

Potentials of Small Hydro Power in Nigeria: The Current Status and Investment Opportunities

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ABSTRACT- This write-up summarizes the small hydro power potentials in Nigeria, its present status and investment opportunities. Nigeria is endowed with so many resources both human and natural; the need to harness these resources in serving the human needs is paramount. Renewable energy remains the cleanest, most reliable and inexhaustible energy type and Nigeria is blessed with almost all types of renewable energy resources. One of the most readily available renewable energy resources is small hydro. Nigeria had the potentials of over 277 dispersed small hydro sites capable of generating electric power of about 734.2MW out of which only 30MW has been harnessed in 2005, and the potential as at today is estimated to reach 3,500MW. This of course is good enough to attract any serious investors considering the overwhelming population of the country as well as the high demands of electricity in all the surrounding villages of the said potential small hydro sites. Although there are few challenges in the sector, but one important assertion is that, the profit margin in SHP in Nigeria cannot be overemphasized and investment in this sector will be highly rewarding.

Index Terms: Electricity, Energy, Small Hydro, Investment

INTRODUCTION

Small Hydro Power Plants are used to generate electricity from small water bodies. According to Sambo (2008) Electricity plays a very important role in the socio-economic and technological development of every nation. The electricity demand in Nigeria far outstrips the supply and the supply is epileptic in nature. The country is faced with severe electricity problems, which hinders its development despite the availability of enormous natural resources in the country. It is broadly accepted that there is a well-built correlation between socio-economic development and the accessibility of electricity. Nigeria is endowed with tremendous natural resources some of which can readily and easily be utilized in the generation of electricity which is the most chiefly transformed energy type. Amongst the sources of electricity generation in the nation are small hydro power resources. Small hydro power is being generated from small rivers. A small River is universally defined as the river with catchments area less than 500km² or in a precise sense, less than 300 km². From the point of view of small hydro power development, river lake or stream with catchments area less than 100 km² is quite of interest (Abdullahi, 2005).

However, Nigeria has numerous of the said small rivers, but yet it's faced with severe energy crises. Harnessing the potentials of small hydro in electricity generation will go an

extra mile towards a drastic reduction of energy crises in the nation. This will also provide the country with easier rural electrification options as well as generate jobs for the youth within the catchment areas where the said small hydro are localized and consequently, the rate of unemployment will be reduced. Without access to reliable and affordable energy services, significant social and economic development principally cannot occur. This is particularly right for the rural remote communities as they are unduly burdened by lack of contemporary energy services and its limiting effect on revenue generating activities and poverty reduction (NCWR, 2008).

POTENTIALS OF SMALL HYDRO IN NIGERIA

According to Bala (2010), Energy consumption in Nigeria by type and by total vindicates hydropower as covering up to 23.9% in 2007; it was 14.2% in 2003, the sudden growth from 14.2% to 23.9% between 2003 and 2007 shows that, there is improvement close to 100% within four years.

Details as shown in the table below:

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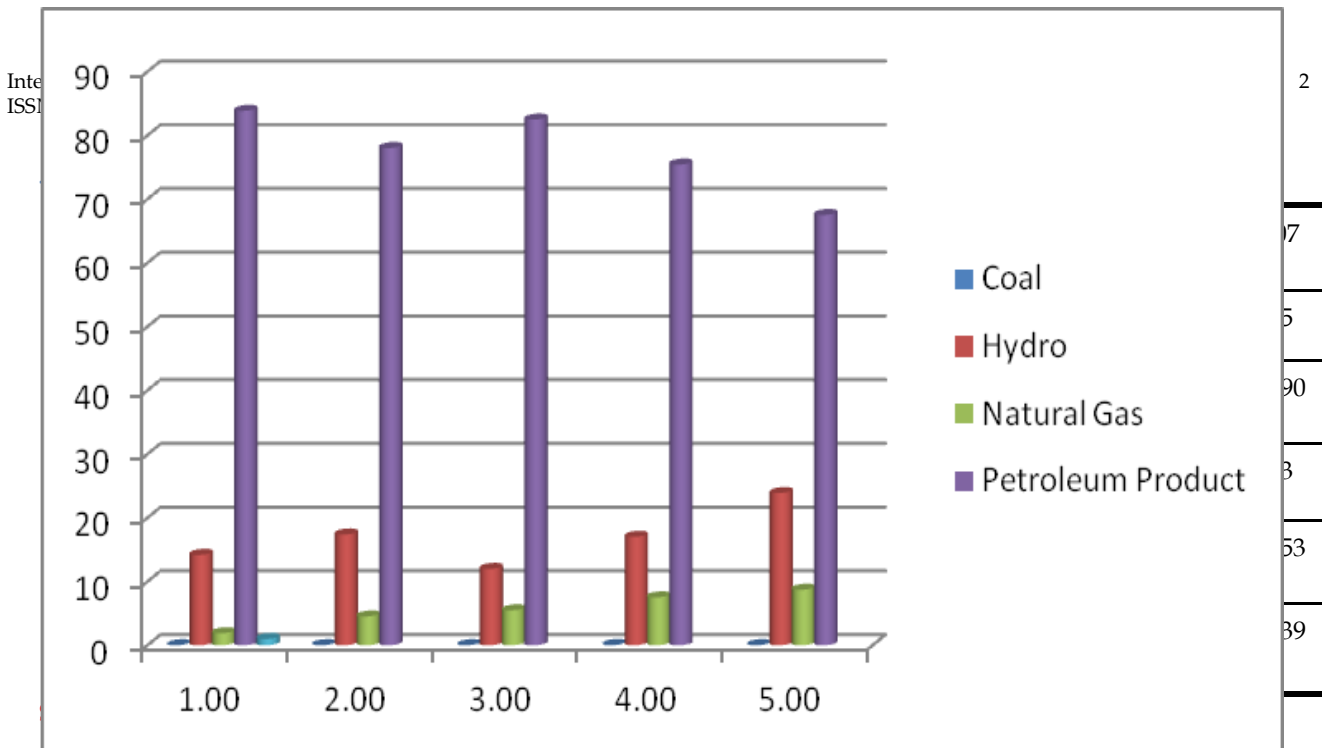


