Project update

Energy storage to optimize domestic CHP

Project details

Project title	Innovative Heat Storage Management for Micro-CHP Units
Participant	Technische Universität München, Germany
Start date	2007

Key aims

- Quantify the benefits of thermal storage in a heating system based on micro-CHP
- Use of micro-CHP units to overcome impacts on the grid from decentralized electricity generation
- Match electricity generation from CHP units to demand curves on power networks
- Reduce peak loads on natural gas grids.

Project summary

Innovations in energy storage that could revolutionize the role of Combined Heat and Power (CHP) plant in homes are being investigated with funding from E.ON's International Research Initiative.

Experts are establishing how a new generation of smaller gas-fired CHP units might be used by thousands of customers to meet their own needs and smooth the peak demands on natural gas and electricity networks.

This project is being run by Professor Ulrich Wagner at the Institute for Energy Economy and Application Technology at the Technische Universität, Munich.

The aim is to develop an energy storage and management system that turns CHP into a multi-functional heating system and expands its operating period to almost 24 hours a day.

The units would:

- Continue their role of efficient production of hot water and electricity for homes.
- Adapt electricity and heat production to match the demand curve on electricity supply networks. This would enable CHP units to meet more of customer's electricity needs and produce heat for longer periods.

Surplus heat available at times of low household demand would go into thermal storage for use during peak periods.

Progress report – 1

The first project activity involved preparation for the main research phase which utilises the university's in-house experimental test rig. This is followed by the experimental phase which will test the system under different weather scenarios.

These activities focused on three groups of objectives:

- Defining a multi-functional heating system (MHS) featuring a micro-CHP unit, and creating test profiles based on load requirements of different types of residential houses and weather conditions
- Adaptations to equipment on the test rig, modifications to control and monitoring software and provision of measuring equipment
- Close-to-reality experiments of standard operation of different micro-CHP units.

In specifying this MHS, a central aim was to provide thermal storage through a heat buffer arrangement.

The energy demands of residential buildings were calculated using typical family homes and multi-occupancy properties, some of which have been renovated in line with environmental performance standards.

The requirements of these properties were simulated using outdoor temperatures during five different types of weather conditions ranging from cloudy winter days to bright summer days.

Measuring instruments were adapted and calibrated for temperature, flow rates, consumption of natural gas and electricity and generation of electricity.

Changes made to the test rig included pipe work re-routing to allow a choice of configurations for the CHP unit, thermal storage and peak load boiler. Adjustments were made to simulators representing the buildings space heating and tap water usage.

Realistic experiments showed current operation of micro-CHP units under different load requirements and indicated the potential for optimization and heat storage management.

Subsequently, more advanced control of micro-CHP units will be developed, which will allow peak demands to be smoothed by uncoupling gas, electricity and heat with help of the heat buffers.

All results obtained so far were tested and verified in the rig's control room, where process measurement and performance data are recorded via a PC.

The next activity comprises optimized CHP operation using a heat buffer and the potential use of heat storage management for different CHP technologies.

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