



S.N. Nuclearelectrica S.A.

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Presentation for investors



*Commitment for excellence*  
*Action for results*

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# SNN, IN BRIEF

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## SNN, IN BRIEF

- Societatea Nationala Nuclearelectrica S.A. (“Company” or “SNN”) is a national joint-stock company, managed in a one-tier management system, with its registered office in Bucharest, District 1, 65 Polona Street, and two branches without legal personality. The company’s main activity is the “Production of electricity” – NACE code 3511, and it is recorded in the Trade Register under no. J40/7403/1998, tax number 10874881, fiscal attribute RO.
- At present, SNN is the only producer of electricity based on nuclear technology in Romania.
- Also, SNN produces nuclear fuel bundles, CANDU type, used for the operation of its own nuclear reactors.NPP branch (Nuclear - Power Plant) Cernavoda, with registered office in Cernavoda,2 Medgidiei Street, registered with the Trade Register under no. J13/3442/11.10.2007, ensures the operation of the two nuclear units, based on CANDU technology type, as well as the administration of all SNN assets in Cernavoda (except for Units 1 and 2 in operation, Units 3 and 4 in different construction stages, Unit 5 for which the shareholders of the Company had approved the change of destination since march 2014, namely, its use for carrying out activities related to the operation of Units 1 and 2, and also the heating system). The two units have a installed capacity around 700 MW (MWe 706.5 Unit 1 and MWe 704.8 MWe Unit 2).
- NFP Branch (Nuclear Fuel Plant) Pitesti, with registered office in Mioveni, 1 Campului Street, registered with the Trade Register under no. J03/457/August 24, 1998, where CANDU fuel bundles are made for Units 1 and 2 of Cernavoda.Unit 1 was commissioned in 1996 and Unit 2 in 2007. The two reactors alone ensure about 17% - 18% of the internal energy production of Romania. The nuclear reactors from the two units are 6 CANDU type, design developed in Canada, by Atomic Energy of Canada Ltd. This type of reactors are cooled and moderated with heavy water and use natural uranium as fuel. The initial project envisages the construction of 5 nuclear units CANDU type.





- According to the Government initial strategy, the construction of CNE Cernavoda Units 3 and 4 will be completed by Energonuclear S.A., a subsidiary of SNN, incorporated in 2009. Currently, there is a new strategy for the continuation of the Project for Units 3 and 4 approved by the Extraordinary General Meeting of Shareholders of SNN of August 22, 2014, providing for the incorporation of a new project company, into which Energonuclear S.A. will be absorbed.
- Unit 5 is currently completely depreciated, due to the fact that there is no plan for its construction; in march 2014, the shareholders of the Company approved the use of Unit 5 for operating activities of Units 1 and 2.
- Units 1 and 2 use, on an annual basis, approximately 11.000 nuclear fuel bundles, each containing 19 kg of uranium. In order to produce the necessary fuel, NFP Pitesti operates at maximum capacity. SNN represents a stability factor for the energy market in Romania, both through the base load electricity production and the competitive production cost.



## II. MISSION, VISION AND VALUES



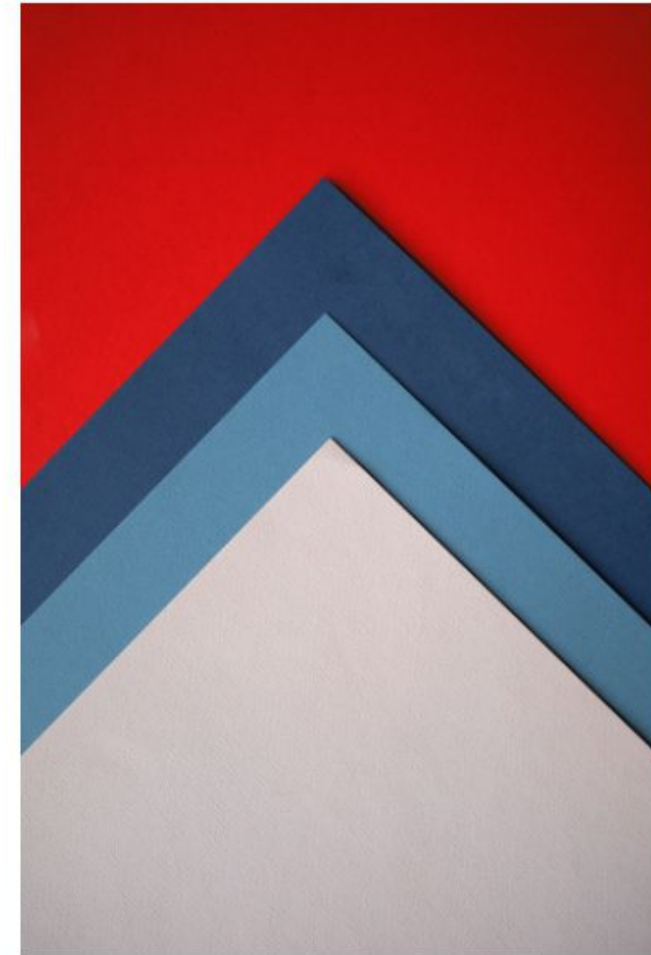




### Vision

Commitment to Excellence. Action for Results.

### Values



### III. SHAREHOLDING STRUCTURE

The shareholding structure as at 31.12.2019 is as follows:

Shareholder type	Number of shares owned	% share capital ownership
Romanian State - Ministry of Energy <sup>*)</sup>	248,736,619	82.4959 %
Fondul Proprietatea S.A.	21,268,355	7.0539 %
Other legal entities	18,175,341	6.0280 %
Individuals	13,333,536	4.4221 %
<b>Total</b>	<b>301,513,851</b>	<b>100%</b>

*\*) Starting with February 11th, 2020, the shares held by the Romanian State via the Ministry of Energy are transferred to the Romanian State via the Ministry of Economy, Energy and Business Environment, as a result of the implementation of the provisions of the Government Emergency Ordinance no. 68/ November 6th, 2019.*

## IV. ELEMENTS OF GENERAL ASSESMENT

During the 12-month period ended on December 31, 2019, SNN recorded a net profit of 535,667 thousand RON.

Indicator [thousand RON]	2019 (audited)	2018 (audited)	Variation
Production (GWh) <sup>*</sup>	10,347	10,443	(0.9%)
Operating income, out of which:	2,417,433	2,178,873	10.9%
Proceeds from the sale of electric power <sup>**</sup>	2,365,564	2,116,992	11.7%
Operating expenses, minus impairment and depreciation	(1,232,455)	(1,089,368)	13.1%
<b>EBITDA</b>	<b>1,184,978</b>	<b>1,089,505</b>	<b>8.8%</b>
Impairment and depreciation	(555,553)	(552,965)	0.5%
<b>EBIT</b>	<b>629,425</b>	<b>536,540</b>	<b>17.3%</b>
Net financial result	1,850	36,083	(94.9%)
Net profit tax expenses	(95,608)	(162,012)	(41.0%)
<b>Net profit</b>	<b>535,667</b>	<b>410,611</b>	<b>30.5%</b>

<sup>\*</sup>Electricity produced and delivered by Cernavoda NPP in the National Energy System.

