

**Council for Security Cooperation in the Asia Pacific (CSCAP), Nuclear Energy Experts Group (NEEG) Meeting  
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**Potential Future SMR Deployment to Emerging Countries –  
Proposed Package Approach to Legislative and Regulatory Frameworks**

**- DISCUSSION PAPER -**

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1. As considered here, a potential future deployment of SMRs/ TNPPs (small modular reactors/ transportable nuclear power plants) to emerging countries may involve early partnering between the vendor and emerging countries within the framework of an intergovernmental agreement (IGA). Subject to financial/ economic considerations, it could also involve a Build-Own-Operate (BOO) model including a competent operator and an ‘off-take’ agreement (power purchase agreement (PPA)). Further, it may also include lifetime nuclear fuel supply, spent fuel/ [HLW] and SMR/ TNPP take-back (end of lifetime), as well as on-going transport between the emerging and vendor countries, in particular, in the case of SMR/ TNPP takeback for servicing/ maintenance (during lifetime).<sup>2</sup> Deployment may also be based on potentially aggressive schedules with short lead times (due to modularization).
2. Not least due to the economy of serial production, a vendor country-industry needs some advanced certainty with respect to target countries. Yet, a number of emerging countries share many common needs, limitations, issues and challenges when it comes to developing the capabilities needed for acquiring nuclear technology, such as a nuclear power plant. Significant issues include adopting the needed national position and overcoming the financial and economic challenges. A major hurdle is first establishing and, then implementing, the required national nuclear legislative and regulatory framework, pursuant to the relevant international nuclear legal instruments, IAEA Safety Standards and IAEA Nuclear Security Guidance, as well as international best practice. A key challenge is developing the required human resources, such as the core competences of the national nuclear regulatory body (RB) i.e. legal, technical disciplines, regulatory practices etc (e.g. SF-1, GSR Part 1 (Rev.1), GSG-4, GS-G-1.1, SSG-12 and SSG-16).
3. It is recalled that INSAG’s (International Nuclear Safety Group) strategy to licensing the first nuclear power plant while ensuring a high-level of nuclear safety, incidentally may expedite the licensing process (INSAG-26 (2012)). Primarily due to the absence of core competences, INSAG identifies a mismatch between the schedule for issuing a construction licence and the ability of the RB to assess the first preliminary safety analysis report. While the RB may benefit from external support in undertaking that assessment, INSAG considers that it needs to carry-out an independent review at the time of commissioning i.e. no external support should be provided to the review of the final safety analysis report. Thus, at that time the RB needs to have in place the required “staff” competent in several technical areas to undertake such a review, at the very latest.
4. An issue in respect of SMR deployment to emerging countries therefore concerns the development of RBs and their competence to perform the needed independent assessment (pursuant to the applicable international legal instruments and standards etc.).
5. With this in mind and building on the aforementioned INSAG strategy, a dedicated so-called SMR Legislative and Regulatory Framework Package(s), is proposed as way to facilitate deployment, while ensuing a high-level of nuclear safety and security. Such an approach should clearly complement/ include some of the ongoing assistance (including by the IAEA) to emerging countries, their RBs and other competent authorities, such as concerns the development of national nuclear laws, HRD programmes and other national infrastructure issues etc. Some of the features of the proposed approach could include:
  - a. the establishment of a reference regulatory framework (including as appropriate, requirements/ regulations and procedures (as reflected in emerging countries’ national nuclear laws)) by the vendor country, its RBs and industry,

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<sup>2</sup> For a discussion of some of the legislative and regulatory issues regarding TNPPs see, “Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study”, [IAEA Nuclear Energy Series No. NG-T-3.5](#) (2013), IAEA, Vienna. Also, for a discussion on licensing issues see, [13th INPRO Dialogue Forum](#) on “Legal and Institutional Issues in the Global Deployment of Small Modular Reactors”, 18-21 October 2016, IAEA, Vienna and [6th INPRO Dialogue Forum](#) on “Licensing and Safety Issues for Small and Medium-Sized Reactors, 29 July - 2 August 2013, IAEA, Vienna.

