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SCIENTIFIC & RESEARCH PROJECTS

Project No.: 05 **Year:** 2016

Project Field: Combined Heat & Power / Co - Generation

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Project Title:

Design of a Hybrid Power Plant Integrated With a Residential Area

Abstract:

Power generation with high efficiency and low CO2 emission is a crucial issue for power production industry. In this research, a retrofit design for a power plant was proposed to use of solar irradiation before combustion section of gas turbine cycle. To do so, a solar tower with heliostat field was employed for compressed air preheating. A steady-state modeling of all parts of the proposed hybrid power plant was performed. Then, a coupled method of Particle Swarm Optimization and Genetic Algorithm was applied for a multi-objective optimization on the power plant performance. Based on the results, with % 62 solar share factor, fuel efficiency was increased to %85 and about 400 kg reductions in CO2 emissions were occurred. Finally, for heat recovery of exhaust gases of solar gas turbine, a CCHP system was designed to supply cooling, heating and power for more than 15,000 households in a residential area near the studied power plant. Therefore, along with effective utilization of thermal content of turbine discharging gases and according to local energy consumption pattern, 4000 MWhe per year of electricity was obtained. Moreover, 31 million cubic meters saving in natural gas consumption were approximately achieved as a result of solar-heat integration.