WORLD SMALL HYDROPOWER DEVELOPMENT REPORT 2013

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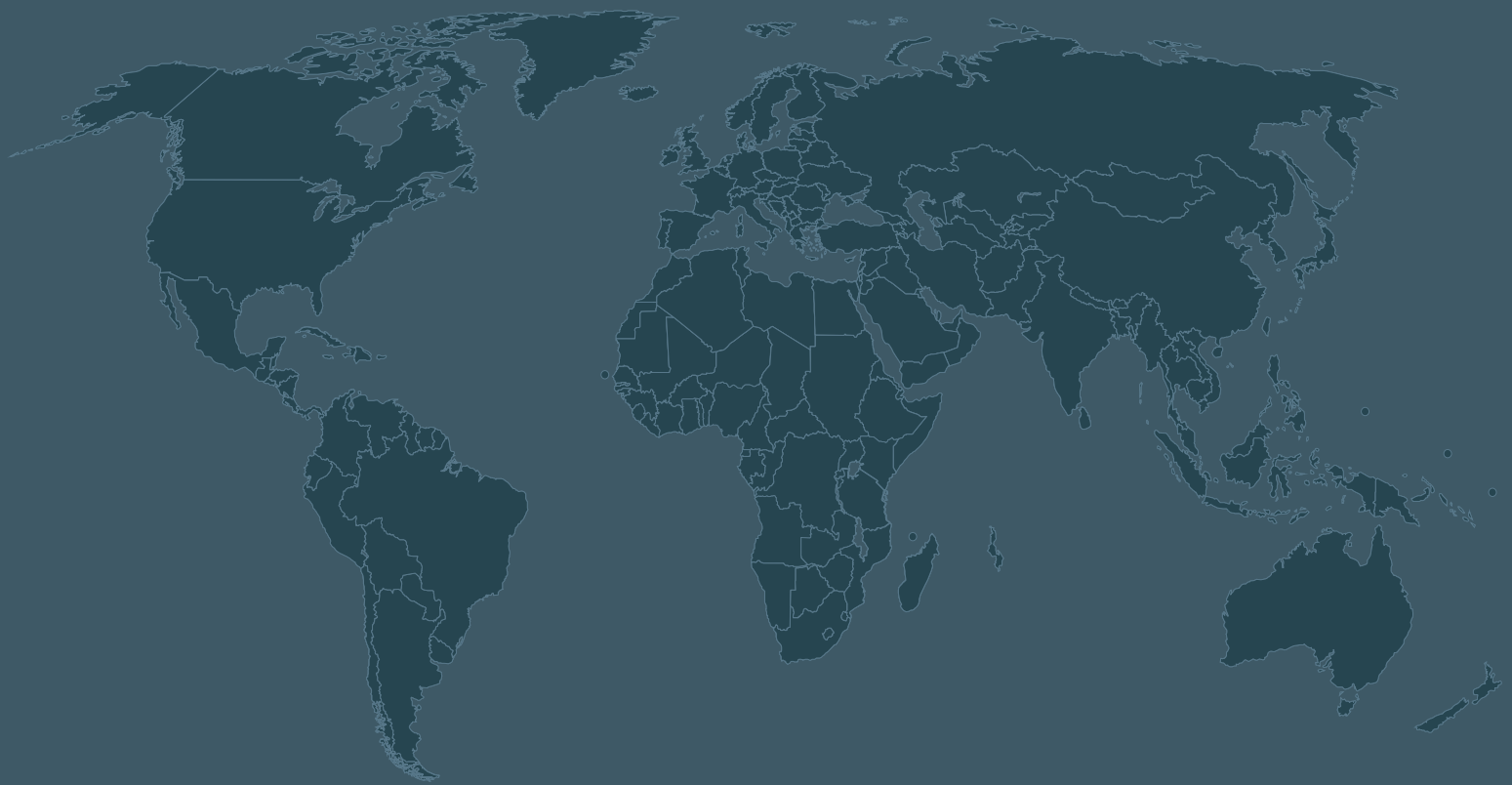
NIGERIA



