

Short-Term Strategies for Electricity Supply

OA Fakinlede

Professor & Dean, Faculty of Engineering, University of Lagos
Formerly **Director**, Energy Commission of Nigeria, Abuja

Introduction

Fact: From the World CIA Factbook data [1] on electricity usage in the world, in Africa, we are doing better than Chad, Sierra Leone, etc. Outside of Africa, the only countries worse than Nigeria in their per-capital electricity availability are Myanmar (Burma), Afghanistan and Haiti! There is no petroleum producing nation on God's earth that is not better than Nigeria in per capita electricity consumption! The people of Nigeria, just like the poor peasants in France, cried for bread, during the Revolution at the closing years of the 18th century, are justifiably crying for a release from the power of darkness! How should the people of this nation strategize in the short term?

Unbundling the government-owned companies, setting up of successor companies for generation and distribution and focusing government direct participation on transmission, etc. are already fait accompli, we need to ask a few questions and ensure that we are continuing in the right direction for the health of our nation, for our children and their future generations. We had the short end of the stick in the world order of today; we do not have to pass on the mediocrity, subservience and underachievement to our progeny!

Electricity is perhaps the most important indicator of efficient modern living: Ambient working and living environments, mass transportations, industrialization and the efficient production of goods and services. It is needed for effective communications, it makes large cities possible places to live in. Without it you cannot effectively control traffic or even offer policing services in an organized way; health services run on electricity; etc. It is a matter of fact that the level of development in any society can be easily measured by the amount of electricity it consumes.

The table and figure below show the ranking of major countries of the world by the individual citizen consumption of electricity. It is quite revealing especially in terms of our desire to be ranked among the industrialized nations of the world. From it we can see a positive linear correlation between the Purchasing Power Parity Per Capita and the daily electricity consumption. This shows that national wealth and electricity consumption are directly linked.

Various governments in Nigeria have been committing treason against their people by their neglecting to make electricity available; that felony is made worse when juxtaposed with the proportion of the people's money the same officials spend (purchasing and running generators at the people's expense) to make themselves and their families comfortable.

While per capita consumption in Nigeria puts the typical citizen at less than daily 400 Watt Hours, the person operating a diesel generator of say, 100 KVA for ten hours a day, is enjoying 1,000,000 Watt Hours while the most advanced nations get 50,000Watt Hours per capital! Needless to say that most of the energy is wasted while we pollute our neighbours with smoke, toxins and noise! Our people are justifiably suspicious of long term strategies. “Housing for all in 1999” slogans are met with the incredulity: “We have heard it before”! Officials are fond of explaining that other nations took some time to achieve full privatization of the electricity sector. The question really is, **how do we survive in the interim?** The answer to that question, (for himself and family) for the government official, is simple: **Get me a good diesel generator!** The same thing goes for other members of the society that are sufficiently wealthy. The rest of the populace await the long term solution encapsulated in a recent interview granted by Mr Sam Amadi, the erstwhile chairman of the Nigerian Electricity Regulatory Commission. When asked to state the achievements of the Commission under his watch, he replied that “**we have licensed 35,000MW**”. The people only need to wait!

