HEINRICH BÖLL STIFTUNG

THE ELECTRICITY HUB

Power Dialogue

Meeting Nigeria's Electricity Needs: is Nuclear an Option?

Thursday, 28th July 2022
@6:00pm - 8:00pm

Thought Pyramid Art Centre,
18 Libreville Crescent, Wuse II,
Abuja

REPORT

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Number of Physical Attendees

62

Number of Zoom Attendees

102

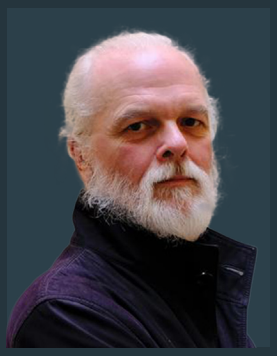
Number of Views on Facebook

60

Panelists

Prof. Abdullahi **A. Mati**

Director, Nuclear Power Plant Devt. Programmer, Nigeria Atomic Energy Commission



Mycle **Schneider**

Coordinator and Publisher, World Nuclear Industry Status Report

Dr. Sam **Amadi**

Director, Abuja School of Social and Political Thoughts

Ifeoma **Malo**

Co-Founder/CEO, Clean Tech Hub Nigeria

Emeka Okpukpara

Partner, Nextier Power

Introduction

The twin challenge of meeting the rising energy demand of a growing world population while having to decrease the negative impact of energy production on the climate is of global concern. In a bid to tackle its huge electricity deficit and against the backdrop of its recent commitment to net-zero emissions by 2060, Nigeria seeks to build and diversify its energy sources through nuclear power.

In 2015, the federal government began talks with Rosatom, Russia's state-owned nuclear corporation, to collaborate on designing, constructing, and operating four nuclear power reactors by 2035. In March 2022, the Director General of the Nigerian Nuclear Regulatory Agency announced that the federal government opened bids to construct nuclear power plants to generate 4,000 MW of electricity.

Nigeria's nuclear power ambitions pose several essential questions: What are some relevant trends in the international nuclear industry, and what are their implications for Nigeria? What is the nature of Nigeria's power sector challenge, and how would the introduction of nuclear energy help to address the electricity gap? What are the intended next steps and the latest timeline by the government to pursue the roll-out of nuclear power in the country? How does the nuclear option compare to alternative energy pathways in terms of cost, reliability, and ability to combat climate change, considering current global energy trends?

In order to discuss these and related questions, the 72nd Power Dialogue hosted by Nextier Power and sponsored by the Heinrich Böll Foundation invited government representatives, power sector experts, concerned civil society, and the wider public to engage.

The Dialogue took place at a time when nuclear energy is receiving increased government and public attention across the world. Following weeks of controversy, European lawmakers at the beginning of July 2022 voted in favour of a proposal by the European Commission that labels natural gas and nuclear power plants as climate-friendly investments.[1] However, EU member states remain split in their positions. Germany, for example, continues to view nuclear energy as unsustainable, whereas France has announced a vast programme to build as many as 14 new reactors by 2050.[2] The new US climate law also includes tax support for nuclear lifetime extensions and hundreds of millions of dollars for nuclear fusion research.[3]

Status and Trends of Nuclear Power in the World[4]

According to The World Nuclear Industry Status Report (WNISR) 2021, as of 1 July 2021, 33 countries operated 415 nuclear reactors. The mean age of these reactors is about 31 years.[5] Since 1996 when nuclear electricity production as a share of world electricity generation reached a peak of 17.5%, the share of nuclear electricity has declined to less than 10% in 2021 – its lowest share in the last four decades. The year 2021 also saw the largest number of nuclear reactor closures since 2011, when the Fukushima nuclear disaster led to a wave of reactor closures worldwide. Nuclear capacity addition (i.e. new startups and fewer closures) declined to 0.4 GW in 2020 before turning negative in 2021.[6]

China has primarily driven the construction starts of nuclear reactors in the world over the last decade. At the end of 2021, 55 reactors were under construction in 17 countries. China

[1]https://www.dw.com/en/european-parliament-backs-listing-nuclear-energy-gas-as-green/a-62377411
[2]https://bit.ly/3BgIdNV
[3]https://us.boell.org/en/2022/08/19/climate-pragmatism-or-faustian-bargain-what-new-us-climate-law-does-and-where-it-fails
[4]This section is largely based on the presentation by Mycle Schneider, Co-ordinator and Publisher of the World Nuclear Industry Status Report, at the Power Dialogue. The full presentation can be viewed here: https://bit.ly/3TLj98X.
[5]https://bit.ly/3TLj98X
[6]https://www.worldnuclearreport.org/Highest-Number-of-Reactor-Closures-in-a-Decade.html

