

# Hydropower Development at Tiga and Challawa Gorge Dams, Kano State, Nigeria

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# INTRODUCTION

- ✦ Kano state is one of the 36 states of the Federal Republic of Nigeria established in 1968 and now has a population of over 12 million people;
- ✦ Kano State used to be the second largest Industrial and Commercial State in Nigeria;
- ✦ Kano State needs about 400MW of Electricity now but gets only about 50MW from PHCN.

# ELECTRICITY GENERATION IN NIGERIA

- ✦ 1896 - Electricity Generation introduced by the Public Works Department (PWD) into Nigeria in Lagos using Steam and Diesel Engines;
- ✦ 1930 - Kano started generating its own electricity with a 2x300KW, 3-phase 400Volts, 50 Hz power plant constructed by the Native Authority (NA);
- ✦ End of 2<sup>nd</sup> World War – The Nigerian Government Electricity Undertaking (NGEU) was established to take over electricity supply from PWD;
- ✦ 1950 - Electricity Corporation of Nigeria (ECN) was formed to take over all the Undertakings of NGEU;

# ELECTRICITY GENERATION IN NIGERIA – Cont.

- ❖ 1959 - the power demand in Kano and Kaduna became so great that the ECN installed a new type of Turbine (Free Piston Plant) which never worked at all. To meet the Kano-Kaduna load demand, generating units were dispatched hurriedly to the area from existing power stations in the South;
- ❖ The whole country became dotted with isolated power stations, making it difficult for power to be supplied economically. To supply reliable and efficient power, interconnection of all the major power sources became necessary and urgent. Thus, the idea of a National Grid emerged;
- ❖ 1962 - the Niger Dams Authority was established to develop hydropower on the main River Niger;

# ELECTRICITY GENERATION IN NIGERIA – Cont.

- 1972 - Niger Dams Authority was merged with the Electricity Corporation of Nigeria to form the National Electric Power Authority (NEPA);
- 2005 - Electric Power Sector Reform Act, establishment of NERC, transformation of NEPA into PHCN and its unbundling into 18 GenCos/DisCos and one Transmission Company;
- Total installed capacity at present is about 4,200MW with an actual generation of only 2,300MW as against an estimated minimum National demand of 80,000MW.



# Existing and Proposed Power Plants under Construction - 2008



# PROBLEMS OF ELECTRICITY GENERATION IN NIGERIA

- Until recently fully Government owned with all the bureaucracy (and inefficiency?);
- Availability and reliability of electricity supply for end users far below what is necessary for the level of social and economic development targeted for the country;
- Not able to provide adequate, or adequately reliable, supply of electricity to its customers;
- Not able to connect and supply new customers in a reasonable time; and
- Not financially sustainable.

# KANO STATE'S EFFORTS AT LOOKING FOR ALTERNATIVES

- ✦ With the low level, poor quality and epileptic supply of electricity, many industries have closed down, with the attended unemployment, especially of the youth;
- ✦ In the year 2003 for example, a single Textile that closed down, led to the loss of about 4,000 jobs.
- ✦ Effect on Water supply, Health, Education, Commerce, Security, Traffic and others
- ✦ Kano State, therefore, started looking at the possibility of generating it's own electricity, once again to supplement the grid;



# KANO STATE'S EFFORTS AT LOOKING FOR ALTERNATIVES

Kano State Committee on Energy looked at various alternatives:-

- ✦ Coal and hydro - review of existing studies. Why have these schemes not been implemented? More detailed economic/commercial feasibility study required;
- ✦ LPFO;
- ✦ Indigenous gas/oil likely to be very long term projects;
- ✦ Gas via pipeline/crude oil schemes;
- ✦ Solar/Wind/Biomass (including waste to energy) - are expensive but are appropriate for rural areas not connected to the Grid;

# KANO STATE'S EFFORTS AT LOOKING FOR ALTERNATIVES

The Committee also looked at the following Policy Framework Limitations: -

- ✦ Any development must be within the Federal Government electricity policy framework
- ✦ Any new generation has to be connected to the transmission system – therefore national implications
- ✦ MYTO is based on cheap gas/OCGT – any other scheme has to be able to recover costs and cost of investment
- ✦ New generation must address transmission and distribution investments

