

small modular reactors

and their applications

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Initiatives in INPRO for SMRs-INPRO

N. DAS, S. JEON, G.SAYIN, C. SCHERER

International Atomic Energy Agency (IAEA) Vienna, Austria

Email: ni.das@iaea.org



ABSTRACT

The concept of sustainable nuclear energy development through strategic energy planning is facilitated by the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), a key programme of the International Atomic Energy Agency (IAEA). The INPRO programme has various activities supporting Member States (MSs) in strategic planning for sustainable nuclear energy incorporating small modular reactors (SMRs). INPRO’s collaborative SMR projects, aim to formulate prospective scenarios and success factors for sustainable nuclear energy systems deployment with SMRs, including potential cooperation models. INPRO supports MSs through its nuclear energy system assessment (NESA) utilizing the holistic INPRO methodology, which encompasses six key areas.

The INPRO methodology helps identify gaps in sustainability including during design phases of a nuclear energy system (NES) and promotes advancing sustainable NES deployment. INPRO is working with several MSs including technology holders in performing NESAs for SMRs.

Another project is the INPRO Dialogue Forums (DF), which provides a platform for technology holders and users to exchange knowledge on sustainable nuclear energy development and deployment; specifically, the 21st and 22nd DFs addressed SMRs.

INPRO Task Areas

There are four task areas in INPRO:



Task 1: ASENES SMR Collaborative Project

This collaborative project will result in an IAEA TECDOC publication. Below are some of the key ideas and themes of the case studies:

- Role of SMRs in mitigating greenhouse gases and achieving nationally determined targets while ensuring the least-cost solution for energy system development over the entire planning horizon.
- Economic aspects of SMR deployment in countries with financial limitation to support nuclear energy projects.
- Prospects of adopting sustainable SMR deployment in NES configurations with existing with large reactors.
- Analysis of nuclear energy deployment scenarios and possible SMR roles based on trend analysis of energy consumption and the latest national plans.
- Scenario analysis on SMR deployment in the context of future energy demand and market conditions, including with conventional and alternative energy sources and current renewable energy resources.

Task 2: Transportable Nuclear Power Plants (TNPPs)

- First Study:** - initiated in 2008, resulted in a publication in 2023.
- identified gaps in existing international legal instruments related to nuclear law and in the non-binding norms for TNPPs.
- Second Study:** - launched in 2015, comprehensive approach
- to explore legal and institutional aspects related to exporting a factory-fuelled, tested, and sealed modular reactor
 - covers the lifecycle of a deployed factory fuelled SMR
 - currently being prepared for publication as an IAEA TECDOC.

IAEA International Symposium on Floating Nuclear Power Plants (FNPPs)



FNPP prototype model by Seaborg

Each of these tasks contributes to the successful and sustainable deployment of SMRs, such as in scenario assessments, economic assessments, studies on innovative SMRs, and creating a global platform for stakeholders to discuss challenges related to sustainable deployment of SMRs.

