From Vision to Reality: Building Capacity and Bridging Gaps in SMR Technology Adoption

Milana OZERINA, BRICS Youth Energy Agency,
milanaozerina24@gmail.com

1.INTRODUCTION

According to the IAEA, there are **83 SMR projects in development** across various countries, with over 90 designs worldwide. Most involve generation IV systems with advanced coolants, offering improved efficiency, safety, and environmental benefits. SMRs, being compact and scalable, present a promising alternative to traditional reactors, aiding the transition to a low-carbon economy by providing reliable clean energy. However, **widespread adoption faces challenges such as technical development, regulatory approval, workforce readiness, public acceptance, and financial investment.**

2. CHALLENGES AND SOLUTIONS IN SMR DEPLOYMENT

LWR SMRs are the most mature technology, but face challenges in manufacturing, supply chain logistics, and adapting infrastructure for smaller units. **HALEU fuel**, enriched to 5-20% U-235, is vital for advanced SMR designs, offering better performance and longer fuel cycles, but its **limited supply chain presents obstacles**. International collaboration can help address HALEU shortages through shared research and enrichment facilities. Regulatory frameworks also need to evolve, with tailored guidelines for SMRs' modular designs and enhanced safety features. **International regulatory harmonization can simplify market access.**

3. CAPACITY BUILDING AND INTERNATIONAL COLLABORATION

Usually, it is governments who initiate nuclear power program development, overseeing the complex process of infrastructure planning and implementation, but Estonia is unique with a private company, Fermi Energia, driving its SMR program. In October 2023, Estonia hosted the first IAEA INIR mission focused on SMRs, marking a notable public-private partnership. The outcome of Estonia's case could provide valuable insights and lessons for other countries considering SMR adoption. Meanwhile, **Africa has seen 11 of 37 global INIR missions**, demonstrating the continent's growing commitment to nuclear energy for energy security and economic growth..