<sup>\*\*</sup>Including revenues from the sale of thermal energy, insignificant in the total revenues.

**The operational profit (EBITDA)** increased by 8.8% as compared to the same period of the previous year, mainly following the increase of operational revenues by 11%, influenced by the increase by 12% of the revenues from the sale of electricity.

**The operating income** increased by 11%, determined by the 12% increase in the weighted average price of the electricity sold in 2019, as compared to the weighted average price from the same period of 2018, considering the sale of a total quantity of electricity in 2019 similar to the total quantity sold in 2018 (only 0.2% decrease).



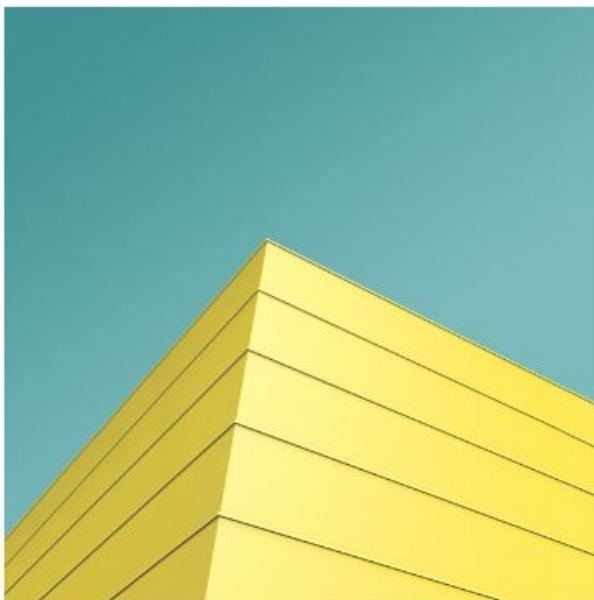
**The operating expenses** increased by 13% in 2019, compared to the same period of 2018. This evolution is mainly determined by the contribution paid by the Company to ANRE, according to the provisions of GEO 114/2018, the increase of the expenses with the purchased electricity and the slight increase of personnel expenses, partially compensated by the decrease of the repair and maintenance expenses.

**The net currency exchange differences** (net financial revenues) decreased by 94.9%, and negatively influenced the net result. The main currencies to which there are exposures are EUR and CAD.

The decrease of **net expenses with the profit tax** positively influenced the net result. This decrease was caused by a reduction in the actual profit taxation rate from 28% in 2018 to 15% in 2019.

## Electricity sales (quantities, prices and values) in 2019

The gross production of electricity of the two operational units of CNE Cernavoda was 11,280,167MWh in 2019; from this gross production, the own technological consumption of the Units during the operation, and during the outages ensured from own production was 933 thousand MWh in 2019



As compared to the same period of the previous year, the quantity of electricity sold on the competition market of bilateral contracts decreased by 9%, and benefited from an increase of the average sale price on this market by 14% (price without Tg), while the electricity quantity sold on the spot market (PZU and PZI) decreased by 34%, considering an average sale price on this market higher by 19% (price without Tg) was registered.

### Electricity sales (quantities, prices and values) in 2019

Sales by types	Quantities in MWh	% of total sales	Average price [lei/MWh with Tg included]	Revenues from sales [lei]
Sales on the regulated market	1,376,963	12.9%	189.51	260,948,252
Sales on the competitive market (bilateral contracts and PZU and PI contracts), out of which:	9,245,123	86.8%	227.70	2,105,074,010
- Sales on PCCB - LE, PCCB - NC, PCSU, PC - OTC contracts and supply contracts	8,194,487	76.9%	228.01	1,868,444,207
- PZU and PI sales	1,050,636	9.9%	225.23	236,629,803
PE positive imbalances <sup>*)</sup>	30,137	0.3%	178.96	5,393,395
<b>Total sales in 2019</b>	<b>10,652,223</b>	<b>100%</b>	<b>222.62</b>	<b>2,371,415,657</b>

<sup>\*) NB: RON 198,067 of the value presented represents redistributed revenues resulted from the balancing of the system, based on the application of NARE Order no. 51/2016, NARE Order no. 76/2017 and NARE Order no. 31/2018.</sup>

## V. PRODUCTION AND SALE ACTIVITY

The gross production of electricity of the two operational units of CNE Cernavoda was 11,280,167MWh in 2019; from this gross production, the own technological consumption of the Units during the operation, and during the outages ensured from own production was 933 thousand MWh in 2019. Thus, the electricity produced and delivered in the National Energy System ("NES") was 10,346,746 MWh in 2019, compared to the same period of 2018 (10,443,078 MWh), which accounts for a decrease of 0.9%. The net electricity production program approved by the Board of Directors for 2019 (revision February 2019) considered an amount of 10,228,403 MWh, and it was achieved at a rate of 101.2%.

The lower value of the factor for using the installed capacity at Unit 2 CNE Cernavoda reflects the influence of the scheduled outage for an actual duration of 850.6 hours (approximately 35.4 days), registered as of May 3, 2019, 11:00, completed on June 7, 2019, 21:22. The unplanned extension of the scheduled outage of Unit 2 CNE Cernavoda lasted for 98.4 hours, and the initial planned moment of the re-synchronization was June 3, 2019, 19:00. During September, an unplanned stoppage of Unit 1 of Cernavoda NPP occurred, lasting 160 hours, starting with September 18, 2019 at 5:30, in order to perform repair works to some leaks (minor leak of cooling agent) from the primary heat transfer system of the reactor. SNN is an electric and thermal power energy producer, the main activity being that of electricity producer. Thermal power sales revenues represent an insignificant portion in the total operating revenues. As well, SNN is a CANDU type fuel bundle producer, which are entirely used for the operation of Units 1 and 2 CNE Cernavoda.

The electrical power of Units 1 and 2 CNE Cernavoda in 2019 was influenced by the duration of the planned outage of Unit 2, amounting to 850.6 hours, the weather and hydrological conditions (the temperature of the cooling water from the Danube, the level of the water in the intake tank, air temperature, etc.), fuel recharges and the unplanned outages of Unit 1, amounting to approximately 160 hours. The annual energy quantity that SNN can produce through its two Cernavoda NPP units is approximately 10.6 TWh (net), given the fact that the units are operated at a high capacity factor. The energy produced by SNN in period January 1 - November 30, 2019 had a weight of approximately 18.4% in the total energy produced in Romania (net values).