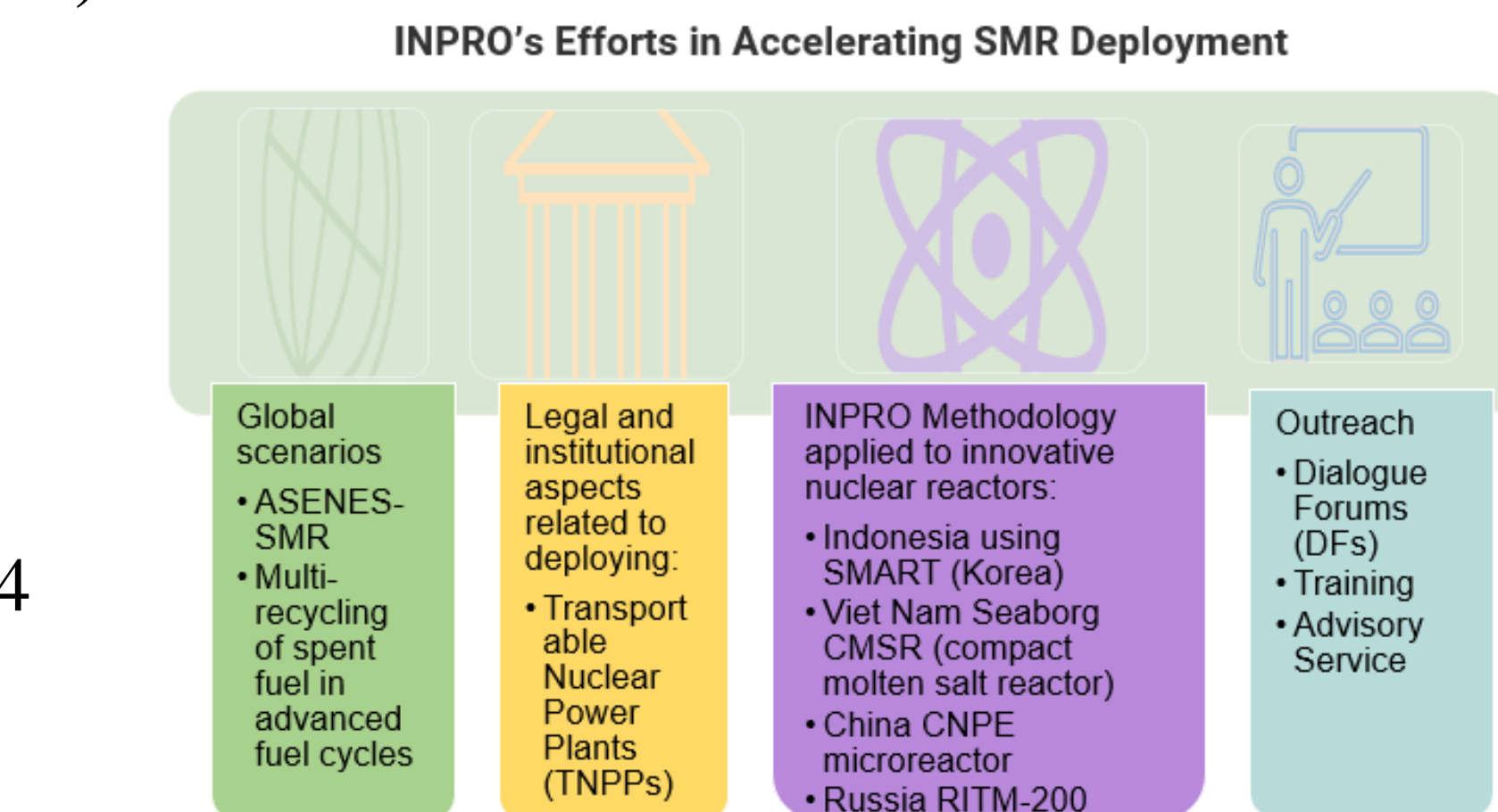
Deployment of SMR Projects and Technologies to Support Development Goals (SDGs)



