

Fuel cells utilised to produce electricity from process industry by-product hydrogen

June 16 2014, by Olli Ernvall

VTT Technical Research Centre of Finland has developed a pilot-scale power plant based on fuel cells that utilises by-product hydrogen from the process industry. The power plant has been in operation at Kemira Chemicals Oy's site in Finland since January 2014. The system produces electricity from hydrogen generated as a by-product of a sodium chlorate process at a high electric efficiency and is the first of its kind in the Nordic Countries.

When scaled into commercial size, the equipment enables the reduction of [energy consumption](#) of the electrolysis process used for sodium chlorate production by 10–20%. The Kemira site's annual [electricity](#) consumption is approximately 578 GWh.

A few similar plants have been built elsewhere in the world, for example in the Netherlands and North America.

The electric power of the pilot plant is approximately 50 kW. The total electrical efficiency of the system, including the fuel utilisation ratio and the power losses due to auxiliary equipment and power electronics, is approximately 44%, while the [fuel cell](#) itself is operating at an electrical efficiency of 54%. The power plant is based on PEM fuel cells - the same technology that is considered most promising for the fuel cell vehicles.

At the moment, the low-temperature fuel cell at the Kemira Chemicals site operates at approximately 60 °C. In the future, utilization of the

waste heat produced by the system is expected to also improve. This is achieved through development of fuel cell materials, which enable higher operating temperatures.

One goal of the DuraDemo project, coordinated by VTT, has been to gather user experience of operating a fuel cell system in an actual end-user application in an industrial environment. The system performance has been recorded and analysed to confirm the assumed level of readiness of PEMFC from technological and commercial point of view and dealing with potential unresolved problems related to this in the by-product [hydrogen](#) application.

The project also provided important information on the reliability of the auxiliary systems and components, and the impact of using industrial-quality hydrogen in PEM fuel cells. The strict quality standards governing the utilisation of hydrogen as traffic fuel today are an important factor in the price formation of hydrogen. In the future, a re-evaluation of these standards may facilitate a major drop in the producer price of hydrogen.

The two-year DuraDemo research project, now nearing its end, has been part of Tekes' Fuel Cell technology programme. The project has been financed by the following corporate partners: Kemira Chemicals Oy, Cargotec Finland Oy, Wärtsilä Finland Oy, ABB Oy, Leppäkosken Sähkö Oy, Konecranes Plc, Woikoski Oy, MSc Electronics Oy, and the Federation of Finnish Technology Industries.

Provided by VTT Technical Research Centre of Finland

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