The number of hours of unplanned outages was within the number estimated according to the 2019 production program (14 days). Within the activity of electricity trading, the Company is obligated to submit letters of bank guarantee to certain contractual partners, according to the provisions stipulated in the electricity sale-purchase contracts. Mainly, these refer to: the contract concluded with C.N. Transelectrica S.A. for electricity transportation (a letter of bank guarantee is not currently necessary given the status of good payer of SNN, but the contract provides situations where the security is mandatory); the agreement concluded with OPCOM S.A. for electricity trading on PZU (Next Day Market) and PI (Intra-daily Market); regulated contracts, concluded with last resort providers, based on ANRE Decision no. 326/2019; contracts concluded on the PCCB - NC platform (centralized market of bilateral electricity contracts - the trading method according to which contracts are awarded by Continuous Negotiation); contracts concluded on the PCSU platform (centralized market for the universal service), plus tender procedure securities; the agreement for participating in the PE (balancing market) concluded with C.N. Transelectrica S.A. and the contract concluded with CigaEnergy S.A. for providing the representation service as the part in charge with balancing (PRE). For the purpose of this activity, between October 1 and December 31, 2019, 14 letters of bank guarantee were issued, in value of 42,022,284 RON. During the same period, a letter of bank guarantee was liquidated in value of 1,603,008 RON, issued in 2019. On December 31, 2019, there are in the balance 52 letters of bank guarantee amounting to RON 164,952,097, out of which, for 29 letters of bank guarantee, there are collateral deposits set up amounting to RON 96,659,494.





### Electricity sales (quantities, prices and values) in 2019

Sales by types	Quantities in MWh	% of total sales	Average price [lei/MWh with Tg included]	Revenues from sales [lei]
Sales on the regulated market	1,376,963	12.9%	189.51	260,948,252
Sales on the competitive market (bilateral contracts and PZU and PI contracts), out of which:	9,245,123	86.8%	227.70	2,105,074,010
- Sales on PCCB - LE, PCCB - NC, PCSU, PC - OTC contracts and supply contracts	8,194,487	76.9%	228.01	1,868,444,207
- PZU and PI sales	1,050,636	9.9%	225.23	236,629,803
PE positive imbalances <sup>1)</sup>	30,137	0.3%	178.96	5,393,395
<b>Total sales in 2019</b>	<b>10,652,223</b>	<b>100%</b>	<b>222.62</b>	<b>2,371,415,657</b>

<sup>1)</sup> NB: RON 198,067 of the value presented represents redistributed revenues resulted from the balancing of the system, based on the application of NARE Order no. 51/2016, NARE Order no. 76/2017 and NARE Order no. 31/2018.

The electricity quantity sold based on contracts, on the spot market (PZU and PZI) and on PE is 10,652,223 MWh, 1.9% more than the sales program, of 10,453,499 MWh (sized on the production estimate, without estimating unplanned outages) and 0.2% less than the electricity quantity sold in the same period of 2018.

The difference between the electricity sold by the Company and the electricity produced and delivered by CNE Cernavoda (305 thousand MWh) is represented by the electricity purchased for the full coverage of the contractual obligations, an electricity quantity that was purchased 51% from the spot market, 36% from the Centralized Markets, and the rest from PE.

The revenues obtained from the electricity market related to electricity deliveries in 2019 are RON 2,371,415,657 (out of which RON 198,067 account for redistributed revenues resulted from balancing the system, based on the application of ANRE Order no. 76/2017 and ANRE Order no. 31/2018), 0.81% higher than the budget revenues for 2019, and 11.7% higher than the same period of the previous year.

According to the sales strategy, 9 contracts for purchase on the Centralized Markets were concluded between August 2018 and April 2019, for a constant power of 145 MWh, with delivery in May 2019, at an average price of 210.93 RON/MWh which partially covered the sale obligations assumed by the contracts whose average weighted price in May 2019 was 216.03 RON/MWh. The average weighted sale price, for the electricity quantities sold (without the regulated market and PE), resulted in 2019, is of RON 227.70/MWh (including Tg).

For comparison, the weighted average price of all the transactions performed on the markets on which SNN operated in 2019 (PCCB - LE, PCCB - NC, PCSU, PZU and PI), calculated based on the values published by OPCOM in the monthly market reports, is 239.11 lei/MWh. In 2018 the average weighted sale price, for the energy quantities sold (without PE) was 198.99 lei/MWh (including Tg). Following Government Emergency Ordinance no. 114/28.12.2018, which amends and supplements Electricity and natural gas law no. 123/2012, ANRE issued Order no. 10/01.02.2019 for approving the Methodology for setting prices for the electricity sold by producers based on regulated contracts and the quantities of electricity from the regulated contracts concluded by producers with last instance suppliers. According to ANRE Resolution no. 326/25.02.2019, the quantity assigned to SNN for 2019 for regulated contracts was 1,377 GWh. ANRE established a regulated price for SNN of RON 188.33/MWh (without Tg).



The sold electricity quantities on the competitive market (bilateral contracts) represented in 2019 a percentage rate of 76.9% out of the total volume of the sold energy. The average sale price on bilateral contracts in 2019 was 228.01 RON/MWh (with included Tg), recording an increase of 13.6% as compared to the average price recorded in the same period of 2018, of 200.67 RON/MWh (with Tg included); given the fact that the values of the electric power input transport fee in the Tg network were the following: RON 1.05 /MWh for the period July 1, 2017 - June 30, 2018, according to ANRE Order no. 48/22.06.2017 and RON 1.18 /MWh for the period July 1, 2018 - December 31, 2019, according to ANRE Order no. 108/20.06.2018. On the spot market (PZU and PI), in 2019, a quantity of electricity representing 9.9% of the total sales volume was sold, compared to the percentage share of 14.9% recorded over the same period of 2018. The average sale price of energy on the spot market (PZU and PI) performed by SNN in 2019 was 225.23 lei/MWh (with Tg included), compared to 189.46 lei/MWh (with Tg included) registered in 2018.

In 2019, SNN performed 206 energy sales contracts, as follows:

- 5 regulated contracts;
- 118 contracts concluded on PCCB - LE;
- 67 contracts concluded on PCCB-NC;
- 13 contracts concluded on PCSU;
- one transaction concluded on PC - OTC;
- 2 supply contracts for 2 end users.

No contracts were terminated, and no significant delays were notified compared to the due payment terms provided in the contracts in 2019. In all the cases in which there have been delays, the Company sent notifications and charged penalties according to the contractual provisions.

## VI. INVESTMENT PROJECTS

The total value of the investment program of SNN for 2019 is 256,548 thousand RON (without the component allocated to the payment of the debt service related to long-term loans), a program approved by Resolution no. 6/20.05.2019 of the Ordinary General Assembly of Shareholders of SNN, as part of the Revenues and Expenses Budget ("BVC") of SNN for 2019. The comparative situation of the investment accomplishments (value and percentage) for 2019 compared to the same period of 2018 is presented in the table below:

Year	Value of the investment program [thousand RON]	Performed (01.01 - 31.12) [thousand RON]	Achievement level (01.01 - 31.12) (%)
2019	256,548	218,455	85.2%
2018	244,867	139,699	57.1%

As in the previous years, Nuclearelectrica S.A. structured its investment development program on objectives defined in relation to the needs of the production branches (Cernavoda NPP and PitestiNFF), so as to achieve a high level of utilization of the production capacity (EAF Energy Availability Factor) in compliance with the nuclear safety norms and the long-term maintenance of the level of excellence in the operation of the plant. At the same time, the goal of the development program is to cover the necessity to upgrade/refurbish certain systems, for economic reasons (specific consumption reductions, improvement of certain parameters related to served processes, with a positive impact on efficiency), and legal ones – the need to implement upgrades associated with nuclear security, environment protection and labor security, representing imperative requirements from the regulatory authorities in the field.





