# DISTRIBUTED GENERATION (RENEWABLE ENERGY) - BEST OPTION FOR OIL BEARING COMMUNITIES

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## ABSTRACT
Energy, particularly electricity is the pivot of social and economical development of any nation. In view of this, oil company operatives in Nigeria enter into Memorandum of Understanding (MoU) with their host communities for the provision of electricity and water supply. This paper examined the energy supply source of these companies to their host communities in place of the available alternatives (renewable energy). The present power supply source is discovered to be inimical to the environment. The use of renewable energy was considered the best option for oil bearing communities as they are already faced with emission from gas flaring and need not to endanger their environment with further hydrocarbon emission.
**Keywords:** Renewable Energy, Hydrocarbon Emission and Oil Bearing Communities.

## INTRODUCTION
Electricity generation in Nigeria started from the burning of fossil fuel, use of small diesel generators to hydro power and gas fired plants. The nation now has a grid system whose electricity supply is mainly from thermal and hydro plants. Over 70% of which is from thermal (burning of fossil). Distributed generation is small power generation at load centre which is not necessarily thermal but targeted to meet the need of the centre. It is usually of renewable source (solar, wind, hydro and bio-mass). This system of generation is very unconventional to the nation even though it has numerous advantages over the traditional convention of burning fossil.

Electricity supply to oil bearing communities is purely by the use of diesel generators. Despite gas flaring in these areas, production of electricity by burning fossil also releases hydrocarbon emission which is a very serious pollutant to the environment. It adds to human activities that are associated with global warming which are responsible for climate change.

## MATERIALS, METHODOLOGY AND RESULTS
### The National Grid
The Power Holding Company of Nigeria (PHCN) is running a 132kv National Grid System with a total installed power capacity of 7,914.4MW in 2008 for an estimated population of 150 million people, as shown in Table 1. Figure 1 shows a bar chart of the capacities distribution with respect to the power plants feed to the national grid.

Total power generated at the end of that year was 2,403.2MW [1]. In 2009, more fund was injected into the power sector with a projected generation of 6000MW before the end of the year. Unfortunately only 3,700MW was achieved [2].

The major problem of PHCN is generation. With a generation of 3,700MW at the end of 2009, the nation's generation per capita is 24.67MW whereas generation per capita of contemporary nations with Nigeria is as shown in Table 2. Figure 2 shows a pie chart of this distribution, where Nigeria's per capita generation is 24.67MW, with a population of 150 million (representing 1% of the total distribution sample), against South Africa's 1510.2MW, with a population of 44 million (representing 35% of the total distribution sample).

**Table 1: Power Generating Plants in Nigeria [1]**

| S/N | Power Plants Feed to the National Grid | Age of Plant (Years) | Installed Capacity (MW) | Available Capacity (MW) | Operational Capacity (MW) |
|---|---|---|---|---|---|
| 1 | Kainji | 39 to 41 | 760 | 440 | 400 |
| 2 | Sapele | 27 to 31 | 1020 | 90 | 65 |
| 3 | Afam | 27 | 702 | 350 | 300 |
| 4 | Jebba | 26 | 578.4 | 385.6 | 300 |
| 5 | Egbin | 24 | 1320 | 880 | 600 |
| 6 | Shiroro | 23 | 600 | 600 | 300 |
| 7 | Delta | 19 | 840 | 540 | 330 |
| 8 | Egbin AES Enron-Lagos | 8 | 270 | 270 | 220 |
| 9 | Okpai | 4 | 480 | 480 | 400 |
| 10 | Omoku (Obrikom) | 4 | 150 | 100 | 70 |
| 11 | Ogeregu | 3 | 414 | 414 | 414 |
| 12 | Ajaokuta | 3 | 110 | 100 | 80 |
| 13 | Omotosho | 2 | 335 | 80 | 75 |
| 14 | Olorunsogo | 2 | 335 | 80 | 35 |
| **TOTAL** | | | **7,914.5MW** | **4,815.6 MW** | **3,589MW** |

**Table 2: Per Capita Generation of Nigeria and selected Developing Nations [1]**

| Country | Population (Million) | Generation Capacity (MW) | Per Capita Generation (MW) |
|---|---|---|---|
| Nigeria | 150 | 3,700 | 24.67 |
| South Africa | 44 | 46,000 | 1510.2 |
| United Arab Emirate | 4 | 4,740 | 1184 |
| Malaysia | 25 | 24,000 | 960 |
| Iran | 65 | 44,000 | 676.9 |

