



National Commission for Nuclear Activities Control (CNCAN)

Plans for deployment SMR in Romania

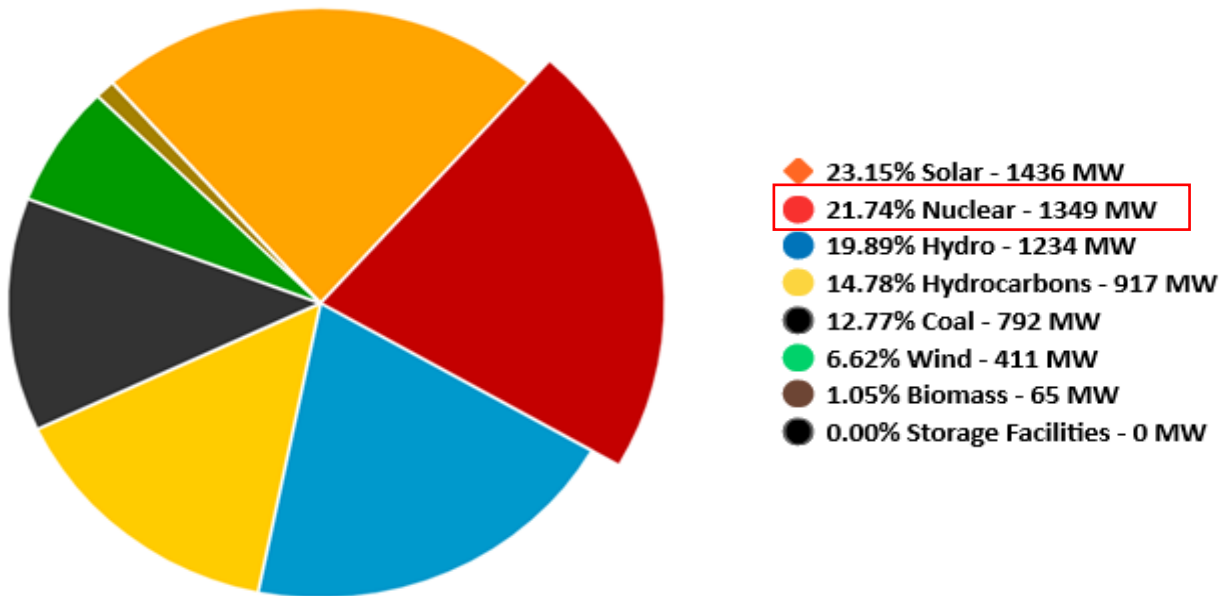
National Commission for Nuclear Activities Control (CNCAN)

Presenter: Terteci – Drăghici Madalina, Nuclear Safety Adviser in the Nuclear Regulations and Oversight Section, CNCAN

- Area: **238.397 km²**
- Capital and largest city: **Bucharest**
- Official language: **Romanian**
- Population (estimate): **19,051,562**



