Promotion of Eco-building Technologies, small Polygeneration and Renewable Heating & Cooling Technologies for Buildings

ProEcoPolyNet
Best practice Sheet
European Virtual Fuel Cell Power Plant

TREN Project Identification

TREN Project Name:
European Virtual Fuel Cell Power Plant

TREN Contract No.: NNE5-2000-208

Programme: 5th Framework Programme Non Nuclear Energies

Description of technology

A Fuel Cell Heating Appliance is build up from a fuel cell generator device with an additional peak boiler, hot water storage and total energy management module. The system generates electrical power and heat (microCHP). An Energy Manager matches the heat production of the system to the heat demand of the object, communicates with the fuel cell, peak boiler and hydraulics. The energy manager also functions as the primary communication interface between the FCHA and the “outside world”.

Project Description

The aim of “The Virtual Fuel Cell Power Plant” (NNE5-2000-208) was to develop, to install, to test and to demonstrate a virtual power plant consisting of 31 decentralized stand-alone residential fuel cell systems. The project was funded by the 5th Framework Programme of the European Commission.

The grid connected residential microCHPs produce both, electricity and heat for the individual use as well as electrical energy for the grid (4.6 kWel, 9 kWth). The field test should deliver important experiences of the installation and operation of the prototypes and to identify major hurdles on the way of commercialisation of microCHP Fuel Cells.

Technical characteristics of installation

- ► *Low temperature PEM microCHP Fuel Cells*
- ► *Electrical output capacity (kW): max. 4.6*
- ► *Thermal output capacity (kW): max. 9*
- ► *Electrical efficiency (%): up to 30*
- ► *Thermal efficiency (%): up to 60*
- ► *Total efficiency (%): up to 90*
- ► *Power to heat ratio: 0,5*

Location and use

- ► *Multi-family homes*
- ► *Small business*

Capital investment and partners

► *Capital investment*

Total project budget (€): 8.4 Million
EU contribution (€): 3 Million

► *Project partners*

1. Vaillant (DE) (project co-ordinator)
2. Plug Power Holland (NL)
3. Cogen Europe (BE)
4. Instituto Superior Téchnico (PT)
5. TEE University of Duisburg-Essen (DE)
6. DLR (DE)
7. Sistemas de Calor S.L. (ES)
8. Gasunie Research (NL)
9. E.ON Ruhrgas AG (DE)
10. E.ON Energie AG (DE)

State of Development/Market implementation

- ► *Prototype*
- ► *Field tested*

Operational data

- ► *Total hours of operation (h): 138.125*
- ► *Total electricity output (kWe): 400.000*

► *Heat output (kW): about 800.000*

Field Test Experiences

The project was completed within the foreseen timeframe and has fulfilled the expectations of the consortium. All 31 field test systems were successfully installed and operated; no system has to be shut down during the project. The consortium has successfully demonstrated the operation of decentralized microCHP fuel cells as a Virtual Power Plant as well of fuel efficiencies of up to 90% and electrical efficiencies of greater than 30%. Within accumulated 138.000 running hours the low temperature (LT) PEM microCHP systems have produced nearly 400.000 kWh of electricity. About 50.000.000 measurement data were collected, checked and analyzed.

With regard to maximum efficiency and modulation range the field test has shown the principle suitability of fuel cell heating appliances in domestic applications. With regards to system integration and reliability/durability the field test results led to improvements which were already performed during the field test or in the requirements for further developments.

Outlook

The project identified three major hurdles to be overcome in the development of a product for the residential mass market:

► The costs must be reduced significantly to increase the technology's economic viability

► The system must be simplified to improve reliability

► The temperature of the heat output must be increased to become compatible with existing heating systems, and to give opportunities for tri-generation.

Within the operation as a Virtual Fuel Cell Power Plant the capability to follow defined load profiles without relevant time delay has been successfully demonstrated. Based on the experiences gained out of EUVPP Vaillant and its partners are now working on a High-Temperature PEM Fuel Cell system in order to overcome above mentioned hurdles.

Contact and further information

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