

## **Exergoeconomic Analysis and Optimization of Internal Combustion Engine Cogeneration System Using Genetic Algorithm**

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### **ABSTRACT**

Exergoeconomic analysis and optimization technique combines second law analysis with economics for cost effective thermal system design. The main concept of exergoeconomic is the exergetic cost and it deals with cost accounting methods.

Internal combustion engines are mostly employed in low and medium power cogeneration units. In this work, an ICE cogeneration system that produces 251 KW of electricity and increases the temperature of water from 80 °C to 120 °C at 2 bar and 1.75 kg/s, is optimized using exergoeconomic principles and genetic algorithm. Evolutionary algorithms are capable of handling problems with non-linear constraints, multiple objectives and dynamic components properties that frequently appear in real world problems.

Objective function represented the total cost of the plant in terms of dollar per second and defined as the sum of the operating cost related to the fuel consumption and the capital investment for equipment purchase and maintenance costs and also the cost of exergy destruction and losses related to equipments and the entire system. Results show that by applying genetic algorithm, 15.1% improvement in objective function is achieved which is very noticeable in thermal systems optimization. Also the effect of change in objective function with change in unit cost of fuel is studied.

**Key words:** Exergy, Exergoeconomics, Optimization, Genetic Algorithm, CHP

### **1 INTRODUCTION**

Developing techniques for designing efficient and cost-effective energy systems is one of the foremost challenges that energy engineers face. In a world with finite natural resources and increasing energy demand by developing countries, it becomes increasingly important to understand the mechanisms which degrade energy and resources and to develop systematic approaches for improving the design of energy systems and reducing the impact on the environment (Ahmadi and Dincer., 2010).

Cogeneration or CHP (combined heat and power) may be defined as a thermal system that produces electrical and heat energy simultaneously from a single source of fuel. For industrial and domestic applications where both kinds of energy are demanded, this turns out to be a very effective energy saving