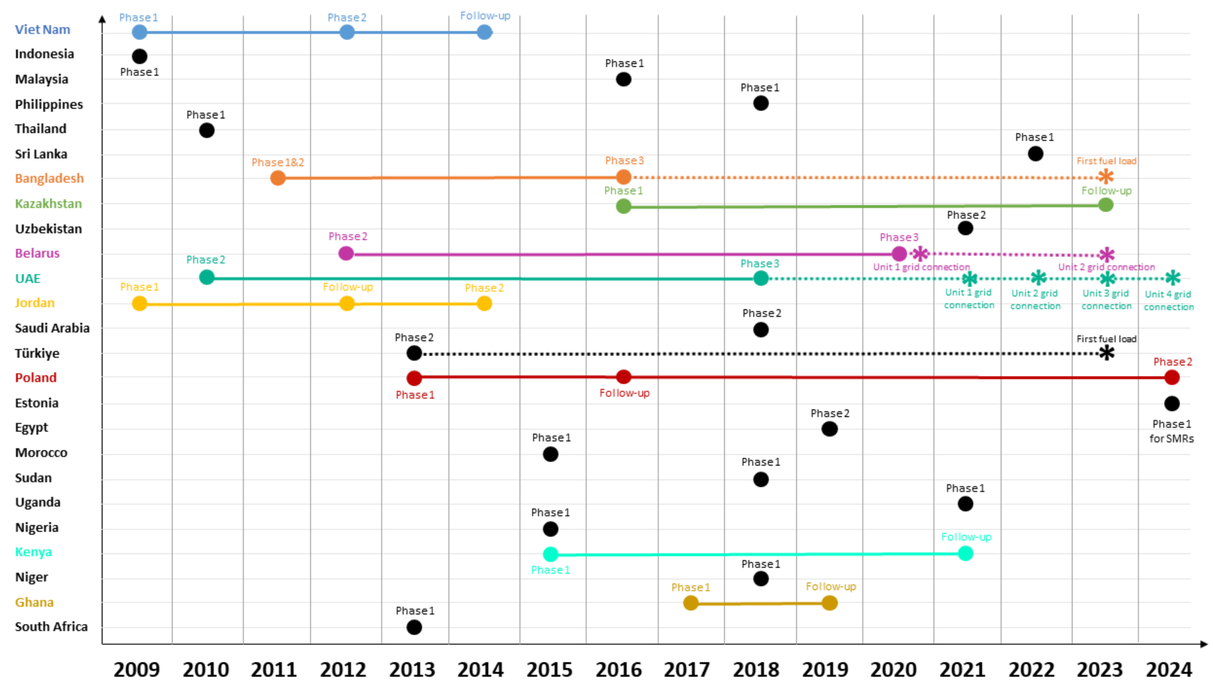

Figure 1. INIR missions conducted by the IAEA from 2009 to 2024

Sub Sahara Region is well represented at the annual IAEA's Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure, as seen at Figure 2. This participation highlights the **growing interest and commitment of African countries in advancing their nuclear power infrastructure**. It reflects a proactive approach to engaging with global nuclear experts, sharing experiences, and gaining insights into best practices and emerging technologies.

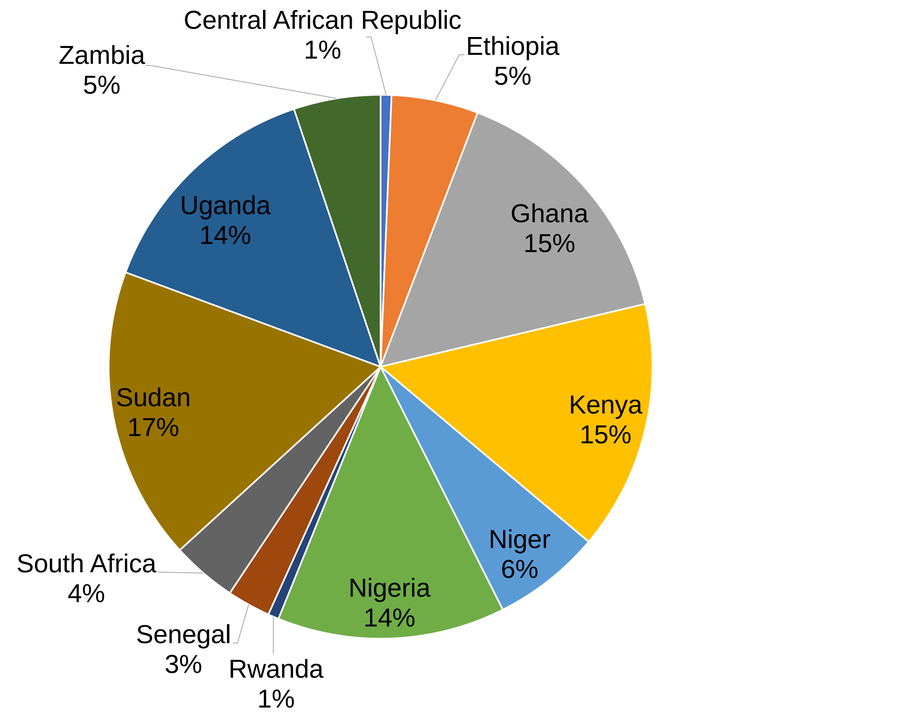

Figure 2. Representation of Sub Sahara Region at the IAEA Technical Meetings on Topical Issues in the Development of Nuclear Power Infrastructure from 2014 to 2024

Over the years, references to SMR technology at the IAEA's Technical Meeting on Nuclear Power Infrastructure have increased significantly (see Figure 3). This reflects growing recognition of SMRs as a promising solution for future energy needs due to their safety, scalability, and adaptability. **This trend highlights the potential of SMRs to reshape global nuclear power.**