(20) and India (8) account for over half of the projects. The overall picture emerges that China is building new nuclear reactors at home while Russia is driving construction abroad.[7] The mean construction time for the 63 nuclear reactors that were started between 2011 and 2020 was just below ten years.[8]

In 2020, for the first time, non-hydro renewables generated more power in the European Union than nuclear, and renewables, including hydro, generated more energy than all fossil fuels combined.[9]

Considering the levelised cost of electricity (LCOE) in USD/ MWh, a measure of the average net present cost of electricity generation for a generator over its lifetime, nuclear (123 ->163) has been outpaced by all other major technologies over the last decade, including solar PV – crystalline (359 -> 37) and gas – combined cycle (83 -> 59).[10]

Meanwhile, the heatwaves that hit Europe in the summer of 2022 have contributed to France's nuclear capacity dropping by more than half at the end of July. High river temperatures and low river flow restricted the ability to use river water to cool nuclear plants as half of the country's nuclear reactors were already offline due to maintenance and repair work which was delayed by the Covid-19 pandemic.[11]

Based on these facts and trends, Mycle Schneider, Co-ordinator and Publisher of the World Nuclear Industry Status Report, concluded at the Power Dialogue that contrary to the impression created by the current level of political and public attention, the nuclear power industry is on a trajectory of long-term decline rather than set to move towards a global revival.

Nuclear Energy in Africa

As a continent plagued by energy poverty, nuclear energy is receiving attention from a significant number of African governments as a means to help bridge their electricity deficits and, more recently, has been positioned as a clean source of energy generation to mitigate against climate change in a region most vulnerable to its adverse impacts.

South Africa continues to be the only country on the continent with a nuclear power plant. The 1,900 MW Koeberg nuclear power station near Cape Town, which is owned and operated by state-run power utility Eskom, currently produces about five per cent of South Africa's domestic power. In September 2021, the South African deputy minister of energy announced that the country will go ahead with plans for a new 2,500 MW nuclear power plant[12], though the exact details and timelines are yet to be determined.[13] The South African government's last attempt to expand the country's fleet of nuclear reactors fell flat after a court declared an agreement with Russia's Rosatom State Nuclear Energy Corporation unlawful in 2017.[14]

In February 2020, Egypt awarded a USD 25 billion contract to Rosatom for a 4.8 GW power plant, the first nuclear plant in the country. Tanzania plans to utilise a subsidy from Rosatom to build a research reactor and develop commercial nuclear power by 2025, following the discovery of uranium deposits in 2018. Uganda's Ministry of Energy has entered into agreements with Chinese and Russian investors in a bid to construct two 1,000 MW reactors by 2031.[15] In 2020, Rwanda's parliament approved a plan for Rosatom to build a nuclear research centre and reactor in the capital, Kigali.[16] Ghana is also taking active steps towards the deployment of nuclear power by 2030. In March 2022, it announced a partnership with the US for the adoption of small modular reactor (SMR)

[7]https://bit.ly/3TLj98X
[8]https://bit.ly/3TLj98X
[9]https://bit.ly/3TLj98X
[10]https://www.theguardian.com/business/2022/aug/03/edf-to-reduce-nuclear-power-output-as-french-river-temperatures-rise
[11]https://www.reuters.com/world/africa/safrica-plans-next-phase-new-2500-mw-nuclear-plant-2021-09-21/
[12]https://www.dailymaverick.co.za/article/2022-04-12-mantashe-sends-clear-signal-sa-will-tender-for-nuclear-power-proposals-as-soon-as-possible/
[13]https://www.reuters.com/article/us-safrica-nuclear-court-idUSKBN17S25R
[14]https://energycapitalpower.com/examining-the-state-of-nuclear-power-in-africa/#:~:text=To%20date%2C%20South%20Africa%20operates,state%2Drun%20power%20utility%20Eskom.
[15]https://www.dw.com/en/russias-nuclear-play-for-power-in-africa/a-54004039
[16]https://www.world-nuclear-news.org/Articles/US-programme-supports-Ghana-nuclear-progress?feed=feed

technology.[17]

Aside from the presence of Rosatom, which has come to dominate the prospective African market for nuclear energy, a common feature of the nuclear plans of most African governments is their ambitious timelines and objectives coupled with limited progress achieved over the years; a feature that also holds true beyond the continent.