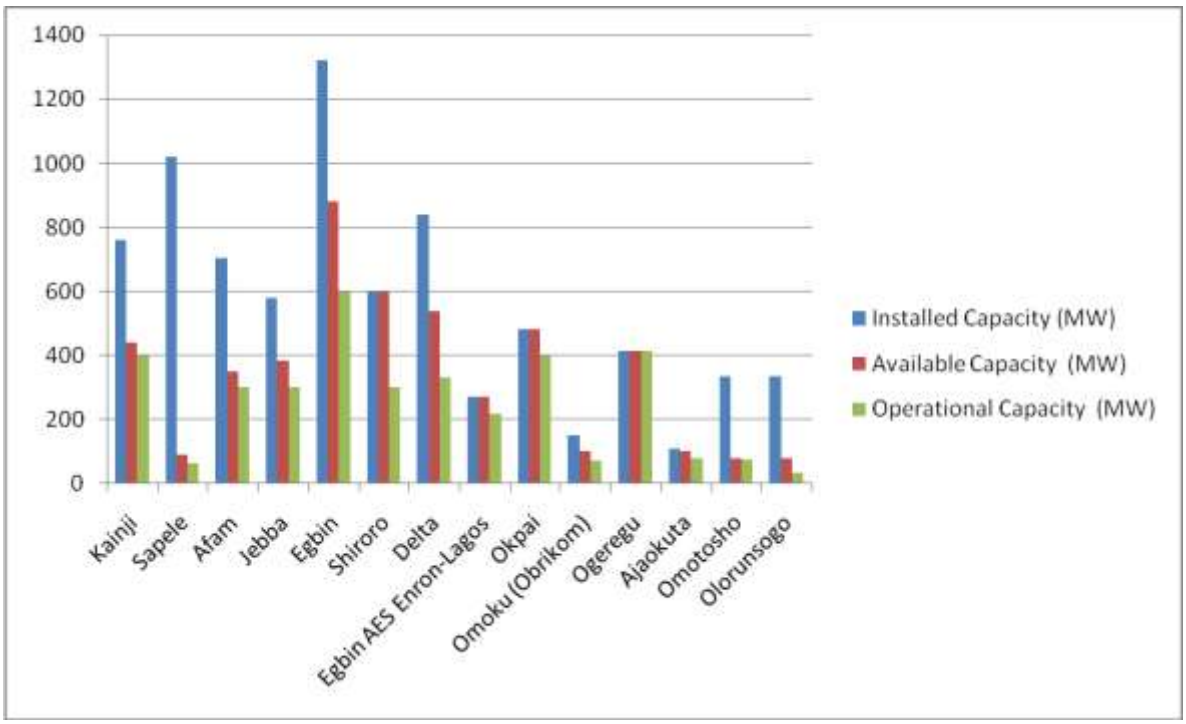


**Figure 1: Bar Chart showing the Installed, Available and Operational Capacities of Power Generating Plants in Nigeria**

