

Adapting European Licensing, EIA, and EP&R Frameworks for Modular Reactors

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Small Modular nuclear Reactors are set to become part of EU policy

20 → 300 MWe
7.2 million kWh/day



1 000 MWe
24 million kWh/day



Source: https://energy.ec.europa.eu/topics/nuclear-energy/small-modular-reactors/small-modular-reactors-explained_en

Not yet in operation in EU—but they're coming.



NERIS WORKSHOP, 2026, April 29th



EUROPEAN COMMISSION

Strasbourg, 10.3.2026

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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Strategy for the development and deployment of Small Modular Reactors (SMRs) in Europe

1. INTRODUCTION

The supply of homegrown, affordable and clean energy is key to achieving the European Union's strategic goals of industrial competitiveness and decarbonisation, as well as strategic independence and security of energy supply.

The emerging category of nuclear reactors known as Small Modular Reactors ("SMRs"), could contribute to attaining these EU policy objectives and become one of Europe's next major industrial development projects.

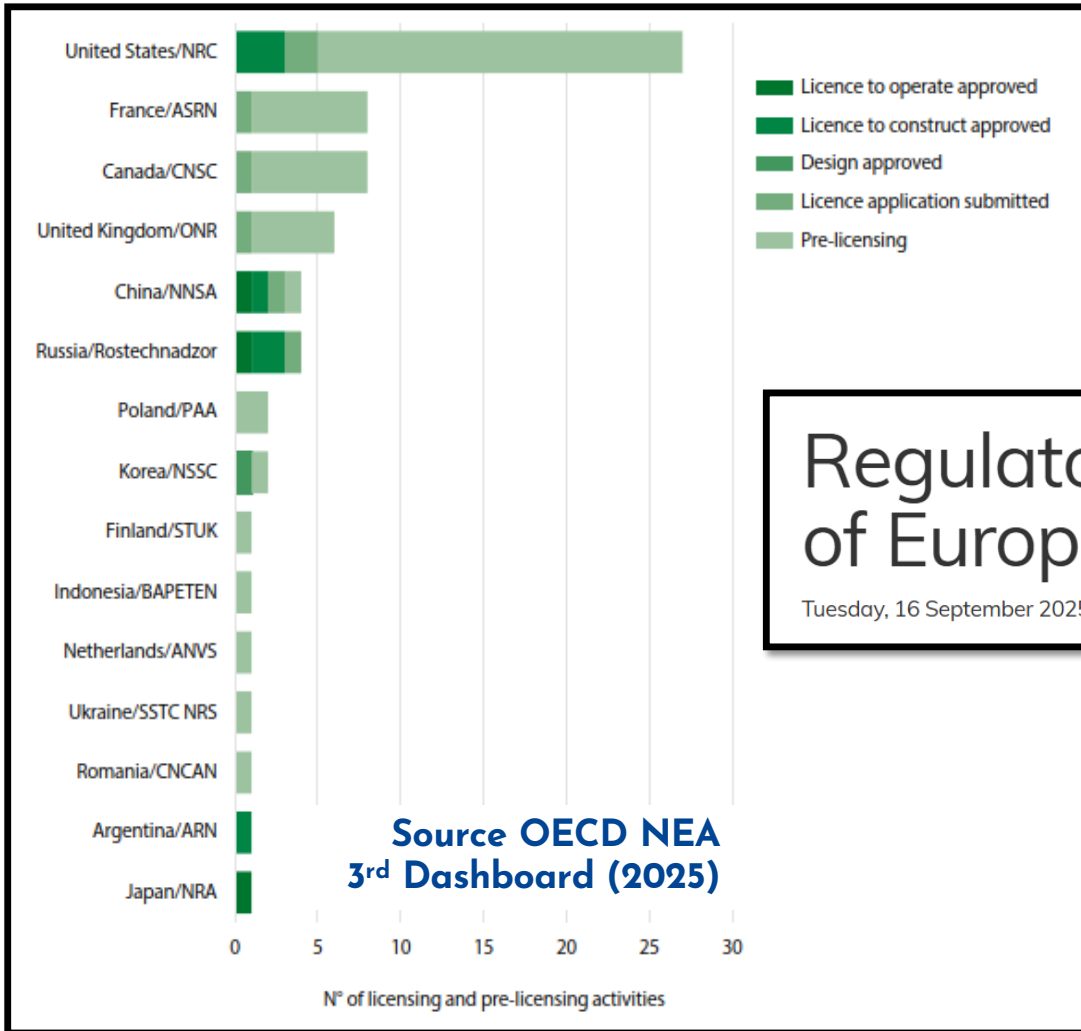
SMRs have the potential to mobilise entire value chains across several EU countries and in different business areas, including engineering, advanced materials and robotics, and to unlock private investment. They can bolster EU research and innovation leadership, create new technological knowledge and skilled jobs as well as long-term export capacity, while ensuring the highest standards of nuclear safety, security, safeguards and radiation protection in the EU to protect citizens and environment.

