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

ProEcoPolyNet Fact Sheet "SOCOOL"

RTD Project Identification

RTD Project Name: Solid Sorption System for Cooling in Tri-generation (SOCOOL)

RTD Contract No.: ENK5-CT-2002-00632

Programme: FP 5

Description of the project and the technology

The project is focused on the development of a small-scale combined cold, heat and power (tri-generation) system, which utilises the engine waste heat for cold production. Development of this tri-generation system will lead to improved exploitation and more effective use of CHP systems.

The general objective of the project is to reduce primary energy usage and to avoid CFC/HCFC/HFC usage for cooling purposes. This contributes to the achievement of the Kyoto targets and to the development of more sustainable energy systems and services, to the diversity of energy supply, and will reduce the environmental impact for cooling, heating and power generation.

The major issue is the development of a small solid sorption system with high power density, by applying new working pairs as well as innovative system designs to achieve high rates of heat and mass transfer.

The cooling system, which has been developed, built and tested at project partner ECN, comes up to expectation, generating 5-6 kW of cooling from 8 kW of heat. Following durability tests at ECN it was moved to the Centro Ricerche Fiat (CRF) in Italy. The technology is now being demonstrated in their Eco-Canteen system: residual heat from a new micro CHP unit (a gas engine) is used to generate cooling for the company canteen.

Operating principle

Tri-generation systems for production of heat, electricity and cooling by utilisation of the waste heat of a CHP system for the production of cold by means of solid sorption cooling technology

The solid sorption system consists of two reactor vessels containing heat exchangers filled with silica gel. An evaporator and condenser are needed beside these two reactors. Heat losses from the exchanger to the environment are minimised by applying vacuum inside the vessel. The heat exchanger is connected with a heat transfer fluid (H_2O) that can be switched rapidly between two different supply temperatures. One sub-system is driven by the exhaust heat recovered from the CHP system and another is driven by the cooling jacket water.

Technical characteristics of installation in the Eco-canteen (CRF)

► *Type:* Tri-generation systems, solid sorption system with two reactor vessels, heat exchangers filled with silica gel

► *Electrical output capacity CHP unit (kW): 20*

► *Thermal output capacity CHP unit (kW): 44*

► *Thermal Output capacity (for air conditioning, hot water) from solid sorption machines (kW): 2 x 16*

► *Cooling Output from solid sorption machines (kW): 2 x 12*

► *Temperature ratio exhaust gas heat exchanger/1st solid sorption machine (°C):*

210/190

► *Temperature ratio CHP unit/2nd solid sorption machine (°C): 95/85*

Location and use

► *Commercial Buildings: e.g. super markets*

► *Public Buildings: e.g. health centres, old people's homes*

► *Others: e.g. canteens*

State of Development/Market implementation

► *Prototype: construction and testing (until end of 2006)*

► Market launch of a commercial system based on this technology is expected to take place in two to four years

Benefits and obstacles

The general benefit of the project is to reduce primary energy usage and to avoid CFC/HCFC/HFC usage for cooling purposes.

An increase in the overall energy efficiency of tri-generation systems of 15-20% will be realised by utilisation of the waste heat of a CHP system for the production of cold by means of solid sorption cooling technology. In addition peak electricity demands for cooling purposes will be reduced.

The new cooling machine developed within this project will be low in cost (cheap to manufacture), will have a high efficiency, and must operate with a high reliability. Important objectives for further development are to produce a more compact system with an even higher volume-to-power ratio and to reduce the cost. This will involve improving the heat and mass transfer in the silica gel and using standard components as far as possible.

SOCOOL Trigeneration system under construction

Photos / function diagram

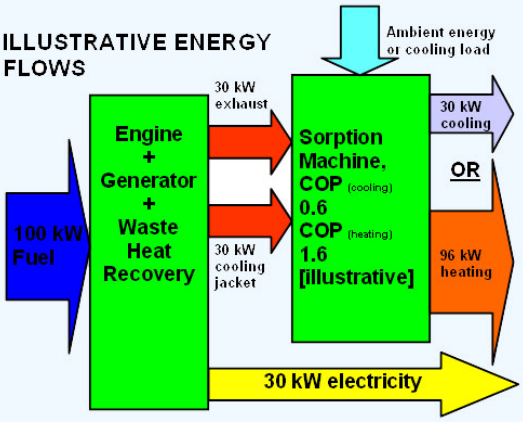


Fig.1 Illustrative energy flow in trigeneration

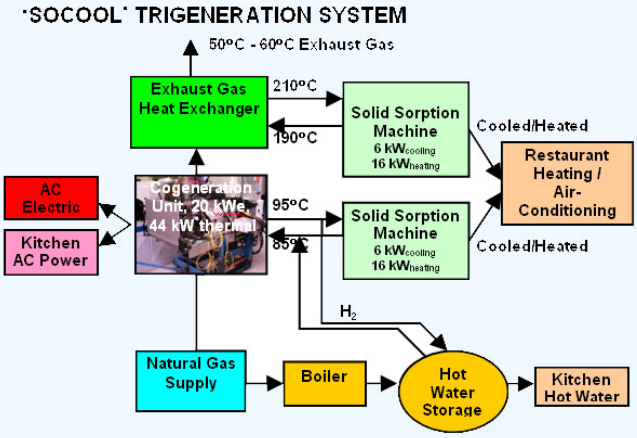
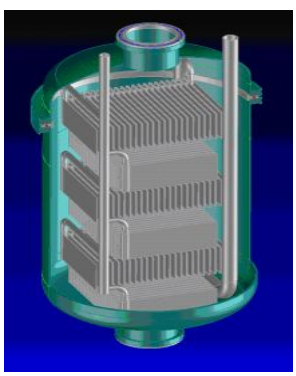


Fig.2 Schematic diagram of "SOCOOL" system



one of the two reactor vessels, filled with heat exchangers

Contact and further information

Name and contact details

Coordinator:
CENTRO RICERCHE FIAT S.C.P.A.
Dr. Carloandrea Malvicino
50, Strada Torino 50
10043 Orbassano, Italy
Tel. +39 01 19083260
Carloandrea.malvicino@crf.it

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ProEcoPolyNet is a **Net**work for the **Pro**motion of RTD results in the field of **Eco**-building technologies, small **Poly**generation and renewable heating and cooling technologies for buildings.
The Consortium consists of the following partners.

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