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1 Africa
1.5 Western Africa

1.5.8 Nigeria

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Key facts

Population	170,123,740[1]
Area	923,766 km^2
Climate	Varying climate; equatorial in south, tropical in center, arid in north[1]
Topography	Southern lowlands merge into central hills and plateaus; mountains in south-east, plains in north. The river Niger enters the country in the northwest and flows southward through tropical rain forests and swamps to its delta in the Gulf of Guinea.[1]
Rain Pattern	Rainfall has decreased from 1,350 mm (1941–1970) to 1,276 mm (1970–2002) annually. However, the coastal area is experiencing a light increase. Apart from the general southward shift in rainfall patterns, the intensity of rainy days has also decreased from 80-360 mm (year 1941 to 1970) to 40-280 mm (year 1970 to 2002).

Electricity sector overview

The dominant sources of power generation in Nigeria are natural gas and hydropower. The estimated installed electricity generation capacity is 8,644 MW, while available capacity is approximately 3,200 MW.[2] With an estimated technically exploitable potential of 20,000 MW, the hydropower potential of Nigeria is high and hydropower currently accounts for about 32 per cent of the total installed commercial electrical power capacity.

Despite the country's abundance of petroleum and other natural resources, more than 60 per cent of the country's population has no access to electricity. The annual electricity consumption per capita of the remaining 40 per cent is about 109 kWh due to frequent power interruptions, load shedding and poor electricity infrastructure. This instability of the electricity system is seen as one of the causes for poor health services and poor economic growth.[3] [4] [5]

Electrification access stands at 50.6 per cent. As of 2009, only 10 per cent of rural inhabitants, which makes up 50 per cent of the total population, are connected to the national grid.[6]

The transmission network is overloaded with a wheeling capacity of less than 4,000 MW and has a poor voltage profile in most parts of the network, especially in the north part of the country where there is inadequate dispatch and control infrastructure, radial and fragile grid networks, frequent system collapses and exceedingly high transmission losses. Indeed, 40 per cent of the electricity generation is lost during transmission to the national grid.[7] According to Llugbo (2012), vandalism and theft of cables and other vital equipment are frequent, as well as accidental destruction of distribution lines and illegal connections, what often results in over-loading of the distribution lines, unannounced load shedding, and prolonged and intermittent outages. Consequently, many industrial outfits have resorted to generating their own off-grid electricity.[8] The African Development Bank (2009) has reported that instability in electricity supply is by far the most binding constraint to doing business in the country.

Small hydropower sector overview and potential

Nigeria adheres to the internationally accepted small hydropower definition (10 MW capacity limit). Plants with capacities up to 1 MW are considered mini hydropower in Nigeria, and those with capacity up to 500 kW are considered as micro hydropower.

With the set-up of the UNIDO Regional Centre for Small Hydro Power in Abuja in 2006, Nigeria is considered as one of the few places for systematic capacity development in small hydropower technology in Africa. It should serve not only for domestic needs but also for giving guidance to other countries in Africa.[9] Nigeria has a short term target of installing 100 MW of small hydropower capacity, and a medium target of 760 MW based on the renewable energy master plan (2006).[10] Please see following discussion on small hydropower potential.

There are various installed small hydropower plants reported for Nigeria. In 2011, it was reported that five small hydropower plants (up to 10 MW definition) exist in Nigeria (23.35 MW and 204.55 GWh/yr).[11] However, the *Baseline Report on Small-Scale Hydropower in the ECOWAS Region* lists 45 MW of existing small hydropower plants (up to 10 MW), 18 MW of which needs to be rehabilitated, as well as an additional 191 kW of micro capacity (figure 1).[12]

There is varying information on the potential of small hydropower in Nigeria. According to UNIDO Regional Centre on Small Hydropower, the gross small hydropower potential (for plants up to 10 MW) is 720 MW, the technically feasible potential is 605 MW and

the economically feasible potential is 498.4 MW.[11] A study from 2006 identified 278 yet undeveloped sites for small hydropower production with a total of 734.2 MW (with a definition of up to 30 MW).[13 14]