Table 1. Purchasing power Parity and Electricity per capita

Country	Population	PPP (billion USD)	PPPPC	GWh/Yr	KW Hr/Capita
Canada	33	1,303.00	39,485.00	620,684.00	51.50
USA	307	14,440.00	47,036.00	4,401,698.00	39.25
Australia	21	803.00	38,238.00	257,247.00	33.54
Taiwan	23	714.00	31,043.00	238,458.00	28.39
Korea	49	1,338.00	27,306.00	443,888.00	24.80
Japan	127	4,340.00	34,173.00	1,083,142.00	23.35
France	64	2,133.00	33,328.00	526,862.00	22.54
Germany	82	2,925.00	35,671.00	617,132.00	20.61
Spain	41	1,402.00	34,195.00	303,179.00	20.25
Russia	140	2,271.00	16,221.00	1,022,726.00	20.00
Netherlands	17	674.00	39,647.00	123,496.00	19.89
Saudi Arabia	29	578.00	19,931.00	204,200.00	19.28
UK	61	2,236.00	36,656.00	400,390.00	17.97
Italy	58	1,827.00	31,500.00	359,161.00	16.95
Iran	66	844.00	12,788.00	211,972.00	8.79
China	1,339	7,992.00	5,969.00	3,444,108.00	7.04
Turkey	77	904.00	11,740.00	198,085.00	7.04
Brazil	199	1,998.00	10,040.00	505,083.00	6.95
Mexico	111	1,567.00	14,117.00	257,812.00	6.36
Thailand	66	549.00	8,318.00	149,034.00	6.18
Egypt	83	445.00	5,361.00	130,144.00	4.29
Vietnam	87	242.00	2,782.00	76,269.00	2.40
India	1,166	3,304.00	2,834.00	860,723.00	2.02
Indonesia	240	917.00	3,821.00	149,437.00	1.70
Philippines	98	318.00	3,425.00	60,819.00	1.70
Pakistan	176	431.00	2,449.00	91,626.00	1.43
Bangladesh	156	226.00	1,449.00	35,893.00	0.63
Nigeria	149	336.00	2,255.00	21,110.00	0.39
DR Congo	69	21.00	304.00	6,939.00	0.28
Ethiopia	85	70.00	824.00	3,777.00	0.12

Before we go on to specific suggestions for the short term, let us look at some of the things that various experts are saying and weigh them in the light of facts available. Several commentators have suggested that we need to look at renewables such as solar, biomass and wind energy. The question is, can these address our short term needs? What really does the world picture look like? How should our policy-makers respond?

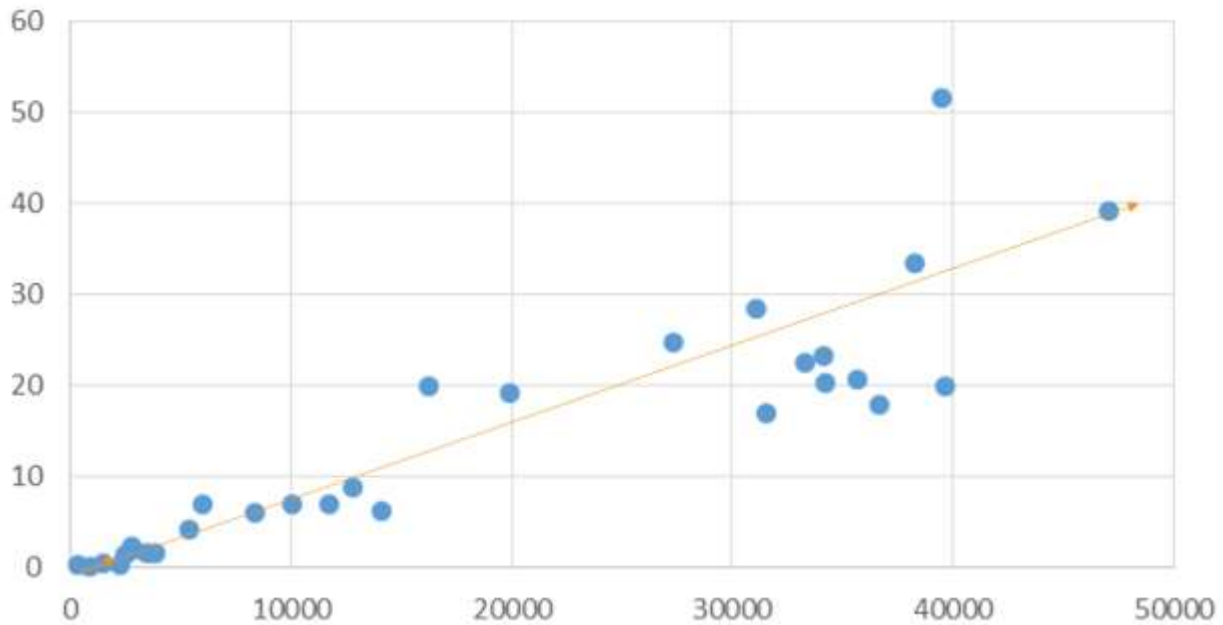


Figure 1 Purchasing power parity in thousands of dollars versus watts per hour consumption

