



## **NUCLEARELECTRICA'S PROJECTS**





# About Nuclearelectrica



- ❖ The National Company “Nuclearelectrica” SA (SNN) is the national Romanian company which produces electricity, heat and nuclear fuel, operating under the authority of the Romanian Ministry of Energy, with the Romanian state holding 82.49% of shares and other shareholders holding 17.50%, after the listing of the company at the stock exchange in 2013.
- ❖ **Nuclearelectrica operates two CANDU nuclear units through Cernavoda NPP, which are two of the most high-performance units among the more than 400 nuclear plants in the world, based on capacity factor, a nuclear fuel factory (Pitesti Nuclear Fuel Factory) and it has an integrated fuel cycle through its uranium concentrate processing line (Feldioara Uranium Concentrate Processing Factory), recently acquired in order to support the long-term investment projects of the company.**
- ❖ Nuclearelectrica has a major role at the national level, contributing by more than 18% of the nuclear energy in the total energy production and by 33% in the total CO2-free energy production in Romania.
- ❖ Thru its investment project, refurbishment of Unit 1, Project of Units 3 and 4, and the project of small modular reactors, Nuclearelectrica will double its contribution in Romania’s energy system, supporting its decarbonation targets as well.
- ❖ The three major investment projects of SNN are complementary: refurbishment of Unit 1, the project of CANDU Units 3 and 4 and development of small modular reactors (SMR), developed in partnership with the USA. The first two provide clean energy, baseload, implicitly security in the provision and availability of the energetic system, and the SMRs flexibility, the opportunity to protect economically and socially the areas with coal-fired power stations decommissioned, local development, workplaces. An essential balance will be struck between the power reactors and SMRs in terms of production and response to decarbonization and the energy system or local needs.
- ❖ Nuclearelectrica is included in the FTSE Russell global index provider's indices from 21.09.2020 in the context of the transition of the Romanian capital market from Frontier Market to Emerging Secondary Market status.

[www.nuclearelectrica.ro](http://www.nuclearelectrica.ro)

[Nuclearelectrica Sustainability Report](#)

# Romania's decarbonation targets



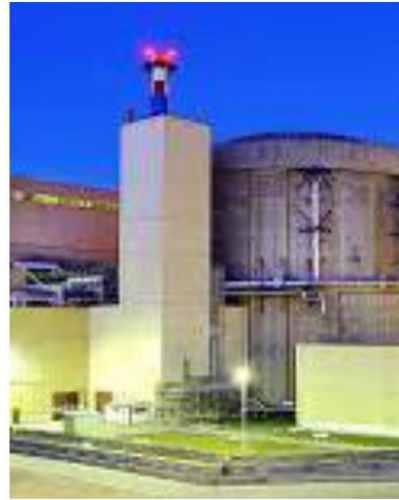
Reduce CO2 emissions by 55% until 2030  
 Reduce import dependency from 20,8% today to 17,8% in 2030



## Retiring coal capacities

Up to 4.59GWe of coal capacities will retire by 2032

**2032**



## Increase of nuclear capacity

Nuclear capacity will increase by 1.400 MW by 2031 with new CANDU UNITS and 465 MW with a 6 modules SMR

**2031**



## Hydrogen estimated demand

According to the EU Hydrogen roadmap, hydrogen in the energy mix will increase from 2% to 14% by 2050

**2050**



# Nuclear Energy in Romania



Reduction of CO2 emissions in Romania since the commissioning of Units 1 and 2

**205 million tones**

Annual reduction of CO2 emissions due to the operation of Cernavoda NPP

**10 million tones**

Nuclear energy in Romania today – 1400 MWe, 10.346,759 MWh, FC: U1 – 93.86%, U2 – 89,18%

**18-20%**

Nuclear contribution to clean electricity

**33%**

Jobs in the industry

**11.000 jobs**

Cumulated turnover in 2017 - approx. RON 2,730 million (approx. EUR 590 million)

