Thermo-Economic Optimization of Solar CCHP Using both Genetic and Particle Swarm Algorithms

Sepehr Sanaye　　　　　　**Hassan Hajabdollahi**[*]

Energy Systems Improvement Laboratory (ESIL)
School of Mechanical Engineering
Iran University of Science and Technology (IUST)

Abstract

A combined cooling, heating and power generation (CCHP) system is modeled and optimized. The heat demand in this plant can provide by prime mover, backup boiler and solar panels. Both the Genetic Algorithm and Particle Swarm Optimization are used to find the maximum of actual annual benefit (AAB) as an objective function. The design parameters or decision variables are capacity of prime mover, their number as well as their partial load, backup boiler and storage tank heating capacity, the number of solar panels, types of electrical and absorption chiller as well as the electric cooling ratio. Both Genetic and Particle Swarm Optimization Algorithms are converged with maximum 0.6 percent difference. As a result, a diesel engine with nominal power of 350 kW combined with 255 solar panels is selected in the optimum situation. In addition, the optimization results show that the advantage of absorption chiller than the electrical chiller due to the extra availability of heat by the prime mover at the warm season in residential area. Finally, the effect of electric cooling ratio, number of solar panels and solar panels investment cost on objective function are investigated and results are reported.

Keywords: Combined cooling heating and power; Actual annual benefit; Solar panels, Particle Swarm Optimization; Genetic Algorithm

---

* Corresponding author: Hassan Hajabdollahi, Energy Systems Improvement Laboratory, Mechanical Engineering Department, Iran University of Science and Technology, Narmak, Tehran, Iran, 16844,
Tel-Fax: +98-21-77240192
E-mail address: Hajabdollahi@iust.ac.ir