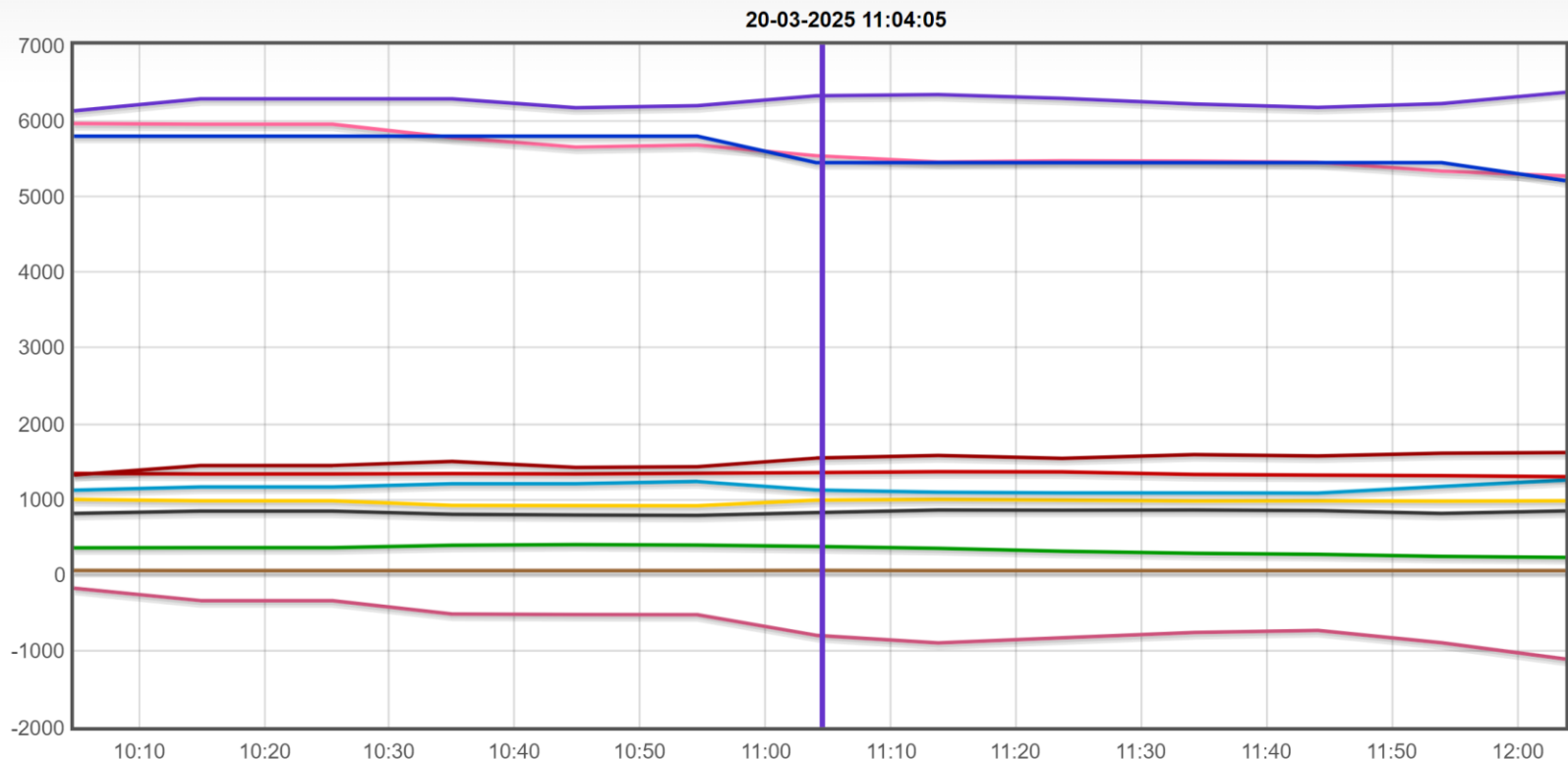
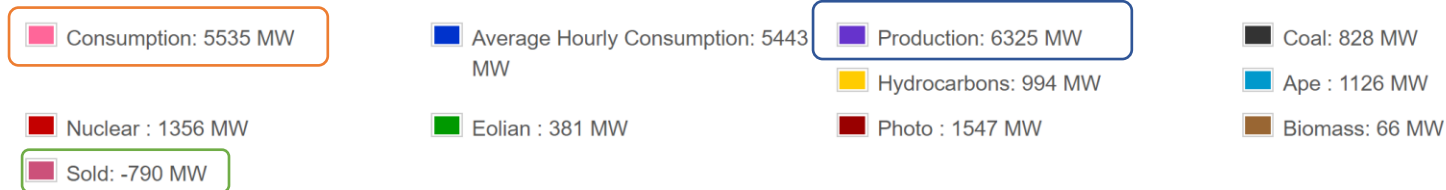
Romania's current energy mix



Total 6186 MW - Production at 11:00:48, 20-march-2025

Regional Workshop on Safety Benefits and Challenges in the Development of the Adoption of Small Modular Reactors

