

قال الله سبحانه وتعالى :

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( اللَّهُ نُورُ السَّمِّ قَالَ اللَّهُ سَبْحَانَهُ وَتَعَالَى : أَوَاتِ وَالْأَرْضِ مَثَلُ نُورِهِ

كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ

يُوقَدُ مِنْ شَجَرَةٍ مُبَارَكَةٍ زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ

تَمْسَسْهُ نَارٌ نُورٌ عَلَى نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَنْ يَشَاءُ وَيَضْرِبُ اللَّهُ الْأَمْثَالَ

لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ )

الاية 35 من سورة النور

# ACKNOWLEDGEMENTS

First of all I thank Allah for completion of this research .I have great pleasure in expressing my intense appreciation and sincere thank to my Superior Dr. Mohammed Musaddag EL-Awad for his close supervision, perceptive interest, guidance, and timely suggestions during the work in the project and continuous encouragement.

I am also grateful to staff of factory A-30 in Yarmouk Industrial Complex for providing me the chance of taking the factory no. A-30 as the case study for research.

I am sincerely thankful to Rosaries Power Station, Khartoum refinery Company, Garri Power Plants, and Khartoum Water Corporation for helping me with information about my research, and for providing me with the necessary facilities for the study.

There is no enough place to thank personally all those who contributed directly or indirectly for my work, my sincere thanks to all of them. My deep appreciation for my parents for their blessing and prayers and the rest of my family and my colleagues in Rosaries Power Station.

## **DEDICATION**

I dedicate this research with much love and appreciation:

To my wife Fatima

To my sons Ahmed, Awab, and Eiad

To my daughter Tassneem

# ABSTRACT

The increasing demand for energy now a day makes the need for saving energy one of the top priorities in industry. The district cooling system is a good concept competitive in increasing energy efficiency, reducing maintenance, increasing system reliability, and environmental friendly. District cooling system provides this by use energy which is currently wasted in industry and nature. The objective of this project is to evaluate the feasibility of a cogeneration system that utilizes the waste energy of the hot gases of a generation unit, such as a gas turbine or diesel engine, to produce electricity and chilled water for Industrial Yarmouk complex, Factory A-30. To satisfy the aim of the research the below procedure would be followed:

- Estimate the thermal load of air conditioning
- Estimate the electrical load for equipments, lighting, etc
- Determination of the appropriate generation unit for the system
- Select suitable chillers for the required cooling capacity
- Conduct an economic analysis of the project

The final results of a techno-economic feasibility study of a cogeneration system for Industrial Yarmouk Complex that carried out for Factory A-30 will meet its requirements for both electricity and air-conditioning. But mechanical system is fairly due to technical and installation consideration.

## المخلص

ان الطلب المتزايد على الطاقة فى الوقت الحاضر جعل الحاجة الى توفير الطاقة واحدة من أهم الأولويات فى مجال الصناعة. ان نظام تبريد المناطق الصناعية هو من المفاهيم الجيدة القادرة على المنافسة فى زيادة كفاءة الطاقة ، والتقليل من أعمال الصيانة ، وزيادة موثوقية النظام ، وليس له اضرار بيئية إن هذا النوع من أنظمة التبريد يودى الى توفير الطاقة باستمرار بالاستفادة من الطاقات المبددة فى المناطق الصناعية ، الطبيعية والمحطات الحرارية. إن الهدف من هذا المشروع هو تقييم جدوى نظام التوليد المشترك للطاقة والاستفادة من النفايات الناتجة للغازات الساخنة لوحدة التوليد ، مثل التوربينات الغازية و محركات الديزل ، لإنتاج الكهرباء والمياه المبردة لمجمع اليرموك الصناعى متمثلا فى المصنع أ - 30. ولتلبية هدف هذا البحث سوف نتبع الإجراءات أدناه :

- تقدير الحمل الحراري لتكييف الهواء
- تقدير الحمولة الكهربائية للمعدات ، والإضاءة ، الخ
- تحديد وحدة توليد المناسبة للنظام
- تحديد المبردات المناسبة لقدرة التبريد المطلوبة
- إجراء تحليل اقتصادي للمشروع

النتائج النهائية لدراسة الجدوى الفنية والاقتصادية لنظام التوليد المشترك ونظام تبريد المنطقة لمجمع اليرموك الصناعى التي نفذت للمصنع ا- 30 سوف توفى بمتطلبات كل من الكهرباء وتكييف الهواء. ولكن نظام التبريد الميكانيكي او التقليدى هو الانسب للاعتبارات الفنية والتركيبية.

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## ABBREVIATION

CHP:	Combined Heat and Power
CO <sub>2</sub> :	Carbon dioxide
AC:	Air conditioning system
DCS:	District cooling system
I.C:	Internal combustion
Btu:	British thermal unit
KWh:	Kilowatt-hour
Kcal:	Kilocalorie
VAM:	Vapor absorption machine
MW:	Megawatt
LPG:	Liquefied petroleum gas
O <sub>2</sub> :	Oxygen
NO <sub>x</sub> :	Nitrogen oxide
SO <sub>x</sub> :	Sulfur oxide
CHCP:	Combined heat, cooling, and power generation
TR :	Ton of refrigeration
VCC:	Vapor compression chiller
VAC:	Vapor absorption chiller
YIC:	Yarmouk Industrial Complex
Kg/h:	Kilogram per hour
A-30:	Number of case study Factory
CNC:	Computer numerical control
HVAC:	Heat ventilation and air conditioning
Hp:	Horse power unit
SHF:	Space sensible heat factor
DB:	Dry Bulb for cooling coil temperature

WB: Wet Bulb for cooling coil temperature

RH: Relative humidity for cooling coil

Kap: Kilopascal, pressure unit

RTAC: Series R Trane Company Model Air-Cooled Chiller

RTAA: Series R Trane Company Model Air-Cooled Chiller

R-134a or HFC: Is a haloalkane refrigerant with thermodynamic properties

Similar to R-12

COP: AC Coefficient of performance

SDG: Sudanese currency pound

\$: USA currency

€ Europe Union currency

CFM: Cubic feet per minute air infiltration

°C: Celsius temperature

L/s: Liter per second