



Nuclear perspectives and SMR development in the EU, European SMR pre-Partnership

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Nucleareurope

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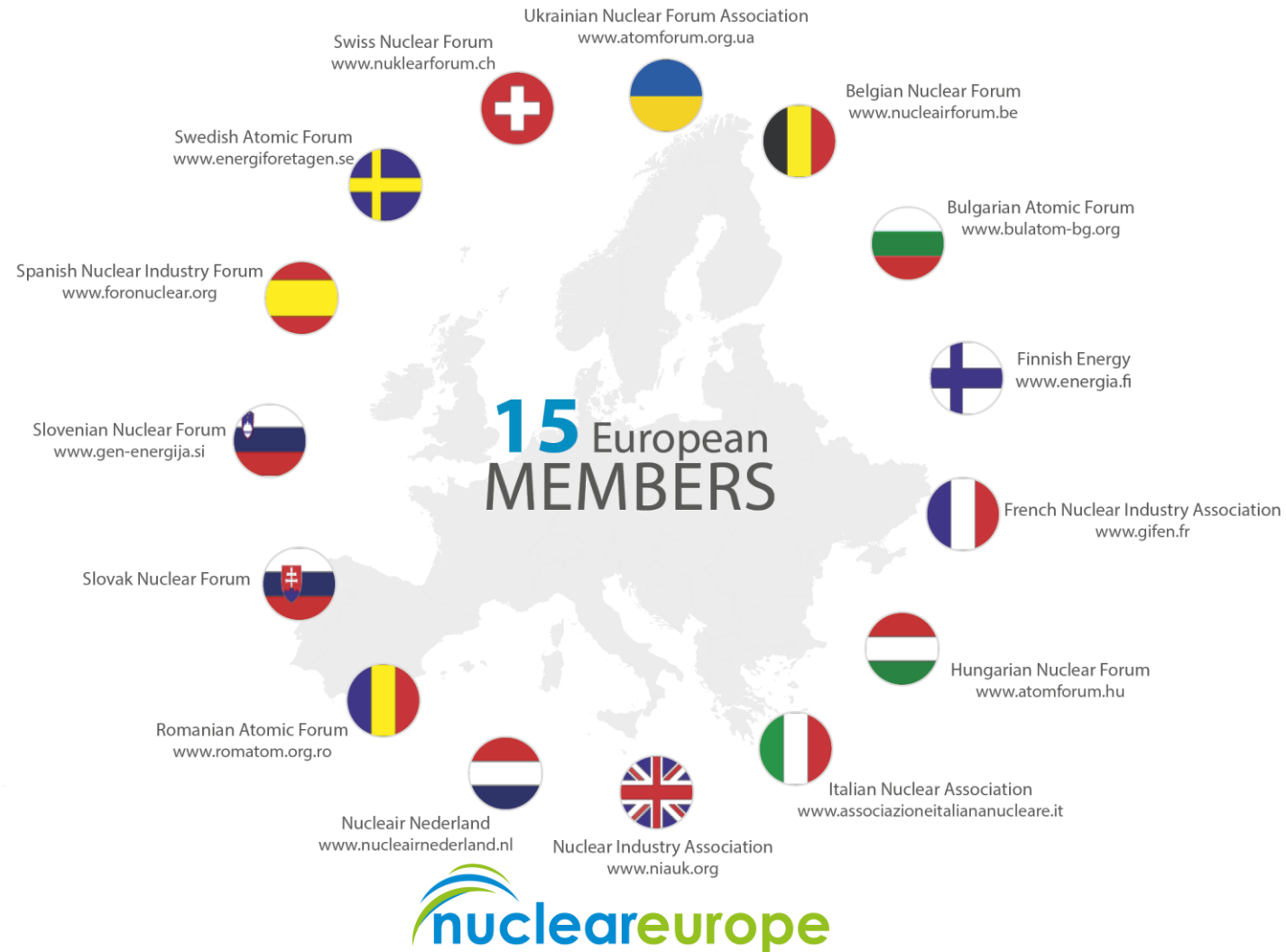


Who we are

We act as the voice of the European nuclear industry in energy policy discussions with EU Institutions and other key stakeholders

Membership

nucleareurope represents 15 national nuclear associations
and several corporate members



Corporate Members:

[CEZ](#) (Czech Republic)
[Fermi Energia](#) (Estonia)
[Nuvia](#) (France)
[PEJ](#) (Poland)
 Rolls Royce SMR (UK)
[Urenco](#) (Global)
[KGHM](#) (Poland)
[NAAREA](#) (France)

What does nuclear contribute to the EU's economy?