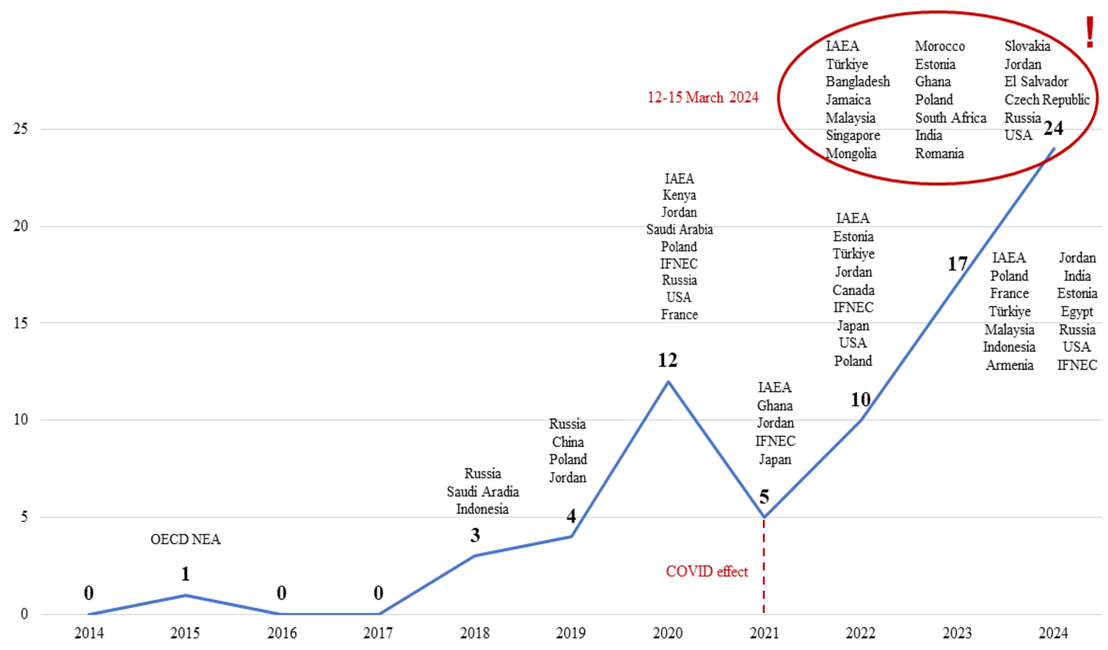

Figure 3. References to SMRs in presentations at the Technical Meetings on the Topical Issues in the Development of Nuclear Infrastructure

4. PUBLIC ACCEPTANCE AND STAKEHOLDER ENGAGEMENT

— Despite efforts to boost public engagement, **skepticism about nuclear energy persists**, partly due to past accidents like Chernobyl and Fukushima.

— While SMRs offer improved safety, public trust is crucial for their success. **Clear, accessible communication** about SMRs, including their benefits and safety, is key.

— In the Global South, it is important to explain that the deployment of SMRs can lead to significant local benefits. **Improved economic conditions, the creation of new jobs, and increased access to education for children** are some of the potential positive impacts.

5. CONCLUSION

— Technical challenges, regulatory frameworks, and supply chain logistics must be meticulously addressed to ensure the smooth deployment and operation of these reactors.

— The need for a skilled workforce and robust infrastructure further underscores the importance of capacity building. Moreover, the limited supply of HALEU fuel remains a critical issue that requires international collaboration and innovative solutions.

— The gap in public awareness highlights the necessity for targeted education and outreach efforts to inform the public about the benefits and safety features of SMR technology. Transparent communication and engagement with stakeholders, including local communities and media, are essential to build trust and support for SMR projects.

— International and interregional initiatives exemplify how global cooperation can harmonize efforts, streamline regulatory processes, and stimulate innovation. Collaborative endeavors not only facilitate the sharing of best practices and resources but also ensure that countries, regardless of their nuclear capabilities, can contribute to and benefit from the advancements in SMR technology.

6. REFERENCES

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