NEED HEAT & POWER?

RES-FC MARKET

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Energy Research Centre of the Netherlands (ECN) || www.ecn.nl

Hydrogen Innovation & Research Centre (HIRC) || www.hirc.dk

International Biogas and Bioenergy Centre of Competence (IBBK) || www.biogas-zentrum.de

IRD Fuel Cell Technology (IRD) || www.ird.dk

The Institute of Systems and Robotics || www2.isr.uc.pt

Das Kompetenz- und Innovationszentrum Brennstoffzelle der Region Stuttgart (KIBZ) || www.kibz.de

University of Iceland || www.hi.is

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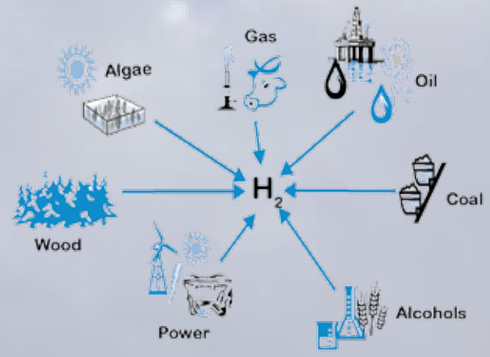
The Project

The EU-project RES-FC Market wants to accelerate the market introduction of fuel cell household systems that use renewable energy sources (RES) because the contribution of these systems to global warming is very small.

For the market development it is essential that the system cost decreases and initial customers can be identified. Lessons from the successful European technology and market development of wind turbines will be transferred into this sector.

This means that 10 regional markets will be described that have an aggregated market of 3000 RES-FCHS units to be realised in the near future.

The cooperation between the regional RES-FC markets shall be used for driving down the costs of RES-FCHS due to acceleration of development and mass manufacturing possibilities



Hydrogen

Hydrogen can be produced from a variety of feedstock. These include fossil resources, such as natural gas and coal, as well as renewable resources, such as biomass and water with input from renewable energy sources (e.g. sun, wind, wave or hydro-power). A variety of process technologies can be used, including chemical, biological, electrolytic, photolytic and thermo-chemical. Each technology is in a different stage of development and offers unique opportunities, benefits, and challenges. Local availability of feedstock, the maturity of the technology, applications and demand, policy issues, and costs will all influence the choice and timing of the various options for hydrogen production.

What is a fuel cell

A fuel cell is an electric power generation technology that is environmentally clean, quiet and highly efficient with no moving parts. Fuel cells generate electricity through an electrochemical process in which the energy stored in hydrogen is converted directly into electricity and thermal energy, as long as fuel is provided. The chemical energy can come from pure hydrogen or hydrogen contained in various types of fuels (such as natural gas, methanol, ethanol, biogas, etc.).

Main applications of fuels cells

Fuel cells are one of the most promising technologies for application in distributed generation due to high efficiency and low emissions. However, the high initial cost of fuel cell equipment is hindering a large scale application of fuel cells. For distributed generation the first markets will establish where heat and electricity have a high value. At the present time, fuel cells are only cost competitive or near cost-competitive within certain niche markets such as power back up for telecommunications, propulsionmfor military submarines and certain indoor small vehicle applications.

Residential co-generation

Fuel cells can be used in households and will in most locations be connected to the existing electricity grid. With a CHP (combined heat and power) Fuel Cell unit it is possible to use the heat produced by the fuel cell for heating purposes and for domestic hot water supply. In order to maximize the energy efficiency of the fuel cell system, the fuel cells are to run according to heat demand/possibility of heat storage. Therefore a great deal of import/export between the fc unit and the electricity grid will occur on an annual basis. When implemented in a larger scale this electricity exchange can prove an important means of grid balancing in a future energy system involving a high proportion of fluctuating renewable energy sources.

Market perspective

The fuel cell technology is still at an early stage of market penetration and needs to be successfully demonstrated in pilot projects to promote its wider application. The main obstacles to the large scale application of fuel cells are its high cost and reliability. Proper incentives are required to promote fc applications.