The investment program of SNN for 2019 annexed to BVC was value-sized by considering the ongoing contractual commitments, the estimates regarding the investment objectives to be made in the following year, including amounts allocated to investment projects for which the fulfillment of certain requirements outside the control of SNN is anticipated (e.g. prior approvals of regulatory authorities, legal terms regarding the completion of public tender procedures, including appeals, obtaining the necessary approvals from SNN corporate bodies, etc.), in order to allow the implementation of these projects by fitting into the approved budget values.



The largest investment programs planned to be finalized in 2019 were: acquisition of horizontal and vertical flow detector extraction equipment of the Hesir type, replacing the control part of an excitation system at Unit 2, modules DICA 10 and 11, as well as stage 1 of the modernization and extension of the Physical Protection System. In addition, the investment program included inspections and capital repairs carried out at Unit 2 during the planned shutdown, other investment projects required within NPP, NFF and the headquarters, as well as investment objectives with completion in the next years.

In 2019 we completed the investments for "Equipment for extracting HESIR horizontal and vertical flow detectors", "DICA - Module 10" and "replacing the control section of the excitation system 2-41280-PL 1615 at Unit 2".

Out of the investment projects provided in the investment program we mention:

- "Planned outage of Unit 2 CNE Cernavoda (regular general inspections and capital repairs".
- "Burnt fuel intermediary storage".
- "Modernization and expansion of the physical security system".
- "Improving the CNE Cernavoda response, respectively the nuclear security functions in case of events outside the design bases following the nuclear accident occurred at the Fukushima 1 nuclear plant, Japan".
- "Extending the life cycle of unit 1 by re-tubing the reactor and refurbishing the main systems (studies)".
- "Fittings", representing procurements of goods and other investment expenses: budgeted at RON70,999 thousand - the value degree of implementation as of December 31, 2019 is 75%.

# Refurbishing Unit 1 of Cernavoda NPP

1. The main objectives of Phase 1 of the Refurbishment Project

**2.1. Phase 1.a. Extension of the life cycle of Unit 1 reactor with current components (PLEX)** Elaboration of the documentation required for the extension the life cycle of the current components of Unit 1 reactor over the 210,000 operating hours, up to approximately 245,000 operating hours at nominal power (EFPH). As part of this process, a series of nuclear safety studies and analyzes shall be carried out, as well as tests on the current components, nuclear fuel channels (distances, pressure tube etc.), calandria tubes and feeders, in order to demonstrate the capacity of Unit 1 to operate over 210,000 EFPH.

**2.2. Phase 1.b. Establishing the purpose of the works of the Refurbishment Project** Assessment of the technical condition of the structures, systems and components (SSC) of Unit 1 (Condition Assessment - CA) represents the basis for the determination of the volume of works to be carried out during the outage for refurbishment of Unit 1, besides the mandatory ones referred to above. Furthermore, this assessment will be used, together with other information, in the Feasibility Study to determine the total costs of the Refurbishment Project. CA represents a complex activity, with a duration of approximately 1.5 - 2 years, in which both specialists of SNN and international experts with vast experience in the assessment of the SSC condition of CANDU reactors will be involved. Elaboration and completion of the Feasibility Study and its submission to the shareholders for approval.

Out of the investment projects provided in the investment program we mention:

- "Extending the life cycle of unit 1 by re-tubing the reactor and refurbishing the mainsystems (studies)": budget 3,665 thousand RON - the accomplishment degree value-wise as of December 31, 2019 is of 17%. In 2019 the following procedures were completed: the purchase procedure on assessing the state of the structures of systems and components of Unit 1 (Condition Assessment), and the contract was signed with the association between CANDU Energy and Ansaldo Nucleare on October 18, 2019, and the purchase procedure for "Integrated engineering services in relation to extending the lifecycle up to 245,000 EFPH", and the contract was signed with CANDU Energy Inc. The contest for solutions on implementing the technical solution for replacing fuel channels, calandria tubes and feeders (ICCTCF) was completed, and the winner of the contest was Candu Energy. Also, at the end of 2019, the procurement procedure for "Engineering services for drafting a preliminary technical study and a Feasibility Study on Managing Radioactive Waste generated during the refurbishment of Unit 1, and during the operation of the two units after refurbishing Unit 1" was in the final granting stage, and the contract will be signed in 2020.



# Tritium removal installation

The tritium removal installation of Cernavoda NPP is part of the continuous preoccupations of Cernavoda NPP for improving the environment performance and shall allow the extraction of tritium which is formed in the heavy water following the operation process, in the CANDU technology. The removal of the tritium from the heavy water and from the primary circuit shall allow the reduction of the costs by ensuring the radiation protection of the personnel involved in the refurbishment of Unit 1, and the improvement of the access conditions, which shall obtain a reduction of the stoppage by approximately 40-50 days, with a direct impact on the economic efficiency of the refurbishment project. Project developed by SNN based on Romanian technology provided by ICSI Rm. Valcea at a cost of EUR 190 million.

The benefits of this investment are complex, beyond the major project of the refurbishment: reduction of the decommissioning-related expenses; reduction of the operational costs by significantly reducing the need for radiation protection materials; reduction of the waste management costs resulting from the normal operation of the units; reduction of the duration of planned stops; reduction of waste management costs resulting from the refurbishment; reduction of the refurbishment costs by significantly reducing the need for the necessary radiation protection equipment during the refurbishment stoppage.

Approval of the updated Feasibility Study (rev. 11) and obtaining all the approvals necessary for the implementation of the project (CA, EGMS), - April 2018, and August 2018 respectively.

## Future activities

- Preparation of the procurement and execution contracting documentation (EPC), according to the implementation strategies - November 2020
- Preparation of the Preliminary Security Report and issue of the building permit - April 2022
- Performance of the construction-assembly works - April 2022 - September 2024
- Preparation of Final Security Report and issue of commissioning authorization - June 2024
- Plant commissioning tests - June 2024 - May 2025
- Plant trial operation - May 2025 - November 2025
- Review of Final Security Report and issue of operating permit - November 2025
- CTRF Transfer to Operation - December 2025

The Tritium Removal Installation project, relevant for the refurbishment of Unit 1, and multiple operational and cost advantages, was also a priority in 2019, and its goal was to complete it prior to the planned stoppage of Unit 1 for refurbishment.