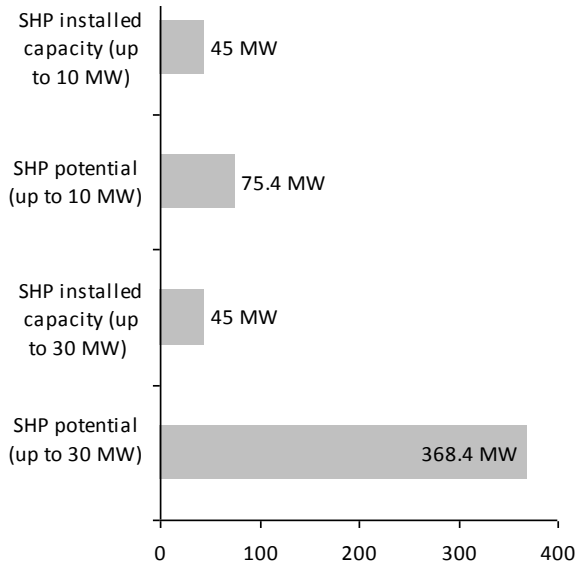

Figure 1 **Small hydropower capacities in Nigeria**
Source: Ecowas Centre for Renewable Energy and Energy Efficiency[12] and authors' calculation

Ongoing small hydropower activities are:

- 2x75 kW Waya Dam, Bauchi State plant completed (United Nations Industrial Development Organisation (UNIDO), Energy Commission of Nigeria (ECN), Bauchi State Government).
- 1x30 kW Ezioha-Mboro Dam small hydropower, Enugu (UNIDO, ECN).
- 2x200 kW Tunga Dam small hydropower, Taraba State (UNIDO)
- Capacity building in hydropower research and development at the National Centre for Hydropower Research and Development (NACHRED), University of ILORIN.

Renewable energy policy

In April 2010, the Federal Ministry of Power established a standing committee to work out ways of developing the country's capacity in the hydropower sector as part of its strategy to tackle its endemic problems.[9] So far there is no feed-in-tariff regulation in place.

Nigeria has a National Energy Policy that has been approved and launched in 2003, as well as a National Energy Master Plan and a Renewable Energy Master Plan in final draft.[15] Main targets are the expansion of electricity supply to 75 per cent of the population by 2025 and a stronger participation of the private sector. It also foresees a promotion of renewable energies and their incorporation in the national energy mix.[9] The goal is to generate 18 per cent of electricity from renewable energies by 2025, and 20 per cent by 2030, with broad objectives as follows:[16]

- To enhance energy security in the nation by diversifying the energy supply mix;
- To increaes energy access especially in the rural and semi-urban areas;
- To facilitate employment creation and empowerment;
- To protect the environment and to mitigate climate change.

Barriers to small hydropower development

As discussed in the previous sections, the issues of vandalism, theft and illegal connections to the grid make investment in electricity infrastructure difficult and limit business opportunities, with many firms struggling or failing to survive as an indirect result of electricity supply problems. However, small hydropower, particularly in its micro and pico forms, offers the possibility of energy security to rural areas. Due to the difficulties in the electricity infrastructure both people and businesses are ready to embrace small hydropower and other mini-grid solutions.[8] This provides a good springboard for small hydropower if it can overcome capacity building and technical barriers such as:

- Lack of small hydropower skills and information of the potential sites;
- Lack of feasibility studies;
- Need of information and awareness raising in rural areas;
- Energy infrastructure financing difficulties;
- Lack of energy service companies which can efficiently develop and operate the sites;
- Absence of local small hydropower research and development and small hydropower equipment manufacturing.[9]

Overlapping mandates and conflicts over responsibilities in Nigeria, including disagreements between the agencies responsible for water resources and those for power generation and distribution also affect small hydropower development.[10]