SMRs are expected to play a key role alongside traditional large-scale nuclear reactors in a flexible, safe, and efficient energy system, characterised by an ever-increasing share of clean electricity and a growing demand for decarbonised heat and steam supplies for industry and households. SMRs present opportunities both to off-takers in need of stable, flexible and clean energy at a large scale, and to an array of nuclear industry players, by, for instance, supplying low-carbon electricity and heat simultaneously.

Due to their size and modularity along with the specific advantages of nuclear energy, SMRs are attracting interest across Member States. Preliminary evaluations of expected SMR capacity in the European Union by 2050 range from 17 GW to 53 GW for electricity generation and other purposes (heat, hydrogen, synthetic fuels) ⁽¹⁾.

What are small and modular nuclear reactors?

SMRs refer to nuclear reactors that are designed (i) to be smaller in size and output compared to traditional nuclear reactors, and (ii) to be modular, meaning that the reactors or their components can be manufactured in a factory setting and transported to a site either for direct use or for assembly.



Pre-licensing & licensing activities have started in some EU countries

Regulators unite for pre-licensing of European SMR design

Tuesday, 16 September 2025

Open Research Europe

Open Research Europe 2024, 3:158 Last updated: 18 DEC 2024

Check for updates

OPEN LETTER

REVISED

ELSMOR – towards European Licensing of Small Modular Reactors: Methodology recommendations for light-water small modular reactors safety assessment

Research conducted by WP4 members (2025-2026) : M. Simon-Cornu, N.S. Abdul Rashid, A. Mathieu, E. Hiittenkivi, M. Nitoi

Objectives and methods of WP4

- To identify data gaps and prioritise stakes regarding radiological impact of modular reactors normal functioning and accident scenarios in EIA and EP&R



Roundtable of experts in May 2025

Gap Analysis Between NPPs and SMRs/AMRs in France, Romania, and Finland

Licensing Frameworks



- SMRs, like NPPs, are classified as Installations Nucléaires de Base (INB) and regulated by the Environmental Code and nuclear laws.



- Both traditional NPPs and SMRs follow the same multi-stage licensing process under CNCAN's NSN-22 (rev. 1) – Regulation on the licensing of the nuclear installations (2023).



- SMRs and NPPs fall under the same legal framework (the Nuclear Energy Act (990/1987)).
- There is no distinct SMR statute, but regulatory updates aim to make the licensing regime more proportionate to reactor size and design.

Gap analysis based on literature review, and roundtable follow up

Focus on emergency preparedness & siting

Siting and EP closely interconnected by a fundamental principle: the site must be selected to ensure that radiological risks to the public remain acceptably low, even under accident conditions (IAEA NS-R-3).



NPPs EP&R Impact

- Emergency planning usually includes:
- On-site emergency plan (operator)
 - Off-site emergency plan (government)
 - Fixed EPZ zones
 - Pre-planned evacuation and iodine distribution
 - Public alert systems

Typical zones: *Exclusion area, Low population zone, Precautionary Action Zone (PAZ), Urgent Protective Action Planning Zone (UPZ), and Ingestion zone*



Remote Area



Non-Remote Area

SMRs/AMRs EP&R Approach

SMRs/AMRs are moving toward the following approaches:

- Adopting performance-based emergency planning
- Reducing the scope of off-site emergency planning
- Considering a site-boundary EPZ
- More focus on on-site emergency response
- Case-by-case regulatory approval

The IAEA is working to specifically link the following elements:

Reactor Design → Accident Consequences → EPZ size
→ EPR arrangements

For example, under the Finnish legislation, there were fixed land use restrictions around nuclear installations, e.g. no permanent dwellings within 1km; no schools, hospitals, care facilities, shops, or significant places of employment or accommodation (except the NPP) within 5kms etc.