Romania's current energy mix



The role of nuclear in decarbonization and energy security in Romania

Romania's Carbon Reduction Commitments

- EU Climate Goals: Romania is part of the EU Green Deal, which aims for climate neutrality by 2050.
- Integrated National Energy and Climate Plan (INECP): Targets a significant reduction in greenhouse gas (GHG) emissions by 2030.
- Replacement of Coal: Romania has pledged to phase out coal-fired power plants, and nuclear energy is a key replacement.
- Cernavodă NPP (Units 1 & 2) currently provides about 20% of Romania's electricity with near-zero CO₂ emissions.
- Nuclear energy avoids over 10 million tons of CO₂ per year, making it one of the most effective tools for emissions reduction.
- Future projects, including the Cernavodă Units 3 & 4 expansion and SMR deployment, will further increase clean energy capacity.

The Role of SMRs in Achieving Net-Zero

- SMRs provide carbon-free baseload power, complementing renewables like wind and solar.
- They can replace retiring coal plants, reducing emissions while maintaining grid stability.
- SMRs can also be integrated into district heating, hydrogen production, and industrial processes, further reducing Romania's carbon footprint.

The role of nuclear in decarbonization and energy security in Romania

Energy security means having a stable, affordable, and uninterrupted supply of energy. Nuclear power is essential for Romania's energy security in the following ways:

Reduction of Energy Dependence

Romania is reducing reliance on imported gas and coal.

Nuclear fuel supply is diversified, reducing the risk of geopolitical disruptions.

SMRs can be deployed domestically, ensuring local energy production.



Reliability and Grid Stability

Unlike renewables, nuclear provides constant baseload electricity (operating at a high capacity factor of ~90%).

SMRs enhance energy flexibility, as they can be scaled up or down based on demand.

Nuclear can stabilize Romania's power grid, supporting intermittent renewables.

Economic and Industrial Benefits

Expanding nuclear power creates jobs in engineering, construction, and operations.

Romania can become a regional leader in SMR technology, attracting investments and strengthening its energy infrastructure.

Nuclear supports long-term energy price stability, reducing dependence on volatile fossil fuel markets.

Romania's National Strategies and Plans for Implementing SMRs



Energy Strategy

Romania's Energy Strategy for 2020–2030.

Integrated National Energy and Climate Plan for 2021–2030.

INECP



NRRP

National Recovery and Resilience Plan

National Hydrogen Strategy for 2023–2030.

Hydrogen Strategy



Nuclear Development

National Strategy for the Development of the Nuclear Sector.

Overview of the National Nuclear Program.

Nuclear Program



Nuclear Safety and Security

National Strategy on Nuclear Safety and Security.

CNCAN may implement a **pre-authorization process** for the preliminary assessment of the compliance of a nuclear installation project with the provisions of the applicable regulations, if the organization developing the project requests it, but only under the condition that the respective project is included in **Romania's national strategies and government plans for the expansion of the nuclear program**, also provided that sufficient qualified personnel resources are allocated to CNCAN to perform the necessary evaluations, taking into account all other regulatory, licensing, and oversight activities carried out by CNCAN in accordance with the provisions of Law no. 111/1996.

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31 March - 4 April 2025



Cernavoda NPP
Units 1 & 2
(in operation)

NUCLEAR INSTALLATIONS and FACILITIES in ROMANIA



Cernavoda NPP
Units 1 & 2
(in operation)



Units 3 & 4 are
projects
waiting for
restart of
construction



TRIGA
Material
Testing Reactor
(operational)



Dry storage
facility for
spent fuel
(DICA)



CANDU Fuel
Fabrication
Plant (FCN)
Pitesti



Feldioara
Conversion Plant



Uranium mines

New projects in the Nuclear Sector of Romania (1)

Refurbishment of U1 Cernavoda NPP

Unit shutdown and the effective refurbishment of the project, scheduled to develop during **2027 –2029**.

Romania is expected to detritiate its CANDU (Canada Deuterium Uranium) units at Cernavoda, with the goal of improving radiological safety. **The authorizations for siting and construction were issued by CNCAN.**

Detritiation Facility (Tritium Removal facility)

U3&U4 of Cernavoda NPP

The last stage of the project consists in resuming construction of civil constructions, construction – installations activities and start-up activities at the site, phase estimated to last 69-78 months. It is estimated that **Unit 3 will be commissioned in 2030**, with the commissioning of **Unit 4 to follow in 2031**.