# Project for Units 3 and 4 Cernavoda NPP

The main benchmarks for continuing the Project of Units 3 and 4 Cernavoda CNE in 2019 are the following:

□ Over the period January 21st - 23rd, 2019, a meeting of the mixed work group Romania - China took place regarding IGA, and the following actions were identified:

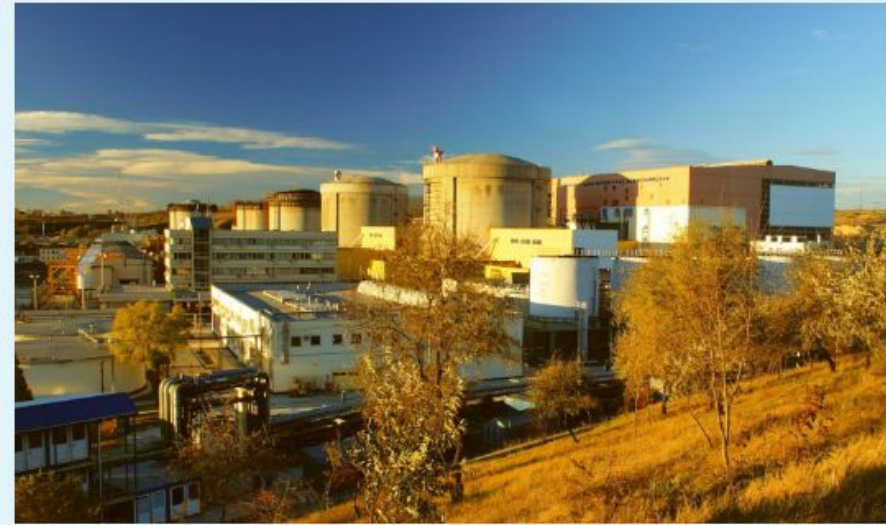
(1) the JVCO establishment as soon as possible to support the implementation of CfD in Romania, ongoing process;

(2) the Romanian party to finalize the preparatory technical measures in view of submitting to the Romanian Parliament and to the European Commission the legislative amendments and updates associated with the adoption of the CfD mechanism;

(3) SNN and CGN to resume negotiations on the Investors Agreement ("IA") in preliminary form.

□ In meeting of February 4, 2019, the SNN Board of Directors approved the revised mandate of the SNN Negotiating Committee to negotiate the IA and the Articles of Incorporation ("AI") in preliminary form to allow the establishment of JVCo by initial minimal cash contribution, calibrated to the development needs of the Project.

□ Resolution no. 4/10.04.2019 of the Extraordinary General Assembly of Shareholders approved the Preliminary Investors' Agreement regarding Units 3 and 4 of NPP Cernavoda between China General Nuclear Power Corporation and CGN Central and Eastern Europe Investment (RO) COSA. and S.N. Nuclearelectrica S.A.



□ On May 8th, 2019, SN Nuclearelectrica SA and China General Nuclear Power Corporation and CGN Central and Eastern Europe Investment signed the Preliminary Form of the Investors Agreement regarding the continuation of the Units 3 and 4 Cernavoda NPP Project.

□ Resolution no. 9/July 29th, 2019 of the Extraordinary General Assembly of Shareholders approved the endorsement of the SNN Board of Directors to approve the modification of the deadlines / due dates provided in the preliminary form of the Investors' Agreement related to the Project for Units 3 and 4 of CNE Cernavoda.

□ At the end of 2019, CANDU Energy Inc. (the authority that designed the NPP of Cernavoda) drafted a report for assessing the manner in which the Project for Units 3 and 4 of NPP Cernavoda complies with the requirements of Nuclear Security Directive 87/2014/EURATOM. The assessment report concludes that the Project, with some additional improvements and in-depth analyses recommended by Candu Energy Inc., is capable of complying with the requirements of the Nuclear Security Directive.

## VII. NUCLEAR SECURITY

Permanent maintenance of a nuclear security level in all phases of performance and exploitation of the nuclear objectives and installations is of vital importance and represents the first priority for SNN.

SNN developed a nuclear safety policy that was approved by CNCAN, with the purpose of maintaining a high and constant level of nuclear safety in all the phases of the commissioning and operation of nuclear installations. The nuclear safety policy ensures performance warranties for all the significant activities regarding nuclear safety, in all the phases of installation and operation of nuclear facilities. This document confirms the fact that nuclear safety has the maximum priority.

The high level of nuclear safety is ensured by the design, construction and operation of the nuclear installations. The risk generated by the nuclear fuel in the reactors is minim for the population and the environment, due to the fact that:

- (i) The power of the reactor is under control;
- (ii) The fuel is cooled;
- (iii) The radiation is contained, all these taking place on a continuous base.

Up to present, no CANDU type NPP recorded events or accidents that pose a threat to the health and security of the population. Among such measures, we mention the emergency preparedness, required by the national law as a pre-requisite for licensing the operation of a nuclear power plant. Within the CNE Cernavoda, the emergency preparedness is verified and improved through quarterly, annual or general drills and exercises (once every three- four years).

After the Fukushima accident, the European Commission and the Group of European Regulators of the SNN decided that the nuclear security of nuclear plants in Europe shall be reviewed based on transparent and extended risk evaluations, called „Stress tests“. The technical purpose of these stress tests was defined considering the risks pointed out by the events occurred at Fukushima. The following issued were stressed: initiation events, such as earthquakes or floods, the consequences of losing the security functions during such events, as well as management difficulties of severe accidents.



CNE Cernavoda, together with AECL Canada and ANSALDO Italia, issued „The reevaluation report of nuclear security limits“. The evaluation performed proves the fact that Units 1 and 2 from CNE Cernavoda comply with the nuclear security requirements established by the project and that they can face severe earthquakes and floods, as well as the total loss of electrical energy and coolingwater supply. Moreover, methods and procedures were planned for managing possible severe accidents.

Also, were identified methods for preventing and limiting the consequences of accidents which may determine the melting of the active area. In order to provide a good coordination with the competent Local Public Authorities regarding the response in emergency situations, CNE Cernavoda created two important facilities for Cernavoda and namely: Local Center for emergency Situations of the Cernavoda City Hall and Personnel Decontamination Area, within the Town Hospital from Cernavoda.



# Decommissioning

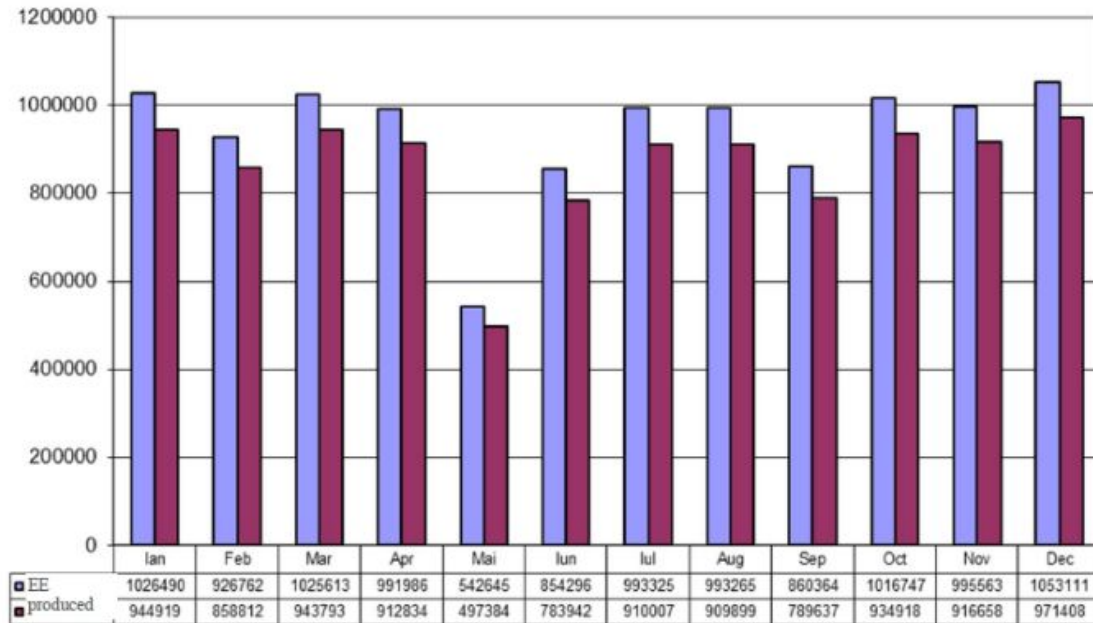
In accordance with Government Decision no. 1080/2007, and Radioactive Waste Nuclear Agency("ANDR") is responsible for collecting and managing the contributions made by the SNN for the dismantling of the two units and for disposal of radioactive waste generated in the operation and decommissioning of units.

