

EU SMR PARTNERSHIP

Workstream #5 – R&D and innovation

Sustainable Nuclear Energy Technology Platform (SNETP) FORUM
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What R&D&I roadmap for a European SMR development?

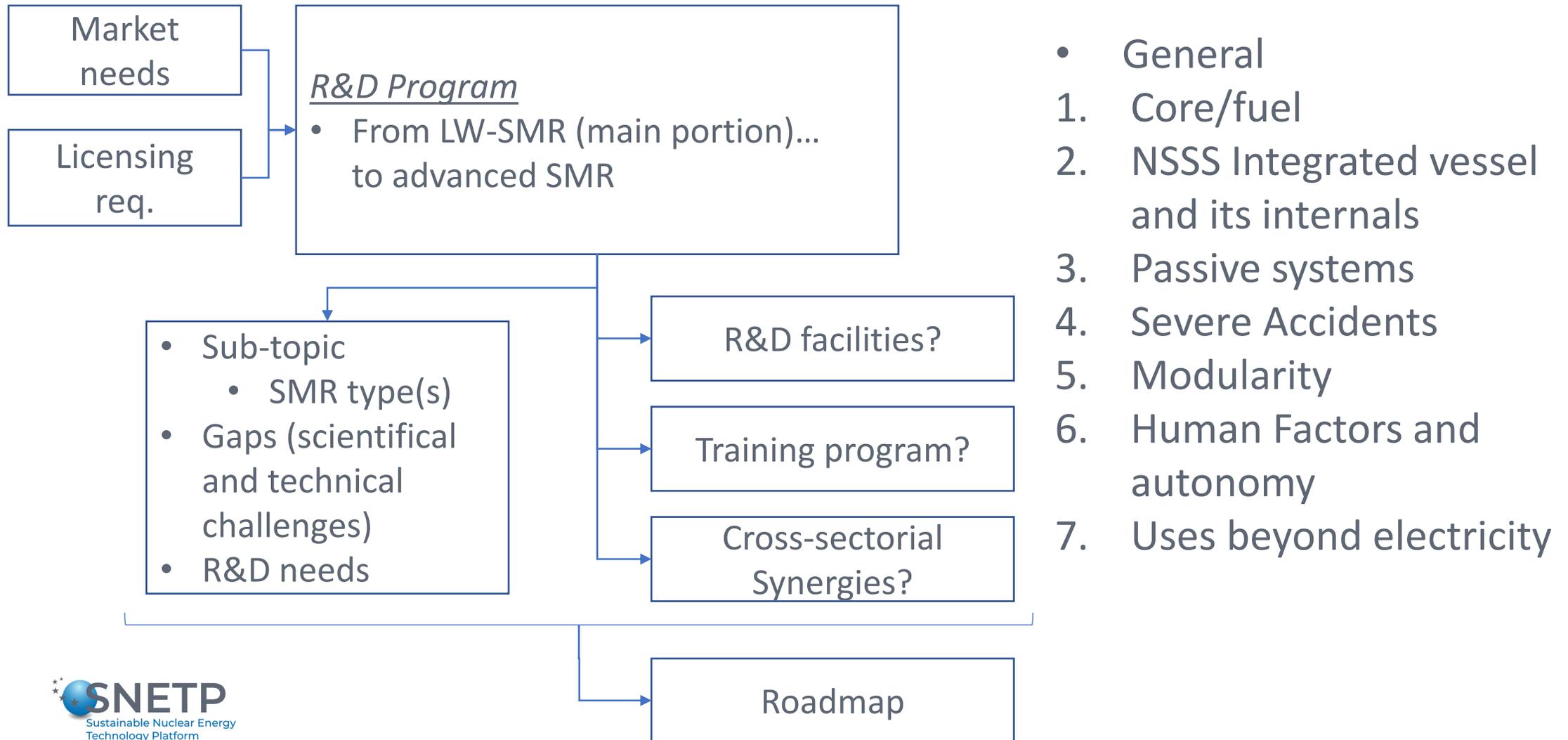
● Objectives of the Workstream 5

- **Define R&D&I program** consistent with market needs and licensing requirements for SMRs development,
 - Share a common view on the roadmap to clear technical/scientific hurdles and necessary R&D to demonstrate the safety and performance of SMR features. Paving the way to LW-SMR deployment to achieve timely the Net Zero by 2050 objective, by demonstrating the maturity and competitiveness of SMR with a first commercial operation in the 2030s.
 - ...and from LW-SMRs to advanced SMR (AMR / Gen IV) in the longer term, for nuclear sustainability (raw materials – uranium, limiting the impact of long-life waste)
- identify the **needed facilities** to execute this program
- set up a coherent **training and education** program