03.10.2019 ICN Pitesti and the FALCON Consortium signed a Memorandum of Understanding regarding the cooperation for the development of the 4th Generation reactor.

ALFRED Project

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Small Modular Reactors

New projects in the Nuclear Sector of Romania (2)

SMRs

In November 2021, Nuclearelectrica and NuScale Power signed an agreement in order to advance the implementation of the innovative technology of the small modular reactors of NuScale, in Romania, in this decade. The plan is to have 6 modules with an installed capacity of 462 MWe. In **August 2023** CNCAN approved the **Licensing basis document for NuScale SMR** and in **July 2024** the request for design & siting authorization was sent to CNCAN.

Expansion of the Dry storage facility for spent fuel (DICA) with type modules **MACSTOR 400**. The primary objective of this expansion project is to double the storage capacity, exceeding the existing configuration of MACSTOR 200 modules in order to accomodate the Refurbishment of U1 and the construction of U3& U4 of Cernavoda NPP.

Dry storage facility for spent fuel (DICA)

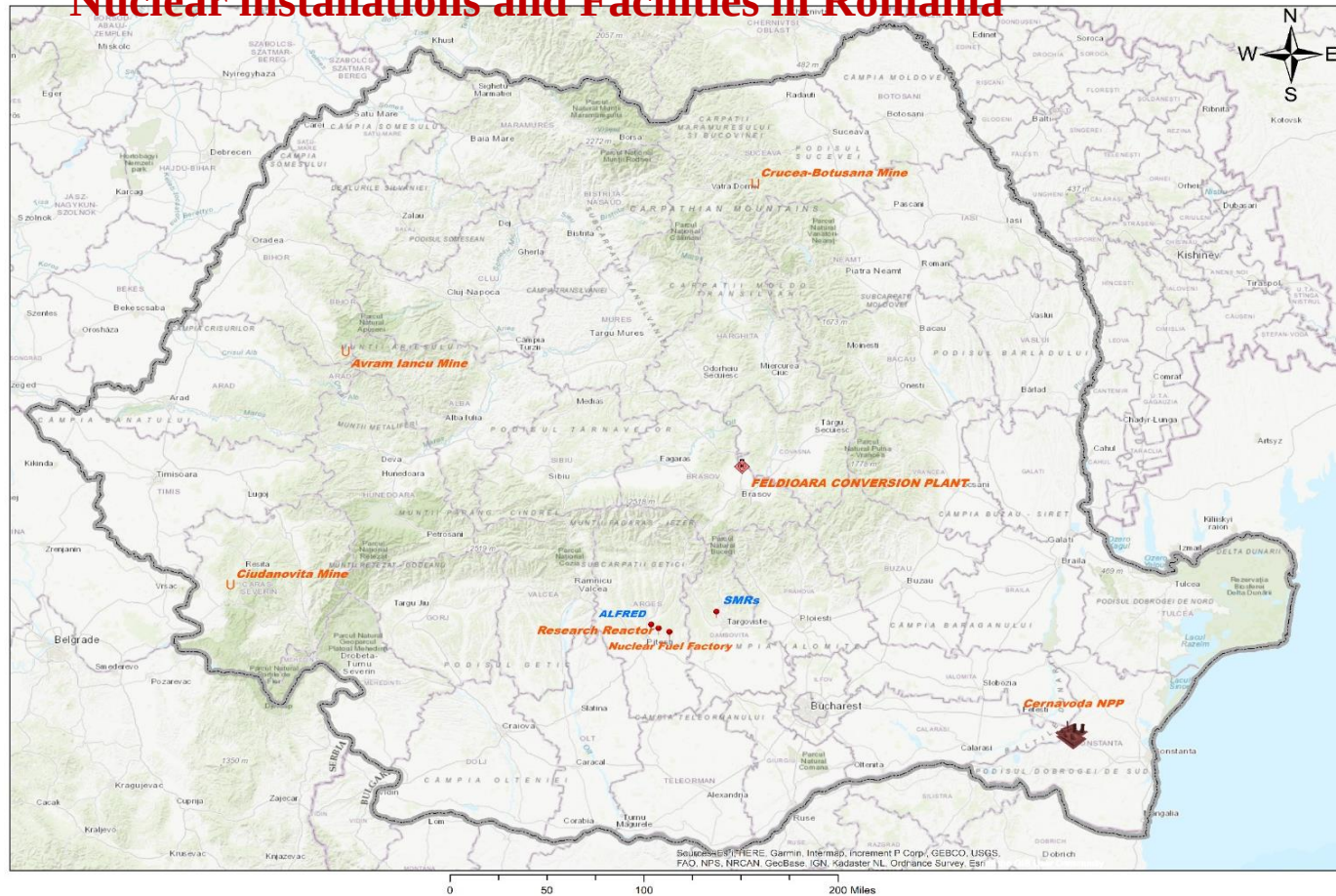
CANDU Fuel Fabrication Plant (FCN) Pitesti