Figure 1: Energy Consumption by Type from 2003 to 2007

The foremost rivers of Nigeria, such as the Niger, Benue, Cross River, Kano and their tributaries along with some smaller rivers, provide a desirable potential for the exploitation of hydro energy in Nigeria. In the same way, mountains and hilly terrains with high river slopes, predominantly in the Jos/Bauchi and Mambilla Plateau regions proliferate, and have very good sites for construction of reservoirs and diverting flows for electricity generation. This technically exploitable hydropower potential is put at 20,000 MW, though the hypothetically approximated potential is about 30,000 MW. The large-scale development of hydro potential is mainly restricted by the fluctuating characteristics of the Nigerian river flows. Usually, the rivers are characterised with high water discharges in rainy season and with very low discharges in the dry season. Currently, the main hydro sites are at Kainji and Jebba on the river Niger and Shiroro on the Kaduna River, with generating capacity of 760, 640 and 600 MW correspondingly. In addition to these, there are numerals of small-scale hydro schemes around Jos Plateau, generating and supplying about 19 MW by a private sector operator, National Electricity Supply Company (NESCO). Viability studies have since been completed for 3 hydro stations at Makurdi, Lokoja and Ikom. In addition to these sites, there are a great numeral of identified sites with potentials for

supporting micro hydro (less than 100 kW), mini hydro (between 500 kW and 5,000 kW) systems, in over 248 small rivers in the country. A network of small decentralized plants may be well favoured as small rivers and waterfalls are widespread and usually more disseminated than large waterfalls and consequently they proffer prospects for the development of isolated and remote areas. As of today, of all the renewable energy resources, only hydro energy is being meaningfully exploited (UNIDO, 2006).

Furthermore, for any small hydro power station, the potential power can be calculated as follows (Sule, 2010):

- Theoretical power (P) = Flow rate (Q) X Head (H) X Gravity (g)
- When Q is in cubic metres per second, H in metres and $g = 9.81 \text{ m/s}^2$ then,
- $P = 9.81 \times Q \times H \text{ (kW)}$
- Nevertheless, energy is forever lost when it is transformed from one form to another.
- Small water turbines rarely have efficiencies above 80%.
- Power will also be lost in the pipe conveying the water to the turbine, due to frictional losses.
- By cautious design, this loss can be abridged to only a little percentage.

The two tables below summarize the identified small hydro power potentials in Nigeria

Table 3: Summary of Small Hydro Potential Sites Nigeria

S/N O	STATE	POTENTIAL SITES	CUMMUIATIVEPOWER ESTIMATE (MW)
1	Adamawa	3	28.600
2	Akwa Ibom	13	
3	Bauchi	1	0.150
4	Benue	10	1.306 (1 Site)
5	Cross River	5	3.000
6	Delta	1	1.000
7	Ebonyi	5	1.399
8	Edo	5	3.828
9	Ekiti	6	1.2472
10	Enugu	1	
11	FCT	6	
12	Gombe	2	35.099
13	Imo	71	
14	Kaduna	15	25.000
15	Kano	2	14.000
16	Katsina	11	234.34
17	Kebbi	1	
18	Kogi	2	1.050
19	kwara	4	5.200
20	Nassarawa	3	0.454
21	Niger	11	110.580
22	Ogun	13	15.610
23	Ondo	1	1.300
24	Osun	8	2.622
25	Oyo	3	1.062
26	Plateau	14	89.100
27	Sokoto	1	
28	Taraba	9	134.720
29	Yobe	5	
30	Zamfara	16	

Source: UNIDO-RC-SHP in Africa, Abuja, 2009

Table 2: Small Hydro Potentials in Surveyed States in Nigeria

S /N	State (Pre 1980)	River Basin	Sit es	Tota l MW
1	Sokoto	Sokoto-Rima	22	30.6
2	Katsina	Sokoto-Rima	11	8
3	Niger	Niger	30	117. 6
4	Kaduna	Niger	19	59.2
5	Kwara	Niger	12	38.8
6	Kano	Hadejia- Jamaare	28	46.2
7	Borno	Chad	28	20.8

