

Micro Grid Project at UNN

Christian N. Madu
University of Nigeria, Nsukka



University of Nigeria



- ❑ Known as UNN (University of Nigeria, Nsukka).
- ❑ First full-fledged indigenous university in Nigeria.
- ❑ Modeled on American educational system.
- ❑ First land-grant university in Africa.
- ❑ One of the five elite or premier universities in the country – UI, UNILAG, IFE, AHMADU BELLO.



COMPOSITION



- ❑ 15 Faculties or Schools with 102 academic departments; several research institutes and centres.
- ❑ 82 undergraduate programs and 211 postgraduate programs.

Three campuses –

- ❖ Nsukka (University of Nigeria, Nsukka, UNN),
- ❖ Enugu (University of Nigeria Enugu campus, UNEC)
- ❖ Ituku–Ozalla (University of Nigeria Teaching Hospital, UNTH) –



Land Area



- ❑ Nsukka Campus – 871 hectares (2,150 acres) of land

- ❑ Enugu campus – 200 hectares (490 acres) of land

- ❑ Ituku Ozalla campus is about 25km away from Enugu campus and covers about 500 hectares (1,200 acres) of land.



Population



❑ Academic staff – 1,519

❑ Non-academic staff – 4,296

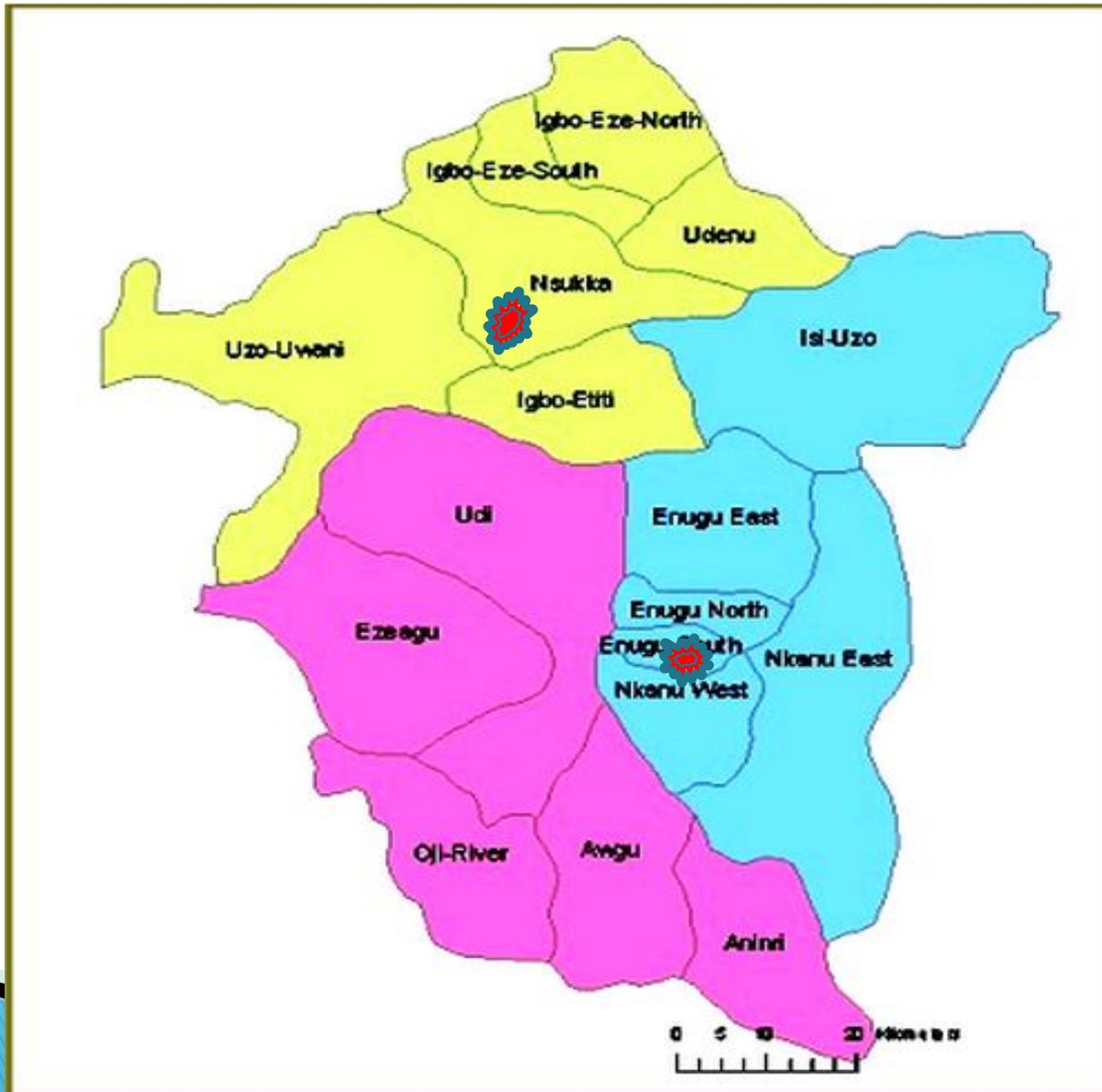
❑ Students \geq 45,000

MAP OF NIGERIA SHOWING ENUGU STATE





Map of Enugu State Showing Nsukka and Enugu campus locations





CURRENT ENERGY SOURCES



- ❑ Hydropower from Kainji Dam about 662km away.

- ❑ Generator sets
 - ❖ Powered by gasoline & diesel

Review of Current hydro Electric Power Systems (HEPS) in Nigeria

- ▶ Before 1960, power production was from coal as the source of fuel for thermal power system.
