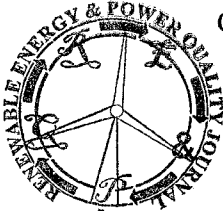


European Association for the
Development of Renewable Energies,
Environment and Power Quality (EA4EPQ)

International Conference on Renewable Energies and Power Quality
(ICREPQ'11)
Las Palmas de Gran Canaria (Spain), 13th to 15th April, 2011

Design of a trigeneration system for a hospital complex in Gran Canaria



C. M. González-Navarro, A.M. Blanco-Marigorta, and J. A. Peña-Quintana.

Department of Process Engineering
University of Las Palmas de Gran Canaria
Edificio de Ingenierías-Tafira Baja, 35017 Las Palmas de Gran Canaria (Spain)
Tel: +34 928 451934 Fax: +34 928 458975
e-mail: meritxell.gn@gmail.com, ablanco@dip.ulpgc.es, jpena@dip.ulpgc.es



Abstract. This article presents the design of a trigeneration system for a hospital complex in the city of Las Palmas de Gran Canaria (Canary Islands, Spain). The absorption refrigeration machine uses water as cooling fluid and lithium bromide as absorber. The energetic analysis shows high values of thermal performance and of electrical equivalent performance. The percentage of primary energy saving is about 23 %. The economic justification is realized taking into account the cost of the initial investment, the operating costs and the income forecast, turning out to be a profitable investment.

Key words

Trigeneration, cogeneration, heating, cooling, natural gas, H₂O/BrLi.

1. Introduction

During the last decade, the cogeneration or production of electric and/or mechanical power and of heat energy for industrial processes has been one of the best alternatives to diminish the consumption of primary energy.

In general, thermodynamic analysis of cogeneration systems shows that the self production of electricity with local utilization of the thermodynamic cycle heat yields good energetic and environmental advantages [1]. The economic profitability of cogeneration systems depends on various and complex factors that are in continuous evolution, such as the market, tariffs, legislation framework and available technology.

Trigeneration combines the production of electricity, heat and cooling and it is usually referred to as CHCP (combined heating, cooling and power generation). Trigeneration plants can reach system efficiencies that exceed 90%. In addition to the economic benefits and advantages, trigeneration plants reduce our dependence

on foreign energy supplies and help our environment by dramatically reducing greenhouse gas emissions such as carbon dioxide - when compared to typical power plants.

This paper presents the results of a preliminary study justifying the replacement of the present energy, heat and cold producer system of the hospital complex of Las Palmas de Gran Canaria into a single trigeneration system [2]. Natural gas would be the primary energy source of the proposed system. The system will serve the heating, cooling and electrical needs of the 3 buildings of the hospital complex.

2. Planning and design aspects

A. Design requirements

The hospital complex of Las Palmas de Gran Canaria consists of the following buildings:

- Maternity and children's university hospital.
- Insular university hospital.
- Industrial building.

First and second buildings are used for typical activities of taking care of the patients (about 1200 beds) whereas industrial building has most of its offices and the required equipment for the production of energy, heat and cold.

The energetic demand of the Hospital complex is characterized by its high value, from both electrical and thermal point of view. Electrical annual demand ascends approximately to 22.79 GWh. The thermal system itself will have to satisfy following needs of the complex:

- Refrigeration.
- Heating.
- Domestic hotwater.