- together with IAEA validation/ review, as well as input from other like-minded experienced country(ies) and other relevant organisation(s)-body(ies),
- b. the use of the SMR reference plant's safety assessment report/ safety evaluation report (or other relevant docs.) by emerging countries' RBs,
  - c. the creation of a dedicated SMR technical support organization (TSO) or other such body, through which the needed core competent "staff" could be provided to emerging countries' RBs (and possibly other competent authorities). The recruitment of such staff should be for a limited tenure while other staff acquire the needed level of competency (including through the implementation of HRD programmes). The dedicated TSO could be established, with IAEA involvement, by the vendor country and/or other like-minded experience country(ies),
  - d. the qualification of such persons as "staff" by emerging countries (and/or their RBs) - this may be an administrative law issue,<sup>3</sup>
  - e. the ongoing support of the dedicated TSO, the vendor country (including its RB), other like-minded experienced country(ies) and the IAEA to the development and sustainability of the human resources needed for regulatory control,
  - f. the creation by the vendor country *et al* of an international advisory panel of renowned international experts for the dedicated TSO,
  - g. the IAEA undertaking generic design and individual site reviews, as well as providing ongoing technical and legal assistance,
  - h. an overall enhanced level of co-operation between emerging countries and their RBs, with the vendor country and its RB, in particular due to the need to inspect SMR manufacturing.
6. The proposal does not appear to be necessarily contrary to the provisions of the existing international nuclear legal instruments, standards and guidance. Yet, it may still give rise to a number of concerns such as regards the potential risk of 'political and/or regulatory capture'.<sup>4</sup> However, depending on the level of possible IAEA involvement (and that of other experienced country(ies)), perhaps such concerns can be alleviated. There will still likely be limits, however, as to which emerging and vendor countries (RBs and industry) would be willing to pursue such an approach.<sup>5</sup>
7. On a final note, the above proposal is separate to issues arising in respect of TNPPs and the application of the existing international nuclear legal instruments etc. to them (see Annex). In particular:
- a. The need to ensure that the existing international instruments, standards and guidance comprehensively cover TNPPs (all stages) in view of design/ technical innovations:
    - i. issues arise from the limited scope of application of the Convention on Nuclear Safety i.e. it only applies to land-based NPPs,
    - ii. there is a need for requirements addressing the transport of a fuelled nuclear reactor i.e. IAEA Transport Regulations, IMDG Code and INF Code - mandatory through SOLAS, Chapter VII,
    - iii. finally, there is also a need for new criteria for TNPP acceptance pre-post transport i.e. fuelled and tested nuclear reactor.
  - b. The possible need for a new dedicated international legal instrument(s)/text(s) and/or amendment of existing ones, as well as other actions including substantial further IAEA/ IMO guidance/ clarification.
  - c. Finally, the necessity to consider further issues arising from the interaction of ocean and nuclear law regimes during transport, placement and operation of the TNPP. *[The application of the international nuclear legal framework to TNPPs will be addressed in a paper being prepared together with Denise Cheong, Senior Research Fellow, CIL.]*

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<sup>3</sup> FANR (UAE Federal Authority for Nuclear Regulation) qualifies some international experts as "staff". The UAE also has an "Emiratization" programme. Yet, many emerging countries are unlikely to have the financial resources of the UAE.

<sup>4</sup> Questions include: What limits apply to emerging countries in benefiting from external support in respect of the national nuclear legislative and regulatory framework? What issues may arise when foreign experts are qualified as staff, as a way of achieving the competence of an emerging country's RB? What are the obligations, responsibilities and functions of an emerging country (and its RB), with respect to the establishment, implementation and maintenance of the national nuclear legislative and regulatory framework? Are there alternative ways to fulfilling these obligations, responsibilities and functions while ensuring an emerging country retains ultimate responsibility for nuclear safety and security? What would be the risks, limitations and constraints? In what way does the need for an independent regulatory review at the time of SMR/TNPP commissioning intensify the challenges facing an emerging country and its RB?

<sup>5</sup> For example, it requires input beyond what would usually be required, such as concerns the needed financial resources. This gives rise to the issue of the economic/ financial viability of such an approach. In this context, how feasible is for the associated costs to be factored into an off-take agreement? Some emerging countries may also wish to pursue an approach based upon the progressive development of regulatory competence which may include the utilization of TSOs and foreign experts but would not involve their qualification as staff.

## - ANNEX -

# TNPPs - APPLICABILITY OF EXISTING INT'L INSTRUMENTS/TEXTS



- One approach: apply the **definitions and scope** of the existing int'l instruments/texts on nuclear safety, security and liability, as well as ocean law.
- The result, is that **TNPPs are essentially covered** by the existing int'l normative guidance i.e. as a facility/installation and transport of packaged material by ship etc.
- **HOWEVER**, significant gaps need addressing.