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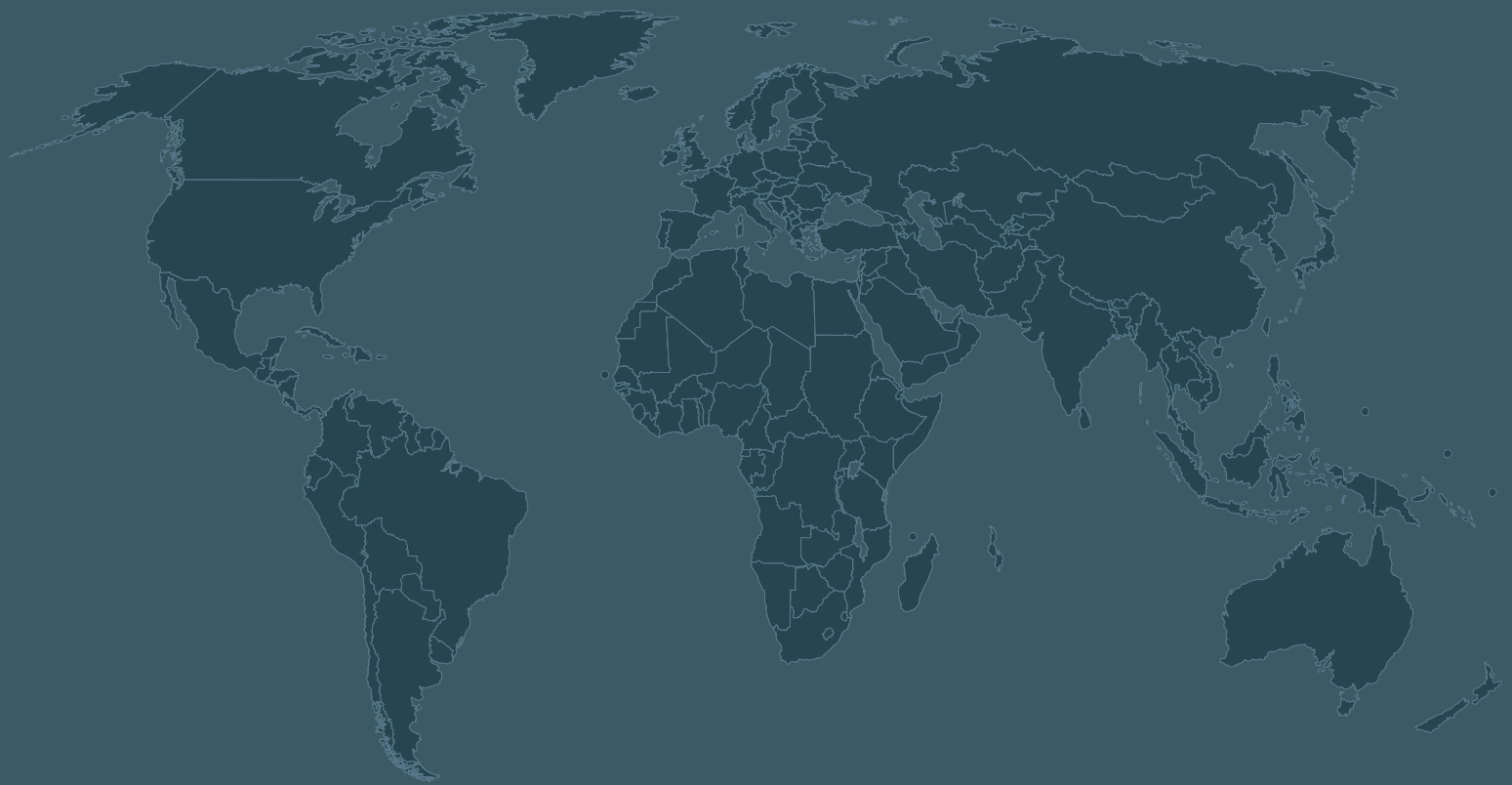

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