102

Nuclear reactors in
operation in the EU



1 million jobs

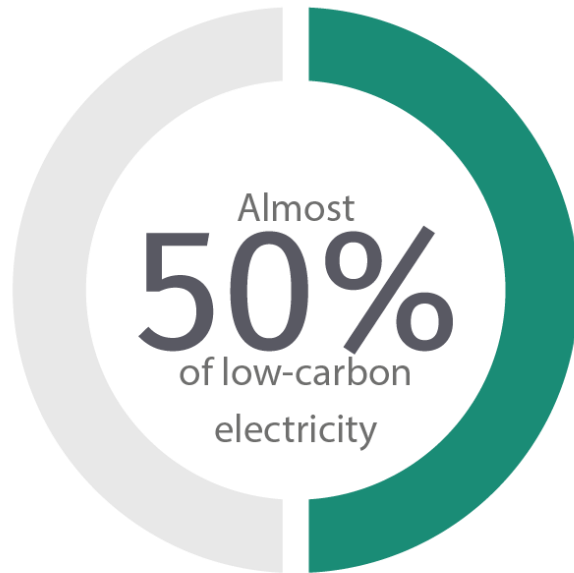
€ 100

billion/year

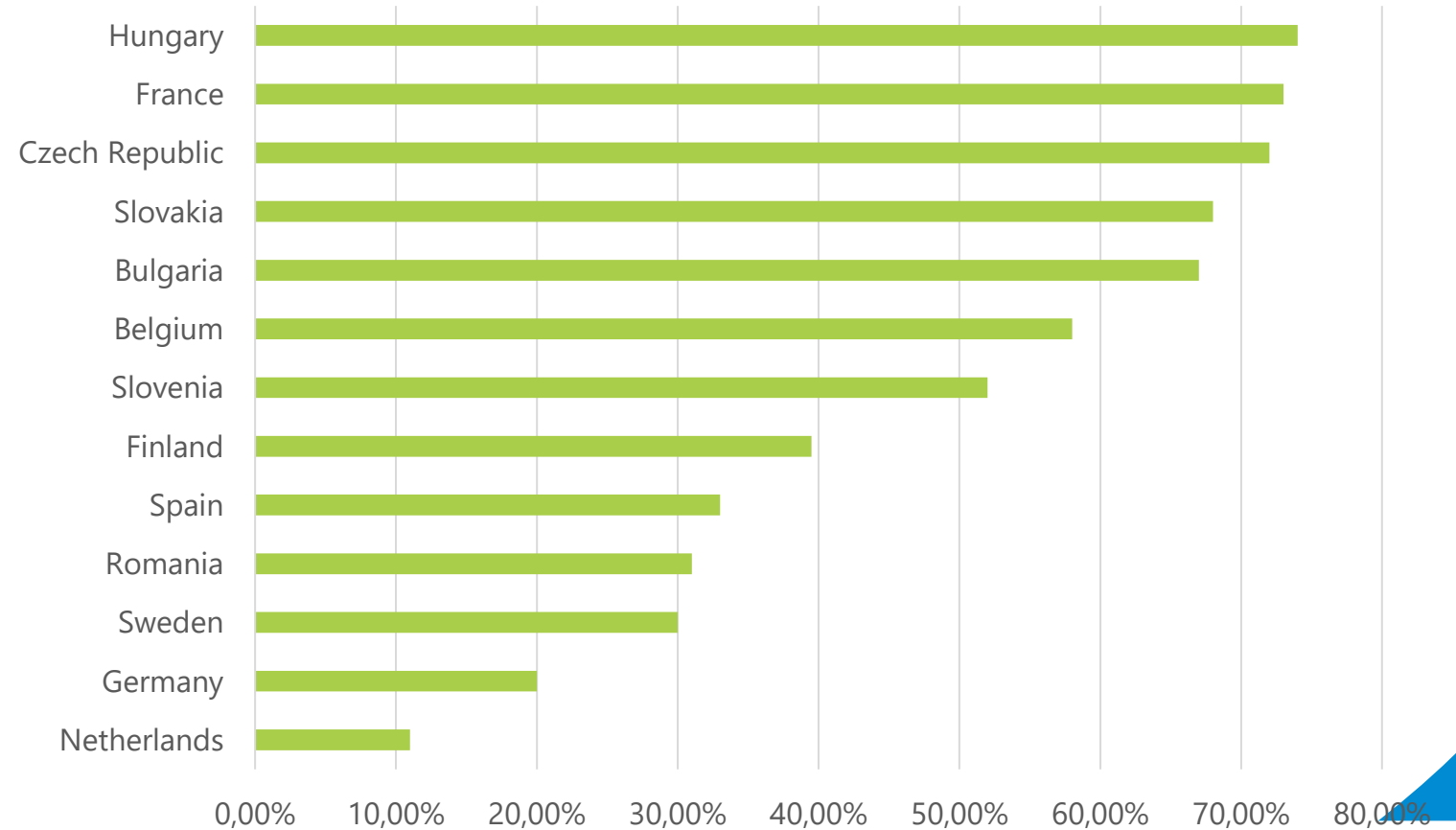


25%
of the electricity production

Nuclear energy in the EU



Nuclear share in low-carbon electricity (2020)

