شبكة المعلومات الجامعية

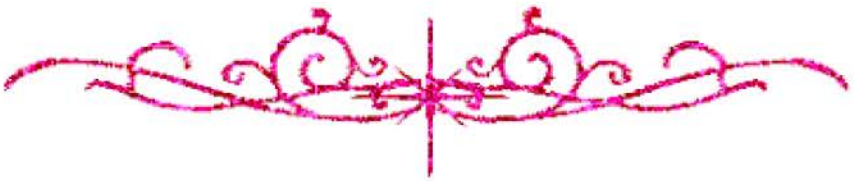
بسم الله الرحمن الرحيم

HOSSAM MAGHRABY

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم



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شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

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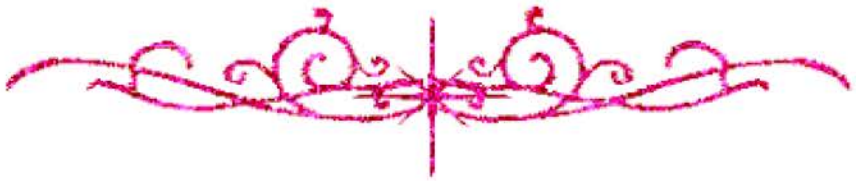
بعض الوثائق الأصلية تالفة



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شبكة المعلومات الجامعية

بالرسالة صفحات

لم ترد بالأصل

HOSSAM MAGHRABY

An assessment of Energy Sources Economics And Environmental Impacts

Case Study:
Amerya Liquefied Petroleum Gas Plant

Thesis submitted to Institute of Graduate Studies and Research in partial fulfillment of the Requirements for the Master Degree in Environmental Studies

By
MOHAMED FAROUK EL- SAYED

B.SC. in Mechanical Engineering, 1992

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SUPERVISORS

Professor Dr. : **Yehia Saeed El-Mahgary**

International Consultant for Energy & Environment

Egyptian Environmental Affairs Authority (EEAA)

Arab Repubic of Egypt

Professor Dr. : **El-sayed Mohamed Marzouk**

Professor of Combustion and Gas Dynamics

Mechanical Power Dept.-Faculty Of Engineering

Alexandria University

Doctor : **Mohamed Abd El-Wahab Abd El-Haleem**

Lecturer of Operation Research and Inf. systems

Department of environmental Studies (IGSR)

Alexandria University

DEDICATED TO .....

MY FAMILY

And

ARWA

For supporting me

ACKNOWLEDGMENT

I would like to express my deepest appreciation to ***Professor Dr Yehia Saeed El-Mahgary*** *for his particular care, which conferred me. Also I owe him with invaluable advice and keen supervision. I am grateful for his sophisticated supervision, valuable spiritual encouragement and support.*

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An assessment of Energy Sources Economics And Environmental Impacts

Case Study: Amerya Liquefied Petroleum Gas Plant

Abstract

In the present work energy and utility patterns for one of the Egyptian gas processing plants (Amerya Liquefied Petroleum Gas Recovery Plant) have been studied and evaluated with respect to the international norms. Preinvestigations of the considered plant have indicated that considerable savings and a more reliable operation can be achieved by the installation of on site combined heat and power station. The study main objectives are; introducing a more reliable and efficient source of electricity, optimizing the cost of energy, and an assessment of the environmental and economic aspects of the different suggested new sources of power compared with the existing source. The study provides a step by step approach for evaluating (technically, economically, and environmentally) the energy optimizing project. After giving a brief description of Amerya LPG Plant and a general guideline scope of work a series of steps was followed to systematically analyze thermal and electrical load data in addition to the plant supply and demand figures.

The first step was to develop the process material balance. This balance is a schematic and numerical accounting of the supply and distribution of different in and out gas streams to know the annual percentage loss of the handled materials. The material balance included combustion process of the plant direct-fired heaters to get acquainted by these heaters direct emissions and the needed fuel gas quantities. Then heat and electricity balances have been carried out for different energy patterns of the plant utilities. Then evaluating the coincidence of the existing thermal and electrical loads as a function of monthly average values. This was done by computing average values of fuel and electric energy consumption for each month based on plant log books and the theoretical estimations through plant energy demand to assure the reliability of the used data. The graphing and results of monthly load profiles have shown that the electric and thermal load profiles are relatively flat.

The second step was to study and select the optimum system that could satisfy the plant energy requirement and achieve the highest possible reliability. A ten stage approach has been presented for the implementation of Combined Heat and Power CHP project. The factors affecting the viability of small-scale cogeneration systems have been studied for Amerya case. A comparison between small size gas turbine and diesel engine as a prime mover for the

suggested heat and power plant has been conducted and concluded to the fact that gas turbine is the correct and recommended solution to cope with the plant conditions. Also, the study has tackled the viability of heaters to be modified as convective heat exchangers capable of satisfying the plant heat demand. Finally, operating scenarios of the selected cogeneration systems have been presented and ready to be financially ranked in the following step.

In the third step, different appraisal techniques have been used on a systematic basis for financially ranking the different alternatives and select the best cogeneration system that meets Amerya LPG Plant energy needs and economic criteria. The final selection criteria for cogeneration system were a combination of financial concerns and operational concerns. The economic feasibility of the selected two cogeneration options was estimated using a cogeneration cash flow model. The cash flow analysis uses a spreadsheets format to compare a twenty-year cash flow, simple payback, and discounted cash flow. The model considers financing options, initial cost, fuel cost, electricity pricing, and system operation and maintenance cost.

Finally, the fourth step in which, studying the environmental impacts of the suggested system with regard to the existing one has been conducting. From the economic study, the technical analysis and the environmental consideration it could be concluded to the following:

- The onsite cogeneration system can increase the plant net profitability by more than MM$ 1.5 per year as a result of generating electricity on site instead of purchasing it from the electricity board. The project pay back period will range from 3 to 5 years according to the used economic appraisal technique and the selected generating scenario.
- The environment will get benefit from a reduction of nearly 10,000 tonnes CO_2 per year (25% of plant emissions) and NOx emissions will decrease to half of its current value.
- The proposed system will insure a smooth and continuous operation with minimum power shortage periods and avail a surplus electricity of about 25% over the plant actual demand.
- An energy saving of nearly 30 % could be achieved due to the reduction of plant Specific Fuel Consumption (SFC) from 0.008 TOE / Ton of products for the existing system to 0.005 TOE / Ton of products for the newly proposed on site generation system.
- Annual production losses (due to electricity outage times) of about 414 ton of LPG and 1032 barrel of condensate could be avoided hence, increases the plant production rates and net profitability.

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