

Comparison of different scenarios in optimal design of a CCHP plant

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Abstract

Optimal design of a combined cooling, heating and power (CCHP) generation system is presented in this paper. The goal of this study is comparison of different outcomes which might be obtained during CCHP equipment selection due to following different scenarios: 1) when selecting the type of prime mover (PM, such as gas turbine or gas engine or diesel engine), what differences could be obtained when the selected nominal power of all PMs are similar (SNP) or they be selected non-similar (NSNP)? 2) what differences could be reached when selling electricity to the grid is feasible (SELL mode) or not (NO SELL mode)? 3) what differences are going to occur when PMs could run at variable partial load during a year (VPL) or constant partial load during a year (CPL)? Particle Swarm Optimization (PSO) method was applied to select the CCHP equipment by maximizing the Relative Annual Benefit (RAB) as the objective function. Optimization results for our case study showed that NSNP-NO SELL-VPL scenario showed 15.41%, 10.80% and 5.23% growth in optimum value of RAB in comparison with that for SNP-NO SELL-VPL scenario for gas engine, diesel engine and gas turbine respectively. Furthermore for our case study, NSNP-NO SELL-VPL scenario showed advantage over NSNP-NO SELL-CPL case, with 26.80%, 27.72% and 13.60% higher RAB values when gas engine, diesel engine and gas turbine were selected. Finally differences were 12.37%, 23.76% and 11.09% when SNP-NO SELL-VPL and SNP-NO SELL-CPL scenario were compared.

Keywords: Combined cooling heating and power generation, Relative annual benefit, NSNP and SNP, VPL and CPL, SELL and NO SELL

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