# STAKEHOLDERS WORKSHOP - COVERAGE

- The initial best view of timing and cost (investment and running cost) for each project;
- Availability, likely cost and security (physical and commercial) of the fuel source;
- Access to market – transmission and distribution networks: technical and commercial position;
- Options as to who will buy the power, including credit rating, need for security, Federal and State Governments commitments;
- Options for finance, including donors, Government (Federal, State and Local), Excess Crude Account, private participation;
- Identification of other key issues through use of SWOT analysis or other analytical approach;
- Identification of other options not in the existing Kano project list;
- Initial prioritisation of projects.

# HYDROPOWER - EARTH DAM CONSTRUCTION IN KANO STATE

- ✦ Due to the climatic condition of Kano State, seven months dry and five months rainy seasons, and the fact that the whole state lies on the basement rock complex, the large amounts of water required for domestic use and dry season farming could only be impounded by dams;
- ✦ Under the First Kano State Government's Master Plan (1974 to 1980), over 20 Earth Dams were designed and constructed for the purpose of supplying water for domestic and agricultural use;
- ✦ Two of these dams, Tiga and Challawa Gorge dams were designed to have facilities for hydro power generation. While Tiga was completed by Kano State Government, Challawa Gorge was started but handed over to the Federal Government, and the two are now under the Hadejia Jama'are River Basin Development Authority;
- ✦ Fifteen of these dams are still within Kano State while the others are in Jigawa State.

# EARTH DAMS IN KANO STATE

S/No	Dam	Year Completed	Catch. Area (km <sup>2</sup> )	Maximum Height (m)	Active Storage (m <sup>3</sup> million)
1.	Bagauda	1970	207	20.73	20.91
2.	Karaye	1971	80	15.24	15.99
3.	Tiga	1975	6,641	47.24	1,845
4.	R/Kanya	1976	N/A	21.95	N/A
5.	Tomas	1976	585	13.72	56.60
6.	Jakara	1976	559	14.33	54.37
7.	K/Chiri	1977	225	16.00	24.60
8.	T/Wada	1977	85	21.00	N/A
9.	Guzu-Guzu	1979	106	17.40	635



# EARTH DAMS IN KANO STATE

## (Continued)

S/No	Dam	Year Completed	Catch. Area (km <sup>2</sup> )	Maximum Height (m)	Active Storage (m <sup>3</sup> million)
10.	Magaga	1980	119	19.35	17.22
11.	Fada	1980	62	14.23	10.50
12.	Marashi	1980	43	11.15	5.79
13.	Gari	1980	1,155	22.00	203.00
14.	Watari	1980	653	19.81	92.74
15.	Challawa Gorge	1992	3,859	39.62	904.00

# TIGA AND CHALLAWA GORGE DAMS AS INITIAL OPTIONS FOR HYDRO POWER DEVELOPMENT

- ✦ 2000 to 2001 – Wardrop was commissioned to carry out Preliminary Technical Investigation;
- ✦ Report confirmed that it is technically feasible and realistically practicable to construct Hydro power Plants on the two dams;
- ✦ Based on 35 year rainfall record, power supply will vary significantly from dry season to rainy season and from year to year following a cyclic pattern (approximately every 30 years);
- ✦ Based on industry standard for Hydro Power projects, the power would cost in the range of N14 to N18, which is two to three times the PHCN (MYTO) price.

# TIGA DAM

- Approximately 2/3 of the time capacity will be 10 to 15 MW during the rainy season and 3 to 4 MW in the dry season;
- Approximately 1/3 of the time capacity will be about 5 MW during the rainy season and 3 to 4 MW in the dry season;
- Average generating capacity 5.3MW

# CHALLAWA GORGE DAM

- ◆ Approximately 2/3 of the time capacity will be 3 to 4 MW during the rainy season;
- ◆ Approximately 1/3 of the time capacity will be about 2 to 3 MW during the rainy season;
- ◆ Dry season capacities are only about 1 to 2 MW;
- ◆ Average generating capacity 3MW.