In 2008 - 2019, SNN paid on an annual basis the following contributions to ANDR:

- (a) Contributions for the decommissioning of each nuclear reactor in amount of 0.6 EUR/MWh of produced and delivered electricity in SEN;
- (b) Contributions for the final storage of radioactive waste, in amount of 1.4 EUR/MWh of produced and delivered electricity in SEN.

## VIII. SNN IN FIGURES AND INDICATORS

Produced/net electrical energy U1 + U2 (MWh)



Total 2019

E produced

11,280,167

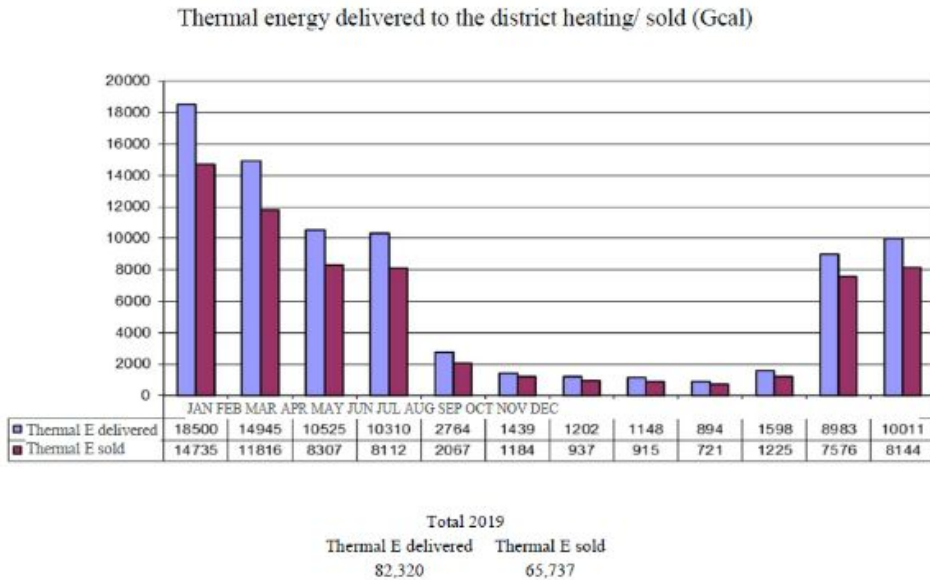
Net E

10,368,211

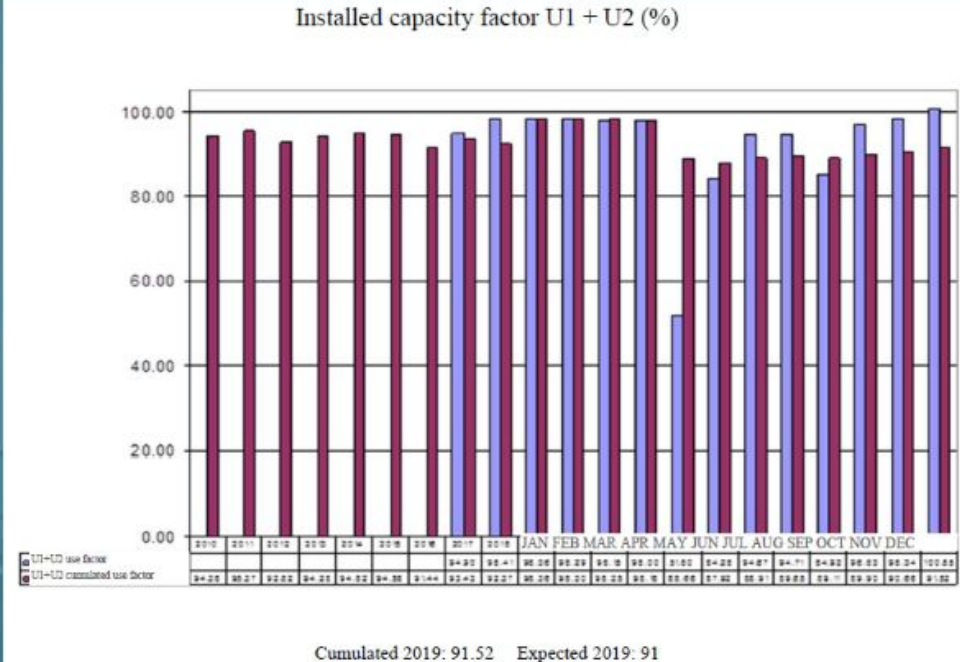
Own technological consumption of electricity