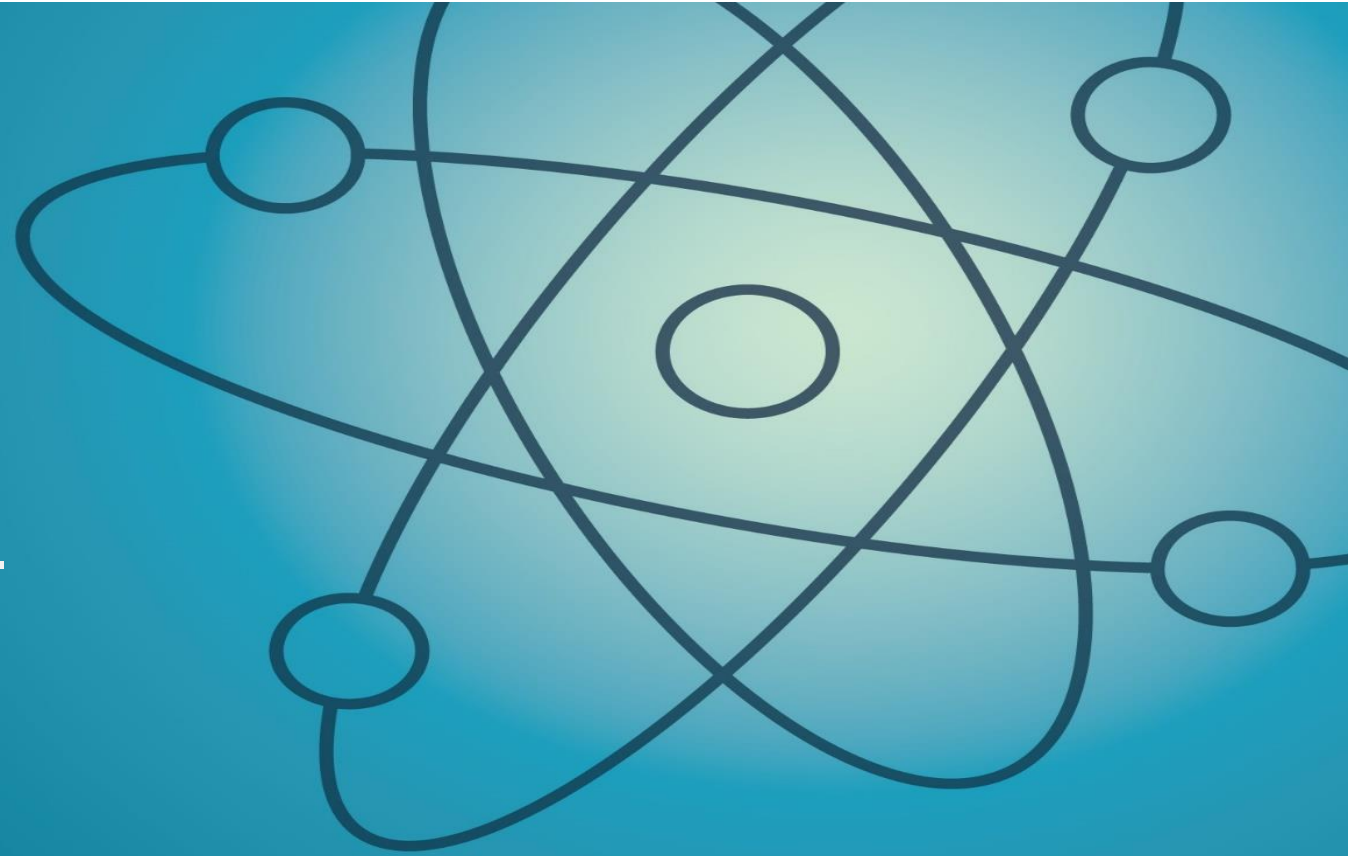


Source: Eurostat 2023

European SMR pre-Partnership



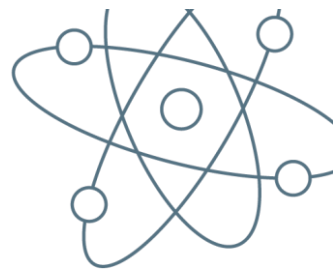
Steering Committee
(SC) and specific Work-
Streams (WSs)



With the support of :



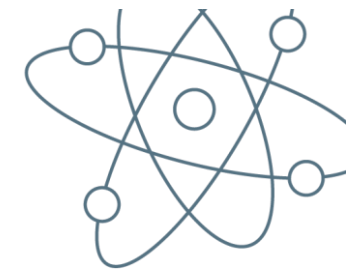
First EU Workshop on Small Modular Reactors (SMRs) - 29 June 2021



- Organised by the European Commission's DG ENER in response to the call of the European nuclear industry;
- 110 participants from 22 Member States;
- A “vision paper” of industry stakeholders widely endorsed by the participants;
- Including a proposal for a ‘European SMRs Partnership’.
 - collaboration scheme involving industrial stakeholders, research & technological organisations, interested customers (i.e. utilities and even Member States), as well as European policy-makers and regulators



European SMR pre-Partnership – Steering Committee



General objectives

Identify enabling conditions and constraints, including financial ones, towards safe design, construction and operation of SMRs in Europe in the next decade and beyond in compliance with the EU legislative framework in general and to the Euratom legislative framework in particular.

Specific objectives

- Encourage the implementation of common (harmonized) licensing process across the EU
