

Regional dissemination activities: the Netherlands

Introduction

The EU-project RES-FC-Market aims to encourage the application of hydrogen fuelled fuel cell CHP units in houses by identification and bringing together regional initiatives around Europe. By using hydrogen produced from renewable energy sources (RES) this option can contribute to the greening of the energy system for houses. In the case of the Netherlands the production of hydrogen from water using wind electricity is considered as the most obvious option because wind power is the most abundantly available renewable energy source in the Netherlands.

In addition to contributing to the greening of the energy system for houses the option may help to resolve grid balancing problems at relatively high wind penetration levels thus offering a way to increase wind power penetration in the energy system. Also the wind energy sector is interested in systems that can improve the predictability of the electrical output of the wind turbine system, e.g. by energy storage systems. This will increase the price for which they can sell their electricity.

Characteristics of the concept

As hydrogen is reconverted into electricity in houses by means of a fuel cell, essentially, the system considered is an electricity storage system. The round-trip efficiency of the system could be about 30%. In addition, about 20% of the energy could be recovered as useful low temperature heat resulting in an overall efficiency of maximum 50%.

To reduce conversion losses and maximise avoided emissions in power plants, wind electricity should be used as electricity directly as much as possible. Ideally only excess wind should be used for the production of hydrogen for this application. The advantage of excess wind could be low electricity prices. On the other hand, the number of full load hour of the equipment required for the concept will be low. Excess wind will only be available a limited number of hours per year while the CHP unit should never operate together with the hydrogen production unit as this would lead to additional excess electricity. A low number of full load hours will result in high specific fixed cost even when considering future cost targets for the equipment.

Dissemination activities

Considering the current views of the stakeholders, an active stimulation and market development of fuel cell CHP systems for houses using renewable wind hydrogen that is produced from excess wind electricity using an electrolyser can not be justified for the Netherlands.

Instead of active encouragement of the concept via presentations on regional seminars and publications in general specialist literature, a scientific article on the assessment of concept for the Netherlands is foreseen.

Stakeholder views

This RES-fuel cell household system is discussed with a number of stakeholders. Their views on the concept can be summarized as follows:

- SenterNovem, the Dutch organization that stimulates sustainability through advise, networking, information and subsidies. Mainly because of the low round-trip efficiency for the application considered, they refrain from stimulating this system as a solution for excess electricity from wind.
- Province Friesland and community Leeuwarden. They have a limited budget for the stimulation of sustainable energy systems e.g. through demonstrations or exposure. They want to know the market potential before they will stimulate, especially because of the round-trip efficiency.
- Nedstack, the Dutch PEM fuel cell systems manufacturer. They consider the low round-trip efficiency of the process and the high system costs for these small systems a too high barrier for this market. They will not develop these small systems; however they see market potential for larger stationary PEM fuel cell systems.
- ECN, the energy research centre of the Netherlands. They consider the economics of this stationary system not attractive to customers. Alternative electricity storage systems with a round-trip efficiency higher than 80% are possible. When hydrogen from excess electricity is produced, it should first be used in (passenger) vehicles for transportation.

Regional operational plan

Household CHP systems operating on natural gas will enter the Dutch market in 2009 and will be subsidized. These are Stirling engines and high temperature fuel cell (SOFC) systems. These systems have the advantages of independence of fuel production, an existing infrastructure and control by the customer in contrast to the considered hydrogen fuelled household CHP system.

The Stirling engines have a low power/heat ratio and will be used in heat following mode and are best suited for existing houses with high heat demand.

The SOFC systems have a high power/heat ratio and will preferably be operated continuously. The electricity company Nuon has ordered 10.000 of these units per year.

The market introduction and penetration of these household CHP systems on natural gas will be actively followed, especially the high temperature fuel cell system. The CO₂ emission reduction from these household CHP systems will be assessed in relation to centralized electricity production and local heating using natural gas as fuel.

Fuel cell systems will be promoted that are cost-effective and lead to greenhouse gas emission reductions.