Nuclearelectrica Investment Projects towards Romania's decarbonization targets

12th IEA IEF OPEC Symposium on Energy Outlooks,

Cosmin Ghita, CEO Nuclearelectrica, Romania

NUCLEARELECTRICA

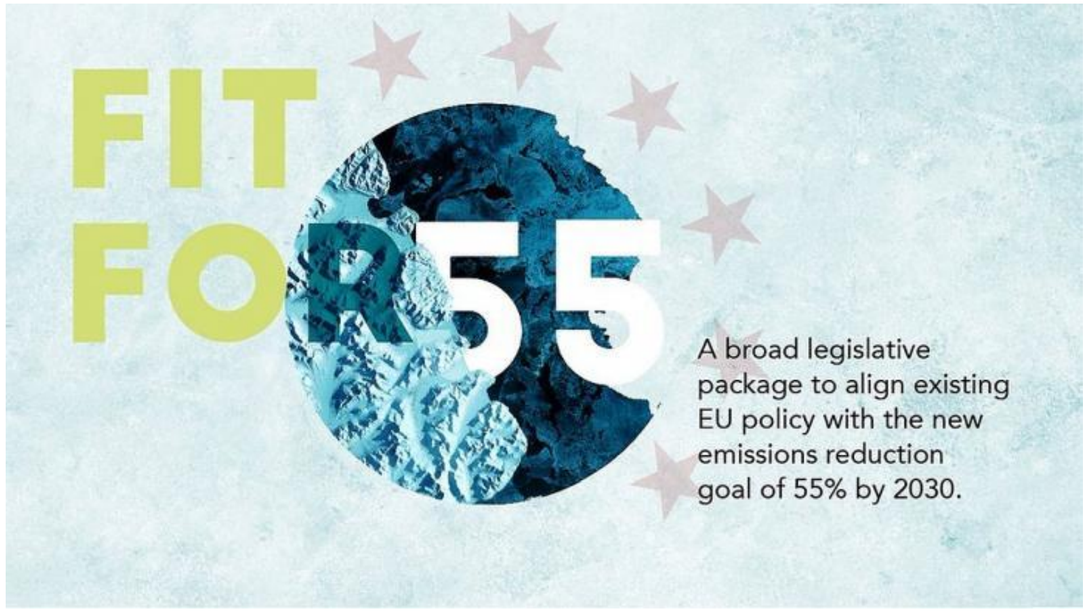
GLOBALLY,
NUCLEAR ENERGY COVERS 10% OF TOTAL ENERGY DEMAND → 17% ACCORDING TO IEA & IPCC

IN EUROPE,
NUCLEAR ENERGY GENERATES 50% OF ENERGY WITH LOW CO_2 EMISSIONS

Sustainable future

European Green Deal
Sustainable Finance Taxonomy
European Union

- **Zero carbon emissions by 2050**
- **The decarbonization target by 2030 accelerated from 40% to 55%.**



Sustainable future

Decarbonation is not possible without nuclear energy

UNECE

TECHNOLOGY BRIEF

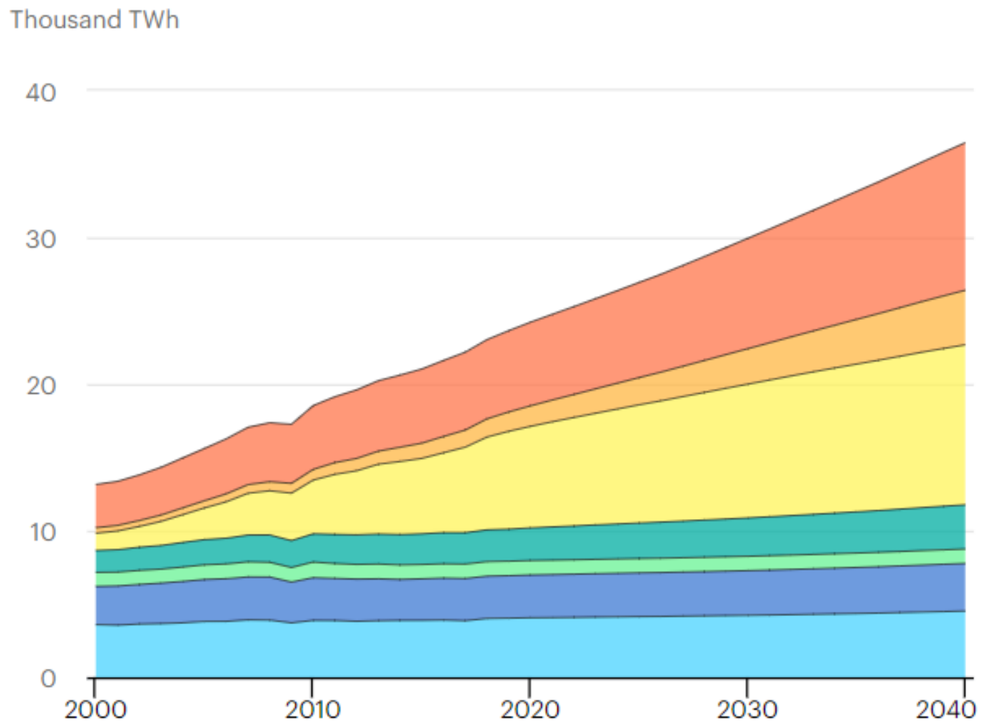
NUCLEAR POWER

- **In the last 50 years, nuclear energy has led to the avoidance of releasing 74 Gt of CO2 into the atmosphere.**

- According to data published in the **McKinsey analysis, the cost of the transition until 2050 is $ 275 trillion (or about $ 9.2 trillion/year, the funds needed for physical assets).**

- The International Energy Agency (IEA) has estimated that **without investment in nuclear power,** two-thirds of the capacity in developed countries will be decommissioned by 2040, leading to a **$ 1.6 trillion increase in transition costs**

Global Energy Demand



United States · European Union · Japan · Other advanced economies · China · India · Other developing economies

International Energy Agency:

- The energy demand will increase by 2.1% per year by 2040, especially in the developed countries.
- The share of energy without carbon emissions is estimated to increase from 36% today to 52% by 2040.

