EFG 2009 – SESSION 2

SOLAR COOLING SYSTEMS AND NATURAL GAS: EXPERIENCES AND RESULTS

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ABSTRACT

In 2006 the Gas Natural Group started the project "*Solar Cooling by Absorption in the Tertiary Sector*", with a deadline in March 2009. This project is economically supported by "Corporación Tecnológica de Andalucía" and "Junta de Andalucía".

Nowadays, the electrical system in Spain and more specifically in Andalusia is characterised by a sustained increase of energy demand and consumption, where electrical energy demand for air conditioning is a key piece; In addition, electricity production system is extremely centralised, where large plants are located far from users.

This situation offers several opportunities to the refrigeration market, such are:
- The increasing demand of electrical energy for refrigeration and mains saturation opens the market to refrigeration systems driven by renewable power sources or natural gas.
- Developing technologies to take advantage from solar thermal energy when production is higher (summer months).
- Agreements and commitments resulting from Kyoto Protocol by which signatory countries are committed to reduce the greenhouse gas emissions, in an 8% with respect to the levels of 1990 between years 2008 and 2010.

AIMS

General objectives of the project are:
- Building a solar cooling demonstration plant based on a LiBr/H_2O double stage absorption chiller and supported by natural gas.
- Promoting solar cooling systems by developing a software application to calculate and design these installations.
- Extending the Spanish program for energetic building qualification in order to include solar refrigeration equipment.

METHODS

The Engineering School of the University of Seville has been identified as an ideal location for this demonstration plant, because of its high energy demand and the extensive sun exposure in Seville, which makes this city ideal for all solar energy applications.

During 2007 and 2008, Gas Natural Group has successfully installed the solar cooling plant based on a double-stage absorption machine and powered by a linear Fresnel collector.

There are several advantages on the Fresnel collector opposite to parabolic trough, such are: low wind and load charges, low visual impact, minor cost, static absorber tube (no need to use mobile joints), possibility to defocus partially and the ease to construct and install. The heat transfer fluid (HTF) is superheated water which is pumped from the collector to the chilling machine. This is a double stage absorption chiller based on the LiBr/Water cycle that includes a natural gas burner which supplies the power needed to drive the system when solar energy is not enough.

According to the second general objective, the University of Seville has developed a friendly software application called SICAR to design and simulate solar cooling installations that is being tested trough the results of the real demonstration plant.

SUMMARY/CONCLUSIONS

After some months operating the system, the main conclusion is that, although it works properly and is ready to be used as a complement of a conventional compression chiller, a thermal storage system is highly needed in order to improve the use of renewable resource and the global efficiency of the plant and to reduce system looses. Nowadays a new study is being carried out to install a storage system at 180 °C based on phase change materials.