- ▶ The total installed capacity of HEPS in Nigeria about 2000 MW. Small HEPS. <100MW
 - Government policies, Operating costs & performance issues.

HEPS	Installed Capacity	Operating Capacity
1964 Kainji on River Niger	760 MW	< 30% – 35%
1978 Jebba Dam, 97 km downstream of Kainji Dam.	540 MW	< 35%
1990 Shiroro Dam built in	600 MW	< 32%
Small HEPS	100 MW	< 20%
Mambilla (construction)	2500 MW	



POWER OUTAGES



- Average of 8 hrs. of power outages per day under previous government.
- With the new government so far, average of 4 hrs. of power outages per day.

Our Needs

- ▶ Ability to deal with power outages
 - ▶ Dedicated micro grids may be provided for critical and essential services especially the University Teaching Hospital and the ICT services
 - ▶ Some of the essential machines/equipment currently operate on Inverters backed by battery packs.
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Cost of energy Consumption at Enugu Campus

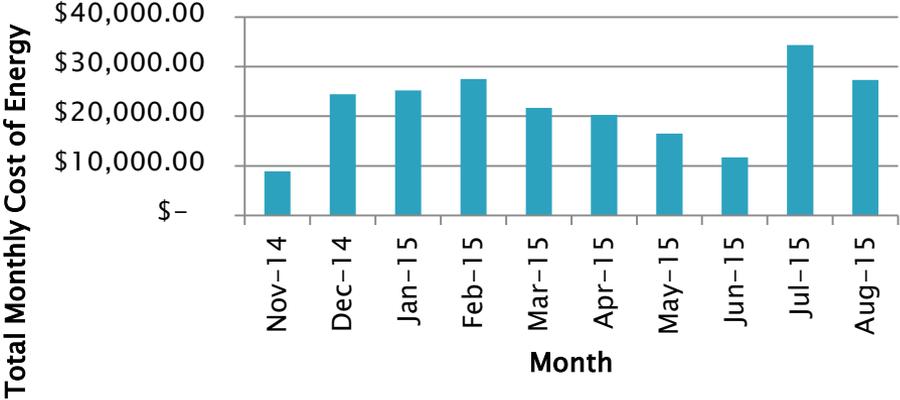
Month	KWH	Unit Cost	Total Cost (N)	Total Cost (\$)
Nov-14	85060	20.31	1727568.6	\$ 8,859.33
Dec-14	234540	20.31	4763507.4	\$ 24,428.24
Jan-15	242110	20.31	4917254.1	\$ 25,216.69
Feb-15	264350	20.31	5368948.5	\$ 27,533.07
Mar-15	208150	20.31	4227526.5	\$ 21,679.62
Apr-15	194740	20.31	3955169.4	\$ 20,282.92
May-15	158310	20.31	3215276.1	\$ 16,488.60
Jun-15	112610	20.31	2287109.1	\$ 11,728.76
Jul-15	329960	20.31	6701487.6	\$ 34,366.60
Aug-15	262190	20.31	5325078.9	\$ 27,308.10

