ELECTRIC POWER GENERATION FROM COAL
CASE STUDY (SONICHAR) NIGER REPUBLIC
(1998-2002)

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CERTIFICATION

I certify that this present project was carried out by me.

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EXTERNAL EXAMINER	DATE

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ABSTRACT

This project aims at the study of electric power generation from at SONICHAR in Niger Republic, a Company, which contributes to the reduction of dependence of electricity from outside.

At SONICHAR the heat of combustion of coal is utilized in a boiler, which generates and delivers steam at a suitable temperature and pressure to the steam turbine, the latter driving the generator for generating electricity.

Conclusions are drawn based on the topic and some recommendations are also made.

GENERATION OF ELECTRIC POWER FROM COAL CASE STUDY "SONICHAR" NIGER REPUBLIC

CHAPTER ONE

1.1 INTRODUCTION

The principal purpose of electric power stations is to produce electric energy and supply it to industrial and agricultural enterprises and public utilities.

In many cases electric power stations also supply heat (as steam or hot water) to industrial services and residential consumers.

In industrially developed countries, the major portion of electric energy is produced at fuel-fixed (thermal) power stations, which utilize the chemical energy of combustion of organic fuels. A certain quantity of electricity is also produced at nuclear power stations, and hydraulic electric power stations.

Steam-turbine power stations are the main types of power stations operating on organic fuels. They are subdivided into condensation plants, which, produce electric energy only and heat and power plants which can produce both electric energy and heat.

Steam-turbine power plants are advantageous over other types in that they permit concentration of an enormous power in a single unit, they have a relatively high economic efficiency and short time of their construction. Nigeria has been supplying Niger Republic with electricity since 1961. During the last 40 years the population has increasing and the demand of energy also increased. This lead to the establishment of companies like SONICHAR, COMINAK. So to reduce this increasing demand of energy, new sources of energy have been looked for, as a solution. It is now find out the production for electricity based on coal in Northern Niger Republic to supply industries and consumers in the northern and Agadez state is desirable.

The company established for this purpose is known as SONICHAR. Coal resource is very large, much larger than oil and gas. The technology for using it will provide the power supply solution. Environmental problems are relevant but technology is available to meet these concerns.

In view of the all the above reasons; the need of electric energy production from coal therefore call for attention.

1.2 LITERATURE REVIEW

The fundamental of modem electric power engineering was laid as far back as the middle of the 19th century when in 1831 the English scientist Michael Faraday discovered the phenomenon of electromagnetic induction. The further study of the interaction between electric current conductors and electromagnetic field led to the invention of an electric generator, which converts mechanicals rotational power into electric energy. The electric generators serve as basic sources of electrical energy to the present day.

The electric generators receive energy from their prime movers, which may be steam against their blades, or hydraulic turbines (water wheels) rotated by water pressure built up by a dam. Sometimes the prime mover function is performed by gas turbines. Wind mills, steam engines and internal combustion engines. This is mainly the case with small electrical stations built for local purposes. A generator coupled with a steam turbine is called two-generators, hence the power plant is known as a thermal power plant. The steam necessary to drive the turbo-generator is also in boilers by combustion of solid. (Peals coal or brown coal.), liquid (fuel oil, petroleum), or gaseous fuel. Steam is also obtained with the aid of a nucleolus reaction.

The largest amount of electric power with world is produced by the thermal electric power plants (more than 70%). Their share, however, will decrease, because these power plants are gradually giving way to nuclear power plants.

A generator coupled with a hydraulic turbine is termed the water-wheel generator. Hence, the power plant is known as a hydraulic station.

In addition to the traditional sources of electric current described above, there are other ways of generating electricity power, thus, in many countries investigates are being made into the magneto hydraulic method in which electric energy is obtained from an organized flowing in a magnetic field.

Studies are also made of thermo electricity and the electric transducers in outer to utilize them for converting thermal energy to electric energy.

In this perspective, taking into account the increased consumption by producer countries, it is urgent to develop a new energy basis for continued economic grown that the availability of increased oil supply have reserved in the past decades. Coal could be one of the principal energy resources on which an orderly transition to the energy system of the future can be based.