- Develop the necessary industrial supply chain in Europe
- Establish a strategic research agenda :
 - LWR, as a mature technology to be deployed in 2030.
 - Advanced SMR (Gen IV) design have to be matured by 2035 for long term prospect

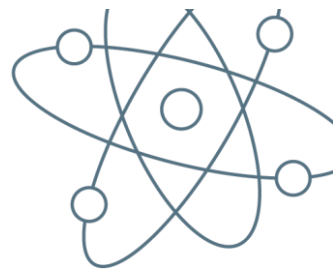
Composition: nucleareurope (chairing), SNETP, ENSREG, EC + chairs of 5 WS

Secretariat: EC, nucleareurope, SNETP

Meetings: Kick-off 17 March 2022; 8 meetings so far (last one 12 June 2023)



WS1 – Market analysis



Objectives:

- Identify future needs of the EU energy/power market (electricity, industrial and residential heat, hydrogen), SMR capabilities for these needs in a context of high RES deployment, market size, and global competitiveness;
- SMRs as technology to replace coal and gas plants, help decarbonize assets/processes such as hydrogen production, district heating, industrial heat processes, and provide load balancing capabilities to Transmission System Operators (TSOs)
- Establish a list of sustainability criteria on a shortlist of SMR technologies (SMR/AMR).

Responsability: nucleareurope

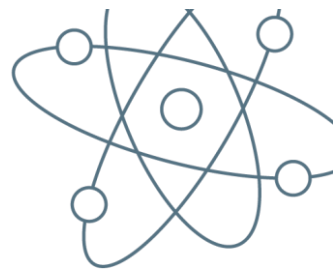
Chair: Tractebel

Contributors:

nucleareurope-SMR Task Force: Tractebel, Engie, Fortum, Rolls-Royce, EDF, Orano, Vattenfall, SCK-CEN, CEA, Nuclearelectrica.



The market need is there!



