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Design and Integration of a Renewable Energy Based Polygeneration System with Desalination for an Industrial Plant

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Abstract : Polygeneration improves energy efficiency and reduce both energy consumption and pollutant emissions compared to conventional generation technologies. A polygeneration system is a variation of a cogeneration one, in which more than two outputs, i.e., heat, power, cooling, water, energy or fuels, are accounted for. In particular, polygeneration systems integrating solar energy and water desalination represent promising technologies for energy production and water supply. They are therefore interesting options for coastal regions with a high solar potential, such as those located in southern Peru and northern Chile. Notice that most of the Peruvian and Chilean mining industry operations intensive in electricity and water consumption are located in these particular regions. Accordingly, this work focus on the design and integration of a polygeneration system producing industrial heating, cooling, electrical power and water for an industrial plant. The design procedure followed in this work involves integer linear programming modeling (MILP), operational planning and dynamic operating conditions. The technical and economic feasibility of integrating renewable energy technologies (photovoltaic and solar thermal, PV+CPS), thermal energy store, power and thermal exchange, absorption chillers, cogeneration heat engines and desalination technologies is particularly assessed. The polygeneration system integration carried out seek to minimize the system total annual cost subject to CO2 emissions restrictions. Particular economic aspects accounted for include investment, maintenance and operating costs.

Keywords : desalination, design and integration, polygeneration systems, renewable energy
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