The industrial revolution that began in Britain early last entry was fuelled by coal. Then in the 1950's and 1960's, it was eclipsed by petroleum as the world's most used fuel, but the oil shocks of the 1970's resulted in a worldwide resurgence of interest in coal as an energy source because of it's relative abundance. About two years ago, Professor Carwall Wilson, of Massadusets institute of technology, who has directed the WAES institute of technology, who has directed the WAES project, the famous study on "Alternative energy strategies " assembled over 80 people from 16 major coal using and producing countries in order to carry out a global study on coal. The final report was released in May 1980.

The fundamental conclusion of the study is that coal can supply the principal part to the additional energy needs of the world in the next twenty years, coal could be a bridge of the energy system the future for the reason the report was called " Coal Bridge to the future". [The Nigerian Engineer Vol. 16 N°] 1981

When electric power was first generated in last at the turn of century, it was from a coal-fired boiler. In a number of the cities in Nigeria like Kano, Kaduna, Enugu, Port-Harcourt etc., coal was first used as fuel. In Ibadan and other places, the fuel was wood. In all cases, wood or coal was burnt in a stocking or drain gate boiler to raise steam. The steam conditions were fairly low and in most places, the steam was used to drive reciprocating engines. There is enough information however to show that by 1950 when the electricity corporation of Nigeria was established, and all the existing power generation facilities in the country were brought under one administration there was a total aggregate installed capacity of 23,880kw. 21,575kw of this capacity was from coal fired, steam plants.

1.3 AIMS AND OBJECTIVES OF THE PROJECT

Niger Republic is very dependent from outside source in term of energy supply upto year 1980.

Energy is generally produced by small thermal power stations using imported fuel, for that reason the price of KWH is very costly.

In order to get cheaper energy and respond to the increasing needs the development of extractive industries in the northern part of the country, became necessary. Government seizes the availability of coal to establish "SONICHAR" national companying of power generation from coal, which contributes greatly to reduce the power price. Hence our dependence from other countries:

- The purpose of this project is to study the way SONICHAR can contribute to decrease the dependence of energy from outside source.
- A case is also made that in view of the growth of the population and increases in energy demand the basic supplier, Nigerian, cannot continue providing sufficient power to Niger Republic.

CHAPTER TWO

2.1 ORIGIN OF COAL

Coal is a sedimentary rock composed drifty of carbon although it also contains hydrogen and oxygen and small amounts of nitrogen and sulphur.

Coal also contains moisture and minerals (clay, limestone, etc) in varying amounts. It's now generally accepted that coal is of vegetal origin. The geologic process, which in the past ages produces the great beds of coal we mine today, are still operating to of form deposits, of new kinds of coal, and the several kinds of coal now mined are the result of different degrees of alternation of the original materials.

The formation of coal represents the final result of the accumulated efforts of organism of erosion, of deposition of sediments and of the movements of the earth's crush, the composed plant materials was formed at first into peat, which, if buried beneath other sediments, was gradually transformed over long period of time into coal.

During this coalification process oxygen and hydrogen were released, the carbon content increased and the hardness and strength increased also, the methane produced during coalification was lost through the porous sediments or formed a natural gas reservoir if it migrated into geological traps in the same way as petroleum.

The rank of coal is a measure of the degree of coalification, under mild conditions the lower rank coal, brown coal and lignite, would be formed.

At higher pressures and temperatures sub bituminous and bituminous coals would be formed. Authoricate, which is the highest rank in the coalification series, could have formed only in areas subjected to the grater increase in temperature accompanying organic movement of the earth's crust.

2.2 COAL CLASSIFICATION

There are many coal classification methods, taking into account the various characteristics of coal rank heating value e.t.c.

According to the International system coal is classified as:

1. **Hard Coal:** This general term covers the geologically more nature denser coals, ranging from anthracite used primarily for domestic burning through bituminous coals used as under boiler fuel. In this class coals having moisture and ash free calorific value above 5.700 Kcal/Kg are included.

