

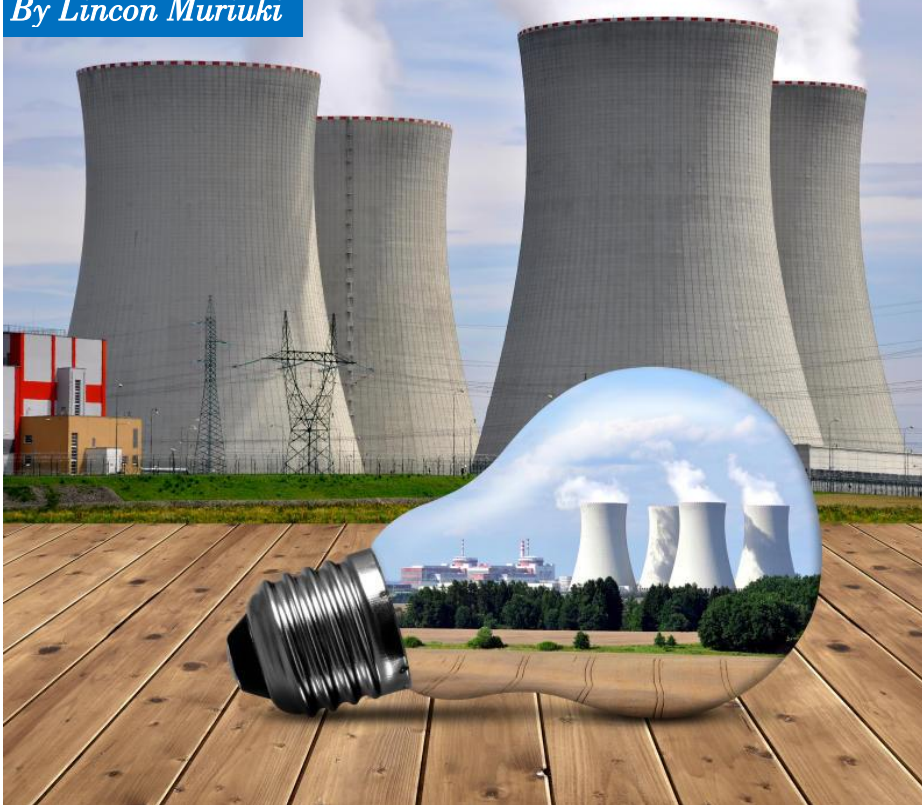


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Nuclear Industry in Kenya

By Lincon Muriuki



Energy is the engine of sustainable economic growth and improved human welfare. **Nuclear energy** provides access to clean, reliable and affordable energy, mitigating the negative impacts of climate change. It is especially suitable for meeting large-scale, continuous electricity demand where reliability and predictability are vital – hence ideally matched to increasing urbanisation worldwide. It is a significant part of the world energy mix and its use is expected to grow in the coming decades.

Power - A Key Element to Kenya Vision 2030

Kenya Vision 2030 aspires to transform Kenya from low-income status into a middle-income country. It identifies energy and electricity as a key element of Kenya's sustainable economic growth and transformation.

DEAR READER

Welcome to KeSEBAE Newsletter.

A fortnightly Newsletter touching on topical issues affecting our environment.

KeSEBAE NEWS is a Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE).

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KeSEBAE News Editorial

Climate Change and the Role of Nuclear Power

Climate change is one of the most important issues facing the world today. Nuclear power can make a significant contribution to reducing greenhouse gas emissions (GHGs) worldwide, while at the same time meeting the increasing demands for energy of a growing world population and supporting global sustainable development. Nuclear power has considerable potential to meet the challenge of climate change by providing electricity, district heating and high temperature heat for industrial processes while producing almost no GHGs.

To address the challenges posed by climate change, and to achieve the goals established in the 2015 Paris Agreement Under the United Nations Framework Convention on Climate Change (UNFCCC), a significantly greater deployment of low carbon energy technologies is needed. Nuclear power has the potential to play a significant role in achieving these mitigation goals and, as a large scale, reliable, and concentrated source of energy, can also contribute to the broader economic and social dimensions of sustainable development. To reach this goal, carbon dioxide (CO₂) emissions from electricity generation must fall to nearly zero by the middle of this century, even as electricity needs worldwide continue to grow and expand in end-uses such as transportation, heating and industrial energy use.

The Road to a Carbon Free Future

Today, nuclear power provides 10% of the world's electricity. But to stem climate change, there is need for far greater amounts of clean and reliable energy. To tackle climate change, 80% of all electricity will need to be low carbon low carbon by 2050. In order to meet climate goals, we have to increase our nuclear capacity.¹

¹ Shant Krikorian, IAEA Department of Nuclear Energy, 2019. Preliminary Nuclear Power Facts and Figures for 2019

² Jeffrey Donovan and Krzysztof Kolasinski, 2020. Nuclear Power: The Road to a Carbon Free Future.