During the French Revolution, by the time the rioters reached the Kings palace, Marie-Antoinette (1755-93), the Queen consort of Louis XVI, confronted with the facts that the rioters demanded bread, was famously alleged to have said, “*Qu'ils mangent de la brioche*”, that is, '**Let them eat brioche**' (brioche is a form of cake made of flour, butter and eggs).” Discussions on energy is very topical in the airwaves today and the experts are many! Some of the solutions proffered are much like Marie Antoinettes' to the hungry in France:

How do we do this? We do so by proffering great solutions in the long run **while providing little comfort in the short run**. They have no bread, let them eat cakes! We need to reflect as a nation and ask ourselves, where did we get it wrongly? How did it happen that a nation like South Korea that generated about the same amount of electricity as we did in the early seventies are now about twenty times our level while our populations have greatly increased? We must ask, and find correct answers to why we have wasted trillions of standard cubic feet of associated gas for sixty years while successive governments keep shifting dates to end gas flaring. We must also ask, how long will we continue to talk about these things without credible, long-lasting solutions!

Solar Energy

The world's largest solar power station opened February 4, 2016 at the “\$9 billion Noor Concentrated Solar Power (CSP) plant could eventually start exporting energy to the European market. The Noor Concentrated Solar Power (CSP), paid for with funds approved by The World Bank, is located in the Souss-Massa-Drâa area in Morocco, about 6 miles from Ouarzazate town. It began operation on Thursday. While the World Bank and other development partners provided financial support, the Noor solar plant is a wholly Moroccan project.” [2] This plant will generate about half a gigawatt of electricity!



Figure 2 World's Largest Solar Power Generator in Morocco

It is interesting to note that the citizens in Morocco have access to six times the power available to their Nigerian counterparts. [1] The bulk of this energy comes from coal despite the fact that Morocco has only about half of Nigeria's proven reserves in coal; has little oil! [8]. Nigeria has been wasting associated petroleum gas for more than sixty years! In 2008, one of the shifting years that Nigeria was supposed to end the flaring of Niger-Delta associated gas, the daily wasted associated gas assets was 1.8 billion standard cubic feet (scf) [4] of gas. If a means could have been found to convert that lost resource into useful energy, we are talking about 21GW of lost energy! If this energy if converted, using the most efficient technology, it is theoretically possible to get more than 50% of it into electricity! That is 10GW of electricity! Nigeria, as we

speak, as a nation, is languishing at about half that number!



Figure 3. Gas Wastage in the Niger Delta

One of the challenges of Solar power is the cost of usable land. The Indians 2014 [4] solved this problem in the Gujarat Canal Solar PV plant generating 10MW. It took a canal length of 3.5 km to achieve this!



