

Licensing, Regulations, and Developing Guidance for Nuclear Technology Deployment for Embarking Countries in Africa

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ABSTRACT

The African region is seeing an increased number of countries at different stages of implementing or considering the introduction of peaceful nuclear power programs to meet the demand of their rapidly growing economies and clean energy needs. Grid size, cost, licensing, and regulations will be some of the challenges for deploying larger power reactors. A key element of the regulatory framework will be including nuclear security information and the assurance that security is integrated into the license review process.

As each country continues to implement and consider different reactor designs from several vendors, the significance of customer knowledge for licensing, regulations, and guidance documents to facilitate deployment and operational needs for nuclear technology cannot be over-emphasized. This special session will bring together a selected panel of key stakeholders and policymakers from embarking countries in Africa to participate in a panel discussion to share their experience in the licensing, regulations, and development of guidance for power plant deployment. The session will also consider and identify potential gaps that may affect the licensing and regulatory applications for the future nuclear infrastructure. As well, the panel will promote regional networking and communication to increase capacities in readiness for the potential deployment of additional technology, such as Small Modular Reactors.

INTRODUCTION

More countries in Africa are looking toward peaceful uses of nuclear energy as a means for national development and meeting the Sustainable Development Goals (SDG) as well as their climate change obligations. This comes with the responsibilities to put in place comprehensive and appropriate infrastructure for safe, secure, and sustainable utilization of technology governed by appropriate leadership with requisite national and organizational culture [1]. About 600 million people representing 43% of total population in Africa lack access to electricity [2]. Whereas nuclear power has continued to play a vital and reliable role as low carbon and reliable cost-effective electricity generating technology in developed countries, with the tremendous opportunity for non-energy use. While peaceful nuclear technology can be essential for national development, its safe and secure implementation and use will be contingent on the promulgation and implementation of effective national legal framework [3] that includes early consideration of safety, security, and safeguards requirements in the framework for licensing, and regulations as well as a well-coordinated platform for review process. Despite the advantages of nuclear technology, the increase in terrorist activities is seen as a threat to the technology and by

implication the global security. Consequently, regulations must be put in place for the prevention and detection, response to theft and sabotage, mitigation of illegal transfer, and deterrence of unauthorized access, or other malicious acts involving nuclear material, other radioactive materials, or their associated facilities.

Though nuclear security is the responsibility of an individual state, the International Atomic Energy Agency (IAEA) supports Member States in the establishment and maintenance of effective nuclear security regimes [4]. When planning or launching a national nuclear infrastructure and framework for a safe, secure, and sustainable nuclear power program, careful and long-term commitment of about 10-15 years [5] must be considered, including strategies for adequate investment in time, building national institutions, finances, human resources, and the competence to implement all relevant international legal instruments for the protection of materials and information, detection, response as well as other contingency measures. All nuclear plants must be licensed to facilitate effective and efficient operational safety standards to protect the health of people, personnel, and the environment pursuant of the IAEA statute governing activities that could give rise to radiation risk from operation, service, transportation, and management of radioactive waste [6]. Though Small Modular Reactors (SMR) are expected to be a viable option for cost consideration, size, and construction, they can fast-track the timeline from consideration to deployment while meeting energy supply security both in new and expanding countries.

While the global SMR and advance reactors designs continue to gain more ground, its deployment may face challenges of licensing, for instance an existing design originally approved for the reactor vendor by the country-of-origin regulator may be subjected to local licensing requirements outside the country of origin. As such, embarking countries should consider the licensing, regulations, and development of guidance for operation at the early stage of program implementation.

BASIC HIERARCHY OF A NATIONAL LEGAL SYSTEM FOR NUCLEAR SECURITY

Regulations are governed by primary legislation, typically the State's national nuclear law, and applicable international instruments. The national legal system must be comprehensive, describe legal hierarchy, and designates responsible State Authority for physical protection, licensing, and authorization method [7] and provides it with necessary powers to enforce regulations. Essential first step to regulatory development is to clearly define purpose, scope, and intended accomplishment. It must be consistent with its general legal system and able to identify the elements of national legislative and regulatory framework that supports safe, secure, and effective management of the technology from cradle to grave. At each phase of the regulatory framework, it is important that all new national laws for nuclear security include the process for regulatory development and associated best practices. The framework must recognize security related provisions and policies that will be included in both primary and secondary legislations as well as the operational guidance documents for all facilities, services, and radiological materials. Embarking countries can benefit from the IAEA Nuclear Law Handbook [8], which echoes common, but not obligatory practices that can be adopted to establish a comprehensive legislation for governing the peaceful use of nuclear technology. The book emphasizes vital principles of nuclear law that could help integrate the domestication of international instruments with national laws. Nuclear law can progress from a national constitution which comprises of fundamental laws

of the state and evolves into primary (laws, act, and statutes) and secondary (regulations, ordinances, decrees) legislations, lastly guidance documents which are non-binding advisory documents and policy statements.