8	Bauchi	Upper Benue	20	42.6
9	Gongol a	Upper Benue	38	162. 7
1	Plateau	Lower Benue	32	110. 4
1	Benue	Lower Benue	19	69.2
1	Rivers	Cross River	18	258. 1
2	Total		27 7	734. 2

Source: ECN-UNDP Renewable Energy Master Plan
2005

CURRENT STATUS OF SHP IN NIGERIA

As at 2005, the recognized SHP prospective for Nigeria was about 734.2MW of which only 30MW had been developed (ECN-UNDP RE Master Plan, 2005). A study of SHP potential in Nigeria had also been considered for support by African Development Bank, (UNIDO, 2006). According to (Brian and Emma, 2009), UNIDO has concluded two of four designed pilot projects planned to build awareness and generate capacity for micro-hydro power development in Nigeria. The project in Enugu State (30KW capacity) and Bauchi State (150KW) were undertaken through a partnership, with UNIDO providing the equipment and proficiency, and states and local government providing erstwhile logistics and labour in-kind. Power generated from the projects will supply electricity for lighting, agricultural processing and information and communications technology (ICT) for local communities. The projects also provide technical training and energy efficiency responsiveness to ensure the technology is maintained locally and sustainably. Furthermore, the National Agency for Science and Engineering Infrastructure, NASENI is developing capacity in the manufacture of SHP Equipments (NASENI, 2011). According to the Agency, it has been approximated that the entire Small Hydro Power (SHP) Potential in the nation might reach 3,500MW, signifying 23% of the country's entire hydropower potential. With this prospective in SHP, there will be a rising demand for local capacities in the expansion of this technology in the country. In the late 2007, UNIDO brought in NASENI to a Stakeholders summit on the Local Manufacturing of Small Hydro Power Equipment in the African constituency. NASENI has been identified as the Host Agency and the delegate of the Nigerian Government on the mission. Whereas UNIDO awaits Nigeria's complementary subsidy, cross flow turbine has been chosen for the first manufacture involving Nigerian engineers and using domestic technology.

CHALLENGES

Despite all the prospects and potentialities in the SHP sector in Nigeria, the sector is still faced with acute challenges which if not overcome, will become impediments to the advancement of the sector and consequently will retard the process of harnessing the whole potentialities of the sector.

Some of the challenges of Nigeria Small Hydro Power comprise:

1- Lack of numerous programmes for capacity building and training on renewable energy and in particular on SHP, to uphold and accelerate sustainable development in the region, such capacity building programmes have to be conducted on frequent basis. This will eventually assist the design of cost effective Renewable Energy Technologies using locally manufactured equipment, resources, and labour, and systematizing consultancy services on broad portions of renewable energy

scheme and particularly those interconnected to small hydropower improvement.

2- There is a particular need to embark on enlightenment campaigns through the conduction of seminars and workshops at both national and regional levels in the area of small hydropower, this is because there is lack of awareness by the public on the significance of this sector and there are less manpower and human resources to accomplish the project in most parts of the country principally in the areas identified for the project

3- There are financial barriers in funding the SHP projects, the government should support with grant, any investor coming to invest in the sector and there should be incentives and subsidies or even loans with a smaller amount of interest and flexible settlement plans so as to overcome the impediment.

INVESTMENT OPPORTUNITIES

- According to the Nigeria Investment Promotion Council, NIPC (2011), Nigeria has a population of about 160 million people with over 2000 years of traditional culture and has one of the most modern life styles on the African continent. Nigeria is endowed with enormous natural resources, abundant mineral wealth, including massive crude oil and gas reserves, large deposits of solid minerals and abundant agricultural lands. Nigeria's pool of highly educated and skilled manpower is the biggest in Africa. Skilled and trainable manpower at all levels with industrial experience abound are a major attraction for situating investments in Nigeria. The government privatization agenda is intended to cut down the cost of doing business in Nigeria and enhance the effectiveness of all public enterprises as well as making the private sector to become the economy's engine of growth.

- SHP can supply power for manufacturing, agricultural and household uses in the course of direct mechanical power or by the union of the turbine to a generator to turn out electricity.

• The nation needs substantial scaling up of quantity and quality of energy services in view of the fact that the nation's energy demand is on the increase and the general power supply body - Power Holding Company of Nigeria (PHCN) has been unable to convene the growing electricity supply. Wider partaking in power production and supply is very vital if Nigeria is to meet up with its energy demand and achieve the required industrial and economic advancement.

CONCLUSION

Nigeria is abound with potentials in small hydro power and has the capacity to generate as much as 3,500 MW of electricity which is more than enough to cater for its rural electrification needs, as well as the ICT power requirement

and irrigation systems of all the surrounding villages, in over 248 small hydro sites cut across the six geopolitical zones of the country. There are few challenges in the sector. The overwhelming population and the widespread demands for energy in the nation make it possible to earn very high returns on investment and hence, the investment opportunities in the sector are motivating for any investor whether local or foreign.

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