INPRO School on Strategic Planning for Sustainable Nuclear Energy

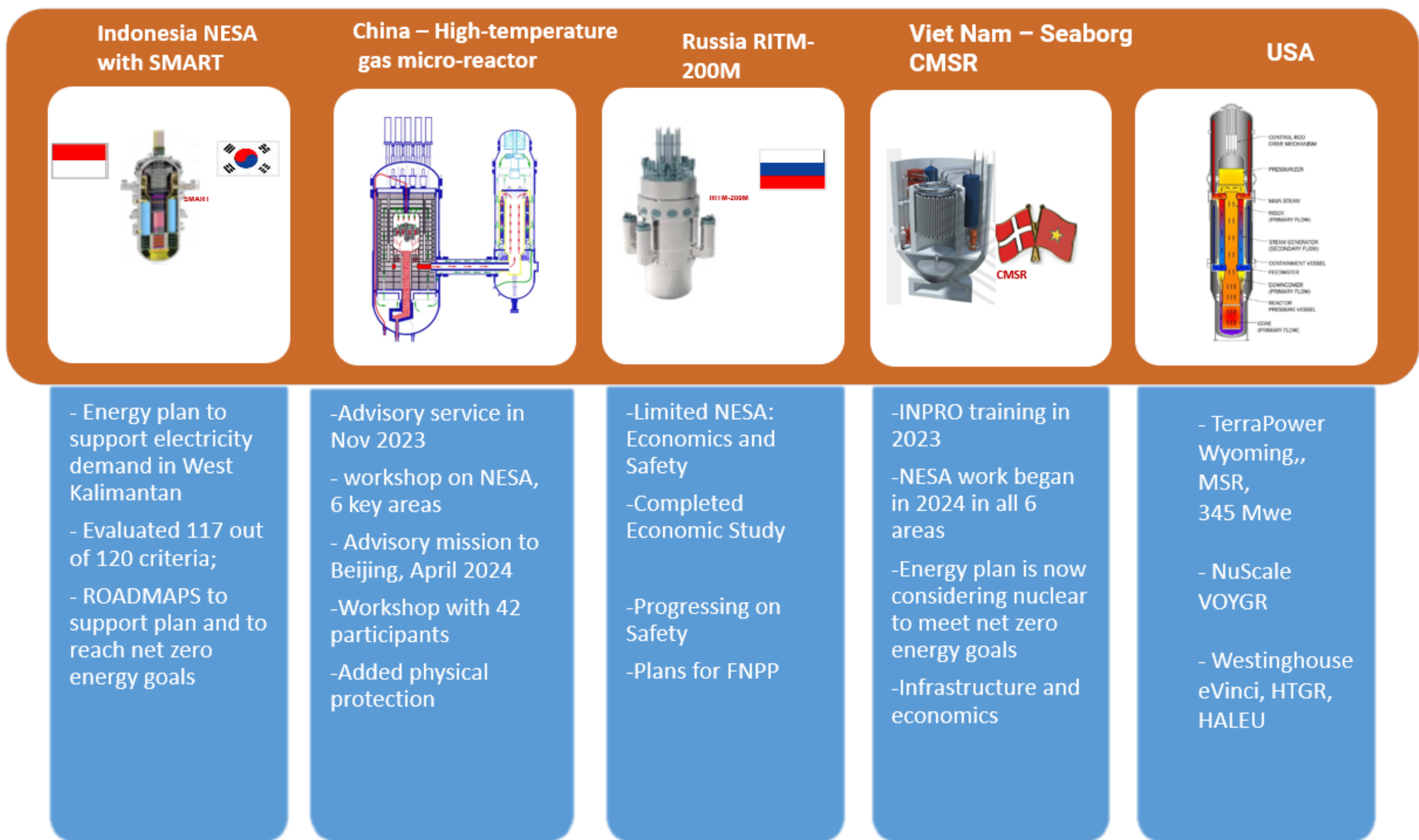
- Jointly held since 2022 with Abdus Salam International Centre for Theoretical Physics (ICTP) in ICTP, Trieste, Italy.
- one of the key topics of the lectures includes various aspects related to planning and deployment of SMRs sustainably.
- enlightens participants on various SMR designs around the globe, challenges involved for MS, technical aspects, sustainable deployment challenges, advantages, issues, and actions to be implemented
- holds lectures and discussions on microreactors (a type of SMR) besides teaching INPRO Methodology topics.
- INPRO initiated regional schools in 2024 upon request from MSs and SMR is a popular topic of discussion.