**EUR 5.7 bln**

Investments projected until 2030

**EUR 12 bln**

# Nuclear energy in Romania after 2030/2031



Annual reduction of CO2 emissions with 4 units in operation + SMR power plant

**24 mil tons**

Contribution of Nuclear Energy in Romania

**36%**

Contribution of nuclear power to total CO2-free energy

**66%**

Jobs in industry

**20.000**



# Nuclear Energy in Romania



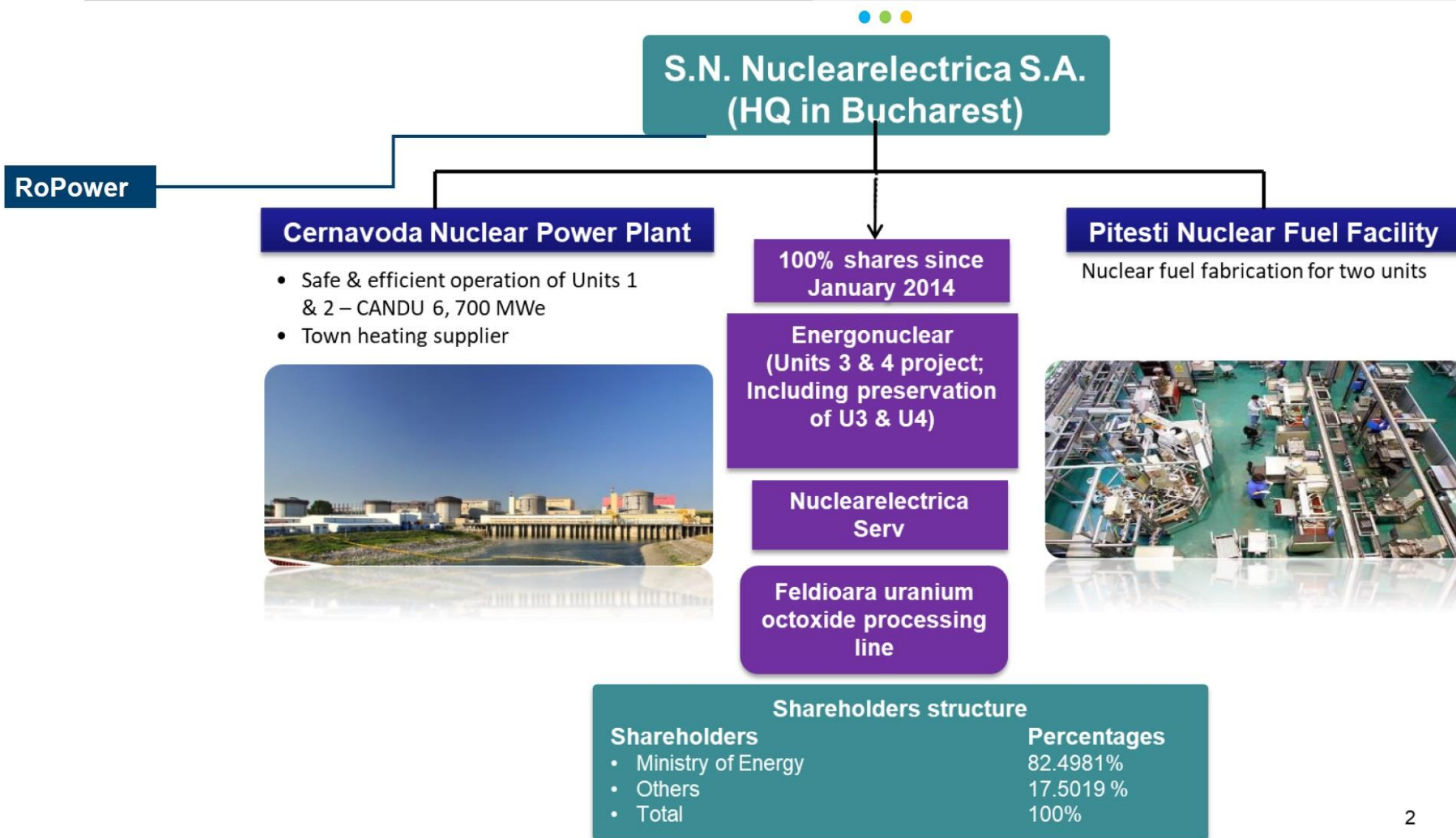


# Romania's experience in nuclear sector



- **More than 26 years of safe nuclear plants operations for Nuclearelectrica**
- **Cernavoda NPP, which are two of the most high-performance units among the more than 400 nuclear plants in the world, based on capacity factor**
- **More than 50 years of experienced rigorous Nuclear Industry Regulator - CNCAN - National Commission for Nuclear Activities Control**
- **More than 50 years of experienced Nuclear Industry supply chain**
- **Highly appreciated engineering education system**
- **By developing its nuclear program, Romania can play a regional role in securing energy security, especially in the 3 Seas Region Initiative.**

