SOFC micro CHP plants to be climate-friendly power stations in homes

EurekAlert

An SOFC fuel cell produces electricity and heat with a very high efficiency. That means less carbon emissions for each kW produced. Furthermore, the production of electricity happens with nearly no emissions of pollutants such as nitrogen and sulphur oxides. Thus, SOFC fuel cells are a strong card in the future climate-friendly energy supply. SOFC fuel cells are flat and thin as a piece of paper, providing a voltage of approx. 1 volt. They are put together in stacks to achieve the desired voltage and wattage.

The results from the research at Risø DTU are known internationally and have spread in ever-widening circles. Risø DTU entered into a long-term strategic cooperation agreement with Topsoe Fuel Cell, which developed fuel cell stacks into a commercial stage and is now marketing them under the name Topsoe PowerCores?. Topsoe Fuel Cell has subsequently entered into a long-term cooperation agreement with the Danish company Dantherm Power, which is selling small CHP plants, among other things. So long-term research conducted in Risø DTU's laboratories is now turning into concrete revolutionary products to be used in the supply of power and heat.

Each home will have a micro CHP plant of its own
To accommodate more renewable energy, the future electricity system will look significantly different from now. E.g. it is believed that today's large, central CHP plants will be supplemented with numerous quite small CHP plants of a few kW, in each home. These micro CHP plants in homes can help balance energy in the future energy system, where more energy will be coming from renewable energy sources such as the wind and the sun. The micro CHP plants will be taking over energy production, for example, when there is no wind, and when the sun is hiding behind a cloud.

"At the moment, we are developing compact micro CHP plants, similar to a conventional oil or gas furnace when it comes to generating heat for the home. What's new about micro CHP plants, is that they also produce the power the home needs. In this way, you avoid transmission loss in the electricity and district heating network," says Jesper Themsen, technical director at Dantherm Power. Simultaneously, the micro CHP plants emit no or very little pollution and less carbon.

"In the spring of 2010 we produced a few micro CHP plants as part of the project 'Danish micro cogeneration'. Now we're doing tomorrow's micro CHP plant in cooperation with Topsoe Fuel Cell, and in October 2010, we produced two systems that we will put into operation among professional users, for example plumbers or electricians. People with craftsman experience who can help us solve the problems

that naturally arise with the plants during the first phase, "says Jesper Themsen. The first plants will generate 1 kW of power and 1 kW of heat and will be powered by natural gas.

"Subsequently, we will produce five micro CHP plants, which will also be put into operation among professional users. We are still in the early process of the technological launch and need to gather as much experience with these systems as possible," says Jesper Themsen.

The micro CHP plants are based on Topsoe PowerCores?. Dantherm Power will build the rest around them. It should be possible to add natural gas purified of sulphur and with the correct pressure. There must be supply of fresh air, a heat exchanger and a heat store. The necessary electronic control for the micro CHP plant to be connected to the grid will be incorporated. Last but not least, the micro CHP plants will have to gain security clearance.

Currently, micro CHP plants are the size of an overgrown American fridge. "It's not that we cannot make them smaller, but here to start with it should not be too compact, but easy for one to supervise and maintain the various parts of the plant," says Jesper Themsen.

Dantherm Power expects to have seven micro CHP plants in operation in early 2011, which will be in operation throughout the entire heating season and well into spring 2011.

In September 2011, Dantherm Power plans to produce 15 new micro CHP plants based on experiences from the first seven. "They'll be so reliable that we can install them in private homes in Southern Jutland," says Jesper Themsen and continues: "In 2012, we believe that SOFC micro CHP plants will be affordable and have the desired properties, allowing ordinary people to easily replace their old furnace with a SOFC micro CHP plant."

Jesper Themsen expects a major breakthrough to happen in 2013 - 2015 and that many Danish families in 2015 will be having a SOFC micro CHP plant, which will not take up more space than a dishwasher. Fuels will initially be natural gas, later it could be methanol and liquefied petroleum gas. In the long term, biofuels could also prove useful.

"We are having a long-term strategic cooperation with Topsoe Fuel Cell on SOFC micro CHP plants, and we are working mutually to make SOFC fuel cell power plants a commercial success," says Jesper Themsen.

In the long term, he imagines that fuel cell power plants will replace generators powered by diesel or gas. They are used as backup in countries where the grid is not as stable as in Denmark. Here they are in operation continuously for many hours with the purpose of using the fuel efficiently.

Dantherm Power's micro CHP plant will in its final shape in 2015 be the size of a dishwasher.

In the future energy system, today's large, central CHP plants will be supplemented with numerous quite small CHP plants of a few kW in each home. They will replace conventional oil or gas furnaces that only provide heat for the home. Micro CHP plants also produce all the necessary power for the home. They are being developed by the Danish company Dantherm Power. Dantherm Power expects to have seven micro CHP plants in operation in early 2011 which will stay in operation through the entire heating season and well into spring 2011.

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