THREE OPTIONS FOR THE TECHNOLOGIES

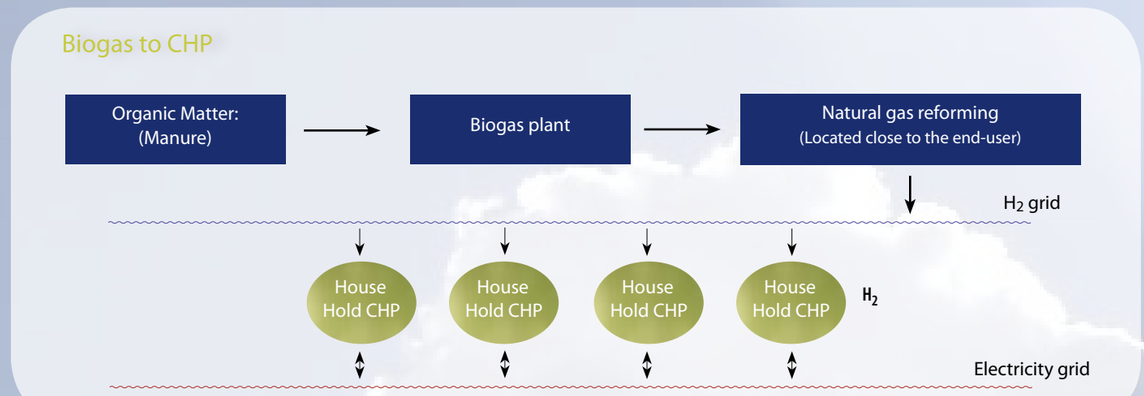
Hydrogen is only an energy carrier and needs to be produced by primary energy sources. In this project the primary energy sources under investigation are:

- Biogas
- Biomass in general
- Wind energy, especially “excess wind”

A. Biogas to CHP

Biogas is produced in a biogas plant converting organic matter (manure) into biogas. The biogas is cleaned/upgraded to natural gas standard and feed in the natural gas network. The biogas/natural gas is transported via the existing natural gas network to a cluster of houses equipped with fuel cell systems for combined heat and power supply.

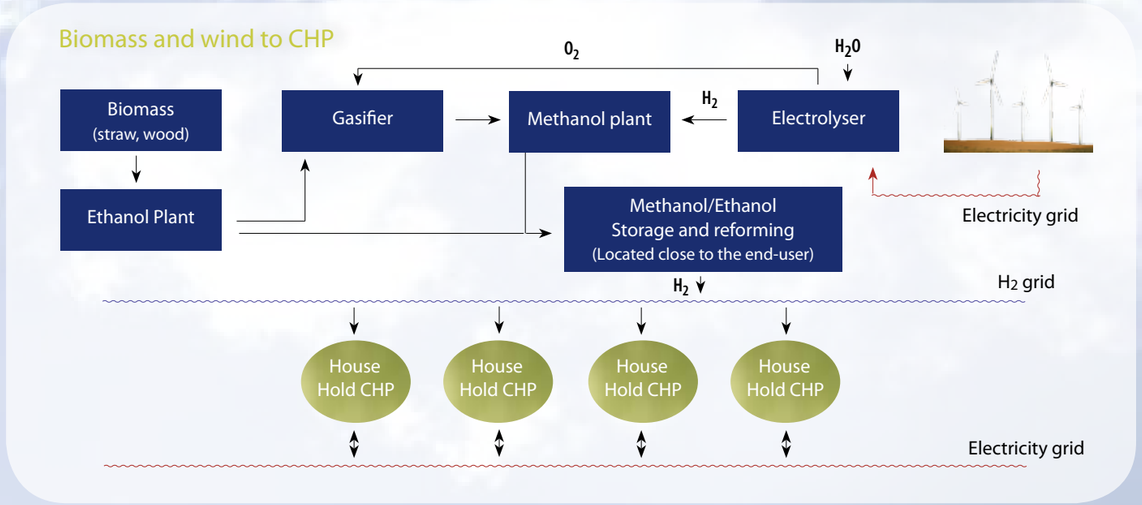
The natural gas/biogas is reformed to pure H2 at a central reforming station located close to a cluster of households. The hydrogen is transported from the reformer station to the household through a new hydrogen grid. The hydrogen is then converted to heat and electricity in the household, using t he CHP fuel cell.