⚡ Electricity

1600 TWh/y

EU Low carbon electricity production to be deployed by 2040

80GW

European Nuclear capacity to be replaced by 2050 (end of life)

🔗 Hydrogen

>20 Mt H₂/y

REPowerEU Market Estimate for 2030

1000 TWh/y

Equivalent additional clean electricity demand

>125 GW

Equivalent nuclear capacity

🔥 Industrial heat

~1250 TWh_{th}/y

Iron – Steel, Non-metallic minerals and chemicals heat demand in EU26

> 45% market

Heat < 400°C

🏠 District heat

~500 TWh_{th}/y

Current district heat demand in EU26

> 2/3 fossil- fueled

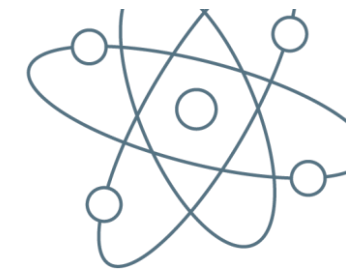
Assets to be retired and replaced in the coming two decades



EN[★]S[★]REG
European Nuclear Safety Regulators Group

nucleareurope

SNETP
Sustainable Nuclear Energy
Technology Platform



The first wave of SMRs will be Light Water Reactors



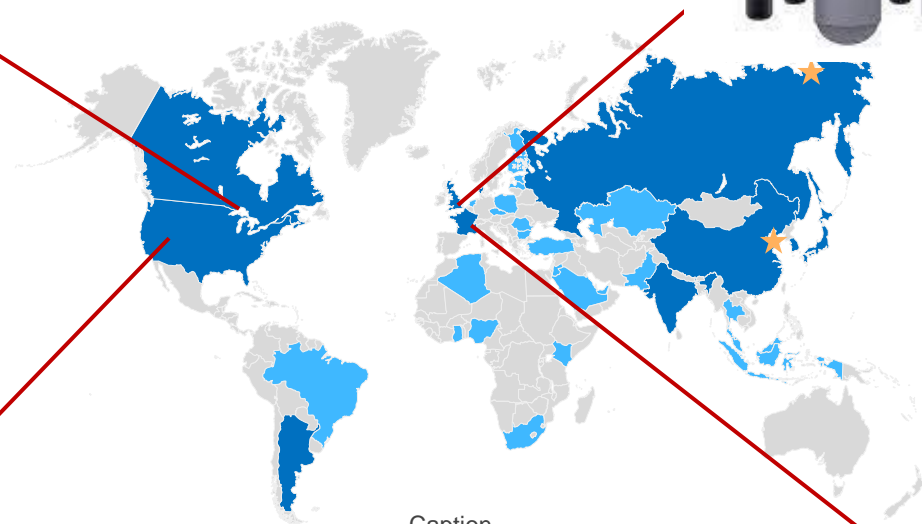
BWRX-300 (GE-Hitachi)
Single-Module BWR
300MW
Expected COD:
- 2028, Darlington, CANADA
- ca. 2029, Clinch River, USA



RR SMR (Rolls-Royce)
Single-Module PWR
470MW
Expected COD: ca. 2030, UK



NuScale VOYGR (Fluor)
Multi-module PWR
6x 77MW
Expected COD: 2029, Idaho Falls, USA



Caption
■ Developer
■ Expression of interest
★ Demonstrator built



Key characteristics of LW-SMR

- **+70 years** industry and operating experience
- **Existing** supply chain
- **Mature** regulatory landscape
- **1** design **approval** granted by US NRC
- **10+** companies actively developing a LW-SMR design
- **10+ deployments** announced in Europe and North America < 2035

