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# Thermodynamic Modeling and Exergoeconomic Analysis of an Isobaric Adiabatic Compressed Air Energy Storage System

**Authors :** Youssef Mazloum, Haytham Sayah, Maroun Nemer

**Abstract :** The penetration of renewable energy sources into the electric grid is significantly increasing. However, the intermittence of these sources breaks the balance between supply and demand for electricity. Hence, the importance of the energy storage technologies, they permit restoring the balance and reducing the drawbacks of intermittence of the renewable energies. This paper discusses the modeling and the cost-effectiveness of an isobaric adiabatic compressed air energy storage (IA-CAES) system. The proposed system is a combination among a compressed air energy storage (CAES) system with pumped hydro storage system and thermal energy storage system. The aim of this combination is to overcome the disadvantages of the conventional CAES system such as the losses due to the storage pressure variation, the loss of the compression heat and the use of fossil fuel sources. A steady state model is developed to perform an energy and exergy analyses of the IA-CAES system and calculate the distribution of the exergy losses in the latter system. A sensitivity analysis is also carried out to estimate the effects of some key parameters on the system's efficiency, such as the pinch of the heat exchangers, the isentropic efficiency of the rotating machinery and the pressure losses. The conducted sensitivity analysis is a local analysis since the sensibility of each parameter changes with the variation of the other parameters. Therefore, an exergoeconomic study is achieved as well as a cost optimization in order to reduce the electricity cost produced during the production phase. The optimizer used is OmOptim which is a genetic algorithms based optimizer.

**Keywords :** cost-effectiveness, Exergoeconomic analysis, isobaric adiabatic compressed air energy storage (IA-CAES) system, thermodynamic modeling
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