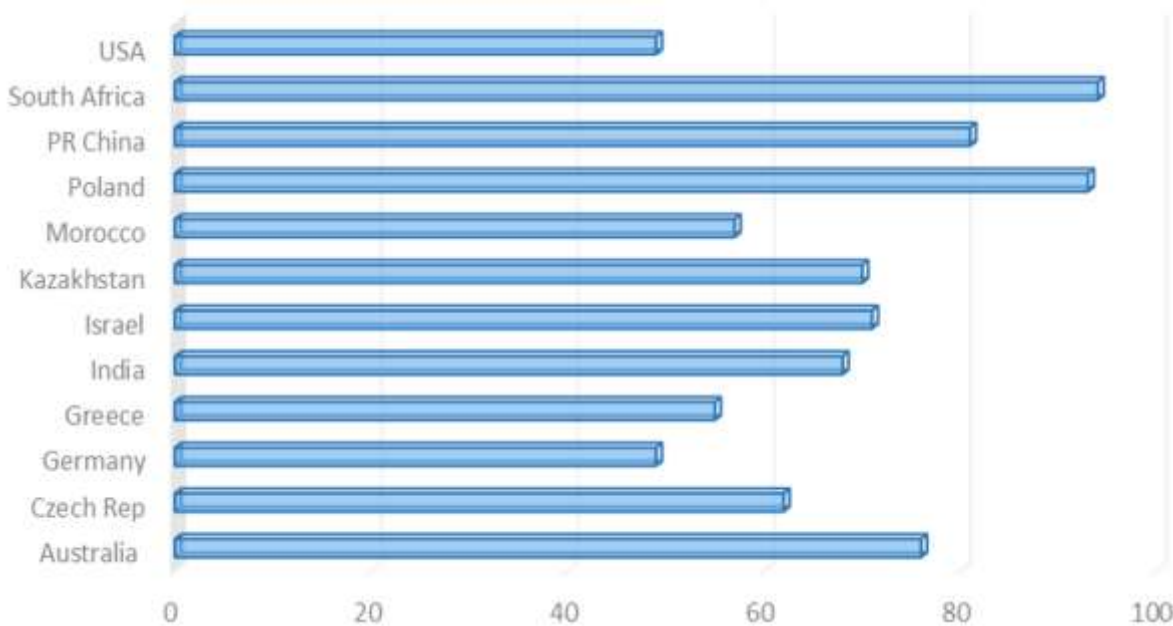
Figure 4. Canal Solar PV in India

“The 10 MW canal top solar power plant has been installed in the city of Vadodara, over a branch of Narmada river canal. The EPC was handled by the Hyderabad-based Megha Engineering and Infrastructure Limited (MEIL). The total capital cost of the system has been

about \$15 million. MEIL will also be responsible for O&M of the solar power plant for 25 years which would cost another \$1.6 million.”

We are told that the collection costs of the associated gas are what made it imperative for us to waste ours for 60 years. If its density is so low that we cannot invest to collect and recover 20GW of energy, will we be able to invest 9 billion dollars for each half a GW as Morocco has done and get half a GW? At same rate as the present cost of large solar energy system, we should be willing to spend 90 billion dollars to recover our associated gas! Is it that expensive?

Coal Electricity Generation in Some Countries



The Journey of forty years

The pie charts in figure 5 tell the world wide electricity generation sources as they changed over a forty year intermission between 1973 and 2013. Coal increased 3% while renewables (outside Hydro) expanded by over 5% in this time. In actual numbers, coal moved from 2350 to 9600 TW hrs while renewables moved from 37 to 1300 TW hrs. Natural gas increased at the expense of oil while Hydro saw a small reduction in its share of the pie. It is also instructive that Nuclear energy increased its share by a factor of three which is actually a factor of 12 in absolute terms.

The fact that Nigeria, that had a virile coal plant at Oji River power station in 1973 has zero coal based generation in 2013! Apart from proof on concept projects, the solar, biomass and wind projects are not a sufficiently significant contribution to the energy mix to be captured by international energy data sources.