## NUCLEAR LIABILITY

- **1963 & 1997 Vienna Convention on Civil Liability for Nuclear Damage & 1997 Convention on Supplementary Compensation for Nuclear Damage:**
  - Applies to a TNPP as a transport of ‘nuclear material’ and as a ‘nuclear installation’.

[IAEA International Expert Group on Nuclear Liability]

## NUCLEAR SAFETY

- **1994 Convention on Nuclear Safety (CNS)**
  - Expressly limited to apply to 'land based nuclear power plants'.
  - **ISSUE: How can the CNS apply to a TNPP?**
- **1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management**
  - Applies to a TNPP as a 'nuclear facility', 'radioactive waste management facility', 'spent fuel management facility', and for transport purposes, as a 'transboundary movement' of 'radioactive waste' and/or 'spent fuel'.

## NUCLEAR SAFETY contd.

- **1986 Convention on Early Notification of a Nuclear Accident; and 1986 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency**
  - Applicable to a ‘nuclear accident’ and/or ‘radiological emergency’ involving a TNPP as a ‘facility’ and/or as an ‘activity’ i.e. during transport.

## NUCLEAR SECURITY

- **1987 Convention on the Physical Protection of Nuclear Material and 2005 Amendment**
  - Applies to a TNPP as a ‘nuclear facility’ (2005 Amendment only) and for transport purposes, as an ‘international nuclear transport’ i.e. of nuclear material.

## NUCLEAR SECURITY cont'd

- **2005 International Convention for the Suppression of Acts of Nuclear Terrorism**
  - Applies to a TNPP as a ‘nuclear facility’ and for transport purposes, as a transport of ‘nuclear material’.
- **1997 International Convention for the Suppression of Terrorist Bombings**
  - Applies to a TNPP as an ‘infrastructure facility’.

## NUCLEAR SECURITY cont'd

- **2005 Protocol to the 1988 Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation**
  - Applies to a TNPP as an ‘infrastructure facility’ and for transport purposes, as a transport by a ‘ship’ of ‘special fissionable material’.
- **2005 SUA Fixed Platforms Protocol**
  - Under certain circumstances, it could apply to TNPP as a ‘fixed platform’ i.e. if permanently attached to sea-bed (continental shelf) – ***but probably an unlikely scenario.***

## LAW OF THE SEA & MARITIME INSTRUMENTS/TEXTS

- **UNCLOS**

- Applies to a TNPP as a ‘ship’ carrying ‘nuclear ... substances or material’ and may be deemed as being an ‘installation’.

- **SOLAS 1974, as amended:**

- Applies to a TNPP as a ‘ship’ on an international voyage in Chapter V and Chapter VII on carriage of dangerous goods also applies.

## LAW OF THE SEA & MARITIME INSTRUMENTS/TEXTS cont'd

- **INF Code** (mandatory through SOLAS, Chapter VII)
  - Applies to a TNPP in the context of the transport of 'INF Cargo i.e. packaged 'irradiated fuel' and/or 'high-level radioactive waste'.
  - **ISSUE: Application to a fuelled reactor needs to be addressed.**

## LAW OF THE SEA & MARITIME INSTRUMENTS/TEXTS cont'd

- **IMDG Code** (mandatory through SOLAS, Chapter VII)
  - Applies to a TNPP as a transport of packaged ‘radioactive material’.
  - **ISSUE: Application to a fuelled reactor needs to be addressed (see slide 11).**
- **MARPOL 73/78**
  - Applies to a TNPP as a ‘ship’.

## IAEA SAFETY STANDARDS

- **Regulations for the Safe Transport of Radioactive Material**  
(incorporated into IMDG Code)
  - Applies to a TNPP as a transport of packaged ‘radioactive material’.
  - **ISSUE: Application to a fuelled reactor needs to be addressed.**

## IAEA NUCLEAR SECURITY GUIDANCE

- Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities, INFIRC 225 Revision 5, NSS no. 13
  - Applies to a TNPP in the context of transport of ‘nuclear material’ and as a ‘nuclear facility’.
  - ISSUE: Possible need to consider adequacy of physical protection measures to a slow moving barge-towed fuelled reactor i.e. sabotage thereof.