TASK 23 Small-scale reformers for on-site hydrogen supply
Semi-annual report
October 2010

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(Operating Agent)

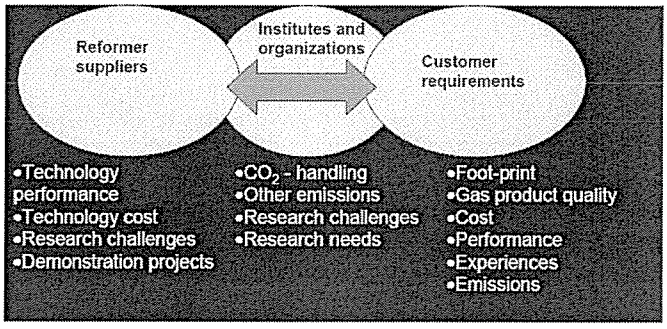
Summary
Task 23 Small-scale reformers for on-site hydrogen supply had its kick-off meeting in October 2006. This task is a continuation of Annex 16, subtask C, which was finalised in June 2006. Task 23 has three subtasks and currently nineteen members from ten different countries.

1. Task description

The main objective of Task 23 Small-scale reformers for on-site hydrogen supply (SSR for hydrogen) is to provide a basis for harmonization of technology for on-site hydrogen production from hydrocarbons – fossil and renewable. The overall objectives of the task are:

- Develop a basis for harmonized capacities for the on-site hydrogen reformer unit
- Identify and examine issues related to the promotion of widespread use of on-site hydrogen reformer units
- Develop a global market guide for the use of on-site hydrogen reformers
- Describe the technology link to renewable sources

The approach can be illustrated as follows



Subtasks
The subtasks are designed to meet the objectives and to provide results in form of deliverables. Task 23 has been organised in three subtasks as follows.

1.1 Subtask 1 *Harmonised industrialisation*

Subtask leader: *Esther Ochoa-Fernandez (Norway)*

The overall subtask objective is to develop a harmonized approach related to reformer capacity. This can facilitate industrialisation and cost reduction.

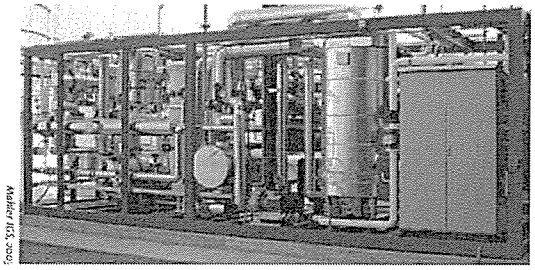


Figure 1. Reformer unit (Mahler-AGS)

There is a need for a framework for design of refuelling stations with on-site production. Technology providers require cost guidelines (e.g. trucked in versus on-site production).

1.2 Subtask 2 *Sustainability and renewable sources*

Subtask leader: *Corfitz Nelsson (Sweden)*

The overall subtask objective is to develop systems for fuel diversification and the use of renewable sources. Furthermore, it is important to study on-site emissions and how to handle these. The tasks include studies and presentations on possible feedstock based on operation experience and based on research and development activities among the members.

1.3 Subtask 2 *Market studies*

Subtask leader: *Isamu Yasuda (Japan)*

The overall subtask objective is to facilitate and support market development by dissemination of technology information.

The market will be studied with respect to quality and quantity. Three cases will be used as basis for a market study. Possible cases are Japan, North Europe and part of the US. These cases will represent markets with different characteristics.

Monitoring of experience from demonstration projects will give valuable input for technology, design and market issues.

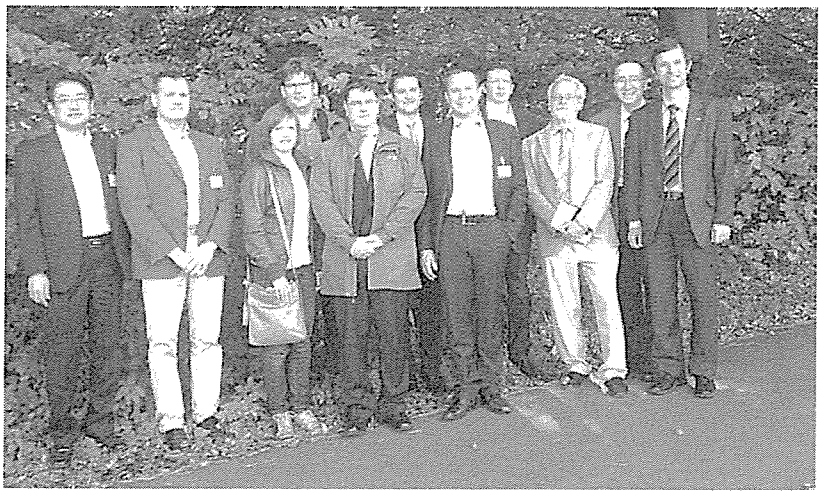
Dissemination activities will be presentations, articles and accessible internet information for external stakeholders.

2. Activities

The majority of the task members are from the industry and therefore the main work in this task is performed at the expert meetings through presentations and discussions.

