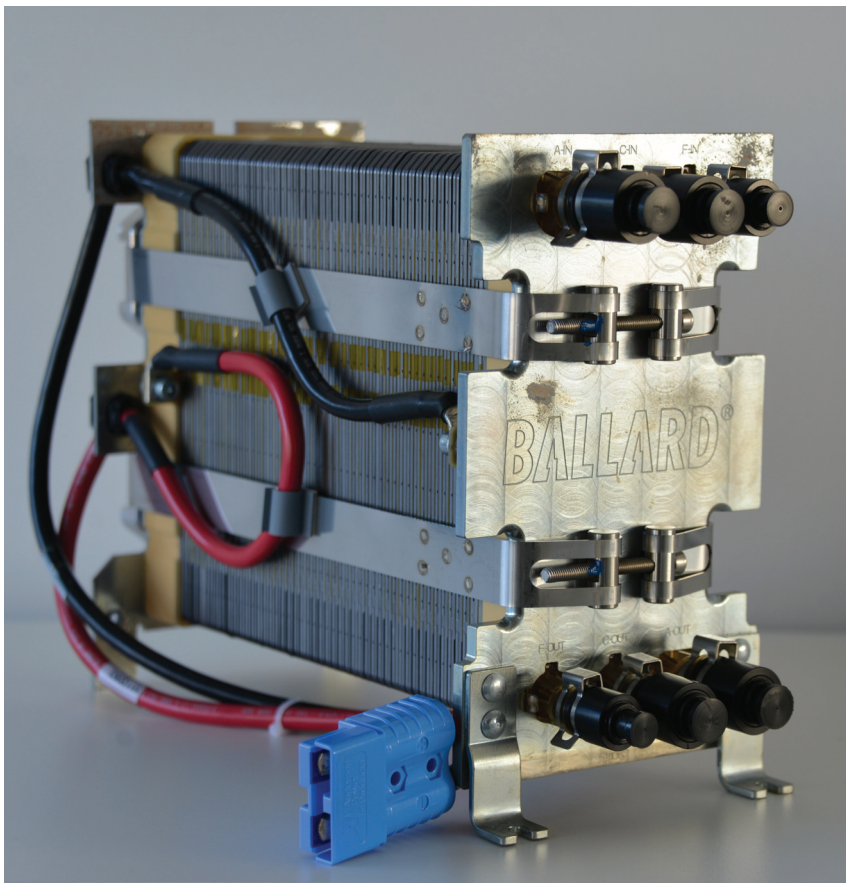


Being environmentally friendly and highly efficient energy conversion units, fuel cells harbour great potential to penetrate the markets in the near future. The Luxembourg-based planning and consulting company Siegel Schleimer Ingénieurs-conseils s.à.r.l is specialised in setting up and implementing this innovative technology. A first fuel cell based micro-combined heat and power (μ CHP) unit was successfully brought into operation in an existing school building in the commune of Sanem.



INTELLIGENT ENERGY USE THROUGH FUEL CELL TECHNOLOGY_

Michèle Weber



1_ Low-temperature polymer-electrolyte-membrane (PEM) fuel cell stack (1.0 kWel / 1.7 kWth).

In 2013, most households still receive heat and power separately and current technologies make inefficient use of fuel supply, with a large amount of primary energy released as “waste” heat into the environment. Combined heat and power (CHP), or cogeneration, systems are power stations for the generation of heat and power. Small-scale CHP units have recently been developed for installation in a small house or business unit. Instead of burning fuel directly in a gas boiler to generate heat, fuel cell based μ CHP units simultaneously generate heat and electricity by “cold burning” of hydrogen and oxygen. Thus, the production of energy on the spot, just where it is needed, becomes possible.

The development of fuel cell based heating systems could represent an improvement in energy efficiency along with considerable potential for energy saving. The technology is currently being tested in field trials worldwide.