Nuclear Energy in Nigeria

In Nigeria, the development of nuclear energy has been in the pipeline for over 40 years, with a decree establishing the Nigeria Atomic Energy Commission in 1976.

Nigeria's only operating research reactor, the NIRR-1, is a Miniature Neutron Source Reactor designed and supplied by the China National Nuclear Corporation and used for scientific research, neutron activation analysis, education and training. The reactor has been in operation since 2004.[18]

In 2015, the federal government began talks with Rosatom to collaborate on designing, constructing and operating four nuclear power reactors by 2035, the first of which was to be in operation by 2025. The Nigerian Atomic Energy Commission at the time selected Geragu in Kogi State and Itu in Akwa-Ibom State as potential locations for producing about 2,400 MW of electricity. The estimated cost was approximately USD 20 billion.[19]

In January 2021, President Muhammadu Buhari approved five new regulations related to the country's nuclear power programme.[20] This included the Nigerian Nuclear Safeguards Regulations, the Nigeria Safety Regulations for Licensing of Site for Nuclear Power Plant, and the Nigerian Uranium Exploration, Mining and Processing Regulations, among others.

In the same year, the Federal Government inaugurated the re-constituted Russian-Nigerian Joint Coordination Committee of the National Atomic Energy Commission in an effort to resuscitate the relationship between the two countries.

On 1 March 2022, Dr Yau Idris, Director General, Nigerian Nuclear Regulatory Authority, announced that the federal government launched bids for nuclear power plants to generate 4,000 MW of electricity.[21]

At the state level, the Governor of Kogi State, Yahaya Bello, is reported to have recently hosted a delegation from the China National Nuclear Cooperation (CNNC) with the view of exploring a partnership for the development of nuclear power generation in the state.[22]

At the Power Dialogue, Prof. Abdullahi A. Mati, Director of the Nuclear Power Plant Development Programme at the National Atomic Energy Commission, however, revealed that Nigeria was still at the point of conducting a pre-feasibility study. Emphasising that the Commission was following the milestone approach to developing its nuclear power programme in line and cooperation with the International Atomic Energy Agency (IAEA). At the Dialogue, he was unable to share any definitive timelines for bids, plant construction, or details on site selection.

[17]https://www.iaea.org/newscenter/news/nigeria-converts-its-research-reactor-from-heu-to-leu-fuel
[18]https://www.researchgate.net/publication/337357463_A_GIS-based_Site_Investigation_for_Nuclear_Power_Plants_NPPs_in_Nigeria
[19]http://www.nuclearbusiness-platform.com/nuclear-industry/nigeria-to-invest-in-nuclear-energy-as-part-of-efforts-to-combat-climate-change/
[20]https://theelectricityhub.com/nigeria-fg-initiates-bids-for-nuclear-power/
[21]https://www.vanguardngr.com/2022/08/kogi-chinese-govt-discuss-nuclear-energy-partnerships-other-ventures/

Nigeria's Electricity Sector Challenges

Nine years after Nigeria privatised the electricity sector, inadequate electricity supply remains a critical challenge affecting millions of Nigerian citizens. According to the World Bank, 43 per cent of Nigeria's population of more than 200 million people continues to lack access to grid electricity.[23] Businesses in the country reportedly lose about USD 29 billion annually as a result of unreliable electricity supply.[24]

The national power grid is in a state of disrepair. Although Nigeria's generation capacity is at around 13,000 MW (mostly from thermal and hydropower sources), the national grid is only able to wheel about 4,000MW or less to consumers.[25] By the end of July 2022, the grid has experienced its seventh system collapse for the year.[26]

Due to insufficient generation and grid constraints, the majority of households and businesses generate their own electricity with diesel/ petrol generators. The combined capacity of small gasoline generators in Nigeria has been estimated to be 42,000 MW.[27]

To electrify communities not connected to the grid, Nigeria, with the support of international development partners, has turned to deploy solar-powered mini-grids across the country. Their economic sustainability and deployment at scale remain a challenge, however. As part of its 2020 Economic Sustainability Plan, the Nigerian government also seeks to roll out 5 million new solar-based connections in communities that are not grid-connected.[28]

The Nigerian on-grid renewable energy target, which is known as Vision 30:30:30 (i.e. to achieve 30,000 MW of available generation capacity on the grid by 2030 with 30 per cent renewables penetration), has remained elusive so far. Though in 2016, Nigeria signed a number of power purchasing agreements with independent power producers who were to supply solar power to the grid, none of the projects has come to fruition over tariff disputes, among other issues.[29]

According to the Energy Transition Plan launched by the Nigerian government on 24 August 2022, the country will tap into its vast natural gas resources as a transition fuel while aggressively scaling solar power in order to achieve its net-zero target by 2060.