2. **Brown Coal:**This tem applies to low rank coal intermediate between peak and hard coal, essentially to sub-bituminous coals lignite. The international classification defines brown coals as coals having moisture, ash-free calorific value below 5,700 Kcal/Kg.

Characterization results can be used to group or classify coals. It has established classification or rankings for coal according to the degree of metamorphism (progressive alternation in the coalification process) as shown below:

The amount of volatile matter, fixed carbon, moisture and oxygen all indicate rank, but no one item completely defined it, in the ASTM classification, the basic criteria are ash, fixed carbon, and the heating value. For higher rank coals, ash and fixed carbon are sufficient criteria.

However theses values alone are not suitable for designating the position of low-rank coals. For a low rank coal, ahs and heating value are the principal criteria.

The Major coals may be defined as follows:

3. **Anthracite Coal:** Coal of the highest metamorphic rank, in which the fixed carbon content is between 92 and 98 percent. It is hard and black, and has a semi metallic luster and semi conch-dial fracture. Anthracite ignites with difficulty and burns with a short blue flame and without smoke. Anthracite coal is also known as hard coal.

4. **Semi Anthracite Coal:** Coal having a fixed-carbon content of between 86 and 92 percent. It's between bituminous coal and anthracite coal in metamorphic rank although it's physical properties more closely resemble those of anthracite.

5. **Semi bituminous Coal:** Coal that ranks between bituminous coal and semi anthracite. It's harder and more brittle than bituminous coal, has or high fuel ratio, and burn without smoke. Semi bituminous coal is also known as meta bituminous coal, which is defined as containing 89 to 91.2 percent carbon, analyzed on a dry, ash-free basis, the term semi coal also is used.

6. **Bituminous Coal:** Coal that ranks between sub bituminous and semi bituminous coal and that contains 15 to 20 percent volatile matter. It's dark brown-to-black in color and burns with a smoking flame. Bituminous coal is the most abundant rank of coal and is commonly carboniferous in age. The most common synonym is soft coal.

7. **Sub Bituminous coal:** A black coal intermediate in ranks between lignite and bituminous coals, or in some classifications the equivalent so black lignite.

It's distinguished from lignite by higher carbon and lower moisture content

8. **Lignite coal:** A brownish-black coal that is intermediate in coalification between peat and sub bituminous coal; consolidated coal with a colorific value less than 8300 cal/kg per pound.

Further classification of lignite is made on the basis of calorific value:

Lignite A: A lignite that contains less than 6300 BTU or more, but less than 8300 BTU per pound. Also known as black lignite.

Lignite B: A lignite that contains less than 6300 BTU per pound. Also known as brown lignite or brown coal.

2.3 CHEMICAL COMPOSITION OF COAL

The coal of SONICHAR is of low quality composition and is as follows:

i.	Carbon content	37.98%
ii.	Hydrogen	2.67%
iii.	Nitrogen and Oxygen	7.17%
iv.	Sulphur	1.18%
v.	Ash	51.00%
		100.00%

2.4 COAL GASIFICATION

Coal gasification includes a number of processes, which can lead to the formation of three grades of gas in terms of their colorific value.

In principle all gasification process as involve the reaction of coal with steam to form carbon monoxide and hydrogen. Because this reaction is highly endothermic, requiring a source of heat to make it go, some of the coal is burned with oxygen to produce the necessary heat. The latter reaction producer's carbon dioxide.

If air is used instead of oxygen, a low colorific value gas (3.8 ÷ 7,6 M/L/m^3) is obtained, because the product is diluted by nitrogen from the air used, since it's hot economical to transport by pipeline this gas, over nay distance, it must be used at the exit of the gasification plant, or power generation or industrial applications.

If oxygen, rather than air is used a medium BYT gas (10 ÷ 16 M/L/m^3) is obtained. Such a gas can be sending economically over reasonable distance and used for industrial and domestic purposes.