Accomplished cumulatively in 2019: 8.08% Provided in the project: max. 10.00%

## Thermal energy delivered to the district heating/ sold (Gcal)

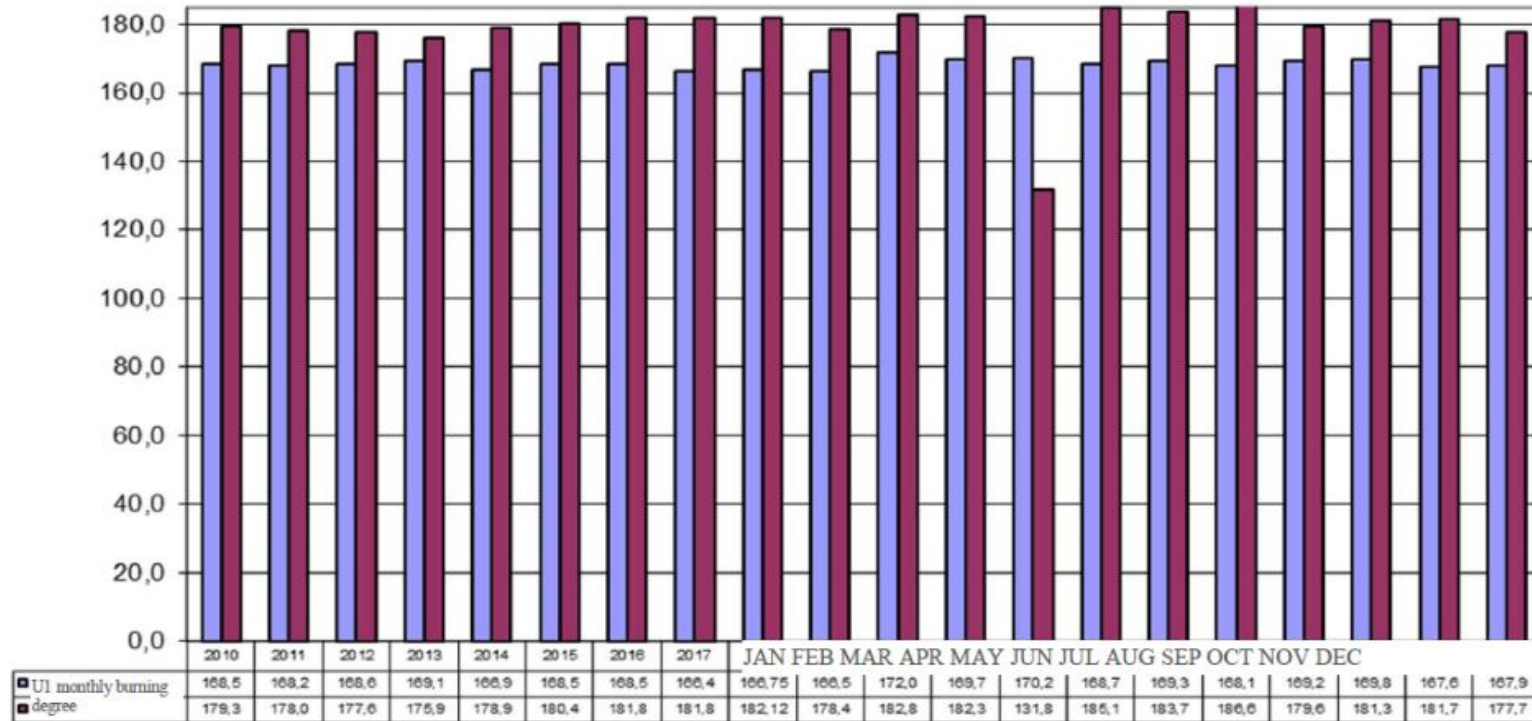


## Installed capacity factor U1 + U2 (%)



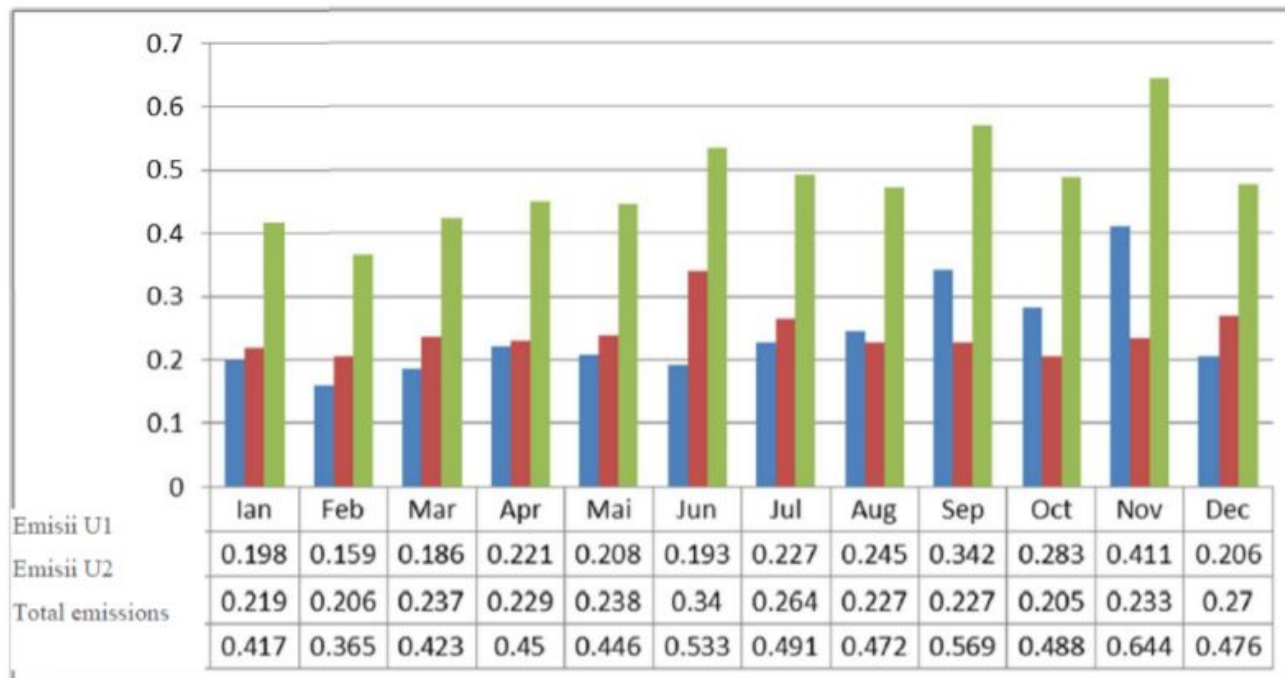


## Nuclear fuel burn up degree (MWh/KgU)



## Volume of radioactive emissions in the environment U1+U2

Radioactive emissions in the environment U1 + U2 in 2019 (microSv)



## IX. CORPORATE SOCIAL RESPONSIBILITY AND SPONSORSHIPS

Nuclearelectrica has launched the campaign “We grow with you!”, a campaign of involvement in the local community of Constanta county, dedicated to improving education and living conditions, as well as access to quality medical services. The actions of involvement in the local community target 3 major development areas derived from the actual needs of various social categories:

- Equipping the Physics and Chemistry laboratories of 11 educational institutions in Constanta county (Cernavoda, Fetesti, Medgidia, Constanta) with modern equipment, laboratory kits, digital educational systems to facilitate the acquisition of practical knowledge in an attractive environment. The total value of the program of outfitting the schools is approximately 3 million lei.
- Equipping the Cernavoda City Hospital with modern medical equipment necessary for the provision of quality medical services for the inhabitants of the town of Cernavoda: mammogram machine, vital signs monitors, electro-cardiogram machines, defibrillators, etc. The value of the project is 995,000 lei.
- The furnishing of playgrounds, relaxation spaces, the modernization of the streets in the town of Cernavoda in partnership with the town's City Hall for the purpose of creating a safe, clean and friendly environment for the inhabitants of the city and their children. The value of these projects is 851,868 lei.

The actions launched by Nuclearelectrica have as purpose a real contribution to improving access to education and medical treatment, and life in a clean and secure environment. As a result of the implementation of the endowment campaign for educational institutions, approximately 8,000 students and teachers per year will benefit from modern laboratories, equipped with the latest generation of educational materials, supplemented by digital equipment and computer technology. The Cernavoda City Hospital provides medical services for approximately 40,000 inhabitants of the town of Cernavoda and the neighboring rural areas, inhabitants who will benefit from better services and treatment. The modernized playgrounds, relaxation spaces, and streets will be beneficial to the ~20,000 inhabitants of the city.