Nuward (EDF)
Multi-module PWR
2x 170MW
Expected COD: ca. 2034, FRANCE

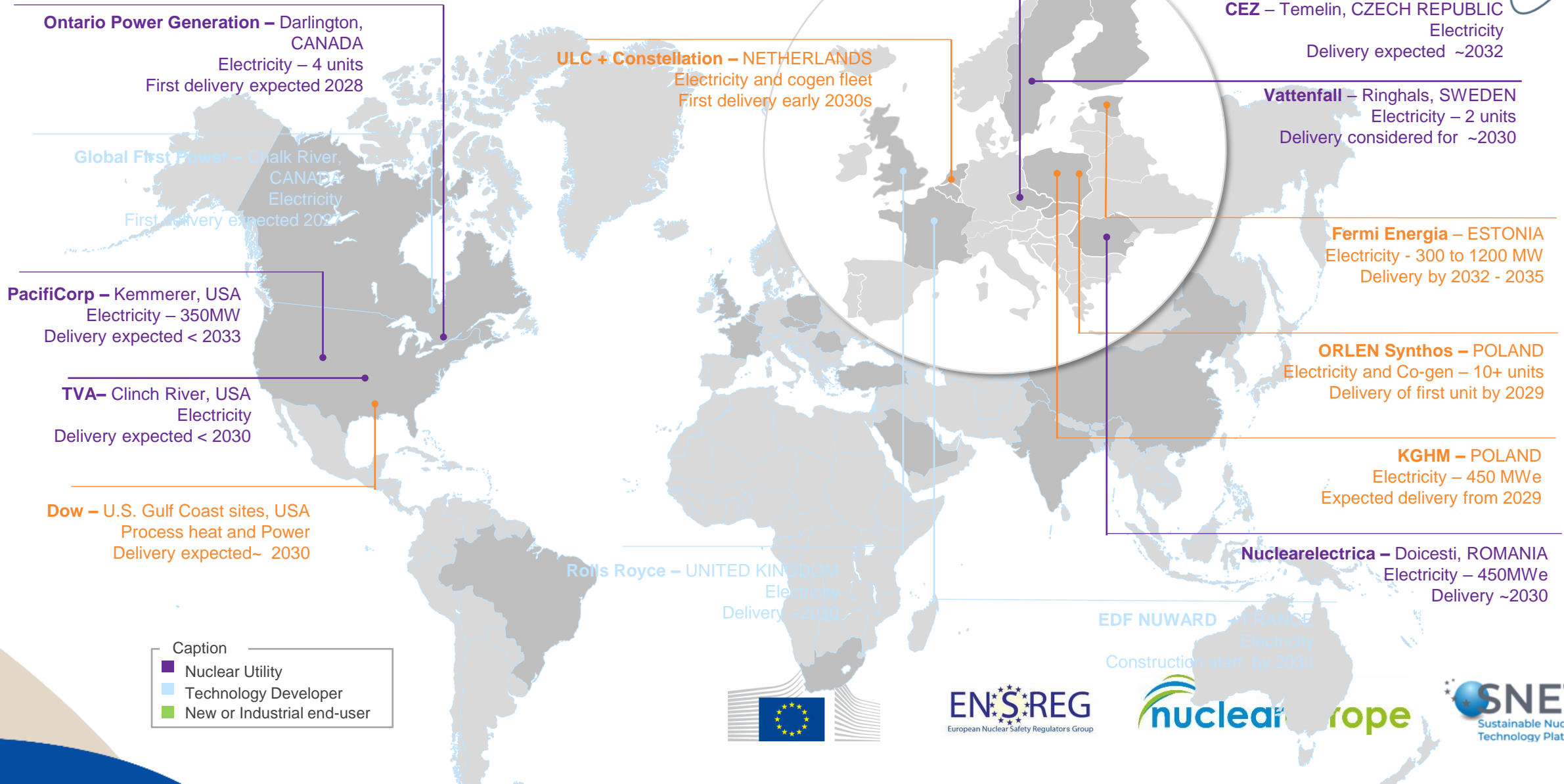
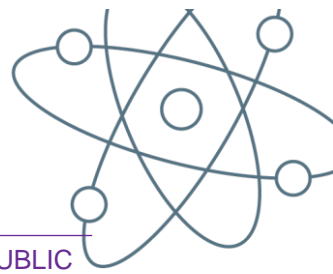


EN⁺S⁺REG
European Nuclear Safety Regulators Group

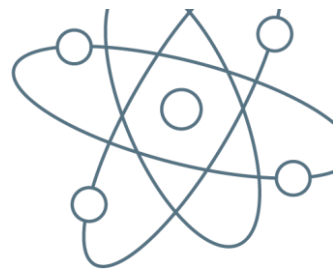
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SNETP
Sustainable Nuclear Energy
Technology Platform

This appetite is materializing



WS2 – Licencing



Objective:

- Identify the elements for establishing a European pre-licensing process based on commonly accepted safety assessments from different ENSREG members interested in the licensing of the same SMR design

Responsibility: ENSREG

Chair: ASN

Contributors: 18 experts from 15 countries' nuclear safety authorities from: AT, BE, DE, HU, LT, FI, SE, IT, FR, RO, SK, NL, ES, CZ and PO + industry representative: ENISS



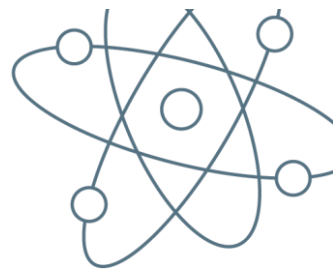
What is key for cooperation?