CONSIDERATION FOR IMPLEMENTING REGULATORY FRAMEWORK FOR EMBARKING COUNTRIES

The legal framework for nuclear security is the basis for establishing effective national nuclear security regimes as well as the footing for international cooperation and assistance, it complements the measures for securing and preventing unauthorized acts concerning nuclear facility and radioactive materials. Countries embarking on a new nuclear program must consider both national and international legally binding and legally non-binding instruments that governs safe and secure deployment of nuclear infrastructure [9]. However, countries can request for IAEA's assistance in adhering and implementing any of the legal instruments.

States can either develop an entirely new legal framework or may leverage on the existing regulatory infrastructure central to internal security and operational procedures relevant to services and facilities utilizing the nuclear or radiological materials. An embarking country must identify key elements of legal and legislative frameworks for nuclear security crucial to developing their infrastructure and assign requisite roles and responsibilities to each of the key elements identified. They must also consider capabilities to assess and select technologies suitable or that are adaptable to the existing infrastructure [10].

Legal framework and nuclear security are two of the 19 nuclear infrastructure issues identified by the IAEA for comprehensive and methodical approach to developing a national infrastructure for nuclear power and all the identified issues are addressed in three distinct phases and 3 Milestones [11]. Following the IAEA Milestone approach, all the legal framework for nuclear security must be identified by the end of Phase 1 during the consideration to launch nuclear power program and preceding Milestone 1. As well, it is expected that this framework is well-established by the end of Phase 2 during the preparatory work and before commencing the Milestone 2 activities. In addition, the IAEA nuclear security series number 19 implementing guide highlights the procedures for establishing an effective nuclear security infrastructure for a nuclear power programs, such as putting in place a national nuclear security policy and strategy, national law and regulations, nuclear security systems, information security, physical protection, as well as the detection and response to nuclear security events [12]. Nuclear regulatory framework must set out all requirements for licensing, enforcement, and inspection.

The implementation of regulatory framework for embarking countries must set to accomplish the:

- Establishment of independent State Authority responsible for safety, security, and safeguards
- Appropriation of requisite legal backing to the State Authority
- Establishment all key elements that are needed for an effective regulatory system
- Establishment Authorization procedures for licensing, inspection, and enforcement
- Addresses Nuclear Material Accountancy and Control
- Establishment transportation regulations
- Establishment procedures emergency preparedness and response

- Establishment procedures for reviews and assessment

TREATIES AND CONVENTION FOR PHYSICAL PROTECTION AND NUCLEAR SECURITY

Embarking countries must consider various international instruments for supporting the deployment of nuclear technology. Listed below are some instruments relevant to strengthening national security:

- Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment
- International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT)
- Code of Conduct for the Safety and Security of Radioactive Sources with its Supplementary Guidance
- Security Council Resolution 1540

IDENTIFYING STAKEHOLDERS FOR LICENSING AND REGULATORY FRAMEWORK

Identification and reaching out to stakeholders will help to establish relationships and coordination mechanism necessary to support nuclear security legislations. As well, early engagement of all stakeholder organization will help to avoid having to rewrite the regulation later to accommodate their needs and concerns.

CHALLENGES OF FUTURE DEPLOYMENT OF NUCLEAR TECHNOLOGY

As countries continue to implement and consider different reactor designs from several vendors, the significance of customer knowledge of licensing, regulations, and development of guidance document to facilitate the deployment and operational needs for the plants cannot be overemphasized. However, the followings are considered as probable challenges:

- Standardized regulation
- Standardized design
- Guaranteed fuel supply
- Security of plant and materials
- Material transportation
- Technology and innovation
- Waste Management
- Sabotage

During licensing, there are several challenges that may be faced

- Familiarity with technology
- Cooperation of stakeholders
- Legal and technical community relation

- Awareness

CONCLUSION

It is vital for embarking countries to establish an effective nuclear security infrastructure early for their nuclear power program. It is possible for the State to develop an entirely new legal framework or build upon existing regulatory infrastructure. Additionally, it is important for embarking countries to identify key elements of legal and legislative frameworks that are crucial to developing their infrastructure and assign requisite roles and responsibilities to each of the key elements identified

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