Russia, India and China are currently leading the way in expanding nuclear power. China has nine reactors under construction Thirty (30) countries currently operate nuclear power plants. More than two dozen others are looking at nuclear energy to meet their power and climate needs. The United Arab Emirates and Belarus are close to operating their first nuclear power plants. Bangladesh and Turkey recently started construction. Currently about 450 nuclear power reactors operate worldwide. To respond to emerging needs and challenges the nuclear power industry is looking ahead towards innovative solutions for long-term operation of existing reactors, the timely expansion of ongoing nuclear power programmes and the deployment of new reactor technologies.²

The world wants to go carbon free. Several countries are developing small modular reactors (SMRs). Nuclear energy can back up other renewable sources of energy, ensuring round the clock clean power, even when there's no sunshine or wind. Investing in a new nuclear technology has not been an easy decision. Cost is a key concern.

In 2018, nuclear power produced about 10 percent of the world's electricity. Together with the expanding renewable energy sources and fuel switching from coal to gas, higher nuclear power production contributed to the levelling of global CO₂ emissions at 33 gigatonnes in 2019.³ Clearly, nuclear power – as a dispatchable low carbon source of electricity – can play a key role in the transition to a clean energy future.

Nuclear Power in 2019



Figure 1: Nuclear Power - Low Carbon Electricity. Source: Adapted, International Atomic Energy Agency, IAEA.

<https://www.iaea.org/newscenter/multimedia/videos/nuclear-power-the-road-to-a-carbon-free-future>

³ International Energy Agency (IEA), 2020. Global CO₂ emissions in 2019. <https://www.iea.org/articles/global-co2-emissions-in-2019>

Kenyan Power Solution

Kenya views nuclear power both as a long-term solution to high fuel costs incurred during times of drought when diesel generators are used and an effective way to cut carbon emissions from the power generating sector.



Figure 2: Rosatom's Leningrad Nuclear Power Plant in Russia. Photo Courtesy of New Europe

Kenya Future Nuclear Energy Plan - \$5B 1000MW Nuclear Power Station

Nuclear Power and Energy Agency (NuPEA) is a State Corporation established under the Energy Act 2019. It is charged with the responsibility of promoting and implementing Kenya's Nuclear Power Programme, carrying out research and development for the energy sector.

The Nuclear Power and Energy Agency, (NuPEA) is on track to build a nuclear power plant. Kenya is set to build a \$5 Billion (Sh540 Billion) Nuclear Power Plant of 1,000 MW on a site in Tana River County over the next seven years with funding from private investors. The nuclear power plant is expected to be commissioned by the year 2027. The government will expand the plant's capacity fourfold (4,000MW) by 2035 under a build, operate and transfer (BOT) model. This will set the total cost of the project at about Sh2

trillion – indicating the high cost of building a nuclear power plant. Private funding for the nuclear power plant will ease the burden on Kenya's strained public coffers. The estimated cost [\$5 Billion (Sh540 Billion)] of the nuclear plant is nearly half the government's annual tax collections.

The project will involve the building of a 'third-generation' plant with pressurised water reactors. Nuclear reactors require reliable sources of water for steam condensation, service water, emergency core cooling system and other functions.

South Africa is the only country in Africa with a nuclear power plant near Cape Town. It operates a commercial nuclear power plant. It's also harbouring some high voltage ambitions with the planned construction of a 2,500MW nuclear plant to enhance its power generation capacity.

The nuclear plant would be Kenya's biggest and most expensive project since the completion of a Chinese-built standard gauge railway in 2017. The nuclear agency said it was evaluating technologies to identify the ideal reactor for Kenya.

The Challenges Facing Nuclear Energy

The **nuclear industry** faces resistance due to a number of factors: ⁴

1. Nuclear Accidents

The public has misgivings about nuclear power because of three nuclear accidents that occurred: The Three Mile Island partial meltdown in 1979, the Chernobyl meltdown and explosion in 1986, and the Fukushima meltdown in 2011 precipitated by an earthquake and a tsunami.

Both the Three Mile Island and Fukushima accidents began after the reactors were shut down and a lack of power prevented the pumps from circulating water to cool the decaying fuel. Similar light water reactors, cooled with ordinary water, make up the majority of the nuclear reactors in use.

While nuclear accidents are rare, the consequences are catastrophic. Fukushima's meltdown drove over

⁴ Renee Cho, 2020. The State of Nuclear Energy Today — and What Lies Ahead.

<https://news.climate.columbia.edu/2020/11/23/nuclear-power-today-future/>

200,000 people from their homes. Chernobyl's reactor site will be radioactive for tens of thousands of years.



Figure 3: **Fukushima Meltdown: The Tsunami Overcame the Sea Wall and Hit the Plant** Source: <https://www.bbc.com/news/world-asia-56252695>



Figure 4: **Fukushima Meltdown: The Damage Led to Nuclear Meltdowns and a Number of Hydrogen Explosions.** Source: <https://www.bbc.com/news/world-asia-56252695>

2. Nuclear Proliferation

The uranium found in nature consists of mostly uranium-238, and a tiny amount of uranium-235, which is what is needed for fission. The process of concentrating and increasing the U-235 in relation to U-238 is called enrichment. However, enrichment is controversial because the process can sometimes be used to create uranium for nuclear weapons, as can

reprocessing spent fuel to recover uranium and plutonium to recycle them for fresh fuel.