# MAJOR CONSIDERATIONS

- Environment;
- Existing Usage;
- Financing;
- Who pays for the Power;
- Regulatory Issues;
- Ownership and control of the Dams;
- Stake holder education  
(Communication Issues).



# ENVIRONMENTAL ISSUES

- ✦ Since the dams and reservoirs have already been constructed, the additional environment problems due to construction of hydro power plants would be minimal;
- ✦ More detailed study is required to confirm the integrity of the dams;
- ✦ Detailed Environmental Impact Assessment will have to be conducted –  
Typer Grass, Farming Communities  
outside the formal HJRBDAs areas, etc;

# FINANCING THE PROJECT

## ◆ Options for finance

- State Government
- Federal Government
- Excess Crude Account
- Bank finance
- Donors
- Private participation
- Hybrid of above

# WHO PAYS FOR THE POWER?

- The power is estimated to cost in the range of N14 to N18, which is two to three times the PHCN (MYTO) price;
- The Subsidy claimed by MYTO is not yet clear neither is the way IPPs would benefit from it;
- No clearly defined policy (Power Purchase Agreement) on who buys the power – the DisCos, PHCN, TCN?

# AQUA ENERGY

- AQUA Energy Nigeria Limited is a new company;
- AQUA Energy is gathering the world's top expertise in hydropower to help Nigeria draw electricity from its dams and rivers.

# AQUA ENERGY

Mission: -

- With the highest regard for reliability and safety, gather some of the world's leading expertise and manufacturers in order to offer Nigeria, from suitable dams and rivers, the solutions that creates the optimal amount of hydro power electricity and clean water.



# AQUA ENERGY

## Partners of AQUA Energy Nigeria Limited:-

### Genfer Lloyd

- medium size company with expertise in **CIVIL-WORKS** (building dams) for hydro power. employs around 500 staff.

### Energi Teknikk AS

- a leading company in Norway for **TURBINES** and **EQUIPMENT** on small hydro power.

### Aqua Vitale AS

- a small company manufacturing **WATER FILTERING** on exit from hydro power generator

## THE NEW DESIGN FOR TIGA AND CHALLAWA GORGE HYDRO POWER PROJECTS

- ◆ Need to provide uninterrupted, good quality power irrespective of the season;
- ◆ Consideration for the Environment;
- ◆ Consideration for the existing irrigation, water supply and others uses of the two dams;
- ◆ Consideration for all the stakeholders.

## NEW DESIGN FOR TIGA

- 2No. GHE Francis-Spiral Turbines with horizontal shaft, runner mounted directly on the generator shaft, with adjustable guide vanes on the River Bed, designed to give a total of 3MW;
- 3No. GHE Francis-Spiral Turbines with horizontal shaft, runner mounted directly on the generator shaft, with adjustable guide vanes on the Channels, designed to also give a total of 3MW;
- A total of about 6MW is therefore expected;
- Environmental Impact Assessment Commissioned.

## NEW DESIGN FOR CHALLAWA GORGE

- 3No. GHE Francis-Spiral Turbines with horizontal shaft, runner mounted directly on the generator shaft, with adjustable guide vanes on the Channels, designed to give a total of 3.5MW;
- A total of about 3MW is therefore expected;
- Environmental Impact Assessment Commissioned.

# FINANCING/PPA

- ✦ IFC/ADB willing to Finance but ...
- ✦ PHCN (Kano DisCo) not willing to buy the power but ...
- ✦ ADB willing to give concessionary loan to KNSG for Sub-stations rehabilitation, transmission/distribution lines rehabilitation, installation of prepaid meters and replacement of bulbs with energy savers;



# MAJOR CHALLENGES - OWNERSHIP & CONTROL OF THE DAMS

- ◆ Federal Ministry of Water Resources;
- ◆ Hadejia Jama'are River Basin Development Authority;
- ◆ KNSG;
- ◆ Other Stake Holders.

# STAKE HOLDER EDUCATION - COMMUNICATION

- ◆ Stake holder meetings



# THE REMAINING 13 EARTH DAMS?

Partners/Donors may consider studying and developing, please!.



THANK YOU VERY MUCH FOR  
LISTENNING!

