

COGENERATION (CHP) IN BUILDINGS: CASE STUDY

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1. Introduction

Combined Heat and Power (CHP) systems simultaneously generate electricity and useful heat, maximizing fuel utilisation efficiency [1]. They are highly suitable for buildings with substantial thermal and electrical loads, such as hospitals, hotels, and large office complexes [2]. Studies indicate that CHP can reduce grid electricity demand by 30–50% and decrease CO₂ emissions by up to 35% [3,4]. Although CHP systems offer significant benefits, they require careful operational planning, high initial investment, and regular maintenance [1].

2. Scopus

This case study aims to examine a CHP system installed in a 10,000 m² office building and evaluate its energy performance, economic benefits, and environmental impact (Fig.1).

3. Methodology

Real operational data were analysed, including fuel consumption, electricity and heat production, and thermal loads [4]. A 1 MW gas engine CHP system was designed and assessed using thermodynamic modelling, cost analysis, and evaluation under varying load profiles [1,2].

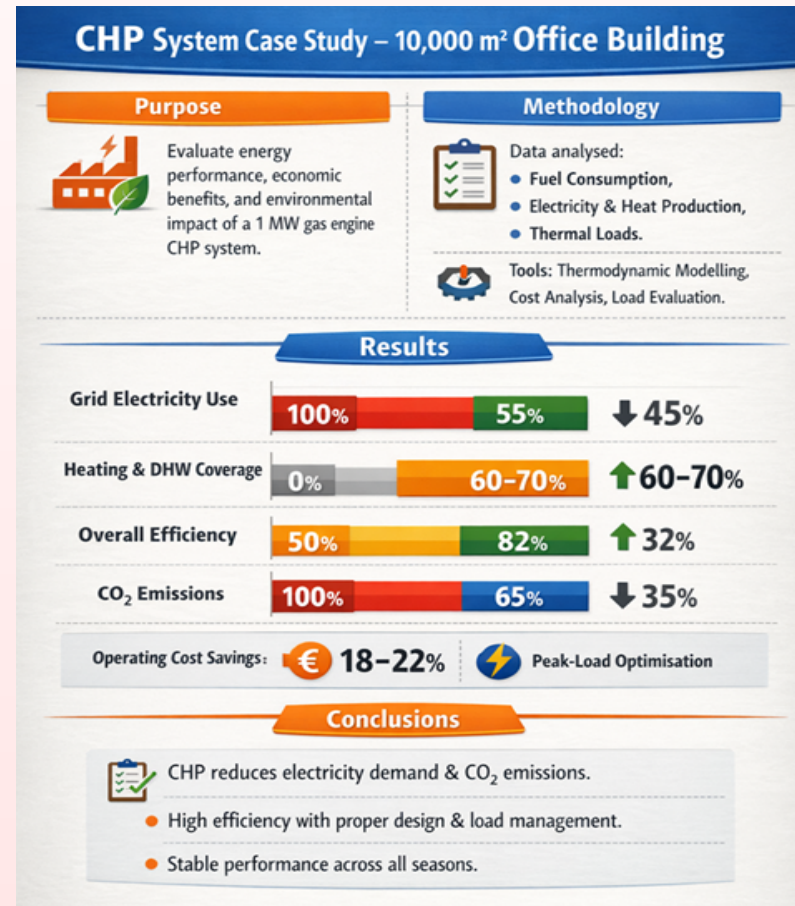


Fig. 1. Energy, economic, and environmental performance of a 1 MW CHP system in a 10,000 m² office building.

4. Results

The integration of the CHP system reduced grid electricity consumption by 45% and provided approximately 60–70% of the building's heating and domestic hot water (DHW) demand [3]. Overall system efficiency increased from 50% to 82%, ensuring much better fuel utilization [4]. CO₂ emissions decreased by 35%, while annual operating costs were reduced by 18–22%, providing significant economic benefits [1]. Peak-load optimization further improved performance by 5–6%, and switching between full and partial load ensured stable efficiency across seasonal variations [2,3]. Overall, the analysis shows that the CHP system provides:

- Significant reduction in grid electricity demand,
- High coverage of thermal energy needs,
- Improved overall energy efficiency,
- Reduced environmental impact via lower CO₂ emissions,
- Economic benefits through decreased operating costs,
- Stable performance under varying seasonal loads.

5. Conclusions

CHP is a highly effective solution for buildings with high energy demand. Proper design, monitoring of thermal loads, and integration with complementary heat recovery systems ensure optimal performance and significant environmental and economic benefits

References:

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