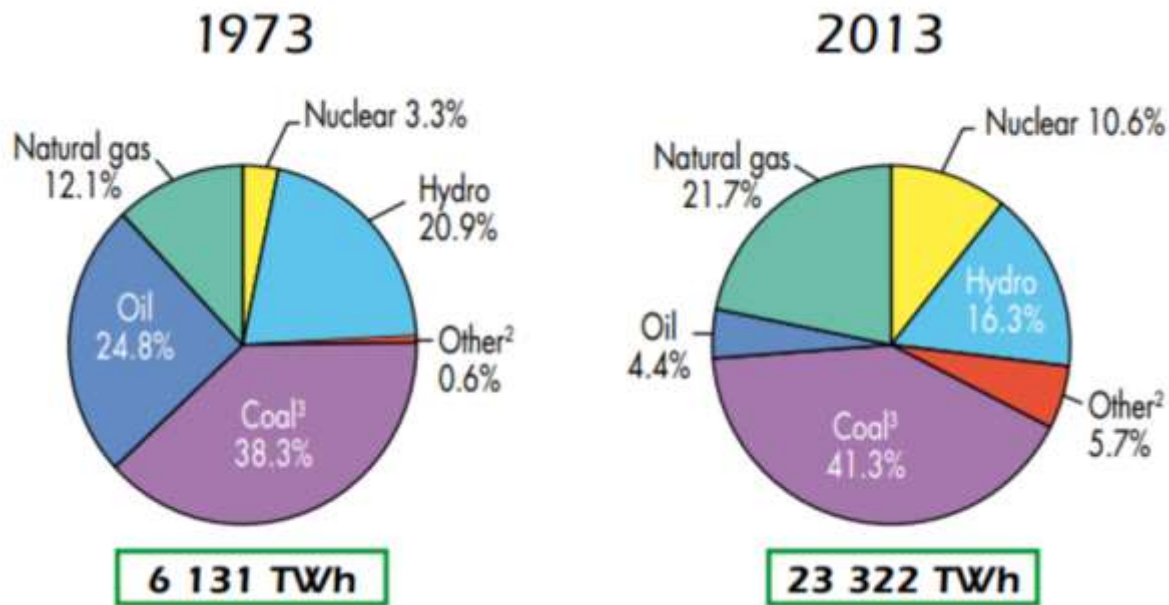


Figure 5 World Electricity by energy source forty years apart

What conclusions can we draw from these? By the time we add the cost of solar collection and wind energy infrastructure, to the generation data, it becomes clear that it is those same countries that have solved their basic energy problems that are trying to become more efficient and earth friendly thereby increasing the share of renewables. It does not appear that there is any example of electricity-starved nations like Nigeria, that also has high-density energy sources and still electing to make Solar or other low density energy sources its mainstay! In fact, the best sources are expecting solar share to reach 11% of world energy mix in 2050! If we go that way, we may not get out of darkness until the year 2150!

National Priorities

1. We are here graduating another set of professional for the Nigerian Power Industry. We are doing this at a time when majority of Nigerians are groaning for deliverance from the powers of darkness that have held sway over this land especially in the past years. The graduates of today are certainly part of the medium term solution to the present quagmire we are sinking in. The setting up of NAPTIN is one of the bright spots in government response to the power problem. We do not wait for the problem to come and react in panic afterwards. This success must be sustained. With proper feedback from the operators in the field, we must continue to respond to the manpower needs that will be necessary to continue to achieve readiness in the manpower needs for the sector.
I am informed that the present leadership may be ending its term. Government must ensure continuity and ensure that the successes we have recorded so far in manpower production continues!

2. In the short term, renewables cannot save us. They are too low in energy density and too expensive as an immediate solution to the power hungry Nigerian industry, homes and institutions. We should, of course, continue in small scale adoptions and have a virile national plan for renewables. However, we need to be cognizant of the fact that, despite the trumpeted emphasis on renewables and earth friendly energy alternatives, most industrialized countries are still dependent on coal and fossil fuels for their electricity needs. It is NOT possible for us to develop without tapping into these in the short term. China was the much maligned world polluter in the past ten years. The same China is leading the world in the addition of solar energy capacity and was second overall in the 2014 reported data. We need to use every available means to generate electricity. Coal plants must be operated where coal is abundantly available. This must also go for all other sources. The neglect of our coal resources is foolish.
3. We must find an immediate solution to the gas flaring problem. It will be better for us to allow technical studies to see if small generators, located in the production fields can be used to produce power in a microgrid for local distribution outside the national grid. It is certainly cheaper to transport electrons out of the fields than to continue waiting after sixty years for the collection of the flared gas. The government can even allow the small royalties to be paid to the communities and let them be shareholders in the oil-well-based generation projects around them. Such a crazy policy may in fact solve several problems concurrently. It will certainly be superior to the present state of waiting indefinitely to end the wastage of our associated gas resources.
4. In Area 3, Abuja, there is a large market where virtually every trader has a “better-pass my neighbor”! It is virtually impossible to breathe inside the market yet people go there every day to trade and subject themselves to the toxins, smoke and noise! We are not doing much better in our homes. Government ought to have compelled them to all contribute to one large generating set! We should come up with an interim measure on private generators. Indiscriminate use of individual generators hurt us in several ways. For one, it permits the well-to-do the luxury of waiting for long term solutions while polluting the rest of the populace to death. Policies such as the restrictions of 10MW on off-grid generation should be scrapped in the short run. In fact, off grid generators should be encouraged so that the weak national grid can have the time and opportunity to develop until it can carry a much larger national load.

