Trnsys simulation results of an existing monitored small scale CHCP system and mathematical model adaptations of the air-cooled ammonia chiller and CHP prototypes

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Synopsis

This work is a TRNSYS simulation of solar thermal system working together with an existing small sized CHCP (Combinet Heat Cooling and Power) demonstration project, included in the workpackage 5 (simulation) of the PolySMART project. The first objective of this work is to fine tune simulation parameters of the simulation Units (or Types), based on monitoring data collected during the first semester of 2010. The second objective is to further develop the mathematical models of type 107 (Hot Water-Fired Single-Effect Absorption Chiller) and type 120 (HYDROGEMS: Diesel Engine Generator System (DEGS) - Version 1.1). This will tackle the remaining differences between the real and simulated systems. These differences are due to the fact that both the CHP and the Ammonia-Water Air Cooled Chiller are prototypes. The third objective is to simulate the performance of different thermal collectors, some of which are also prototypes, and choose a proper solution for future experiments. The forth objective is to compare local weather data sets, collected on site since 2007, with proven standard data sets. Further work may be developed regarding the fan coils used to carry in/out heat.

3 System description

The CHCP is running in Lisbon (Portugal) with an Atlas Copco QAX 12 biodiesel electric generator providing 9.6 kW of electricity and a purpose made heat waste recovery system an estimate 27 kW. There is an 8 kW prototype air cooled ammonia-water absorption chiller connected to two water rings: a driving circuit with high temperatures, ranging from 60ºC to 110ºC, and a delivery circuit for heating and cooling purposes. The hot water buffer tank has a coiled heat exchanger for a future solar installation.

4 Simulation Project

The simulation project is organized in five different macros: Weather and Phenomenon, Heating and Cooling needs, CHP performance, Absorption Chiller performance and Solar System Performance.

The Weather and Phenomenon macro will undertake monitoring data collected since 2007 from another ongoing monitoring project in Solar XXI building[1]. The Heating and Cooling macro sustains nearly 4000 kWh for heating demand and 4500 kWh for cooling demand and were obtained from the adaptation of previously developed work[2], which includes the full characterization of the heated/cooled rooms. This was the basis for dimensioning the constructed demonstration project. The CHP prototype performance is initially obtained using type 120 and latter by an adaptation of its mathematical model, using work developed by PolySMART partners[3]. The Absorption chiller performance was obtained from unpublished experimental

correlation work, compared and adapted to the LNEG (formally INETI) test site. The type 107 mathematical model is being reviewed in order to better address the air temperature effects on air cooled chiller. The Solar System Performance macro has two separate configurations: one supporting the existing CHP and the other with a standard boiler. The first configuration uses the monitoring data from the existing CHCP demonstration project and the other is a standard solar cooling system dimensioning. This will include a study between standard certified medium temperature solar collectors and two prototypes (not confirmed), one a 2D with one axis solar tracking and the other a CPC with a functional prototype.

3 Refrences

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