MONITORING RESULTS OF A SMALL SCALE CHCP SYSTEM

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Synopsis

A small scale trigeneration system for combined heat, cold and power production was developed and installed at the *Laboratório Nacional de Energia e Geologia, I.P.* campus in Lisbon, Portugal. This system is one of the twelve experimental trigeneration systems being developed and tested across Europe within the PolySMART project.

The CHCP system main constituents are a purpose made CHP prototype with an estimated 27kW maximum heat capacity and 9,6kW maximum electrical capacity and a TDC prototype with 8kW cooling power.

The hydraulic scheme is presented and briefly analyzed. The data obtained during the monitoring of the system during heat and cold seasons is presented and analyzed for the global system. Main components behavior is analyzed with regard of their real performance when installed on a CHCP system.

1 Introduction

PolySMART is an European Union partly funded project which gathers 32 partners from universities and research institutes to CHP and TDC manufacturers and end-users from different European countries. PolySMART main aim is the development of a set of technical solutions for the market of small tri-generation systems [1]. This project studies two basic types of small CHCP systems: centralized heat and power production and distribution with decentralized cold production and decentralized heat, power and cold production.

One of the demonstration plants was erected and monitored at the *Laboratório Nacional de Energia e Geologia, I.P.* (LNEG) campus in Lisboa, Portugal. This installation consists of a decentralized combined heat and power production system coupled with small capacity absorption chiller. This system has been assembled and is being monitored since January 2010.

2 System description

The main goal of the system installed at the LNEG campus is to heat and cool a 95 m^2 lecture room and an 80 m^2 office room. The electricity produced will supply part of the building load. As a secondary goal part of heat produced by the CHP will supply part of the DHW demand of the building.

The system can be seen on figure 1. It is possible to split the system on two main circuits, the driving circuit and the delivery circuit. The driving circuit main component is a biodiesel fuelled combined heat and power generation unit prototype. This unit is connected to a thermal driven chiller, a 500l heat storage, a 300l DHW tank, an emergency heat rejection unit and to a plate heat exchanger that bridges the driving circuit and the delivery circuit. The delivery circuit is composed by a thermal driven chiller, a 500l deposit to store heat or

cold the heat and cold distribution equipments and the plate heat exchanger.

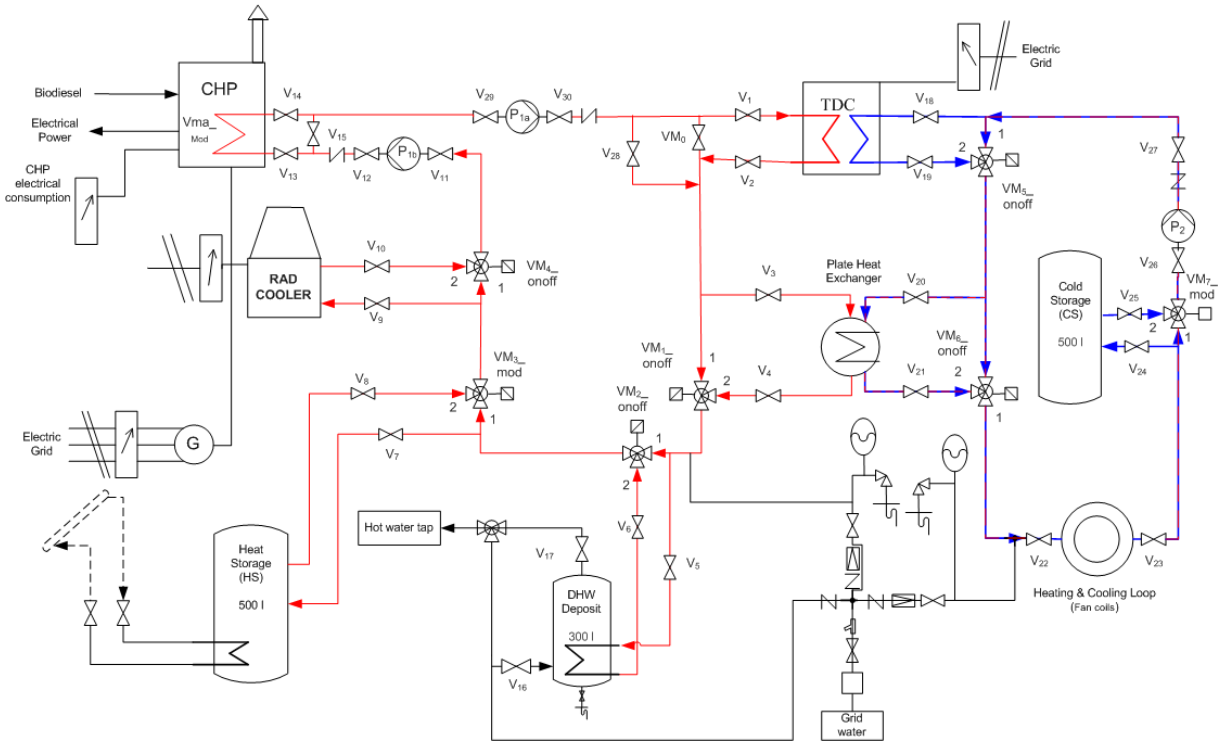

Figure 1 – Hydraulic scheme of the CHCP system

The CHP prototype is composed by a Deutz engine F2M2011 coupled with an Atlas Copco generator QAX12, with an estimated maximum thermal capacity of 27kW$_{th}$ and a maximum electrical capacity of 9,6kW$_e$. The TDC is an 8kW ammonia-water absorption chiller prototype developed by Ao Sol.

3 Experimental results

The system monitoring activities started with the commissioning process and proceeded during the heating and cooling seasons. Measurments of water flow temperatures, volume flows, electricity consumption and production, biodiesel consumption and indoor and outdoor temperature and humidity are obtained by a data acquisition system. Starting from these measurements the plant overall energy balance and performance is achieved. Energy balances and performance evaluations are also made for individual components like the TDC and the CHP.

4 References

[1] "*POLYSMART - POLYgeneration with advanced Small and Medium scale thermally driven Air-conditioning and Refrigeration Technology*", Integrated Project, FP6-2004-TREN-3. Contract No. 019988.