

## Climate Change and Nuclear Power. Evaluating Tanzania's Potential

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**Abstract:** Nuclear power technology is among the best for producing energy because it emits clean energy while preventing greenhouse gas emissions from entering the atmosphere. Nuclear energy now provides about 10% of the world's electricity from about 440 power reactors. There are several areas in Tanzania where Uranium has been discovered (Namtumbo, Bahi, Galapo, Songea, Simanjoro, Tunduru, Madaba, and Nachigwea). This policy brief explores Tanzania's legal environment, the use of nuclear energy to combat climate change, nuclear power potential, and obstacles to the construction of nuclear power facilities. It recommends that the government make more efforts and a strong commitment to establishing nuclear power plants, enhance community awareness, research, and training, establish a stand-alone Uranium policy, and optimize for small modular reactors. It concludes that there is a potential to use the Uranium that is currently available to meet energy demand and significantly reduce climate change.

**Keywords:** Climate change, Nuclear power, Climate policy, Uranium potential.

### INTRODUCTION

Climate change is one of the problems or challenges that the world is currently facing. The hazards posed by climate change are already apparent in a number of vital economic areas that are necessary for Tanzanians to survive and earn a living. As greenhouse gases such as carbon dioxide (CO<sub>2</sub>), methane, water vapor, and nitrous oxide build up in the atmosphere and cause global warming, they cause climatic changes such as erratic rainfall, droughts, and unpredictable seasonal changes. These changes pose risks to the economy, infrastructure investments, food and water systems, agriculture, public health, and way of life.

One of the best ways to produce energy around the globe has been through the use of nuclear energy. The production of clean, dependable, dispatchable, and baseload electricity through nuclear power is crucial. Because very few greenhouse gas emissions occur, the nuclear energy produced is safely free of carbon dioxide (CO<sub>2</sub>). The 1950s saw the opening of the first nuclear power plants for commercial use. Around 440 power reactors use nuclear energy to generate 10% of the world's electricity today. With 28% of the total in 2019,

nuclear power is the second-largest source of low-carbon energy worldwide. Over 220 research reactors in more than 50 nations use nuclear energy. These reactors are also employed for teaching, the manufacture of industrial and medicinal isotopes, and research.

As nuclear energy has been used for 50 years, carbon dioxide emissions have decreased by approximately 60 gigatons, making it the second-

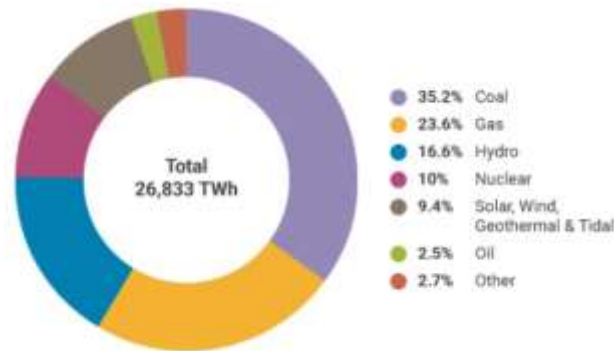
largest source of low-carbon energy now used to generate electricity. Nuclear power not only reduces carbon dioxide emissions but also produces a significant amount of energy. For instance, in the United States, the smallest reactors have a net summer generating capacity of roughly 520 megawatts. According to an infographic from 2021, an estimated 19% of American electricity and 10% of global electricity are produced by nuclear power (Jawery).

According to the International Atomic Energy Agency (IAEA), 600 million people and 10 million small businesses in Africa lack access to dependable electricity, and the continent's energy consumption is increasing twice as quickly as the global average (Brickstone, 2022). The only nuclear power plant in Africa is in South Africa (Koeberg Nuclear Power Station), which has two reactors and generates around 6% of the country's electricity needs (Goodrich, 2022). At Koeberg, South Africa produces more than 10 million kilowatt-hours of clean baseload electricity. Several African nations intend to employ nuclear power to produce electricity, including Egypt, which has already begun building its nuclear plant; Ghana, which also wants to introduce nuclear power; and Tanzania, which has plans to do the same following the discovery of Uranium.

Currently, Tanzania focuses on producing energy through hydroelectric power, coal, and gas. However, these sources are not sustainable due to their significant negative effects; therefore, using nuclear power will likely lessen these effects. Tanzania generates 1605.86 MW of energy, of which 566.79 MW (42%), 607 MW (45%), and

173.40 MW (13%), come from hydroelectric power, natural gas, and liquid fuel, respectively. Electricity demand is predicted to rise by 10–15%

annually. Tanzania works to increase energy production by at least 10,000 MW annually to keep up with demand.