Emergency Planning Zone in France & Finland (1/2)



Regulator	ASNR	STUK
Nuclear Law	SMRs, like NPPs, will be classified as <u>Installations Nucléaires de Base (INB)</u> and regulated by the same legal framework, including e.g. <u>Arrêté du 7 février 2012</u> . Nuclear laws and regulations will remain unchanged.	SMRs and NPPs fall under the same legal framework (the <u>Nuclear Energy Act (990/1987)</u>). Ongoing renewal of legislation in Finland, which will take effect in 2027. No SMR-specific requirements, but one set of goal-setting, technology-neutral requirements that can be applied to different reactors
EPZ principles	For each INB, there is a <u>Plan Particulier d'Intervention (PPI)</u> , which establishes planning. Distances are different from one installation to another.	EPZ distances used to be fixed In February 2024, <u>Emergency Planning Zone (EPZ)</u> regulations were updated.

Emergency Planning Zone in France & Finland (2/2)



	NPP	Other INB	Old	New (Ongoing process) 
Principles	Determined based on dose calculations, harmonized for all NPP and similar INB		Fixed	Determined case-by-case
Precautionary Action Zone (PAZ)	5 km for immediate evacuation [2 km for sheltering]	Case-by-case (e.g. 1 or 5 km for immediate evacuation)	5 km	Outside PAZ: dose < 1 mSv in 10 h
Urgent Protective Action Zone (UPZ)	"PPI" = 20km	Case-by-case (e.g. 1, 5 or 20km)	20 km	Outside UPZ: dose < 10 mSv in 48h
SMR/AMR readiness	Nuclear laws and regulations for SMR/AMR in France remain unchanged. They can accommodate differences in EPZ distances, as required by the INB.		EPZ to be determined on a case-by-case basis for all nuclear installations. No separate legislation for larger NPPs or SMRs/AMRs, nor is any planned	

Note that these distances apply to emergency planning.

In emergency response, distances can be different, specific to the accident.

Conclusion (for WP4)



- There have been no changes to nuclear laws and regulations regarding SMRs/AMRs.
- Flexible EPZ distances are compatible with the current legislation
- However, there is ongoing discussion regarding SMRs/AMRs in licensing process, EIA & EP&R



- In Finland, EPZ used to be fixed, the EPZ will now be determined on a case-by-case basis for all installations
- No separate legislation for larger NPPs or SMRs/AMRs, nor is any planned
- Ongoing renewal of legislation in Finland, which will take effect in 2027

Challenges highlighted by the Finnish experience:

SMRs/AMRs challenge traditional emergency planning paradigms by shifting from distance-based to risk-informed approaches. This transition introduces new considerations, but **regulatory harmonization, multi-module risk, and public acceptance** remain key barriers to implementation.



It's not just a report—it's a decision-making process embedded in project approval across EU Member States.

All SMRs in the EU will be required to undergo an Environmental Impact Assessment.

"A process to ensure that projects likely to have significant effects on the environment are subject to an assessment of those effects before consent is given."

(Directive 2011/92/EU (as amended by Directive 2014/52/EU))

An EIA in the EU requires:

- identifying and assessing direct and indirect environmental effects (e.g., on population, biodiversity, land, water, air, climate, cultural heritage);
- considering reasonable alternatives;
- **conducting public consultation;**
- **ensuring authorities take the results into account before granting development consent.**

Objectives and Method of the study

- to analyse experiences and practices of public participation in both nuclear and non-nuclear EIAs.
 - Systematic literature review. (n=47: 35 non-nuclear and 12 nuclear articles fulfilling the eligibility criteria)
- to identify how to make the public participation effective
 - Semi-structured interviews with EIA specialists (n=7), technology researchers (n=11), regulators (n=4), Ngo (3), loc. government (n=1), SMR proponent (n=1), Belgium - Portugal, a=55 min, June-Sep., 2025) - Ethical approval received
 - Insights from interviews with public (Semi-structured interviews with non-nuclear related citizens, randomly recruited, Belgium (n=20) - Portugal (n=20), a=55 min, Nov-Jan., 2025/26, a=45 min), - Eth. app. received