- **Definition of commonly shared Safety Objectives for SMRs** between the EU “interested” nuclear safety regulators
- Agreement on the **definition** of what is the **sufficient level of maturity** for a **SMR** designer-licensee to engage a joint safety pre-assessment
- Definition of the **possible options and conditions for another regulator or licensee to join** the pre-assessment **at a later stage**
- Close **collaboration needed** between the **different initiatives launched on SMRs** at international level (IAEA, NEA, EU, WENRA, etc.) to **ensure mutual benefits and avoid duplication**
- **Collaboration between Regulatory Bodies and EU research organisations** could be a mean for the regulators to get a common understanding of the **challenges related to SMRs key safety features**.



WS3 – Financing



Objectives:

- Identifying the best suited structure for the EU SMR initiative (short term task)
 - 3 subgroups to prepare an assessment of the different options identified on:
 - Industrial Alliances
 - Public Private R&D partnership in Horizon Europe
 - Joint Undertakings
- Defining needs for a conducive investment environment / framework for SMRs development (medium to longterm task)
- Identify barriers and enablers, EC financial support to technology/ innovation demonstrators

Responsibility: nucleareurope

Contributors: Amphos21, CEA, CEZ, EC, EDF, Endesa, Framatome, Fortum, Gifen, KGHM, Nuclearelectrica, Nuklearforum Switzerland, Nucleon, Orano, RoPower, Selmeda, Sfen, SGV-Usam, Thorizon, Uniper, Urenco, Vattenfall, Vuje

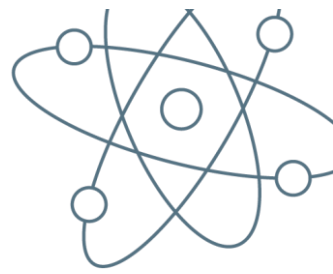


Industrial Alliances



- Industrial Alliances constitute flexible, adaptable structures that can be tailor-made to suit the needs of involved stakeholders. IA can be used as an umbrella to oversee diverse structures within the initiative such as Horizon Europe public-private partnerships, Joint Undertakings, IPCEI,...
- IA require strong political engagement to be a success. This engagement needs to be maintained over time to keep the alliance working.
- They do not preclude the creation of an IPCEI and are not funded by EU institutions but are aimed to encourage and facilitate investments in strategic project.

WS4 – Supply chain adaptation



Objectives:

- Identify the key features of an SMR supply Chain (vs. current practice)
- Analyze the existing gaps and the main hurdles to overcome
- Identify which ones are largely technology-independent and define roadmaps to address them
- Identify recommendations to systematically address technology-dependent hurdles from various partnerships

Responsability: nucleareurope

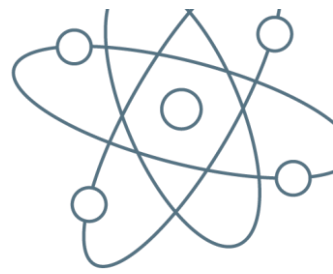
Chair : Ansaldo Nucleare

Contributors:

Ansaldo Nucleare, Fortum, Orano, Engie, Empresarios Agrupados, Rolls-Royce, Nuclearelectrica, GIFEN, EDF, Framatome, Assystem, SNETP



EU Supply Chain **capability**



Main topics

60% EU suppliers familiar with more than one technology (30% more than 2)

Most of them with internal engineering capabilities

Largely familiar with main C&S (e.g. ASME and RCC for mech. components)

>50% ready to reconcile their products

Digitalization underway for the majority => confidence to be able to increase their productivity

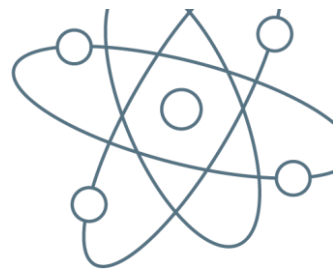


Info collected from 121 suppliers, from various EU countries:

A, BE, BG, CZ, DE, ES, FR, FI, U, HR, IT, SE, NL & CH



EU Supply Chain **capacity**



Main topics

>60% respondents confident to increment their capability

Main bottleneck appears to be Human Resources availability and training

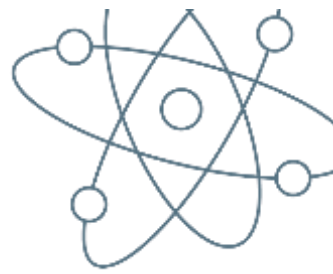
Expectation for more harmonized practices to verify quality requirements

Other bottlenecks associated to raw materials availability, as well as high tech components (typically manufactured by Vendors or nominated subsuppliers)