Further, the synthesis gas obtained by heating coal with steam, can be utilized to produce, through complex and costly operations, a high BTU gas (D 21 M/L/m^3). The gas formed is essentially, methane and consequently called substitute natural gas (SNG). The synthesis gas, low or medium BTU is produced in a gas through the following reactions.

$$C + H_20 = \quad CO + H_2$$

$$C + {}_2H_20 = \quad CO_2 + 2H_2$$

The heat necessary for these endothermic reactions supplied by the combustion reaction of carbon.

$$C + 0_2 = CO_2$$

In the gasification a part of hydrogen reacts with the coal producing a certain amount of methane.

$$C + 2H_2 = CH_4$$

The raw synthesis gas produced in the gasification contains impurities such as carbon dioxide, sulphur compounds, water, ammonia, tar oils, these impurities are removed by scribing with selective solvents. In order to produce SSNG, from synthesis gas, the proportion of hydrogen and carbon monoxide in the purified synthesis gas must be adjusted in the proportion of 3:1 by reacting some of the carbon monoxide with steam (Shift reaction).

$$CO + H_20 = CO_2 + H_2$$

The synthesis gas is then scribbled to remove the co-product carbon dioxide and then passes to the methanation stage where carbon monoxide and hydrogen read in the presence of a nickel catalyst.

$$CO + 3H_2 = CO_4 + H_20$$

The gas obtained can be mixed to the natural gas and distributed through the existing network.

CHAPTER THREE

3.0 POWER GENERATION

3.1 THERMAL STEAM POWER STATION

3.1.1 DEFINITION

Thermal steam power station is a production plant of electrical power from fossil fuel: carbon uranium, liquid oil or gas. Its functioning principle is based on transformation of energy from one form to another.

3.1.2

Thermal steam power station consists of three major parts:

i. The furnace of 78, 5 T/H of flow rate or steam generator: Inside the furnace, the chemical energy of the combustible matter and the oxygen are transformed by combustion into calorific energy, which can be collected in form of steam.

The furnace produced the steam with a temperature of 500^0c and a pressure of 62 bars.

ii. **Turbine:** Inside the turbine, the calorific energy of the steam is transformed into mechanical energy by rotation.

iii. **Alternator**: Inside the alternator the rotational mechanical energy in transformed into electrical energy. See figure 3.1 and 3.2

3.1.3 Description of functional process:

In the furnace or steam generator the combustion process transforms the chemical energy of the combustible matter and the oxydant into heat energy. The water inside the tubes transformed into steam by heat of combustion. The humid vapour vapourizes to the heat reservoir where it undergoes drying. The dry vapour passes through the super heater, which raise its potential heat. The super heater vapour enters the turbine where the heat contained is transformed into rotational mechanical energy of the prime mover see figure 3.1.

The rotation of the turbine is carried along to the alternator where the transformation of mechanical energy into electrical energy occurs.

At the outlet of the turbine the weak vapour is condescend into water by the condenser in heat exchanger.

The extraction pump transfers the condenser water to degasified through the channel of the low-pressure reheated.

The supplying pumps transfer the degasified water to the furnace through the high-pressure reheater and economizer. Thus, a portion of thermal vapour-water cycle is closed.

Schematic Diagram of Energy Transformation in a steam Turbine:

