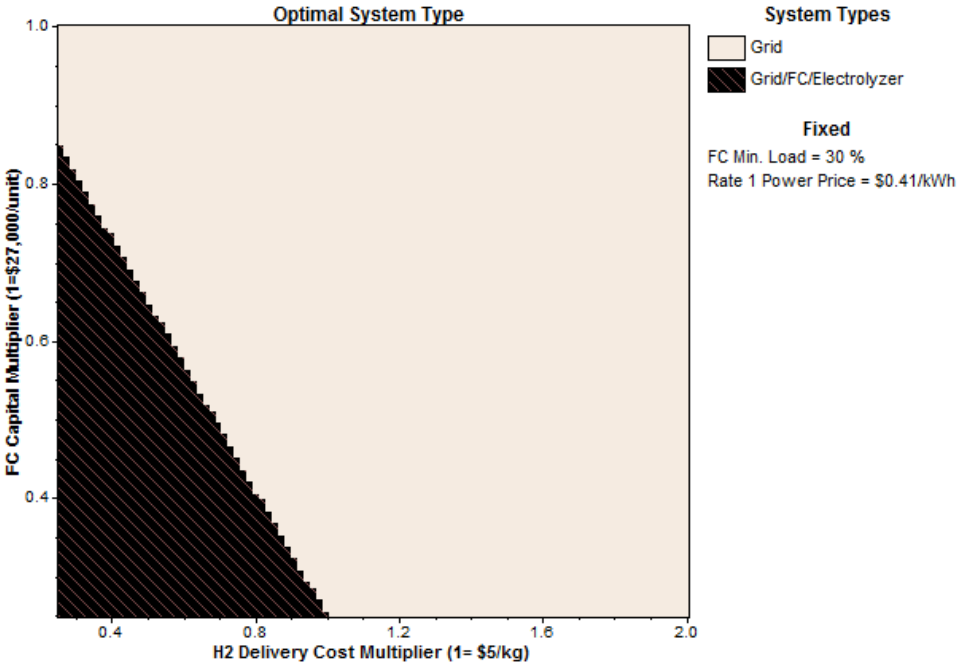
Production	kWh/yr	%
Fuel Cell	7,050	56
Boiler	5,579	44
Total	12,629	100

Consumption	kWh/yr	%
Thermal load	12,629	100
Total	12,629	100

Accomplishments

Subtask 3 - Model concept development
HOMER analysis example on Lolland CHP

FC capital cost vs. H2 delivery cost



When the multiplier = 1,
FC capital= $27,000
H2 delivery cost = $5/kg

Fixed parameters
FC output : 1.5kW (AC)
Power rate: 0.41$/kWh
Gas rate: 1.66$/Nm3
Minimum load ratio: 30%

Under the present power price ($0.41= €0.30/kWh), the requirement cost of H2 delivery would be under about $3.5/kg, when FC capital was $13,500 (multiplier =0.50).

Accomplishments

Subtask 4 - Concept replicability Framework

- This task studies the potential for the concept applicability among selected stakeholders by suggesting application sectors in order to achieve market penetration.

- Subtask 4 has investigated Concept replicability ("market readiness") for each selected system from the aspects of
  - Technical risk – system maturity
  - Economics – cost of energy
  - Market transformation
  - Sustainability

Accomplishments

Subtask 4 - Concept replicability
Market Readiness Assessment

In Summary – a Qualitative Market Readiness Matrix is Produced for Each Case Study

Assessments 1-9 scale

Technology readiness
TRL/SRL/accessible project reports, etc.

Market economics
Homer analysis
Technology learning

Market access factors
Warranty, sales chain, servicing and maintenance

Assessment notes

Drill-down notes and references

Summary Market Readiness Matrix
9 step colour coded bar graph:
- Green = level met
- Orange = some issues remain
- Red = not proven
- Grey = insufficient data / evidence
- White = not relevant / not considered

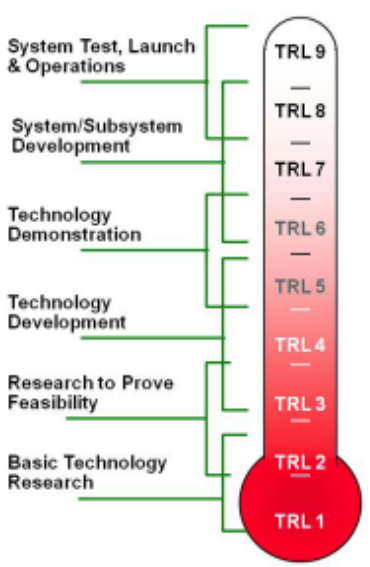
Accomplishments

Subtask 4 - Concept replicability Assessment Example

An example Market Readiness Evaluation Matrix (Japanese CHP)

	Annex 29 ST4 Analysis	Score Code:	Green	Level met in all aspects						
	PROJECT:		Orange	Some issues/uncertainties remain						
	Japanese CHP		Red	Not reached/unlikey to meet						
	Date:		Grey	Insufficient data/evidence						
	17/05/2014		White	Not Scored/not relevant						
	SYSTEM DIMENSION		**TECHNOLOGY/MARKET MATURITY SCORE**							
	Technical/Environmental		1	2	3	4	5	6	7	8	9
1	Reformer subsystem maturity										
2	Fuel cell subsystem maturity										
3	Boiler subsystem maturity										
4	BOP system maturity										
5	System software maturity										
6	Integration between hydrogen components in the system										
7	Integration with existing energy technologies										
8	Sustainability benefits - GHG reduction										
9	Product documentation maturity – technical, marketing										
	Economics										
10	System economic validation – case studies, documentation										
11	Potential impact of technology learning on costs										
12	Multiplicity of suppliers and market standardisation										
13	Market transformation potential										
14	Industry capacity for installation and maintenance										
	Community										
15	Does it meet stakeholder use expectations?										
16	Service support and training										
17	Insurance and indemnity										
18	Social, education value										
	Regulatory: RCS, policy and law										
19	Application performance standards										
20	Application safety standards										
21	Regulatory consents and permissions										

TRL Maturity Scale



Technology Readiness Levels (TRLs)

9. Actual system proven through successful mission operations (sw mission-proven operational capabilities)
8. Actual system completed and qualified (sw mission qualified) through test and demonstration (sw in an operational environment)
7. System prototype demonstration in an operational (sw high-fidelity) environment
6. System/subsystem model or prototype demonstration in a relevant environment (sw module and/or subsystem validation in a relevant end-to-end environment)
5. Component and/or breadboard (sw module and/or subsystem) validation in relevant environment
4. Component and/or breadboard validation in laboratory environment
3. Analytical and experimental critical function and/or characteristic proof-of-concept
2. Technology concept and/or application formulate
1. Basic principles observed and reported

Summary

- This Task will be successful when the technical, economic, social and environmental benefits of hydrogen in communities are evident and the Task has played a role in helping to implement such systems leading to replication or mass production.

- Good cohesion and cooperative effort has been shown by the partners for three years, and the task is in the final phase.

- Final report (including subtask reports) will be published in the first quarter of the next year (2015). In addition, we plan to publish the supplemental report related with “Guidebook” for each community.

IEA HIA

A premier global resource for technical expertise in H2 RD&D

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Thank you very much!