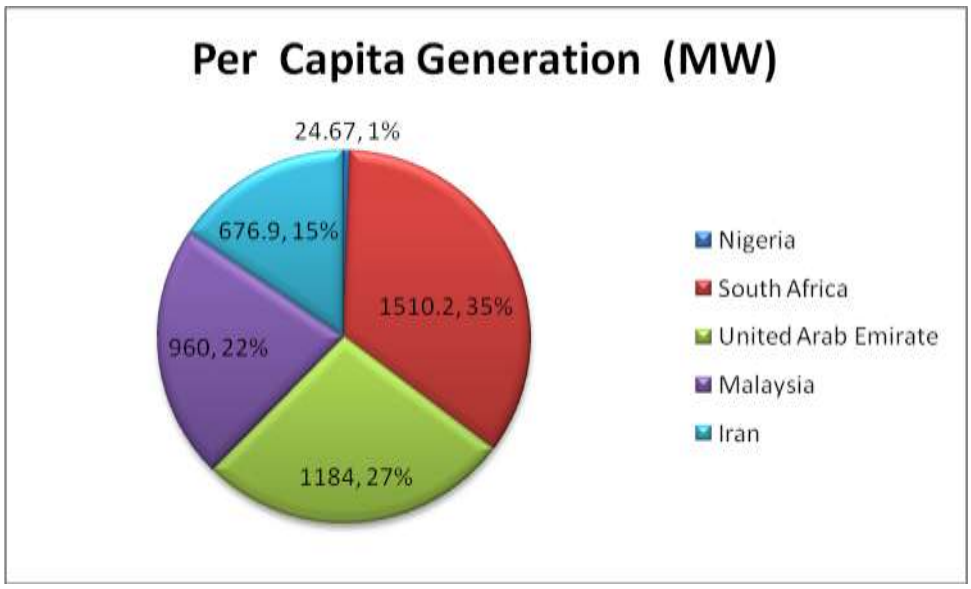


**Figure 2: Pie Chart showing the Per Capita Generation of Nigeria and selected Developing Nations**

## DISCUSSION: DISTRIBUTED GENERATION (DG) FOR OIL BEARING COMMUNITIES

Electricity and water supply are usually the basic things oil bearing communities require from the multinational oil companies. These amenities are usually provided with the installation of diesel generators, which means emitting more hydrocarbons into the

environment. The companies most times, opt for the installation of such generators with the view that it is cheaper and more convenient. The communities on the other hand are satisfied that electricity and water supply have been provided for them. In some cases, a community may have two or more diesel generators. This means more hydrocarbons are emitted into such environment.

The use of DG as source of electrical power supply in Oil Bearing Communities of Nigeria will not only reduce the waste in burning off useful hydrocarbons but will eliminate the presence of environmental pollutants that are associated with burning of fossil. The common sources of DG in such communities are photovoltaic and wind energy.

**Photovoltaic (PV)**

PV is the most viable alternative source of DG in the oil bearing communities of Nigeria. It a clean source of energy with zero emission having no noise, air or water pollution to the environment [3]. Studies have shown that average isolation in Nigeria (Oil bearing communities inclusive) is 5080TWh/day and that PV unit of 1% efficiency in 1% surface area has 508GWh of electrical energy which is equivalent to about 1 million barrels of oil [4].

**Wind Energy**

Possible plant sites for wind energy in the Oil Bearing Communities of Nigeria are on the coastal areas. Average annual wind speed is 2.32m/s with extractable power per unit area of 4.51W/$m^2$ of blade area. Aerodynamic power of the wind turbine is expressed as shown in Equation 1 [5].

$$P = \frac{1}{2}\rho\pi R^2 V^3 C_p \quad (1)$$

Where: ρ = Air Density;
R = Turbine Blade Radius;
V = Velocity of Wind;
$C_p$= Turbine Coefficient.

Like the photovoltaic energy source, this source of energy generation is also environmental friendly. With renewable energy (photovoltaic or wind energy) the electricity and water supply needs of oil bearing communities can adequately been met without pullulating the environment. Besides, it is cheaper on the long run to have DG (renewable energy) installation than fossil powered electricity supply. Table 3 shows the comparison of a 25KVA (20KW) Diesel Generator and 20KW photovoltaic system in terms of cost as at October 2009.

Also by using renewable energy, the fossil can be reversed for economic use (possibly export trade of the nation).

**Table 3: Annual Cost of 25KVA Generator and an equivalent of PV in Nigeria in October2009**

| S/N | Economic Parameters | 25KVA(20KW) Generator ₦ | 20KW Photovoltaic ₦ |
|---|---|---|---|
| 1 | Capital Cost (Purchase and Installation) | 1,300,000.00 | 2,800,000.00 |
| 2 | Annual Fuel Cost (average of 10 litres/day at ₦150/litre) | 547,500.00 | - |
| 3 | Annual Maintenance Cost (servicing only at ₦ 20,000.00/month) | 240,000.00 | - |
| 4 | Annual salary of operator (minimum wage of ₦7,500) | 90,000.00 | - |
| 5 | Operational alone (i.e. S/Nos 2-4 after 10years) | 8,775,000.00 | - |
| 6 | **Total Cost after 10years** | **10,075,000.00** | **2,800,000.00** |

## CONCLUSION

It obvious from Table 3, that PV power source is cheaper on the long run than thermal. Besides PV plants and wind mills are environmental friendly. They have no radioactive disposal waste which can lead to environmental pollution and climatic change[4]. While the conventional source of power generation (thermal, nuclear and big hydro plants) produce pollutants. Emission from the thermal and nuclear sources is agents of climatic change while noise from big hydro plants cause noise pollution.

Oil Bearing Communities are seriously faced with the challenges of gas flaring. The gas flaring is associated with hydrocarbon emission, environmental pollution and is responsible for climatic change. The use of diesel generators for power supply would mean polluting the environment further.

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