Monthly Energy Usage

Monthly Energy Usage over cost in \$



Monthly Energy Usage over cost in \$



Explaining the swings in usage and cost

- ▶ School closures either due to school holidays or student strikes.
 - ▶ Unavailability of power from the power generator.
 - ▶ Loss of power as a result of unpaid bills.
 - ▶ Seasonal variation in power usage (dry vs. rainy season).
 - ▶ Power failures as a result of technological problems.
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Exclusions

- ▶ University power needs are not fully explained by the charts
 - Cost of independent power generators and fuel consumption is unaccounted for.
 - Cost of maintaining the university generator systems and fueling them is unaccounted for.
 - The lost of customer goodwill as a result of unavailability of power is unaccounted for.
 - Recent student planned demonstration and school closure were attributed to unavailability of power.
 - The data presented illustrates the usage of only one of the three campuses of the university.

Current status in the country

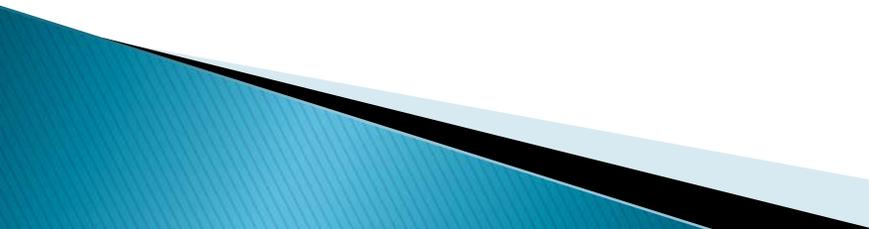
- ▶ Due to the incessant power outages in the country, different groups are considering their own Micro grid projects.
 - ▶ Groups are concerned about laws that prohibit the sale of excess power or Micro grid capacity to sectors of the economy.
 - ▶ Manufacturing groups are seriously considering pulling out of the National Main Grid and are currently in discussion with the relevant government agencies.
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POSSIBLE SOURCES OF ALTERNATIVE ENERGY

- Nigeria is endowed with several energy sources including renewable and nonrenewable energy.
- The country is one of the leading producers of crude oil and a major producer of natural gas.
- There is abundance of coal in Enugu.
- Country is endowed with renewable energy such as solar, wind and biomass/biogas resources.
- Microgrid can run on the platform of any of the renewables sources of energy.

Challenges

- ▶ Even though the country is endowed with these renewable energy sources, there are problems:
 - The technology is not fully developed to grant the needed access to fully develop solar or biogas/biomass.
 - Natural gas which is in abundance is flared and not fully tapped and utilized.
 - There is poor management of both these resources as well as human resources that shortages are common occurrences.
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Challenges

- Price fluctuation is also an issue as well as artificial scarcity and this can hamper the effectiveness of the Micro Grid.
 - Instability in government policies and the legislative branch often affect investment decisions especially in this case where the government has monopolized power generation business although gradually privatizing.
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Low Plant Capacity issues

- Combined installed capacity of HEPS in Nigeria is far below the country's electricity demand.

Problems

- **a) Hydrological factors:**
 - (i) seasonal variation in flow to the reservoir,
 - (ii) sediment trapped in the reservoir
- **(b) Non hydrological factors,**
 - (i) maintenance and spare part problems.
 - (ii) inadequate fund, (iii) human resources.
 - (iv) Policy issues and Politics

Micro Grid

- The local micro power source will reduce reliance and could generate revenue by selling power to its surrounding businesses
- Other benefits



THEN WHY MICROGRID?

- Micro Grids may be more secure, create independence, and give control to the user.
- Micro Grids may use renewable resources hence are more environmentally friendly with lower carbon footprints.



WHY MICROGRID CONT'D



- The local power source will reduce reliance on a hydroplant/power that are miles away from the UNN community and are highly unreliable. Other benefits are:
 - *Price stability*
 - *Energy efficiency*
 - *A more resilient energy supply.*
 - *Public safety*



Conclusion

- ❑ UNN is ready to be a test model for Micro Grid project.
- ❑ It is imperative to have uninterruptible power supply especially in units like the UNTH.
- ❑ The University can conserve its limited resources and use the excess payment for power to enrich students' experience.
- ❑ Power is a major challenge facing the university and this is a priority project.
- ❑ If the laws are amended, the university may generate revenues by selling excess capacity to other stakeholders.