To prevent nuclear proliferation, most countries have signed onto international agreements to limit nuclear weapons, and the International Atomic Energy Agency regularly inspects nuclear facilities to monitor their nuclear materials.

3. Nuclear Waste

There is still no viable way to permanently dispose of the radioactive material that is produced at every stage of a nuclear power plant's life, from the mining and enrichment of uranium through operation to the spent fuel. Of this radioactive material, three percent—mostly spent fuel—is considered high-level waste, meaning that it is extremely dangerous and will be radioactive for tens of thousands of years; it needs to be cooled, then safely contained virtually forever. Seven percent is intermediate waste, material from the reactor's core and other reactor parts; this is also dangerous but can be contained in canisters. The rest, made up of building materials, plastics and other miscellany, is considered low-level waste, but also needs to be stored.

4. Cost

New nuclear reactors can cost over \$7 billion, which makes them expensive propositions, especially when natural gas is so cheap. Some of the newest nuclear projects have gone far over schedule and over budget

Conclusion

Long construction periods (about 10 years), and costly decommissioning of plants at the end of their lifespan, have dissuaded many developed countries from investing in nuclear energy. But in an unexpected shift, several African countries are now betting on nuclear energy to meet their rising electricity demands – with a third of the nearly 30 countries considering nuclear power being in Africa, according to the International Atomic Energy Agency (IAEA). **Kenya being one of the countries considering Nuclear Power.**



CALL FOR ARTICLES TO KeSEBAE NEWS

KeSEBAE NEWS Editorial wishes to call for topical articles for publication in future editions of KeSEBAE NEWS.

Please transmit the same to the **Editor: Ezekiel Oranga** via Email: info@kesebae.or.ke

NOTE: A payment will be made to the author of each selected article

CALL FOR PAPERS TO THE NEXT EDITIONS OF JEAE

JEAE

Journal of Engineering in Agriculture and the Environment

The Journal of Engineering in Agriculture and the Environment (JEAE) is a Publication of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE) through which researchers in the fields of Environment, Agriculture and related fields share research information and findings with their peers from around the globe.

The JEAE Editorial Board wishes to invite interested researchers with complete work in any relevant topic, to submit their papers for publication in the next editions of the Journal.

Manuscripts may be submitted online or via email to:

Prof. Lawrence Gumbo, Chairperson, JEAE Editorial Board

Via Email: info@kesebae.or.ke or online via: https://www.kesebae.or.ke/journal/manuscript_submit.php

CRITERIA FOR ARTICLE SELECTION

Priority in the selection of articles for publication is that the articles:

- Are written in the English language
- Are relevant to the application of engineering and technology in agriculture, the environment and biological systems
- Have not been previously published elsewhere, or, if previously published are supported by a copyright permission
- Deals with theoretical, practical and adoptable innovations applicable to engineering and technology in agriculture, the environment and biological systems
- Have a 150 to 250 words abstract, preceding the main body of the article

- The abstract should be followed by the list of 4 to 8 "Key Words"
- Manuscript should be single-spaced, under 4,000 words (approximately equivalent to 5-6 pages of A4-size paper)
- Should be submitted in both MS word (2010 or later versions) and pdf formats (i.e., authors submit the abstract and key words in MS Word and pdf after which author uploads the entire manuscript in MS word and pdf)
- Are supported by authentic sources, references or bibliography

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The annual dues are as follows:

Membership Category	Annual Subscription Fee (KES)
Fellow	5,000
Member	2,000
Ass. Member	1,000
Aff. Member	500
Student Member	300

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Branch	Nairobi University Express Branch
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JEAE

Journal of Engineering in Agriculture and the Environment

Volume 6 No. 2

The society published its current edition of the Journal of Engineering in Agriculture and the Environment - **JEAE Vol. 6 No. 2 in December 2020.**

To get a copy of the Journal, get in touch with us **email** at info@kesebae.or.ke or phone at +254 788 712 156

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If you wish to get more involved in KeSEBAE Initiatives, feel free to get in touch via **email**: info@kesebae.or.ke or **website**: <https://www.kesebae.or.ke/>

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CALL FOR MEMBERSHIP

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The annual subscription fees, admission fees and reinstatement fees for members of all grades (except Honorary and Life Members who shall pay no dues or fees) are indicated below:

<i>Membership Category</i>	<i>Annual Subscription (KES)</i>	<i>Admission Fees (KES)</i>	<i>Reinstatement Fees (KES)</i>
<i>Fellow</i>	5,000	1,000	2,000
<i>Member</i>	2,000	1,000	2,000
<i>Ass.Member</i>	1,000	1,000	2,000
<i>Aff.Member</i>	500	1,000	2,000
<i>Student</i>	300	100	-

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KeSEBAE NEWS EDITORIAL

The **KeSEBAE NEWS** is a Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers

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