Pioneers in fuel cell technology

Siegel Schleimer Ingénieurs-conseils s.à.r.l in Luxembourg is an independent planning and consulting company specialised in setting up innovative fuel cell based μ CHP units, besides offering other solutions in the areas of building services, energy efficiency and simulation technology. Christian Siegel, CEO and co-founder of the company explains its goal: “We aim to systematically plan and implement such systems with the target of no longer burning primary energy without producing electrical power.” The electrical engineer specialised in energy technology holds a diploma from the University of Karlsruhe and previously worked in research and development at the Centre for Fuel Cell Technology in Duisburg (Zentrum für BrennstoffzellenTechnik, ZBT) alongside his employment in the heating industry. Together with co-founder Markus Schleimer, a building technology engineer with expertise in planning and consulting, Mr Siegel works with national and international partners, builders and architects to deliver individualised solutions from project design through to final implementation.

Award-winning fuel cell based heating system

In late 2011, Siegel Schleimer Ingénieurs-conseils s.à.r.l successfully brought the first fuel cell based μ CHP unit into operation in Luxembourg, together with the town of Sanem. In this field trial, heat and power is efficiently supplied to a small school building in Ehlerange using a Gamma 1.0 system from German company Baxi Innotech GmbH. Mr Siegel explains how it works: “The fuel cell is fed with hydrogen that is extracted from a natural gas or biogas source, and oxygen from the air. A controlled chemical reaction generates electricity, heat and water.” With an excellent current-to-heat performance ratio of 1.0 kWel / 1.7 kWth, longer full load running times of around 5,000-6,000 hours per annum can easily be achieved.

The Gamma 1.0 system has a relatively short start-up time of around one hour. The amount of energy generated de-

depends on how much electricity is needed at the time. Depending on the demand, the system can be modulated in the range of 300 to 1,000 W of electrical power. An auxiliary gas boiler was additionally integrated to cover high heat demands during peak hours. According to Mr Siegel, the excellent modulation performance and short start times are the main benefits of fuel cell based μ CHP units, apart from its silent operation, an energy efficiency above 90% and greatest possible potential for CO₂ savings.

The main goal of the field trial is to evaluate the technology and ultimately make it accessible for citizens. Siegel Schleimer Ingénieurs-conseils s.à.r.l. delivered solutions from the very start of the project to its final realisation. This included a feasibility study, engineering, hydraulic implementation, supervision during technical installations with selected partners, start of operations and monitoring of significant parameters of the fuel cell based μ CHP unit.

"We are very pleased with the results so far," comments Mr Siegel. "The field trial has been running since October 2011 and we have had practically no downtime." The initial plan was to install the fuel cell based μ CHP unit for two years but the trial period may be extended. The success of this project is further underlined by a number of recent awards. In April 2012, the commune of Sanem received the European award "Climate Star 2012". The project also received the national "Prix spécial Nova Naturstrom 2012".

Research-oriented engineering company

Fuel cell technology is still very much a pioneering domain. According to Mr. Siegel, it will take quite a few years for μ CHP units to become commercially available and his company aims to be an active player in the maturation of this technology. "We are an engineering and research company," emphasises Mr Siegel. "We can provide support during the implementation of field tests and be a partner in R&D projects". The company is involved in the European research project "ene.field", which aims to deploy and monitor around 1,000 new installations of residential fuel cell CHPs across member states.

Moreover, the company uses numerical simulation calculation, multiphysical modelling and scientific argumentation



to help decide for or against a possible building service concept. Mr Siegel's research at the ZBT was in the area of computational fluid dynamics in fuel cells. This work was funded by a "Bourse Formation Recherche" grant from the National Research Fund. Mr Siegel has published his findings in a number of reputed scientific journals and is currently compiling his doctoral thesis for submission.

www.siegelschleimer.lu

2_ Fuel cell powered μ CHP unit installed in Ehlerange, town Sanem.