Is Nuclear Energy a Viable Option to Meet Nigeria's Electricity Needs?

Nigeria's nuclear power ambitions beg an essential question: given Nigeria's electricity sector challenges, would introducing nuclear energy be the best option to address the current electricity gap?

At the Power Dialogue, the conversation pointed to, among others, the following considerations:

- Inadequate transmission capacity: as stated above, the poor state of Nigeria's transmission infrastructure affects the wheeling capacity to transmit power from generation companies. Against this backdrop, Sam Amadi, Director of the Abuja School of Social and Political Thoughts and former Chairman of the Nigeria Electricity Regulatory Commission (NERC), asked whether the government should not be focused on expanding the capacity of the grid to ensure that the current generation capacity gets fully and reliably distributed to customers.

- Poor maintenance of infrastructure: One of the pressing issues facing the power sector

[23]https://www.worldbank.org/en/news/press-release/2021/02/05/nigeria-to-improve-electricity-access-and-services-to-citizens
[24]https://www.thecable.ng/world-bank-nigeria-has-worlds-largest-electricity-access-deficit
[25]https://www.usaid.gov/powerafrica/nigeria
[26]https://guardian.ng/news/nationwide-darkness-as-nigerias-grid-collapses-seventh-time-in-2022/
[27]https://a2ei.org/resources/uploads/2019/06/A2EI_Dalberg_Putting_an_End_to_Nigeria%E2%80%99s_Generator-Crisis_The_Path_Forward.pdf
[28]https://nep.rea.gov.ng/federal-governments-5milion-solar-connections-program/
[29]https://www.energyforgrowth.org/memo/how-to-resolve-the-tariff-disputes-blocking-nigerias-solar-project-pipeline/

is the poor maintenance of infrastructure. This has not only resulted in the reduced performance of the national grid but also led to poor performance at the level of power generation. In the first quarter of 2022, about 14 power plants were reported to have shut down, resulting from several factors, including poor maintenance.[30] Panellists argued in the absence of an adequate maintenance framework and culture, a complex undertaking such as nuclear power plant was unlikely to deliver reliable power.

- Environmental and safety concerns: The radioactive waste that nuclear power produces and its storage remain a significant concern. Wastes remain radioactive and dangerous for thousands of years. Given Nigeria's poor track record in environmental protection and the currently high level of insecurity across the country, Ifeoma Malo, Executive Director at the Clean Technology Hub, pointed out that nuclear energy would be a dangerous choice to make.

- Transparency: The lack of public awareness and openness of political decision-making processes regarding the development of nuclear power in the country was also pointed out. Although Prof. Abdullahi A. Mati, Director of the Nuclear Power Plant Development Programme at the National Atomic Energy Commission, revealed that Nigeria was following a milestone approach to the development of its nuclear power programme in close cooperation with the International Atomic Energy Agency (IAEA), he was unable to share any definitive timelines for bids, plant construction, or details on site selection. At the same time, the Director General of the Nigerian Nuclear Regulatory Agency March 2022, announced that the federal government opened bids to construct nuclear power plants to generate 4,000 MW of electricity. This points to a mismatch of information released to the public about the current status of Nigeria's nuclear programme between relevant government bodies.

- Energy alternatives: Panellists also pointed to the abundantly available alternative resources the country has and is already utilising to expand energy access, such as natural gas, solar and other renewable energy sources that, if deployed at scale and in combination with each other, are more cost competitive compared to nuclear.

Based on these and other considerations, panellists largely agreed that nuclear energy is not a viable option to address Nigeria's current electricity challenges. However, some did not discard the idea of introducing nuclear power generation entirely, suggesting that given the right preparations in terms of research, feasibility assessments and electricity sector reforms, it may become viable in future.
Ultimately, it will be up to the Nigerian government and public to ensure that the country's scarce public resources are invested with foresight and in ways that will grant access to clean and reliable electricity to every Nigerian at the least cost possible.

[30]https://guardian.ng/news/nigeria/total-darkness-looms-as-14-power-plants-cripple-supply/#:~:text=Transmission%20Company%20of%20Nigeria%20(TCN,keeping%20output%20at%20record%20low.

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