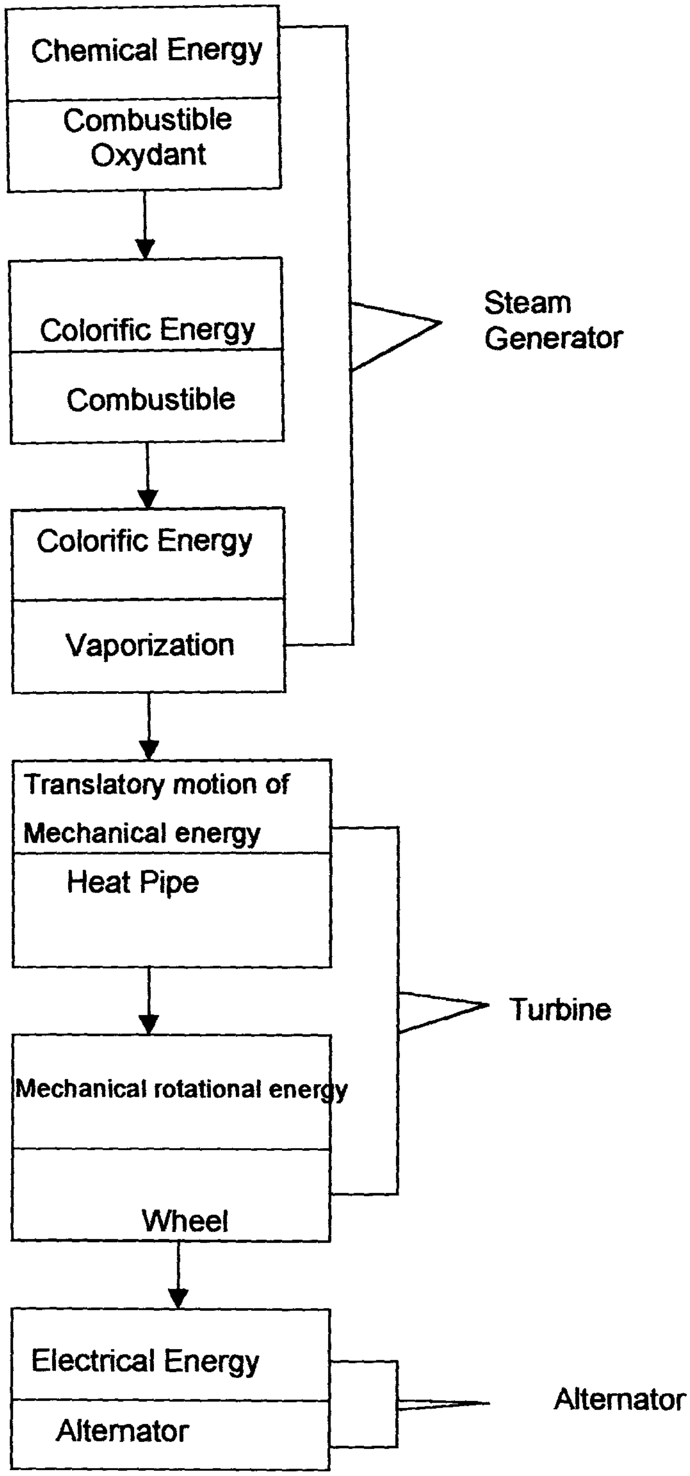


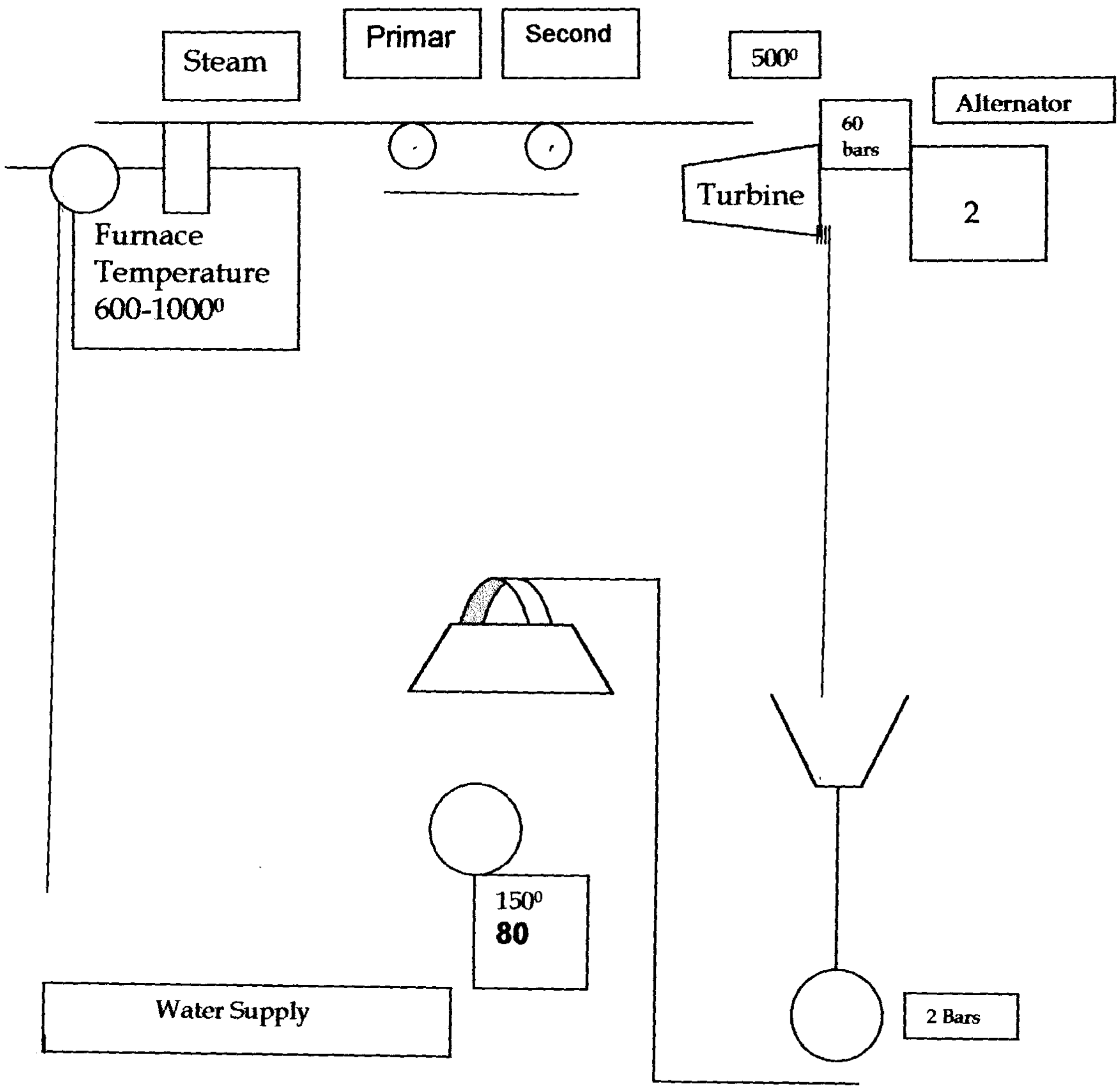
Fig. 3.1

GENERATION OF POWER FROM COAL IN "SONICHAR" NIGER REPUBLIC

The thermal power station is composing of 2 groups of turbo alternators with a Nominal Power of 2 x 18.8 Mw.

See figure 3.2 below

Schematic Diagram of the Principle of the Power Generation AT SONICHAR



3.2.0 DESCRIPTION OF INSTALLATION

3.2.1 THE STEAM GENERATION

3.2.2 COMBUSTION INSIDE THE SOURCE

The furnace or Mark Fives Cail Babcock (FCB) is equipped with a source fluid ignition See figure 3.3 (Page 24).

The combustion of coal is effected in fluidized bed on a noble grill which is inclined from the back of the frontiers and is installed in the lower part of the source.

The furnace of 78, 5T/H of flow rate where the coal is burnt to heat distilled water.

The furnace provides the steam with a Temperature of 500^0c and with a pressure of 62 bars.

The air caisson place under the grill distributes the primary air on all the length of the grill in the way to create and maintain the suspension of carbon particle to promote combustion inside the fluidized bed.

The secondary air penetrates into the combustion chamber through injection pipes, which on two screen internal. The secondary air contributes to a complete combustion of line particles of carbon in the fluidized bed and the recycled flue gases.

3.3.3 AIR CIRCUIT

The combustion air is given by a fan, which blows through a filter and a silencer. It drives back the air towards a reheated with tubular air. At the outlet of the reheated, the air is distributed into:

- ✓ Dispersion of air to the carbon conveyor
- ✓ Primary air inside the caisson under the grill.
- ✓ Secondary air on the lateral lining.
- ✓ Transport air for flue gase recycles.
- ✓ Combustion air in the caisson of fuel burner.

3.3.4 TURBO-ALTERNATOR

The Turbine

The turbine Mark BBC is the type that has only on condensation and by-pass starting, it possesses two steam discharges. The steam is admitted through a flow value and three (3) regulators valve, it's related in an action wheel follow by reaction wheel as several levels.

The turbine runs the alternator by the mediation of the reduction with gearing.