It is more efficient to compel local generating systems to unite and generate electricity for local distribution and not restrict them at all! If Lagos State, for example, were allowed to set up generating stations of more than 100MW in the past 12 years, the result would have been to lighten the load on the national grid by removing several of the large industrial estates from the responsibility of the grid. Such generating systems could have become matured providers by the time the grid is ready to take the loads and provided alternatives for the users. The same solution could have been applied to rich neighbourhoods where

everyone is a NEPA unto himself! If we think this idea is crazy, let us note that the de facto state we are in is much crazier! It is ridiculous that in Lekki, for example, well-to-do neighbours all operate huge generators that can actually service whole streets with no government regulators calling them to order and preventing the hazards they cause the society! Instead of proscribing such large generators, we should actually find a way to provide them with feedstock in a reliable manner!

5. We either reconstitute the NERC and add energy promotion responsibilities to its terms or form another government agency that will have the mandate of promoting the generation of electricity for local distribution. We used to have the rural electricity boards in bygone years that showed government recognition of the need to promote generation. Twelve years are enough to convince us that legal regulation cannot, by itself, give us generating capacity! It is easy to license 100,000MW, getting the production out of them is the difficult problem!
6. The United States of America as at today generates nearly 50% of its electricity from coal [USEIA, IEA (a)]. China, a serious nation as far as developing its people is concerned, creates at least 2000MW of coal power each month! Germany generates 49% of its electricity from coal. Most of South African Electricity comes from coal. Nigeria has even more coal than oil. After the last drop of oil has been sold, coal will still be there! Why are the people of Anambra, Enugu, Benue States allowing their local government people to get away with NOT developing their coal resources. These states ought to become net power exporters to other parts of Nigeria. They have no need of oil. In the forty years between 1973 and 2013, the world has increased its capacity in coal fired electric generators four fold! It is stable at more than 40% of world's electricity output! The best prediction for Renewables is that we may reach 11% by 2050! [3] Nigeria has retreated to zero [7] in that same time frame. We must change this!

Research

In the sixty years of gas flaring in Nigeria, how is it that Nigerian Universities and Research institutions were NOT given the challenge to find solutions to this problem? The expectation that the foreign oil companies are all-knowing and benevolent enough to act in our best interest has led us to the present pass. It is necessary for governments to challenge its citizens with difficult problems and let them at least try. The technical issues resulting from increasing the local off grid distributions of electricity will certainly require a lot of technical inputs that should be the object of active research in power systems and distribution options. These are problems that can challenge our universities and technical experts as a deliberate government sponsored competitive research.

Conclusion

To be saddled with the responsibility of getting us out of the energy conundrum is no easy task. Office holders often commit self-immolation by not recognizing the enormity of the technical challenges and the charlatanism that pervades the Nigerian Space. Data and facts should be allowed to speak! We should also begin to invest in our own people in the research and analysis required to obtain workable solutions.

Meanwhile, I wish the set of trained professional in our electricity industry the best of experience and that through them, Nigeria may be delivered from the power of darkness! Let there be light!

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