Theoretical background

(Renn O., Webler T., 1995, 2025: Fairness and competence in citizen participation)

Criteria for “effective” public participation:

- **Input legitimacy** (Preparing the process: e.g. inclusiveness and representation, equal opportunity to shape process design, clearly stated purpose...)
- **Procedural legitimacy** (Conducting the process: e.g. equal opportunity to speak and be heard, constructive, intense deliberation, rational discourse...)
- **Outcome legitimacy** (Making outcomes useful: e.g. report reflects participants preferences, enhanced capacity to participate, outcomes resonate with general will of non-participating public, participants leave with better understanding of their own and others' opinions and beliefs...)

Results: Pitfalls from non-nuclear fields related to decision-making as reported in the articles (selected)



- Poor communication and social learning
- Deficient and not enabled public participation
- Inappropriate stakeholder information and involvement (especially in early stages like screening and scoping)
- Lengthy and/or ineffective scoping
- Inadequate follow-up and monitoring procedures
- Late initiation of EIA
- Unconvincing and unrealistic analyses of alternatives
- Weak administrative support and guidance

(Barker and Wood, 1999, Cashmore et.al.,2007; Doelle and Sinclair, 2026; Hartley and Wood, 2005; Wilkins, 2003, Webler et al., 1994)

Results: Pitfalls from non-nuclear fields related to structural issues as reported in the articles (selected)



- EIA often implemented as a separate administrative and technical process,
- Weak connection to the overall project lifecycle.
- Lack of integration with sustainability principles which should enable a balanced redressing of environmental, social and economic issues

Results: Insights from EIA in the nuclear sector as reported in the articles

- Public engagement in EIA for new nuclear builds is relatively recent, reflecting changes in legal frameworks and democratic practices; experience is still limited, with most cases linked to lifetime extensions, add-ons at existing sites, or waste facilities
- Need for local authorities to be involved (but this was not the case in past)
- Need to engage stakeholders outside the immediately affected region.
- Residents reported preferring supervision of participatory procedures/facilitation by unbiased authorities.

(Ionestcu et al, 2024; Bond et al, 2004; Strauss H., 2010;)

Results: Insights related to public participation in EIA from interviews

EIA Literacy (How aware they are about the process)

- Experts reported strong, experience-based knowledge, though some gaps remain
- Public participants described limited familiarity, often relying on assumptions
- Several noted that understanding improved once the process was explained

Information & Accessibility

- Both groups reported that EIA information exists but is not easily accessible
- Public participants highlighted difficulties finding and understanding information
- Experts and public pointed to communication gaps affecting awareness and engagement

Results: Insights related to public participation in ELA from interviews

Reaching the Public

- Experts **emphasized the existence of multiple “publics”** with different needs
- Public participants **confirmed preference for diverse engagement channels**
- Generational differences noted: **digital vs. in-person/paper formats**

Barriers to Participation

- Both groups **identified technical complexity as a key barrier**
- Public participants **expressed concerns about bias and lack of trust**
- Experts and public **suggested clearer communication and independent facilitation**

Discussion & SMRs

- Participants **highlighted the importance of inclusive but manageable deliberation**
- Experts **noted that SMR EIAs can build on existing frameworks, with adaptations**
- Both groups **stressed the need for context-specific approaches across countries**

Results: Insights related to public participation in EIA from interviews

- Some experts noted that the EIA process for SMRs should not be any different than prior processes for traditional nuclear reactors; however, some noted that the EIA must be adapted because of the smaller size of SMRs and their proximity to residential areas, or because they are new technologies.

Conclusions (WP5)

- The EIA for SMRs will need to give stakeholders real influence over EIA framing and scope—not just information within predefined boundaries for participation.
(Input legitimacy)
- The process will need to enable substantive deliberation—where arguments can challenge assumptions and reshape positions, not just be voiced.
(Procedural legitimacy)
- Outputs will need to show traceable links between contributions and decisions—demonstrating how preferences and trade-offs were integrated.
(Outcome legitimacy)