The turbine with which the steam develops the mechanical energy by pressure reduction turns with a speed of 6291T/mn.

3.3.5 ALTERNATOR:

The alternator MARK REM is the synchronic type with horizontal axe, the excitation is assured by a induiser.

The cooling is assured by air circulation in close circuit.

The alternator with a power of 18.8mw, is carried along by the turbine with aped of 1500T/Mn. It produces the electric energy delivered to the network with a frequency of 50HZ and the output voltage of 6600v. One station of transmission raises the voltage from 6600v to 132000 v. This is then transmitted to the high voltage at ARLITY (COMINAK, SOMAIR).

Another transformer steps down the voltage from 132000v to 20000 for the limes of Agadez (the state of the northern Niger Republic).

3.3.6 STEAM WATER CIRCUIT

A steam boiler is a combination of heating surfaces in which steam in generated from continuously fed water by utilizing the heat librated on combustion of organic fuel which is fed into the boiler furnace together with the air required from combustion. The water supplied into a steam boiler is called feed water. Feed water is preheated to the saturation temperature and vaporized and the saturated steam thus produced in further superheated.

As fuel is burned (coal), if forms combustion products. These serve as heat transfer agent, in the heating surfaces where it gives up its heat to the water and steam, which are called the working fluid.

The Main Transformer:

The evacuation transformer of energy of MARK CEM is the type decreasing-increasing, cooling by air-cooling.

The capacity of the station installed is 42MW, which is divided as follows:

1. Generating unit which produces 12.8 MW each based on coal.
2. Generating unit which produces 2.2 MW each based on fuel.

The Atmospheric refrigerant

The atmospheric cooling of MARK S.C.A.M. is supplied from the sinking water, which is stocked inside two reservoirs of 5000 M3 each.

The atmospheric cooling is the type of humid forming ventilation.

They are constituted of five (5) cartridge each composed of the following:

- The bowl of cooling water reception.
- One envelope
- One interior equipment with
- The water distribution.
- The dispersion.
- The droplet separation.

3.4 DATA COLLECTIONS OF SONICHAR

Table 3.1 gives data collection for SONICHAR from 1985 to 1999.

YEAR	ENERGY PRODUCTION (TWH)	WATER PRODUCTION (T3)	COAL CONSUMPTION POWER STATION	WATER CONSUMPTION POWER STATION	FUEL CONSUMPTION (T3)	ENERGY SELL (TWH)	POWER STATION AVAILABI -LITY %
1985	133081	213856	148278014	1040377	383,181	106000,95	99,36
1986	138950,3	2263828	158353,614	1032492	287,702	10963,47	98,14
1987	139781,5	2112032	158628,2	1243409	412,371	111622,61	98,23
1988	138148,7	2207034	156655,136	1485636	316,854	103488,222	99,36
1989	133442,1	2339485,1	151430,136	1551705	253,631	998531	99,43
1990	133649	2365382.3	147869,488	1036136	201,656	100149,784	95,35
1991	137806,3	2340500,8	148363,65	1407059	189,376	104022,104	99,62
1992	127534.1	2281206	132929,696	1282507	72,985	96414,78	99,85
1993	133565,2	2351995,6	141451,088	1294709	137,064	100669,52	99,64
1994	138216,5	23984413	148363,604	1326288	94,155	105482,696	99,5
1995	140680,2	2364004	151452,816	126l054	410,206	106614,568	99,37
1996	144585,2	2495286,18	151688,128	1198206	178,531	109690,429	99,77
1997	152553,3	2665118,6	757180,346	125048	267,051	117337,772	99,73
1998	158087,2	2953795	180126,15	1277492	506,353	121535,647	99,54
1999	138747,9	2721076	141753,861	1090119	729,094	106277,926	99,04
Cummlative	24871105	359977212	2711779,793	19279237	109313	1920561	

CHAPTER FOUR

The problems often encountered and possible solutions

4.1 The control of installations

At the creation of the Company the technicians that the Sonichar took did not have adequate knowledge of the principle of function and this resulted in many problems in the production of electrical energy.

4.2 The second problem is related to ignition system: The coal, which is of lower quality, formed a block, which extinguished the combustion and stop the production of energy.