Expert meetings

Two expert meetings have been held in 2010, one in the Netherlands (hosted by ECN) and the other in Denmark (hosted by Haldor Topsøe).



Expert meeting Lyngby, October 2010 (Photo: Ingrid).

3. *Major Accomplishments*

Subtask 1 Harmonised industrialisation

Parameters defining a harmonized system are crucial. A list identifying suppliers of reformer technology and components has been developed as well as a set of standards related to each component constituting units for on-site small scale reforming. This will contribute to the harmonization of the technology. Moreover, actual efficiency numbers will be determined for use in Task 30 and other international studies.

Subtask 2 Sustainability and renewable sources

Fuel paths and sensitivity analysis has been derived and the discussion is completed.
A survey on small scale CCS technology has been generated by ECN, this report is completed and will be included in the final report of Task 23.

Subtask 3 Market studies

Three market segments have been considered:

- Asia (Japan)
- North America(California)
- North-Europe (Germany)

An a*verage* cost comparison of *reformer units* has been performed. Three capacities were considered 50Nm3/h, 100Nm3/h and 500Nm3/h. This will be the basis of calculation of hydrogen supply costs.

4. Status of Milestones

The main milestones are the expert meetings and two expert meetings have been held in 2010.

5. Semi-annual work plan

The work plan for the next 6 months is as follows.

Subtask 1

The work for the next period of time will focus on the following:

- The safety and harmonisation. Information on safety analysis performed on 2 refuelling stations will be gathered and compared for recommendation with regards to the use of standards and tolerable risk level.
- The supplier list will be modified and a specification of the maturity of the available technology will be made, as well as reference plants related to the suggested harmonized capacities.
- Defining future research challenges related to small scale reformer technology.

The following activities have been defined for the next period:

Work task	**Work description**	**Deadline**	**Responsible person**
List of suppliers	Based on the list of suppliers conclusions will be drawn as regard to harmonisation issues	June 2011	Esther Ochoa Fernandez (Statoil)
Refuelling stations with reformers	Specification of maturity of technology	June 2011	Ingrid Schjølberg (SINTEF)
Equipment standards	Comparison of methods for safety analysis and choice of standards	February 2011	Ingrid Schjølberg (SINTEF)
Research challenges	Specification of future research challenges	February 2011	Ingrid Schjølberg (SINTEF)

Subtask 2

The work for the next period of time will focus reporting the results.

Table 1. Work plan Subtask 2 for the next period

Work task	**Work description**	**Deadline**	**Responsible person**
Fuel paths	Complete the final report	June 2011	Corfitz Nelsson (SGC)

Subtask 3

To reach the goals of subtask 3 the following activities have been defined for the next period:

- Further develop the cost analysis
- Include target numbers from the various countries

Table 2. Work plan Subtask 3 for the next period

Work task	**Work description**	**Deadline**	**Responsible person**
Data collection	Haldor Topsøe data will be supplied for 500Nm3/h	December 2011	John Bøghild Hansen
Market study	Prepare description on 1. Current market situation (H2) 2. Refuelling	January 2011	All

	stations /number of cars 3. Outlook, roadmaps Sweden, Norway, Netherlands, Germany, Japan, Turkey, California, Denmark,Italy, France		
Final conclusions	Organise final report	June 2011	Isamu Yasuda (Tokyo Gas)

6. Effectiveness of Task participation

Participation at the task meetings has been excellent. The current member list is as follows.

Table 3. Member list

Nr.	Country	Organization	Expert	Contact address
1	Denmark	Haldor Topsoe	J.B.Hansen	Jbh@topsoe.dk
2	Germany	Mahler AGS	R. Stauss	Ralph.stauss@mahler-ags.com
3	Japan	Tokyo Gas	I.Yasuda	iyasuda@tokyo-gas.co-jp
4	Japan	Mitsubishi Kakoki Kaisha	A. Obuchi	obuchi@kakoki.co.jp
5	Norway	Statoil	E. Ochoa Fernandez	eoch@statoilhydro.com
6	Norway	SINTEF	I.Schjølberg	Ingrid.Schjolberg@sintef.no
7	Netherlands	HyGear	D. Lieftink	Dick.lieftink@hygear.nl
8	Netherlands	ECN	E. van Dijk	h.vandijk@ecn.nl
9	Netherlands	JRC	Georgios Tsotridis	georgios.tsotridis@jrc.nl
10	Sweden	SGC	C.Nelsson	Corfitz.nelsson@sgc.se
14	Italy	ENEA	Eugenio Calo (ENEA)	Eugenio.calo@casaccia.enea.it
15	Turkey	TÜBITAK	A.Ersoz	Atilla.Ersoz@mam.gov.tr
16	France	N-GHY	D.Grouset	Didier.grouset@n-ghy.com
17	France	N-GHY	P.Marty	Philippe.marty@n-ghy.com
18	France	H2Plus	J.Saint-Just	Jacques.Saint-Just@h2plus.net
19	USA	Intelligent Energy	Christian Hulteberg	Christian.Hulteberg@h2-solutions.com