Front end fuel cycle could require significant upscaling and investments when large fleets of AMR, or LW-SMR relying on HALEU, would be deployed



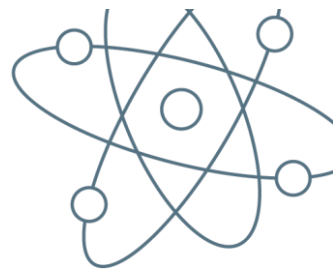
Conclusions



An efficient European Supply Chain to support SMR successful deployment

- 1 Early interaction between Vendors and Supplier to plan HR needs for fleet deployment
- 2 Establish a “win-win “ relationship between Vendors and Suppliers to make “savings by series” available to final Customer
- 3 Promote harmonization of C&S and quality verification requirements among various EU countries





Objectives:

Build a comprehensive and credible R&D&I roadmap to secure an on-time deployment of SMR in Europe

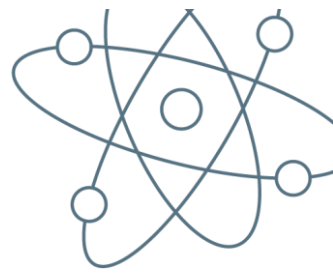
- Identification and prioritization of the relevant R&D work needed to enable SMR deployment, considering market needs and regulators expectations.
- Make it possible to pool resources for common R&D needs among SMR designs, e.g. enhancing the experimental database for accuracy of numerical simulation
- Network of R&D facilities across EU

➔ *Next step is to prepare the upcoming Euratom call on LW-SMRs and AMRs*

Responsibility: SNETP

Contributors: (~60 p.) JRC, EDF, CEA, IRSN, GRS, Framatome, SCK.CEN, VTT, Engie/Tractebel, UJV Rez, ENEA, Ansaldo Nucleare, NCBJ, NRG, Ecole des Mines, CIEMAT, NINE, NC2I, Becker Technologies, ...



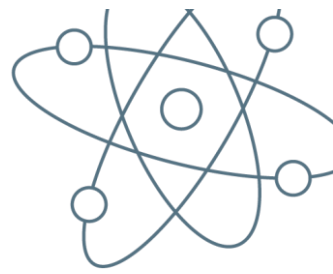


Main elements to support SMR development:

- Establishment of an **R&D program to demonstrate the feasibility** and the performance of **envisaged innovations for SMRs** and their associated benefits.
- **Maintenance of the existing experimental infrastructures and further development of new ones** is key not only **for the test, demonstration, and qualification of innovative technologies but also for the education and training in Europe**. Emphasis is made especially on the need for Material Testing Reactors and irradiation facilities (for AMR), large scale thermal-hydraulic test facilities, and demonstration prototypes for the integration of SMRs into an energy mix;
- Development of computer simulation codes, digital twins, robotics, artificial intelligence technologies, advanced materials, etc. are as well essential for innovation.



Next steps



Public consultation opened on the 5 Workstream reports:

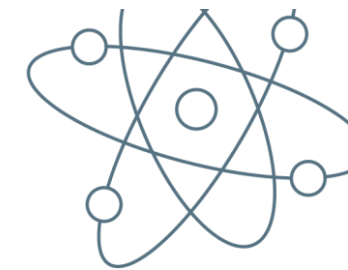
- To ensure openness and full transparency in the preparation of this European SMR initiative, the draft reports prepared by the different Work Streams are now available to comments from all stakeholders, including the public.
- The consultation has been extended until September 29
 - <https://ec.europa.eu/eusurvey/runner/EuropeanSMRPrePartnership>

Stakeholder's Forum on October 26

- Exchange with various stakeholders (policy makers, industries, civil society, R&D&I providers, universities, ...) on the content of the draft reports issued by the different Workstreams of the pre-Partnership
- Take stock of the comments received during the consultation
- Discuss the next steps of this initiative.



SMR INI REPORT



SMR INI report – European Parliament ITRE Committee - [2023/2109\(INI\)](#)

- Rapporteur – Frank BOGOVIČ (EPP, SI)
- Shadow rapporteurs
 - Erik BERGKVIST (S&D, SE)
 - Klemen GROŠELJ (RE, SI)
 - Damien CARÊME (Greens, FR)
 - Paolo BORCHIA (ID, IT)
 - Robert ROOS (ECR, NL)
- Deadline for amendments – 21 September.
- Adoption in ITRE committee – December - TBD



Thank you!

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