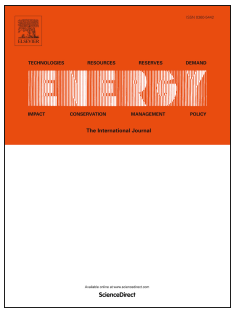
Accepted Manuscript



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PII: S0360-5442(18)31566-4

DOI: 10.1016/j.energy.2018.08.046

Reference: EGY 13522

To appear in: *Energy*

Received Date: 9 January 2018

Revised Date: 2 August 2018

Accepted Date: 6 August 2018

Please cite this article as: Amiri S, Honarvar M, sadegheih A, Providing an Integrated Model for Planning and Scheduling Energy Hubs and Preventive Maintenance, *Energy* (2018), doi: 10.1016/j.energy.2018.08.046.

Providing an Integrated Model for Planning and Scheduling Energy Hubs and Preventive Maintenance

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Abstract

In this paper, a bi-objective mathematical model is presented for energy hub scheduling with consideration of preventive maintenance policy. In the model, the hub equipment is assumed to be at risk of random failure, and a periodic preventive maintenance action is planned considering the energy hub utilization plan to take the system into an operational state as good as new. The aim of the proposed model is to determine the preventive maintenance cycles and the best strategy to allocate hub energy capacity under different demand scenarios, while the goals are to minimize costs and to maximize the reliability of the system. The novelty of this paper is the integration of preventive maintenance scheduling and energy hub scheduling. Considering the uncertainty of the demand, a scenario-based two-stage stochastic programming approach is used. CPLEX solver of GAMS is used to solve the model based on the Epsilon-constraint method. The sensitivity analysis is provided to define the effect of parameters such as demand and capacity on the model. The performance of the proposed integrated model is compared with the solutions offered by two well-known techniques from the subject literature. The results show that the integrated model possesses outstanding performance.

Keywords: Energy hub, preventive maintenance, bi-objective integer linear programming, Epsilon constraint

1. Introduction

In recent years, a concept of Energy Hub is defined to integrate energy infrastructure such as electricity, natural gas, and district heating (DH) networks. The energy hub receives various energy carriers such as natural gas, heat, electricity, etc. at its entrance, which after the conversion, transfer or storage the energy, delivers the output required energy carriers, such as electricity, heating and cooling to the customers. Energy hubs are actually considered as an intermediary between the energy supplier, the consumer, and the energy transport infrastructure. Each hub can include a number of equipment such as boilers, absorption chillers (Ab.chiller), electric heat pump (EHP), micro turbines, transformers, combined heat and power generation technologies (CHP), electrical storage units (EES), etc. for combining various energy carriers, converting and storing energy in order to supply the consumer needs.

Maintenance operation and scheduling in order to achieve maximum accessibility and reliability is an important issue which should be considered. The two main categories of maintenance are corrective and preventive maintenance. Corrective maintenance (CM) refers

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