

Polygeneration plants to supply energy and desalted water in hotels located at the Spanish coast

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Received 30 September 2008; accepted in revised form 27 May 2009

ABSTRACT

The Mediterranean area is a very suitable location for tourism, and every year the arrivals to the Mediterranean are continuously augmenting. This fact represents an economic growth but it is associated with the consumption of natural resources to provide energy and water demands, especially in summer due to the high occupancy rate in tourism destinations. Power consumption derived from the massive use of air conditioning systems is sometimes causing problems in grids. Moreover, fresh water supply is more and more difficult to assure in the Mediterranean area, and desalination is becoming the alternative to surface and ground waters. Therefore, there is a clear need to confront the above-mentioned problems. Polygeneration systems can be a means to provide the energy and water with more advantages than individual conventional systems. Their main benefit is the primary energy saving (PES) obtained because of their higher overall efficiencies, which could be even increased with integrated renewable systems and their associated reduction of greenhouse gases (GHG) emissions. Furthermore, dependency and losses of power and water grids are considerably reduced, contributing to the “distributed generation concept” usually only pursued to electricity issues but followed by the UE. In this paper an in-depth optimization sequence of the design of a polygeneration plant has been carried out. It provides simultaneously power, heat, cold and desalted water to a hotel located in the Spanish Mediterranean coast. The main aspects investigated here are: hotel location, desalination process, operation mode (following heat/power demand, or full load operation), and legal issues as the possibility of selling water and power surpluses. According to polygeneration scheme constraints, only two types of desalination plants were considered: LT-MED and RO units. The results show that the first two above mentioned points mainly affect the plant design and definite configuration (that is, which the technologies and capacities which are more convenient for the selected hotel); and the last two points (operation mode and legislation) only have strong influence on the plant feasibility once polygeneration plant was designed. Recent optimization techniques have been used to conclude those results, which could be exported to similar multiple-demand installations.

Keywords: MINLP optimization; Polygeneration; Integration; Energy saving; Tourism

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Presented at EuroMed 2008, Desalination for Clean Water and Energy Cooperation among Mediterranean Countries of Europe and the MENA Region, 9–13 November 2008, King Hussein Bin Talal Convention Center, Dead Sea, Jordan.