**Figure 1:** World electricity production by source 2020  
(source: International Energy Agency)

### Nuclear Power Potential's in Tanzania

Huge uranium resources have been discovered mostly in Tanzania's Namtumbo, Bahi, Galapo, Songea, Simanjiro, Tunduru, Madaba, and Nachigwea regions. More than 25 firms in Tanzania are pursuing uranium exploration in various places. The presence of uranium may help with the production of electricity to meet national demand.

The main uranium project in Tanzania is the Mkunju River project, which is located in the Namtumbo district (which includes the Ruvuma region). As of 2013, the project's measured and indicated resources totaled 48000 tonnes, and its inferred resources totaled 10600 tonnes, with an average uranium content of 0.026%.

In the Bahi district, the uranium deposits are reported to be shallow, causing the radioactivity levels in the surface soil to be high, (Uranex's Bahi project), and it is approximated to have 7–15 million pounds of Uranium oxide (U3O8) (Madenge, 2021). Manyoni district (6 deposits) has uranium resources of 11125 tU with an average grade of 0.022%, while Nyota has uranium resources of 55135 tU with an average grade of 0.025%. The uranium concentration in the Minjingu phosphate rock deposit was  $446 \pm 0.4$  mg/kg. All of these uranium sources will only help fight climate change if they are utilized to produce energy.

### Policies, Acts and Regulations that Govern Nuclear Energy

#### 1. National Energy Policy 2015

The presence of uranium in Ruvuma and Dodoma represents a significant opportunity for nuclear power generation. Despite various challenges in

project implementation, this policy envisions developing nuclear power in accordance with international standards as well as legal and regulatory frameworks. Create an enabling environment for nuclear electricity generation,' says the policy statement.

#### 2. National Nuclear Policy 2013

This national policy aims to provide proper guidance on nuclear technology development and safety management, as well as improve the country's preparedness to meet the health and environmental challenges that may result from commercial Uranium mining.

#### 3. National Environmental Policy 2021

The objective of this policy is to ensure sustainable and equitable use of natural resources to meet the basic needs of present and future generations. Management of the impacts of energy development and use to minimize environmental degradation.

#### 4. Atomic Energy Act, 2003 (No. 7)

The purpose of this act is to phase out the use of nuclear energy for commercial electricity generation; to protect life, health, and real assets from the hazards of nuclear energy and the negative effects of ionizing radiation; and to promote the safe and peaceful use of atomic energy and nuclear technology.

#### 5. Protection from Radiation Act, 1983(No. 5 of 1983).

This act governs the use of radioactive materials and other issues concerning the protection of people from harm caused by ionizing radiation.

#### 6. Nuclear Energy Act (No. 990 of 1987)

This act establishes general principles for the use of nuclear energy and nuclear waste management. It applies to the construction and operation of nuclear facilities, as well as uranium mining and enrichment activities.

### **7. National Climate Change Strategy 2012**

The goal of this strategy is to enable Tanzania to effectively adapt and participate in global efforts to mitigate climate change. One of the objectives of Tanzania's climate change strategy is to enable accessibility and utilization of the available climate change opportunities (to promote and improve the use of alternative energy sources), so the availability of nuclear energy will be useful as an alternative source of energy.

### **8. Environmental Policy 2021**

The goal of this policy is to strengthen the national capacity for addressing climate change impacts, based on resource mobilization this policy intends to collaborate with stakeholders to facilitate the availability of adequate resources for environmental protection and management

### **The Role of Nuclear Energy in Mitigating Climate Change**

#### **➤ Nuclear Power Prohibits Emission of Greenhouse Gases**

Fossil fuels predominated as an energy source throughout industrialization due to their accessibility and ease of transportation, but the world was severely at danger of global warming as a result of the large-scale emissions of greenhouse gases. Since it creates very little carbon dioxide and shields the environment from the accumulation of greenhouse gases that cause global warming, nuclear power has a substantial influence on climate change. Tanzania, one of the nations that produce uranium, can use its resources (uranium) in energy production. This will aid in producing energy in large enough quantities to meet demand while also preventing global warming.

#### **➤ Nuclear Power in Combating Drought**

The significance of nuclear power's non-electrical potential is seawater desalination, hydrogen production, and oil extraction. Nuclear energy can significantly reduce linked greenhouse gas emissions (IAEA, Climate Change and Nuclear Power, 2018). In Aktau, Kazakhstan, nuclear power has been used as a source of energy for seawater desalination, and it produces up to 120000 cubic meters (m<sub>3</sub>) of water per day. In Tanzania, recent rainfall in the north of the country

was less than 35% of the average, contributing to the current drought. The supply from the Ruvu River as the major source of water in Dar es salaam city has decreased from 466 million liters to about 300 million liters per day, while the demand is estimated to be 500 million liters in a city (Frace, 2022) So, since we can use nuclear power to battle with drought by creating saltwater desalination plants, drought concerns can be handled.