Strategic plans to **increase the production capacity** of the Nuclear Fuel Plant. This expansion initiative is aimed at meeting the growing demand for nuclear fuel required for the efficient operation of Cernavoda NPP's Units 3&4. The detailed plans encompass enhancements in manufacturing processes, technology upgrades, and logistical improvements to ensure a seamless and sustainable increase in production capacity.

The **enhanced of 37-element fuel bundle (37M)**, currently in operation and with the aim to optimize Critical Heat Flux (CHF) performance within ageing pressure tubes.

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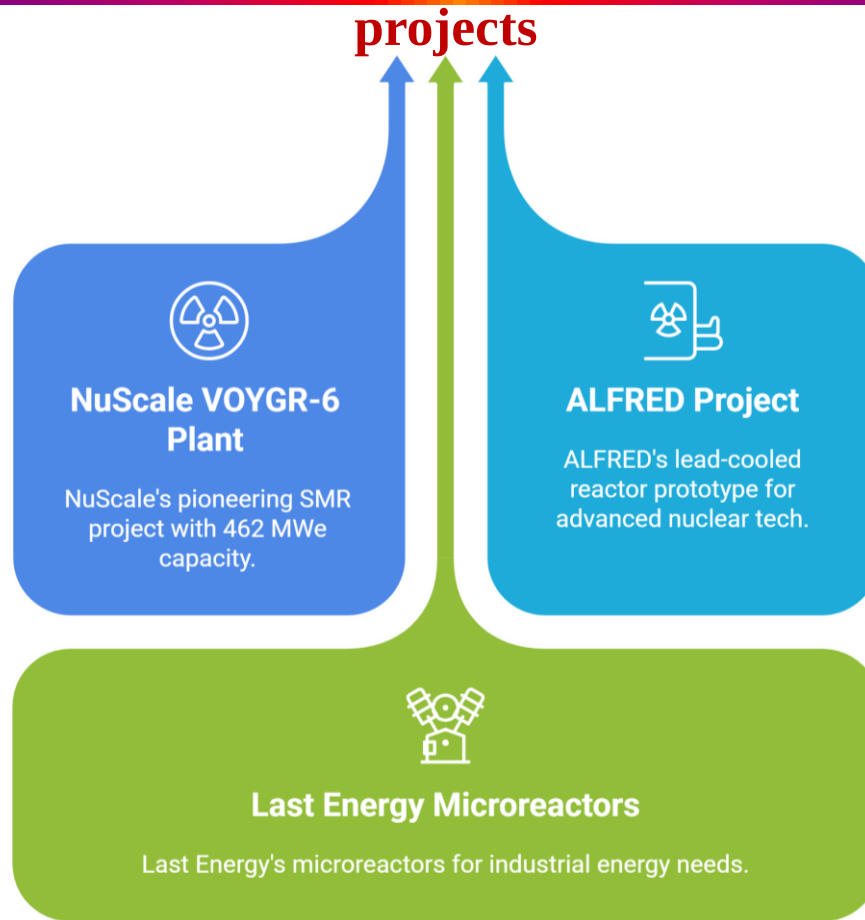
Nuclear installations and Facilities in Romania



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Romania is actively advancing SMR deployment through multiple



ALFRED (Advanced Lead Fast Reactor European Demonstrator)

The goal is to construct a technology demonstrator which is also prototype for a lead-cooled-based small modular reactor. To reach this ambitious goal, an important research, development and qualification infrastructure is planned in Romania.