# Nuclear Energy in Romania

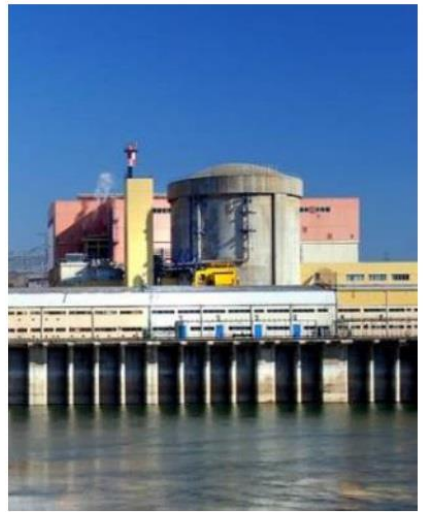




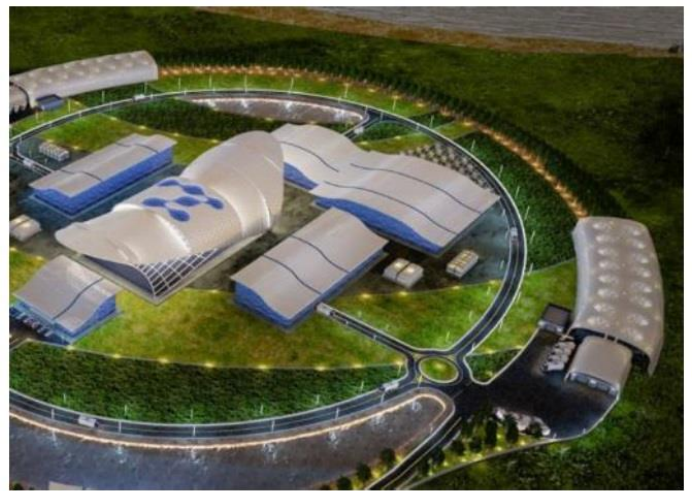
# SNN's Projects to Meet Romania's Decarbonation Targets

Two new CANDU Units  
around 2031

Refurbishment/  
Life Extension of Unit 1



SMR Development



CTRF



Integrated Nuclear  
Fuel Cycle



# Refurbishment / Life Extension of Unit 1 of Cernavoda NPP



Nuclear Power Plants have a limited lifespan mainly due to the lifetime of the reactor vessel.

For CANDU Reactors, such as Romania's Cernavoda NPP's reactors, the lifespan is given by reactor components (Fuel Channels, Calandria Tubes and Feeder Assemblies). Their life span is 30 years and their life can be extended by the refurbishment projects.

**The refurbishment of Unit 1 of Cernavoda NPP means another 30 years of operation after 2029, at less than half the cost of a new nuclear reactor, although similar in terms of pre-project complexity. In concrete terms, it means another 30 years without CO2 emissions.**

Unit 1 of the Cernavoda nuclear power plant (CNE), with an installed capacity of 700 MW, was commissioned in 1996 and has so far delivered 133 million MWh, representing 9% of national consumption, over a period of 26 years. Unit 1 has also prevented the release of 130 million tons of CO2 into the atmosphere.

**The project started in 2017 and will be finalized in 2029.**



# CANDU Units 3 & 4 of Cernavoda NPP



Romania, in relation to the reduction of coal capacity, will need new capacity, high capacity reactors, as a solution to decarbonisation and transition, but simultaneously offering to the grid: stability, safety, availability.

Through the CANDU Units 3 & 4 Project, Romania will double its contribution of clean energy in the grid, reaching approx. 66% and will avoid approx. 20 million tons of CO<sub>2</sub> annually with 4 units in operation. Moreover, approx. 20.000 jobs will be sustained for more than 30 up to 60 years of operations.

The project will benefit from the experience of CANDU technology evolution and Romanian engineering and industry will be part of this effort.

It is estimated that Unit 3 of Cernavoda NPP will be delivered in 2030 and Unit 4 in 2031.



# Cernavoda Tritium Removal Facility (CTRF) Project



- Cernavoda Tritium Removal Facility (CTRF) technology is aimed at extracting the tritium from the heavy water in the moderator and thus ensuring a significant reduction of the radioactive emissions in the environment and of the professionally exposed personnel internal dose.
- CTRF is beneficial during the Refurbishment as well as Decommissioning of CANDU Units, creating a safe environment for the involved work force
- On June 27, 2023, Nuclearelectrica and Korea Hydro & Nuclear Power (KHNP) signed the Engineering, Procurement and Construction (EPC) contract for the completion of Europe's first Tritium Removal Facility (CTRF) at Cernavoda Nuclear Power Plant (Cernavoda NPP).
- Using a Romanian innovative technology, developed by the Romanian National and Development Institute for Cryogenic and Isotopic Technologies (ICSI), Cernavoda Tritium Removal Facility (CTRF) will be the **world's third and Europe's first Tritium Removal Facility**
- CTRF represents an opportunity for **contribution to global tritium supply for fusion, mainly with respect to ITER** (the International Thermonuclear Experimental Reactor) as well as to recover and use He3 resulted from tritium disintegration.

