Small-scale Fuel Cells: Integration of Fluctuating Power

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Micro-CHP systems can create more flexibility to increase the wind power share especially in countries without district heating.

Cogeneration of heat and power (CHP) systems are used actively in Denmark to integrate wind power, but in countries without district heating, this was not an option before the advent of very small CHP plants for individual dwellings. The introduction of fuel-cell-based micro-CHP systems for individual houses might expand the use of wind power above 20-25% of electricity supply. Naturally, the fuel used must be produced from renewable energy sources. Reversible fuels cells producing and consuming hydrogen are particularly interesting, as they support downward as well as upward regulation.

The Fuel-Cell Market

Stationary applications are emerging, in which fuel cells are used to supply individual houses with electricity and, as a by-product, with heat. The EU-supported renewable energy sources (RES) fuel cell household systems (FCHS) Market Project has investigated barriers and preconditions for such applications in Denmark, Netherlands, Germany, Portugal, Spain and Iceland. The ability of the fuel cells to supply regulating power adds value to help balance the investment. However, public regulations in most European countries do not accommodate such small producers of power and of regulating power. Technical changes in the energy systems must thus be accommodated by institutional changes, including promoting tariffs.

Household Fuel Cell, Example:		
Electrical Power	Nominal: 1.5 kW_AC	Range: 0.5-2.0 kW AC
Heating:	Nominal: 1.5 kW;	Range: 0.5-3.0 kW
Efficiency: Electrical:	>45%; Total: > 80%	
Technology	PEM Fuel Cells	
Life expectancy	Not tested at systems level	

Cost of Developing the Technology

Costs must be brought down and life expectancies must be improved. Fuel-cell unit life expectancy should be at least 40,000 hours, but most barely last through 10,000 hours of operation.

A proposed goal in Denmark is commercially available mass-produced 1.5 kWe domestic fuel cell units priced by 2012 at approximately 4000 € for units run on pure hydrogen or 5300 € for units operated on natural gas or cleaned biogas. These prices are comparable to those of new oil furnaces for house heating, though the latter have higher heat outputs. Such fuel-cell units will thus require better insulated houses.

FC system for single house. IRD Fuel Cells, Denmark

Ambitions like these are in the process of being met through actual technology development and a number of field tests being conducted worldwide. In Denmark, a 7-million-€ demonstration project is underway, focusing on national technology development and testing three different technologies operating on natural gas and hydrogen. German Baxi, using Danish IRD Fuel Cell's low-temperature Polymer Electrolyte Membrane (PEM) technology, has conducted field tests for some years, and Tokyo Gas has a very large project with more technologies and 1000s of units being field-tested.

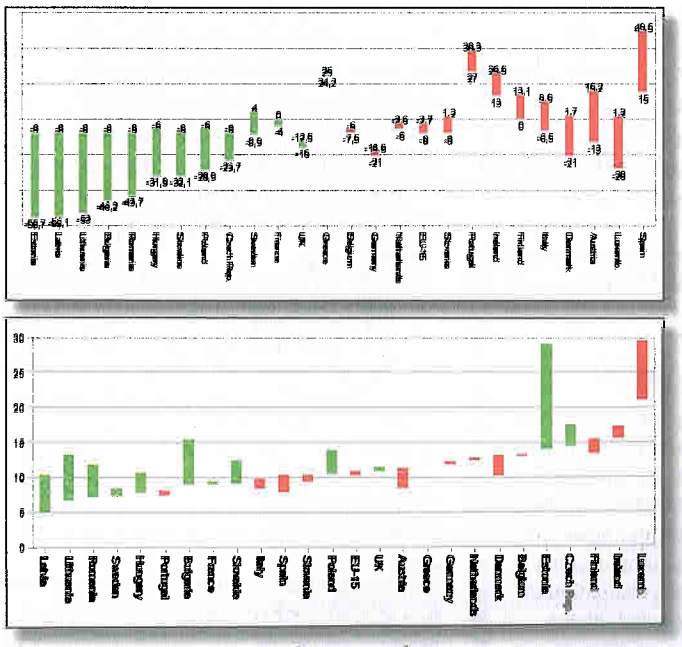
With technology development progressing and barriers for their implementation being identified, fuel cells may one day be an important element in the energy system.

More: www.resfc-market.eu.

Greenhouse Emissions in EU: A Study in Variations

It is always interesting when the European Environmental Agency (EEA) publishes its overview of greenhouse-gas emissions, even though the data comes 1 1/2 year late. Sorting the countries according to how well they did in 2006 compared to their Kyoto 2008-2012 targets, it is clear that all the new EU countries except Slovenia (as well as Cyprus and Malta, which have no targets) are well below their targets, while many Western Europeän countries are well above. Of the countries with ambitious targets (reductions greater than 20%), only Germany is close to meeting its goal.

If we compare emissions and targets with the per-capita emissions, a somewhat different picture appears, showing that some countries with high emissions have even higher targets, while others with lower emissions have to reduce. There are some explanations for that in the power sector structure, but they only partially explain the situation. The graph below also shows that all EU countries are above global average emissions and will have to reduce substantially if and when an equitable, global greenhouse-gas reduction scheme is agreed.



Greenhouse-gas emissions of EU countries in 2006 and corresponding Kyoto targets, in % relative to the base year (1990 with modifications). For countries with green bars, the targets are higher than their emissions, so they have reached their targets if they stay at the 2006 emissions level. Countries with red bars have to reduce emissions.

Countries according to per capita emissions. The bars show the distances to the targets. Green bars are for the countries below targets. Red bars are for the countries above targets.

Based on EEA statistics. www.eea.europa.eu