Technical details :

Thermal power: 300 MW

Electrical power: 125 MW

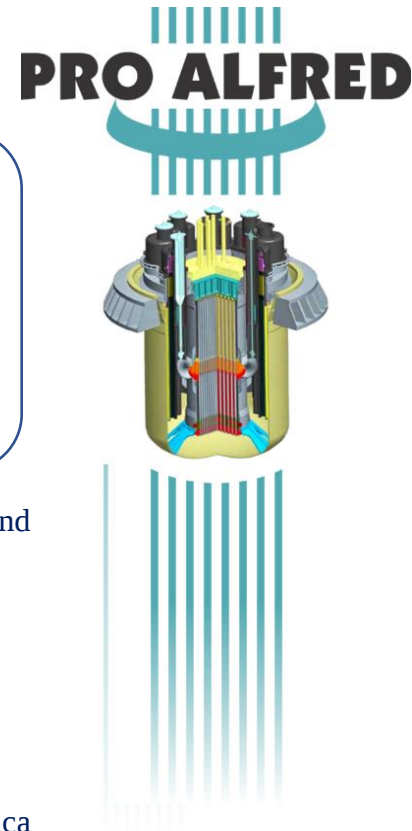
Spectrum: Fast

Coolant: Lead

Average lead coolant temperature: 520 °C (968 °F) on entry, 390 °C (734 °F) on exit of the steam generator.

Fuel: MOX

- Assessment of the competence, skills and personnel needed for the research, qualification, design, licensing and operation of ALFRED
 - 310 graduated staff +287 technicians
- Mapping the education programmes in the Romanian Universities
- Solutions combining updates of the curricula with training programmes of the young scientists
 - Implemented and tested - more than 40 participants involved
 - new course on I&C in UPIT for students
 - new course for young scientists on safety aspects of ALFRED reactor provided by University Politehnica Bucharest
- Human Resource Strategy for ALFRED



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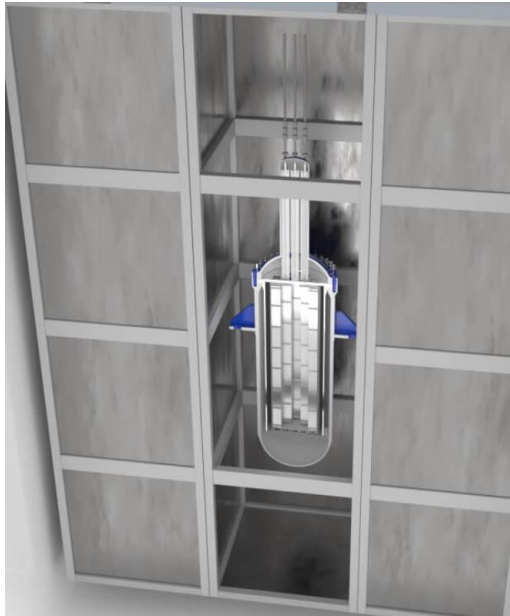
SMR projects in Romania - status

- ✓ 2011 - ICN site was nominated as reference site for the LFR technology demonstrator – ALFRED
- ✓ 2013 - FALCON Consortium – Fostering ALFRED Construction (ANSALDO, ENEA, RATEN ICN)
- ✓ 2017 - National partnerships with Universities, SNN, ROMATOM
- ✓ **The beginning of design phase is foreseen for 2029 with the operational phase to commence in 2036**
- ✓ Memo of understanding of 11/2023 for the “EU SMR LFR“ consortium formed by Ansaldo, ENEA, RATEN and SCK CEN (and Westinghouse)
- ✓ During May – December 2022 a series of virtual workshops referring to 10 topics were delivered by the FALCON Consortium to CNCAN staff
- ✓ The aim of the dialogue between CNCAN and FALCON was to set up the basis for definition of a licensing approach, due consideration given to LFR technology and the nature of ALFRED as a demonstrator reactor
- ✓ FALCON identified as its fundamental objective the development of a lead- cooled fast reactor demonstrator having SMR oriented features that would replace the old generation NPP
- ✓ December 2024 - Kick-off meeting FANC/CNCAN on pre-licensing review for LFR-SMR. FANC and CNCAN reached an agreement on the next steps and the way to proceed with setting up of the project.