B. Biomass and wind to CHP

Methanol and ethanol are produced in a plant converting biomass and electricity into methanol and ethanol. The ethanol is produced through biomass fermentation. Hydrogen from the electrolyser is then mixed with the gas from the exiting gasifier in a “methanol plant”. The gas mixture is used to produce methanol, which is stored as a liquid under normal conditions.

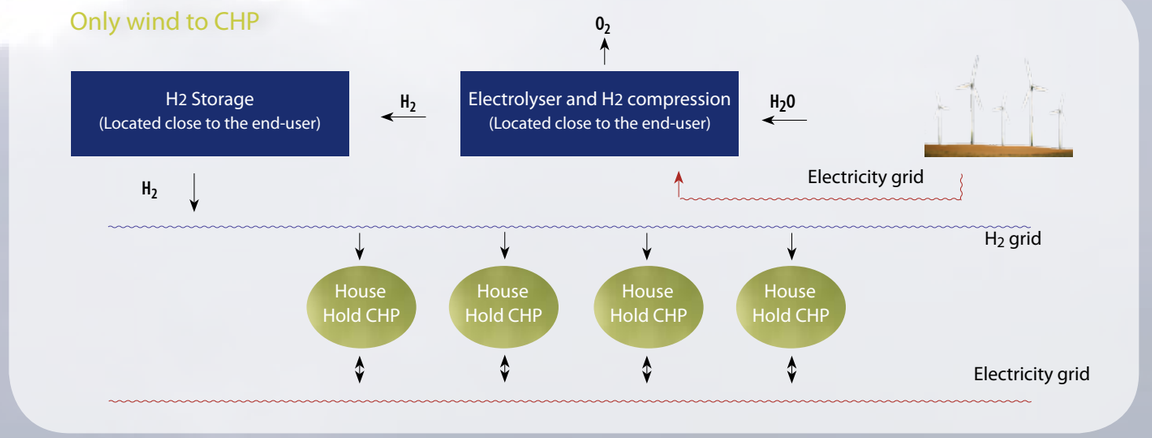
The methanol is transported to a local storage and reformer station located close to the cluster of households equipped with fuel cell systems for combined heat and power supply. The methanol is reformed to pure H2. The hydrogen is transported from the reformer station to the household through a hydrogen grid. The hydrogen is converted into heat and electricity by a fuel cell CHP in the household.



C. Only wind to CHP

Hydrogen is produced from electricity, through an electrolyser unit, located close to a cluster of households equipped with fuel cell systems for combined heat and power supply. The electrolyser is operated only in the hours when the electricity is relatively inexpensive (off peak hours and when it is very windy). The electrolyser will be used to regulate the electricity grid, and will give room for more fluctuating renewable energy in the energy system.

The produced hydrogen is stored in a hydrogen storage located close to the electrolyser. The hydrogen is transported through a new hydrogen grid from the hydrogen storage to the households. The hydrogen is converted to heat and electricity by a fuel cell CHP in the household.



Creating a market

The main challenge in bringing this promising technology to the market is to bring the systems cost down for the demonstration project developers, and at the same time understand and specify the political measures necessary for creating an early consumer market for these technologies.

The RES FC Market project is searching for ways to deal with both these challenges.

In the pursuit of economic improvements it has been discovered that significant cost reductions can be achieved by producing FCHS in larger series. Today, most systems produced are for laboratory purposes or small scale demonstration projects. By designing and building standardized systems that can be used across all the hydrogen carriers studied, and combining this with a modular structure, it will be assured that the same systems can be used in different climates (and regions). Only thereby the possibility of doing a large scale common European purchase emerges.

With regards to the political incentives and the legislation required for creating an early consumer market, the study investigates the feed in tariffs required as well as the need for a clear and preferably common European legislation on fuel cell household systems.

This brochure is published by the 12 regional partners in the project and addresses everyone interested in renewable energy.
For more information: www.resfc-market.eu

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