شبكة المعلومات الجامعية

بسم اللّه الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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شبكة المعلومات الجامعية

بعض الوثائق الأصلية تالفة

بالرسالة صفحات
لم ترد بالأصل

Ain Shams University

Faculty of Engineering
Electric Power & Machines Department

Design Optimization of Energy Hub for Electricity and Fuel Production

A Thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Electrical Engineering
(Electric Power & Machines Engineering)

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Cairo - (2019)

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Statement

This thesis is submitted as a partial fulfilment of Master of Science in Electrical Engineering (Electrical Power Engineering), Faculty of Engineering, Ain Shams University.
The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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List of Publications

- A.Emad, M. EL-Shimy & G. Amer, Super Sustainability through Hydrogen Cities–An Overview, The 2nd International Conference on New Trends for Sustainable Energy (ICNTSE 2018) At: Alexandria – Egypt.
- A.Emad, M. EL-Shimy & G. Amer, Sustainable Energy Technologies and Systems, ISBN: 978-620-2-05640-3 Book, Chapter 7, A Generalized Approach for Sizing of Single Source Variable Renewable Energy Systems with Storage.
- Selim, A. E. E. D., El-Shimy, M., & Amer, G. (2020). Sizing methodology for hybrid photovoltaic/hydrogen system using Deterministic balance method (DBM). JURNAL NASIONAL TEKNIK ELEKTRO, volume 9(1).
- Emad, A., El-Shimy, M., Amer, G., & Ihoume, I. Power Management Control of Hydrogen-Based System Using Fuzzy Logic Method, The 4th IEEE International Conference on Electrical and Information Technologies (ICEIT 2020) At: Rabat-Morocco.
- Submitted to International Journal of Renewable Research paper (IJRER) entitled" Simulated Hybrid Off-grid System Configurations Based on Deterministic Method in Cairo International Airport" (under review)

Abstract

Nowadays, Renewable energy resources are playing a significant role in presenting the best alternative source for energy production. Not only they provide a clean source of energy with no emissions, but they are also offering the electricity and fuel at an affordable price to the end users. Additionally, the concept of hybrid systems integrating various renewable resources has become a dominant approach for investors, decision makers, engineers and researchers to work on.

In this thesis, a technical-economic analysis based on modeling, simulation is conducted to achieve the best sizing optimization of the components of the hybrid off-grid system. The main components of this system are solar panels, wind turbines, electrolyzer, fuel cells and hydrogen cylinders. The primary sources for energy production are Solar PV modules and wind turbine generators. The hydrogen system acts as an energy storage element for producing energy in times of lack of generation for the system.

A novel method named "Deterministic Balanced Method" is introduced which is based on integration of power ratings of the system components to get the total annual energy production for project lifetime. This method is used in comparison with the results of other software tools such as HOMER and SAM. Then, verification of the sizing optimization results for the conducted methods is achieved through comparing the power ratings and annual energy production

This thesis has also included a real case study of the use of hybrid renewable energy generation systems in Cairo International Airport, after considering amount of solar radiation and wind speed collected by international weather data platforms such as NASA and METEONMRM. System design was also based on an actual load studied and represented to ensure the feasibility of this study. Finally, a power management control technique is applied to the hydrogen system to schedule the devices' time of operation and decrease their degradations rates due to the switching operations.

Keywords: Sizing optimization, Renewable fraction, Solar Photovoltaic, Wind turbines, Hydrogen system, Power management control, Hybrid off-grid power plant

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