

# الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(اللَّهُ نُورُ السَّمَاوَاتِ 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)

صدق الله العظيم

سورة النور

الآية (35)

## **Dedication**

To my father's soul

My mother

My sisters and brothers

My husband

My teachers

My colleagues...

## Acknowledgements

My first words, gratefulness and thank go to **Allah** for all thing given to me.

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## **Abstract**

In Sudan, demand for electric power continues to increase rapidly due to the increase of the population growth, economic, industrial development, and progressive replacement of exchange technology with clean forms of energy generation. Atmospheric circulating fluidized bed (CFB) technology has emerged as an environmentally suitable technology for burning an extensive range of solid fuels to produce steam and electricity power. Since 20 years CFB is considered to be a wide technology with more than 400 CFB boilers in operation worldwide, ranging from 5 MW to 250 MW. The National Electricity Corporation of Sudan (NEC) has selected a technology that will operate an extensive range of low-cost solid fuels, decrease emissions, decrease life cycle costs, and provide consistent steam generation for electric power generation. Therefore, CFB is often the preferred technology.

In this thesis was study the performance of CFB boiler in Garri 4 power plant and calculated of efficiency using the indirect method, through the difference between the percentage of input energy and percentage of heat losses. In addition has been defined and described units in the boiler. Also explain the methods of measurement and test preparation. Finally efficiency of CFB boiler was calculated according to the American Society of Mechanical Engineers and the result of efficiency was 91.45%. According to the guarantee value of boiler efficiency in Garri 4 power plant is 90.06% that means that the result is reasonable.

## مستخلص

في السودان، فإن الطلب على الطاقة الكهربائية في تزايد مستمر بسرعة نظراً لزيادة النمو السكاني والاقتصادي، والتنمية الصناعية، والاستبدال التدريجي للتكنولوجيا تبادل مع أشكال توليد الطاقة النظيفة. برزت الغلايات ذات التدوير والانسحاب التي تعمل في ظروف ملائمة للغلاف الجوي (CFB) وتعتبر ذات تكنولوجيا وتقنية مناسبة بيئياً لحرق مجموعة واسعة من أنواع الوقود الصلب لإنتاج البخار والطاقة الكهربائية. منذ 20 عاماً وتعتبر (CFB) ذات التكنولوجيا الواسعة الافضل مقارنة مع أكثر من 400 نوع من غلايات (CFB) التي تعمل في العالم، تتراوح الطاقه المنتجه ما بين 5 إلى 250 MW ميغاواط. اختارت شركة الكهرباء الوطنية في السودان (NEC) هذه التكنولوجيا التي تعمل مع مجموعة واسعة من الوقود الصلب منخفض التكلفة، ونقصان انبعاث الغازات، وانخفاض تكاليف دورة الحياة، وتوفير م لائم لتوليد البخار لتوليد الطاقة الكهربائية. لذلك، فإن CFB تعتبر تقني المفضل.

في هذه الأطروحة تم دراسة أداء الغلاية CFB في محطة توليد الكهرباء قري 4 وحساب الكفاءة باستخدام الطريقة الغير مباشره وذلك من خلال الفرق بين نسبة الطاقة الداخلة ونسبة الفقدوات . وبالإضافة إلى ذلك تم تعريف ووصف الوحدات في الغلاية . تم ايضاً شرح طرق القياس و التجهيز لإجراء الاختبار. وأخيراً تم حساب كفاءة ال غلاية CFB وفقاً للجمعية الامريكية للمهندسين الميكانيكيين وكانت نتيجة الكفاءة 91.45% . وفقاً لقيمة ضمان كفاءة الغلايات في محطة قري 4 هي 90.06% وذلك يعني أن النتيجة معقولة.

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## Abbreviations

Abbreviation	Description
CFB	Circulating fluidized bed
PC	pulverized coal
NEC	National Electricity Corporation
FGD	Flue Gas Desulfurization
CFBAC	Compound Fluidized Bed Ash Cooler
RAC	Rolling-cylinder Ash Cooler
O&M	Operation and Maintenance
IEA	International Energy Agency
CIAB	Coal Industry Advisory Board
MDC	Multi-cyclone Dust Collector
AH	Air Heater
TCs	Thermocouples
RTDs	Resistance Temperature Devices
HVT	High Velocity Thermocouple
PTC	Performance Test Code
ASME	American society of Mechanical Engineers
THC	Total Hydrocarbons
FID	Flame Ionization Detector
HHV	High Heat Value
HHVF	High Heat Value of Fuel
BMCR	Boiler Maximum Continuous Rating
Ppm	Parts per million