Design of a trigeneration system using a high temperature fuel cell

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Abstract

Fuel cells are one of the technologies available for CHCP, combined heat, cooling and power production, systems. They offer several advantages over more conventional systems, but they still need to overcome a number of barriers until they are readily available for commercialization. At this stage, it is important to fund demonstration projects that experiment with fuel cell technology in pre-commercial situations. In this context, a CHCP system, using a high temperature fuel cell (SOFC) and an absorption chiller, was designed in order to meet the energetic demands of a hospital for electricity, cooling, heating and hot water. The hospital load profile was determined taking into consideration the hourly energy consumption for four different typical days in the year. The CHCP system was designed so that the fuel cell meets the electrical demand of the hospital and, since the SOFC did not produce enough thermal energy, a boiler was considered. The artificial thermal efficiency of the CHCP system is 68%. The investment analysis is presented and it is concluded that, at the present and at three other scenarios, the system is not financially feasible. Despite this conclusion, it is important to invest on demonstration projects to help fuel cells reaching commercialization.

Keywords: trigeneration, absorption chillers, fuel cells, SOFC, design.