## Romania has the opportunity to:

- Become a European hub for tritium production and export – the fuel candidate of future clean fusion reactors.
- Develop its suppliers' chain in partnership with Korea and become a center for development and export of the Romanian tritium removal technology and know-how, using localized factories and workforce.



# Small modular project - NuScale Technology



- **NuScale SMR is the first small modular reactor design approved by the U.S. Nuclear Regulatory Commission (NRC), since August of 2020.**
- **A six-module NuScale project is under development in US, at the Idaho National Laboratory (INL), Idaho Falls, Idaho, US**

**Romania is advancing its plans to deploy a NuScale power plant with 6 modules of 77 MWe each, 462 MWe installed capacity**

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

The SMR Project in Romania will be the first in Europe and second after US.

Project implementation will be compliant with the Romanian and European legislation and is aimed to be developed this decade.



# About nuclear energy

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- ✓ The current global geopolitical context has underlined more than ever the importance of a resilient, decarbonised and independent energy system. Security of energy supply and affordable prices for citizens and businesses are urgent issues for policy makers around the world.
- ✓ Nuclear energy is a safe, affordable and clean source of energy, available 24/7, with extensive operational experience, which has been contributing to the decarbonisation of economies for more than half a decade and currently supplies more than 10% of the electricity consumed worldwide. Moreover, nuclear energy is supplying 50% of European Union's clean energy.
- ✓ **In terms of costs, and implicitly of the subsequent impact on the market, a [NEA-OECD study confirms](#) that the extension of the lifecycle of nuclear units sustains the lower cost out of all sources - 32 USD/MWh, compared to 50 USD/MWh for wind power and 56 USD/MWh for solar powers, and coal – 94 USD/MWh.**
- ✓ Nuclear energy has no CO2 emissions for production and has the lowest life-cycle CO2 emissions per kWh of all energy sources (6g/kWh). Moreover, uranium is abundant and well distributed around the world. The cost of fuel is only a small part of the cost of electricity generated, so nuclear energy can provide a stable cost of electricity for citizens, public administration, industry, agriculture and all other human activities that depend on electricity.
- ✓ International Energy Agency (IEA) [shows that energy demand grows by 2.1%](#) per year until 2040, especially in developing countries and clean sources will provide up to 52% of consumption in 2040 compared to 36% today.
- ✓ Yet, more renewables without investments in the nuclear field will increase the cost of transition.



# About nuclear energy (2)

- ✓ **USD 275 trillion, or approximately USD 9.2 trillion/year**, are the funds needed for physical assets during the transition period by 2050 (according to [The McKinsey analysis](#)).
- ✓ Without investments in nuclear industry, **the cost of transition to a sustainable economy increases by USD 1.6 trillion** (according to the [report of the International Energy Agency \(IEA\)](#), published in May 2019).
- ✓ Nuclear power is essential **to keep global warming below 1.50 C.** according to [The Intergovernmental Panel on Climate Change \(IPCC\)/UN](#).
- ✓ Last, but not least, the [UNECE report](#) (The United Nations Economic Commission for Europe-from 2021) concluded that the use of **nuclear energy has prevented emission of 74 gigatons of carbon dioxide over the past 50 years.** The CO2 emission reduction targets cannot be attained unless nuclear energy is included in the energy portfolio intended at putting an end to climate change.
- ✓ According to [Nuclear Europe](#), if the share of renewable energy increases by 190% and the nuclear capacities installed across the EU remain unchanged by 2050, **Europe will end up being 26% dependent on gas and 12% coal, both sources with CO2 emissions.**
- ✓ New build nuclear projects are also cost-competitive and small modular reactors (SMRs), currently under development, will bring the added advantage of lower initial costs and shorter construction times. In addition, large reactors, SMRs and advanced modular reactors can offer a wide variety of non-power applications such as clean hydrogen production, district heating, desalination, industrial heat, as well as complementing the variable nature of renewable technologies.
- ✓ The global commitment to increase renewable energy generation will require additional dispatchable low-carbon capacity to balance our electricity grids. Global nuclear expertise and innovation should be fully utilized to secure current and future energy needs. Energy transition is not possible without maintaining and expanding the role of nuclear energy.