ALFRED
Project

Last Energy Microreactors



Last Energy is a full-service developer of micro modular 20 MWe nuclear power plants with the goal of enabling global clean energy access and decarbonization in a way that is rapid, scalable, and economically competitive.

Technical details :

Reactor Type: Pressurized Water Reactor (PWR)

Thermal Power per Module: ~80 MWt

Electrical Capacity: 20 MWe

Coolant/Moderator: Light water

Fuel Type: UO₂, <4.95% enriched

Fuel Assembly Type: 17x17 array PWR fuel bundles of standard ~3.65 meter length

Structure: Subterranean nuclear island, low profile balance of plant

<https://www.lastenergy.com/technology>

SMR projects in Romania - status

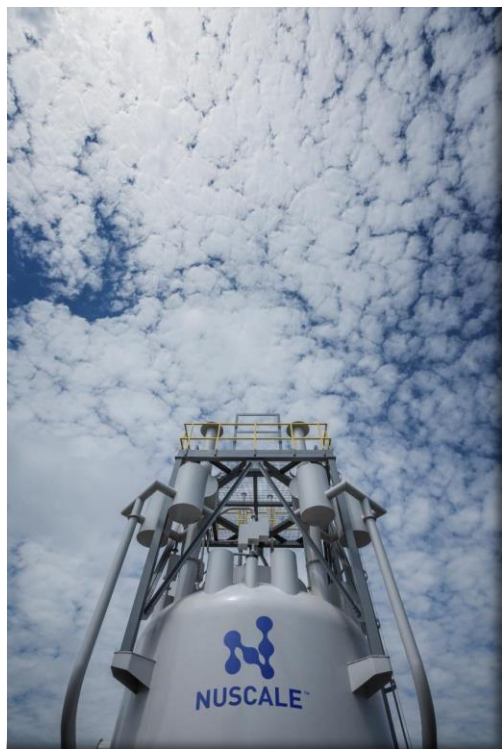
Last Energy branch in Romania requested a series of meetings with CNCAN in 2022-2024; following the meetings, several licensing basis documents were submitted and reviewed by CNCAN.

- ✓ STRATEGY FOR THE DEVELOPMENT AND LICENSING IN ROMANIA OF A NUCLEAR POWER PLANT WITH PWR-20 NUCLEAR REACTOR PROMOTED BY LAST ENERGY USA
- ✓ LICENSING AND ENGAGEMENT PLAN IN ROMANIA FOR NUCLEAR INSTALLATION PWR-20 describes the workstreams and planned submissions by the developer of the nuclear installation PWR-20 to CNCAN Romania for the approval of the Integrated Management System, licensing of the design, of the selected site in Romania and of the construction.



Quantum / Last
Energy

NuScale power plant (VOYGR-6)



NuScale Standard Plant Design was approved by the U.S. NRC (Final Rule published August 2020, for 50 MWe design); the updated 77 MWe design (NPM-77) was submitted to the NRC for approval in **2022** under a Standard Design Approval (SDA), currently under review, with a decision anticipated by mid-2025.

Technical details :

Reactor Type: Integral Pressurized Water Reactor (iPWR)

Thermal Power per Module: ~250 MWt

Electrical Output per Module: 77 MWe gross (net varies depending on configuration)

Number of Modules (VOYGR-6): 6

Total Electrical Output (gross): 462 MWe

Coolant/Moderator: Light water

Fuel Type: UO₂, low-enriched uranium ($\leq 4.95\%$ U-235)

Fuel Assembly Type: 17x17 PWR-type assemblies, shortened for module height constraints

Workforce:

- 193 permanent jobs
- 1500 jobs during construction
- 2300 jobs in manufacturing
- 4 million tons of CO₂ avoided every year

Project implementation will be compliant with Romanian and European legislation.

