



**Sudan University of Science and Technology**  
**College of Engineering**  
**Power Engineering Department**



**Effect of High Pressure Heat Exchanger on Steam Power Plant  
Efficiency**

أثر المبادلات الحرارية ذات الضغط العالي في كفاءة محطات الطاقة البخارية

***Case study (Garri 4)***

**Project submitted in partial fulfillments for the degree of  
B.Eg. (Honors) in Mechanical Engineering (power)**

**Prepared By:**

- 1. HamamKamalelden Ibrahim Mohamed**
- 2. Ibrahim Siddeg Ibrahim Suliman**
- 3. Mohammed Osman Elsir Osman**

**Supervised by:**

**Dr: AbdallahMokhtar Mohammed Abdallah**

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# الآية

قال تعالى:

{لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا ۚ لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ ۗ رَبَّنَا لَا تُؤَاخِذْنَا إِنْ نَسِينَا أَوْ أَخْطَأْنَا ۗ رَبَّنَا وَلَا تَحْمِلْ عَلَيْنَا إِكْرَامًا كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِنْ قَبْلِنَا ۗ رَبَّنَا وَلَا تُحَمِّلْنَا مَا لَا طَاقَةَ لَنَا بِهِ ۗ وَاعْفُ عَنَّا وَاعْفِرْ لَنَا وَارْحَمْنَا ۗ أَنْتَ مَوْلَانَا فَانصُرْنَا عَلَى الْقَوْمِ الْكَافِرِينَ }

سورة البقرة الآية (286)

# Dedication

*We would like to take this opportunity to finally give back a small something to my parents whose support and unconditional love are the reason for*

*my being here today .they have supported us through the peaks and troughs of life and refused to give up on us at times when we almost gave up on ourselves .they gave us the power to push through university and get gave us the head start in life what we need to make something of ourselves, we also dedicate this for that hidden soul which encourage us to do good things.*

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## **Abstract**

Development of power plants is one of most important studies that may be heuristically in the field of power engineering department, where these studies aimed at developing stations by reaching for ways to increase performance and reduce the cost of the plants.

From this upstream we conducted our research in this field and chose us as a model of Garri power station (4) which operated by steam turbine and boiler type Circulating Fluidized Bed (CFB).

The importance of our project is to study the effect of high pressure heat exchangers in raising the efficiency of the steam turbine generating stations, thus increasing the productive capacity and supplying the national network with a current that meets the consumer's needs. On the other hand, it reduces the vibrations in the turbine shaft and increases the operating life of the steam turbine station. High pressure heaters are of great importance in increasing the operating life of the boiler type by reducing the voltage exerted by the absence of high pressure exchangers.

Through our study, we followed the calculation of the ratio of the amount of heat added in the presence of these high pressure heat exchangers and lack of presence and which are more effective in increasing efficiency and calculating the impact of each of them we have concluded that heat exchangers high pressure oils have the effectiveness in increasing the generating capacity so the efficiency increased from (31.6%) to (36.6%) .

We have also made a simulation of the movement of Belding from turbines to high pressure heaters and their impact on turbine shaft, efficiency and general simulation of the water and steam cycle of Garripower plant.

## التجريدة

أصبحت الدراسات لتطوير محطات توليد الطاقة الكهربائية أحد أهم الدراسات التي يمكن أن تجريها في مجال هندسة القدرة، حيث تهدف الدراسات لتطوير المحطات من خلال البحث عن طرق لرفع الأداء وتقليل التكلفة للمحطات.

من هذا المنبع أجرينا بحثنا في هذا المجال وإختارنا كنموذج محطة كهرباء قري ( 4 ) التي تعمل بواسطة التوربينة البخارية ومرجل نوع ( Circulating Fluidized Bed ).

تكمن أهمية المشروع في دراسة أثر المبدلات الحرارية ذات الضغط العالي في رفع كفاءة محطات التوليد التي تعمل بواسطة التوربينات البخارية وبالتالي زيادة القدرة المنتجة و امداد الشبكة القومية بتيار يلبي حوجة المستهلك ومن جانب اخر فهي تقلل الاهتزازت في عمود التوربينة وزيادة العمر التشغيلي لمحطة التوربين البخاري وايضا تعتبر المبادلات ذات الضغط العالي ذات أهمية عالية في زيادة العمر التشغيلي للمرجل نوع الصومعة بتقليل الجهد الواقع عليه في عدم وجود مبادلات الضغط العالي.

من خلال الدراسة التي قومنا بها واتبعنا فيها حساب نسبة كمية الحرارة المضافة في ظل وجود هذه المبادلات الحرارية ذات الضغط العالي وعدم وجودها وايهما اكثر فعالية في زيادة الكفاءة وحساب اثر كل واحد منهم توصلنا الى ان المبادلات الحرارية ذات الضغط العالي لها فعالية في زيادة القدرة المولدة وبالتالي زادت الكفاءة من (31.6%) إلى (36.6%).

وايضا قد قومنا بعمل تمثيل لحركة الاستتواف من التوربينة الى السخانات الضغط العالي واثرها علي عمود التوربينة وكفاءة وتمثيل عام لدورة المياه والبخار لمحطة كهرباء قري 4 .

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### List of abbreviation and symbols

BFP	Boiler feed pump
HRSG	Heat recovery steam generator
HPH	High pressure heater
LPH	Low pressure heater
KRC	Khartoum refinery cooperation
HFWO	Heater feed water open
NEC	National electricity
SSC	Specific steam consumption
LMTD	Log mean temperature difference
CFB	Circulating Fluidized Bed
LDO	Light diesel oil
TTD	Terminal Temperature Difference
DCA	Drain Cooler Approach
HFWC	Heater feed water close