4.3 Transmission of energy : The company is in the northern part of Niger Republic, where the weather is so hot and so rains hardly fall. So violent wind knocks down poles and obstructs the transmission o energy. We have to note that each day the company would loose 500 to 600 million CFA when the production is stopped.

4.4 Possible Solution

4.4.1 The Company asked for the assistance of specialist from CFDI (Char bonnage de France international) to help them, to teach the technicians in the operation of the power section. A section was created for teaching technicians.

4.2 At this point the basement is composed to two couches divided as follows:

Couch A: The composition of ash is very low about 40% the coal is very good.

Couch B: The composition of ash is very high about 60% the coal is very poor.

So only the couch A since the coal is very good. There will be no more blockages, which may stop the combustion.

At this point they can't do any thing against the violent wind, but they suggest to the company, which supplies them the poles of increase hardness.

To avoid a problem to the company and the embarrassment of the customers, Sonichar bought the components of motor and any device useful to the company, which will easily, spoiled in France. If there is any problem they will quickly repair it. Like every other company, Sonichar cannot operate continuously without a failure but in the electrical field those problems above are the major problems associated with the company.

The Problems

The decline of uranium price and the decrease of demand had resulted in non-implementation of some project on one hand. On the other hand the weight of the debt on the SONICHAR because of the increase of Dollar in 1981, the damage and incident of running of the network and installations lead SONICHAR at the end of 1982, of the following results.

Cumulative Lost:	15,8 Billions CFA
Treasurer	2,2 Billions CFA
Supplier Debt	2.2 Billions CFA
State Debt	2.6 Billions CFA

The Niger Republic quickly requested the technical assistance of the Char bonnage de FRANCE international "(CDFI) to save SONICHAR from disappearance prematurely.

Solution

During the period of straightening, CDFI worked particularly on:

i. Rising of tariff

ii. Spreading out of borrowing

iii. Spreading out of debt of supplier and the State.

After 2 years the plan of straightening was a success. So the treasury became positive, the result of work became positive and technical work was better known. The results are as follow after 2 years.

a. Cumulative lost 8 Billions CFA

b. Treasurer 6.2 Billions CFA

c. Supplier Debt 153.911 Billions CFA

d. State Debt 1.080 Billions CFA

CHAPTER FIVE

JSION

…electrical energy supply to Niger Republic is from Nigeria and local …r, which used fuel. But the price of fuel and the need to extent power …y to Northern Niger make research for new and sources of energy is …perative, The establishment of SONICHAR is a success in the reduction of the dependence in electricity supply from Nigeria.

The steam power station "(SONICHAR)" is a reliable alternative source of energy, but unfortunately the coal is of low quality (51% of ash) There is therefore urgent need to find solutions to ensure the continuity of electricity supply.

We have to note, however that the thermal power station from coal is of low cost and easily maintained at 1.1kg/Kw.

During my visit, the Engineer in charge of the exploitation shown me all the components involved in the generation of electricity from steam power at SONICHAR (Niger Republic). I became convinced that power generation from coal has a great future in Niger Republic.

RECOMMENDATION

1. In order to decrease the dependence of Niger Republic on energy supply from Nigeria, studies should be done to expand the generation of energy from SONICHAR to meet 80% of the country's need.

2. Training of Staff should be given attention in order to achieve high degree of performance and efficiency.

3. Studies should be done to discover new basements of coal.

4. Laboratory test of coal should to be full, with a modern materials and equipment so that good quality coal can be identified and use to avoid the formation blockages in furnace which stop the combustion and efficient production of energy.

REFERENCE

1. A. K. THERAJA AND B.L. THRAJA: A textbook of Electrical Technology 22nd Edition 1999 S. Chand Publishing Company, New Delhi.

2. M. M. EL-WAKIL Power plant Technology Mc Graw-Hill Book Co- Singapore 1985.

3. ARCHIE W. CULP. JR: Principles of energy conversion Mc Graw- Hill Book Co- Singapore.

4. NWOHU, O., Power System and source of energy (300 Level Lecture Handout), 2001/2002 session.