● WS5 is composed of ~60 contributors from various EU players:

- JRC, EDF, CEA, IRSN, Framatome, SCK.CEN, VTT, Engie/Tractebel, UJV Rez, ENEA, ANSALDO Nucleare, NCBJ, NRG, Ecole des Mines, CIEMAT, NINE, NC2I....

R&D&I proposed roadmap is structured according to 7 technical topics



Topic 1: Core / Fuel

- Leader: Eric Hanus (CEA) + 12 contributors
- A: LW-SMR vs. B: AMR
 - Different topics: A then B
- Sample of key R&D&I topics
 - Critical Heat Flux of shorter Fuel Assemblies, burnable poisons, InCore instrumentation, vibration and mechanical behavior of the fuel assemblies / Control rods
 - Specific AMR fuel qualification

Topic 2: NSSS vessel and internals

- Leader: Oliver Martin (JRC) + 7 contributors
- A: LW-SMR vs. B: AMR
 - Common portion + A (iPWR specific) then B
- Sample of key R&D&I topics
 - Specific components development for compact designs
 - Thermal-Hydraulics in integral reactors
 - Advanced incl. additive manufacturing
 - Adaptation of In-Service Inspection requirements/means
 - Materials, especially for advanced SMR

Topic 3: Passive systems

- Leader: Fulvio Mascari (ENEA) + 8 contributors
- A: LW-SMR vs. B: AMR
 - Common
- Sample of key R&D&I topics
 - Lack of available experimental test campaigns: large scale facilities at low flow regime, experiments to validate CFD, high-resolution data
 - Deterministic analysis codes qualification
 - Passive systems reliability

Topic 4: Severe accidents

- Leader: Philippe Dejardin (ENGIE/Tractebel) + 13 contributors
- A: LW-SMR vs. B: AMR
 - Different topics: A then B
- Sample of key R&D&I topics
 - Tools and methods to demonstrate
 - RPV integrity
 - Containment integrity
 - and Emergency Planning Zones
 - SA Scenarios for advanced SMRs

Topic 5: Modularity

- Leader: Massimo Marconi (Ansaldo) + 8 contributors
- A: LW-SMR vs. B: AMR
 - Common
- Sample of key R&D&I topics
 - Adaptation of engineering methodologies
 - Construction techniques and technologies to shorten construction duration
 - Modules assembly and connections to the structure

Topic 6: Human factors

- Leader: Stanislas Couix (EDF) + 4 contributors
- A: LW-SMR vs. B: AMR
 - Common
- Sample of key R&D&I topics
 - Multi unit operation in a single main control room
 - Impact of the passive safety system on tasks and activities of staff

Topic 7: Uses beyond electricity

- Leader: Ville Tulkki (VTT) + 7 contributors
- A: LW-SMR vs. B: AMR
 - Common
- Sample of key R&D&I topics
 - Technical coupling technologies between nuclear plant and heat use facility
 - Safety & licensing issues due to the colocation of nuclear + other plant
 - Operability / Maneuverability performance of hybrid systems

WS5 way forward

- Clarify the interfaces and expectations from other workstreams, especially WS2 on licensing: e.g., streamlined EU Regulatory Bodies position on topics of interests such as passive system qualification, severe accidents scenarios, or operator crew organization; specific SMR safety objectives?
- Issue a first revision of the R&D program document in the short term, before complementing it with insights from designers/licensees forerunners of the EU SMR partnership, and EU R&D facilities
- Be in position to provide a consolidated R&D&I roadmap at the effective launch of the Partnership addressing R&D gaps beneficial to all EU SMR partners

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