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SMR projects in Romania - status

Nuscale SMRs



- ✓ In November 2021, Nuclearelectrica and NuScale Power signed an agreement in order to advance the implementation of the innovative technology of the small modular reactors of NuScale, in Romania. The plan is to have **6 modules with an installed capacity of 462 MWe**.
- ✓ In **August 2023** CNCAN approved the Licensing basis document for NuScale SMR
- ✓ In **July 2024** the authorization request was registered with CNCAN
- ✓ In **January 2025** the first 2 chapters of the safety analysis report were submitted to CNCAN and also in **March 2025** the 3rd chapter was submitted.
- ✓ In the framework of the cooperation agreement between CNCAN and US NRC, several meetings were organised and 3 CNCAN staff were trained at NRC headquarters in 2024



Training simulator for NuScale SMR



- With the support of US, in partnership with NuScale, Romania developed an Education Center (E2 Center), including a Control Room simulator, to be used for the training of the new generation of nuclear engineers.
- The simulator is used for educational purposes, to support the development of the workforce capacity of the next generation of experts, technicians and nuclear operators in Romania aspiring to the position of nuclear operators for NuScale type reactors.



Training simulator for NuScale SMR

On **May 12, 2023**, the University POLITEHNICA of Bucharest (UPB) and Nuclearelectrica officially inaugurated the Energy Exploration Center (E2 Center), which hosts the control room simulator for the NuScale Small Modular Reactor (SMR).

This center, the first of its kind in Europe, was developed as part of the Foundational Infrastructure for Responsible Use of Small Modular Reactor Technology (FIRST) program, an initiative of the United States government.

The center's objective is to strengthen Romania's position as a leader in the safe implementation of SMR technology and to serve as an education and training hub for specialists in the field.



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Challenges to produce competent personnel and KM

Currently, in partnership with the Technical Universities there where identified challenges **of guiding young people in the medium and long future towards engineering specializations.**

In this sense, Nuclearelectrica runs an extensive employer brand program, “Nucleus of Excellence”, to attract and develop a new generation of young specialists in the nuclear industry and to prevent a lack of them in the medium and long term.

The strategy for training a new generations of specialists includes:

- Internships programs;
- Scholarships;
- dual education;
- promoting the nuclear industry in high schools and universities through science fairs and presentations.

Technical universities from Romania already update the curriculum for the training of future engineers in the field of nuclear energy and specifically, the development of educational programs (master) dedicated to the preparation and development of competences for the operation of SMR.

Also, CNCAN's active participation in the “Ovidius Engineering Hub” project underscores its strategic commitment to strengthening Romania’s technical and nuclear workforce through educational partnerships. By supporting the development of dual education infrastructure and curricula, CNCAN not only contributes to the modernization of technical education but also ensures alignment with the safety, regulatory, and operational standards of the nuclear industry.

Conclusions

- Strong National Commitment to SMRs Romania has made the deployment of Small Modular Reactors (SMRs) a strategic component of its national energy transition.
- Last Energy and ALFRED are currently in the pre-licensing phase, meaning that discussions and preparatory activities are ongoing to clarify regulatory expectations and requirements before formal license applications are submitted.
- NuScale project has moved further in the process, with the authorization request for design and siting already submitted to CNCAN. Currently, regulatory evaluations are ongoing to assess the compliance of the submitted documentation with applicable nuclear safety and security requirements.
- Romania also inaugurated the E2 Center with a full-scope simulator for NuScale training, the first of its kind in Europe, reflecting strong capacity-building efforts.
- Through its active participation, CNCAN supports the training of future generations of technical and nuclear specialists, helping to build national capacity for the safe and effective implementation of advanced technologies, including Small Modular Reactors (SMRs), and reinforcing the long-term sustainability of the nuclear workforce in Romania.

National Commission for Nuclear Activities Control

CNCAN

Thank you
for your attention!!