Summary



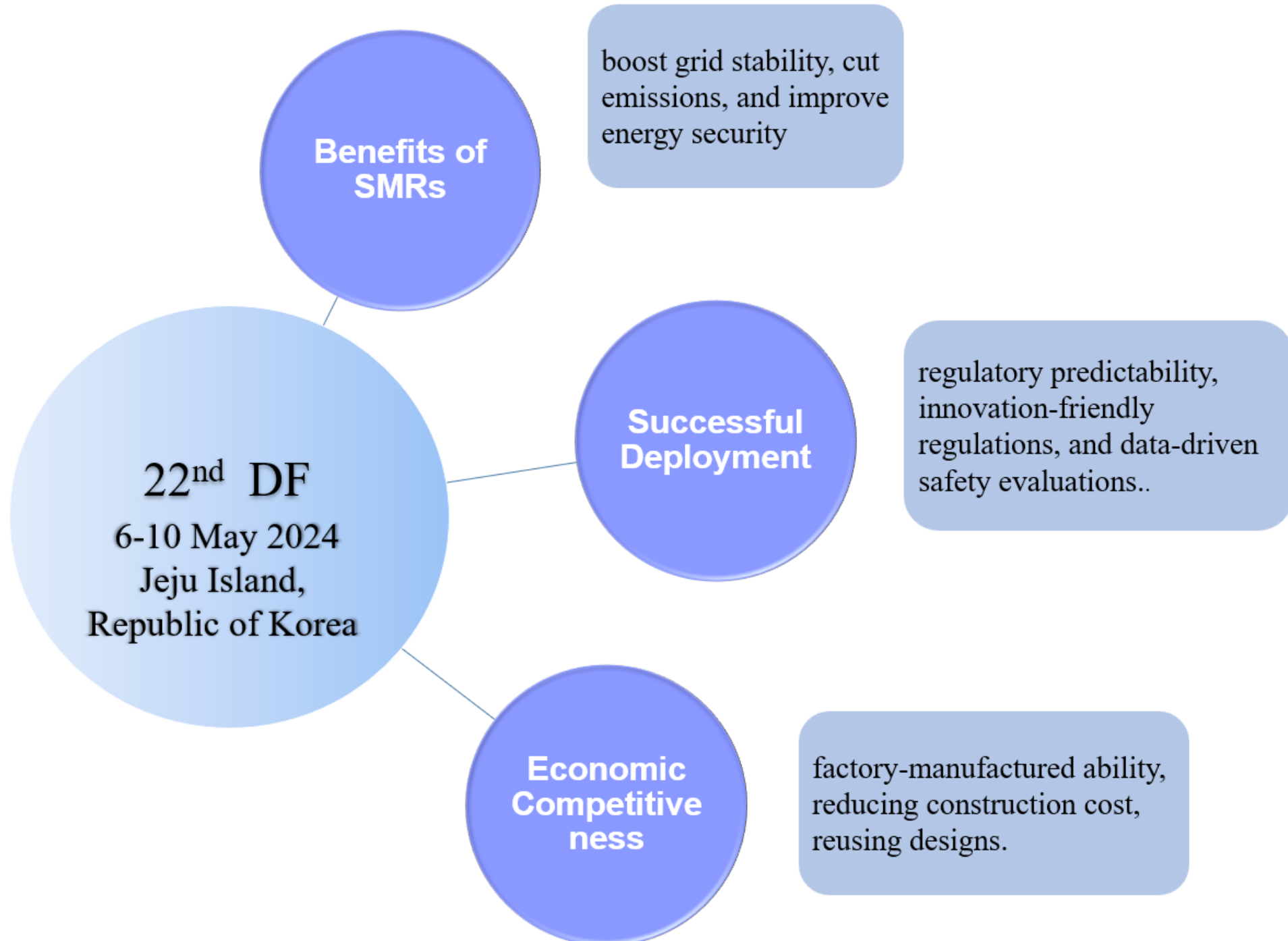
INPRO actively supports MSs for sustainable NES development, including NES with SMRs, through assessment methodology, modelling and analysis, dialogue and capacity building.

Task 3: Assessment and Strategies



Task 4: Dialogue and Outreach

The INPRO DF is a platform where technology holders, technology users, and other stakeholders come together to discuss and share perspectives and challenges related to the deployment of sustainable nuclear energy systems. The DFs focus not only on technology, but also on institutional aspects, such as market resources, effects of regulations, public acceptance, and contribute to sustainable nuclear energy deployment.



Successful Development and Sustainable Deployment of SMRs