#### **➤ Mitigation of Greenhouse Gases**

Nuclear energy's main purpose is to prevent greenhouse gas emissions into the environment, and it also lowers the flow of these heat-trapping gases into the atmosphere. The amount of greenhouse gases in the atmosphere has decreased as a result of the quick increase in prevention of greenhouse gas emissions to the environment. There will be a tremendous possibility to stop the discharge of greenhouse gases into the environment once nuclear power is introduced in Tanzania, but it could take some time.

### **Challenges on Establishment of Nuclear Power Plants in Tanzania**

#### **➤ High Construction Cost**

When building a nuclear power plant, substantial capital expenses are required. New nuclear power costs about 5 times more than onshore wind power. For instance, in Lazard, the financial cost of the nuclear power plant in 2018 was \$151(112 to 189)/MWh, compared to \$43(29 to 189)/MWh for onshore wind (Jacobson, 2021). Tanzania is one of the developing nations that struggle with poverty; thus, building a nuclear power plant could take a very long time to complete.

#### **➤ Low Level of Research**

The government has plans to build a nuclear power plant, but there are currently no academic institutes in Tanzania that deal with nuclear energy, making the country's low level of study in this area challenging.

#### **➤ Public Consciousness or Awareness**

Since most people in the country only understand the negative effects of nuclear power, including health risks, accidents, and environmental harm from uranium mining, processing, and transportation, they simply view this as a dangerous process. The general public thus has a poor opinion of this technology.

#### **➤ High Operation and Maintenance Costs**

Nuclear power facilities not only have high building costs but also significant operating costs,

which is why it takes so long to begin the project's establishment and implementation. For example, the estimated cost for cleaning up the damage at the Fukushima Dai-ichi nuclear reactors (three reactors) is \$460 to \$640 billion, which is 10% to 18.5% of the capital cost for each reactor. Every year, approximately \$500 million is spent to safeguard nuclear waste from approximately 100 civilian nuclear energy plants. But they also take a long time to build.

#### ➤ **National Security and Terrorists**

The existence of nuclear power facilities opens the door to sabotage and terrorist strikes. Nuclear power facilities have the potential to have disastrous effects, including the sickness and death of individuals as well as the massive eviction of local communities.

#### ➤ **Nuclear Proliferation**

The misuse of nuclear energy, such as the production of weapons and bombs, is an argument against nuclear power (Marden, 2018). The same technology used to create nuclear fuel is also used to create explosive material for nuclear weapons.

#### ➤ **Challenges on Nuclear Waste Management**

This has been one of the challenges of nuclear energy production; nuclear waste is produced at various stages of energy production, and no permanent disposal solution exists. For example, the United States currently has over 90,000 metric tons of nuclear waste to dispose of (Ghosh, 2022), and Tanzania, as a developing country, probably will face significant challenges in managing nuclear waste.

#### ➤ **Social and Community Security**

Groundwater contamination from dissolved metals and radioactive materials, as well as the release of radioactive gas and radioactive dust into the air, will contaminate the air. The community will be put at risk if nuclear products and byproducts are not properly managed.

### RECOMMENDATIONS

- Education should be provided to the majority regarding nuclear power so that people understand the benefits and protective measures of this nuclear power.
- The government should recognize the great potential of Uranium deposit in the country
- The government should optimize for the small modular reactors
- The government should establish a stand-alone Uranium policy to support and govern the Uranium mining industry

- Governments and private operators need to make a considerable investment that includes projected waste management and decommissioning costs
- The government should invest in nuclear power research, technology, and trainings
- Using a consistent, carbon-free energy source when vendors agree to pay
- A cooperative approach between countries could assist in gathering critical mass for developing nuclear as a viable source of energy.
- As nuclear technology is heavily regulated, the nation must create a strong regulatory framework for all prospective Uranium programs.

### CONCLUSION

Nuclear power technology is the ideal method to utilize as an energy source since it creates little to no greenhouse emissions, which reduces the risk of climate change, and it provides a lot of energy compared to other forms of energy, making it the solution to the energy gap. Aside from that, there are numerous benefits of nuclear energy for a nation since it fosters economic development at the national level and offers job possibilities for individuals. Climate change will be significantly impacted if the government works more to develop and use nuclear power.

Since that nuclear power is recognized to carry a number of dangers, including health problems, the government should be aware of this and set certain principles and regulations controlling nuclear power before its development and execution while also focusing on the current policies.

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