FORATOM study:

- In case the percentage of renewable energy increases by 190% and that of nuclear remains unchanged by 2050, Europe will continue to be dependent on natural gas up to 26% and 12% on coal, both highly CO2 emitting.

Nuclear Energy in Romania

Nuclear Energy in Romania

Reduction of CO2 emissions in Romania since the commissioning of Units 1 and 2	**170 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 590 m**
Investments projected until 2030	**EUR 8-9 bln**

Romania’s decarbonation targets

Reduce CO2 emmissions 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

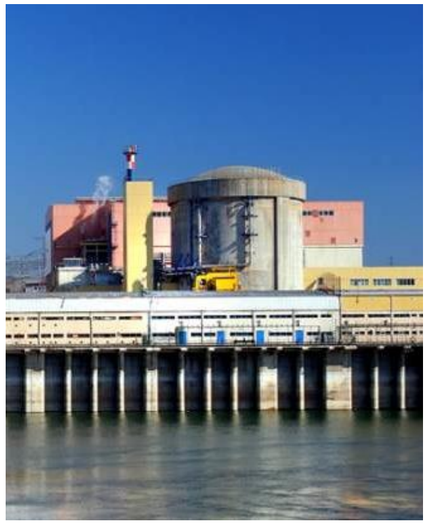
Hydrogen estimated demand

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

2050

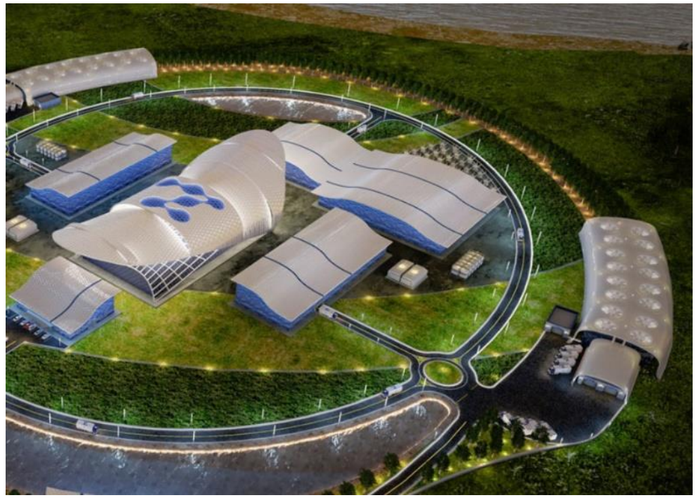
SNN's projects to meet Romania's decarbonation targets

Refurbishment / Life Extension of Unit 1



New CANDU Units after 2030

SMR Development



CRTF

Integrated Nuclear Cycle

Refurbishment / Life Extension of Unit 1

Phase 1 — close to finalization
Final Investment Decision subject to GMS approval on February 23rd, 2022

Phase 2 — Project implementation (engineering, procurement, EPC contract, authorizations, FID).

Phase 3 — Effective development of the refurbishment project - estimated at 24 months (December 2026 - December 2028).

CANDU Units 3 & 4

Preparatory Stage:

- Energonuclear S.A., the project company, signed the first contract with Candu Energy, a member of the SNC-Lavalin group and the Design Authority of Units 3&4 and OEM of CANDU technology.
- Within the contract, **Candu Energy** will offer **engineering services** for the elaboration and updating of some documentations necessary to restart the CANDU Units 3&4Project (among which updating the licensing basis documents, updating the Safety Design Guides, updating the list of safety related design changes etc.).

Cernavoda Tritium Removal Facility (CTRF):

It 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.

Using LPCE – CD (Liquid Phase Catalytic Exchange – Cryogenic Distillation) 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.

Integrated fuel cycle

Cernavoda NPP branch operates two CANDU nuclear units, a nuclear fuel plant and is in the process of achieving an integrated fuel cycle by purchasing a uranium concentrate processing line to support the company's long-term investment projects.

Deploying NuScale SMRs technology

- In November, 2021, Nuclearelectrica & NuScale Power signed a teaming agreement to advance the deployment of NuScale's innovative small modular reactor (SMR) technology in Romania.

- **NuScale SMR is the first small modular reactor design approved by the U.S. Nuclear Regulatory Commission (NRC), since August of 2020.**

- In early 2021, Nuclearelectrica received $ 1.2 million in USTDA grants to assess potential sites for small modular reactors.

Deploying NuScale SMRs technology

The NuScale power plant will have 6 modules

462 Mwe installed capacity

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

Long term vision

Romania has the potential to accommodate the first deployment of SMRs in Europe and become

- **a catalyst for SMRs in the region**
- **a base for supporting production and assembly of components**
- **a hub for preparation and training of future operators and specialists**

Romania will develop the first full-scope simulator for the command room of a NuScale SMR in Europe, to be used for the training of the new generation of engineers.

NUCLEARELECTRICA