“We need long term sustainable development and this can only be achieved through direct involvement, with all our strength, in the fields that matter. In today's complex environment, we must understand that a company's resilience depends on the existence of vital resources in the environment, whether highly qualified labor force, economic development, and social welfare. Responsibility is a watchword of Nuclearelectrica's activity, at all levels of operation, from the production of nuclear energy to the beneficial impact on the environment. Through the campaign “We grow with you!” for equipping schools, the hospital and the green spaces in the local community, we wish to bring a lasting contribution to the creation of better conditions for the people. The SNN campaigns shall extend to other areas of the country and shall target fields such as education, medicine, the development of young talents and the protection of the disadvantaged” - Cosmin Ghita, Chief Executive Officer of Nuclearelectrica.



**45** campaigns initiated

**17** completed projects

**28** under implementation

**10.856.000** RON allocated budget

**10** projects in the medical sector

**6** projects in the cultural sector

**8** projects in the educational sector, of which one project includes 11 educational institutions in the Constanta and Ialomita Counties

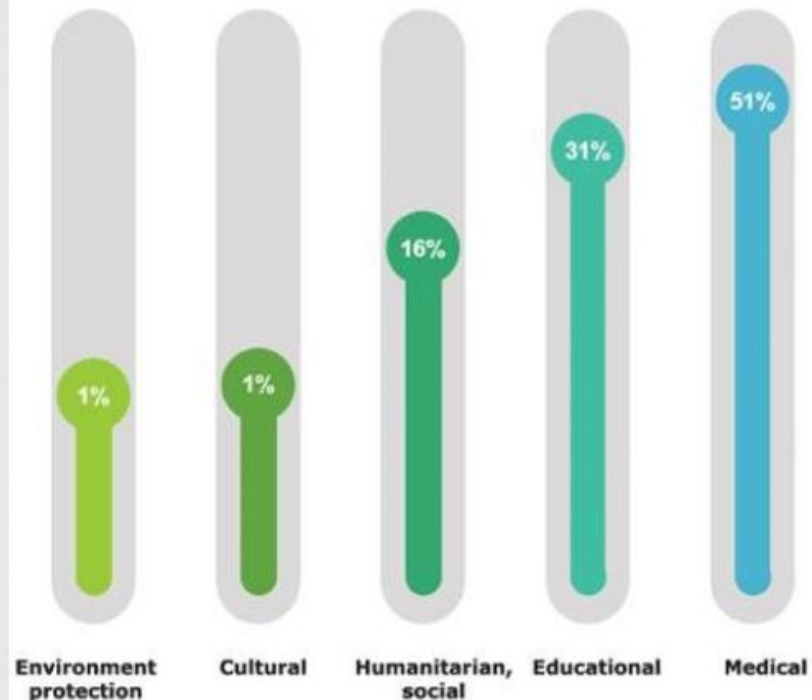
**11** projects in the humanitarian sector

**1** project in the sector of environmental protection

**Over 2.000.000**

romanian beneficiaries of the CSR program and sponsorships from SNN

## The distribution of the amounts spent in 2019 on the framework of the CSR and sponsorship program



## X. INTERNATIONAL RELATIONS

The nuclear industry is especially through the fact that inside it, there is a continuous flow of experience and information exchange. Each operator of Nuclear Plants is part of an international network of approximately 440 Nuclear Units globally. At international level, the leader in international cooperation, in the nuclear field, is the World Association of Nuclear Operators ("WANO"), and at the government level, the International Agency for Atomic Energy from Vienna ("IAEA"). The purpose for the development of this international cooperation network is the analysis of different event categories and the dissemination of lessons learned in order to eliminate recurrence, promoting experiences and optimum practices adopted and implemented internationally, benchmarking and evaluation of implementing standards at international level, control and monitoring of performance indicators and updating them to keep a constant high level of nuclear security, organizing inter- pares evaluation missions for ensuring the adherence and for each operator of Nuclear plants to adopt the best practices at international level and evaluated through de facto performance. Therefore, at the nuclear industry level, it is created what is called the "inter-pares pressure", element which determines keeping certain high security nuclear standards. In general, the international cooperation programs, mainly in the technical operating area, are divided in four distinctive categories: international evaluation missions, experience in operation, technical support and, implicitly, exchange of information and experience, continuous technical and professional development. All information categories and data resulted following the development of these programs are disseminated to all members, within the international system.

SNN pays particular attention to safe operation of nuclear facilities which it operates, to equipment reliability, increased performance in operation, exchange of experience, with direct results on employee performance, involvement in building political support and development programs related to integrated development of the company. Therefore, according to the practice at international level, SNN is an active member in a series of international organisms, with different areas of applicability, from nuclear security, radioprotection, management of radioactive waste up to procurement, financial benchmarking, international law. Depending on their specificity, these organizations can have a regulation and inspection nature for its members in order to improve their performance (e.g. World Association of Nuclear Operators - WANO) or consultative, participatory and inter-sharing of knowledge character, participation in joint projects as an effective mechanism to reduce research and purchase equipment costs.



SNN is affiliated with a number of organizations both at European and international level in order to benefit from the operational experience available in their participation in decision-making processes that may affect European policy and global alignment of nuclear safety standards imposed by CNCAN, recognition of results, among which we mention:

- **World Association of Nuclear Operators (WANO):** represents the association of all owners of Nuclear Power Plants in the world, founded in 1989. SNN has been a member of Atlanta Regional Center since 1991. In 2011 it became a member of London Coordination Centre. WANO membership guarantees: participation in assessment missions, exchange of experience in operating, technical support, technical and professional development. The WANO membership facilitates the information exchange in the field of exploitation experience of Nuclear Plants, therefore WANO members working together for reaching the highest standards in the field of Nuclear Plants exploitation under high nuclear and reliability security standards. Through WANO, all Nuclear Plant holders may communicate and exchange information between them, openly and cooperatively. This working method allows each WANO member to benefit and learn from the experience of other members, to get in line with the best practices global practices in the field, all with the final purpose of increasing the security degree in exploiting the Nuclear Plants they own.
- **Candu Owners Group (COG):** represents a private international non-profit organization, which includes organizations from Canada (AECL, Ontario Power Generation, NB Power, Bruce Power Generation, Hydro Quebec), Argentina, China, India, Korea, Pakistan and Romania. Within COG, SNN participates in the basic program Information Exchange (IE), Research and Development Program (R&D), Nuclear and Environment Safety Program (Nuclear Safety & Environmental Affairs NSEA), Joint Projects Program (Joint Projects - JP). The COG activity is generally focused on a regulation, research, maintenance, development, technical assistance and information exchange program between its members.
- **The International Agency for Atomic Energy (IAEA):** serves as inter-government world forum for the scientific and technical cooperation in the nuclear field. IAEA encourages the use of atomic energy by the signatory states, offering them the necessary technical assistance and providing them experts in the field, respectively the necessary logistic base. Romania is a founding member of IAEA.

NEA OECD: Romania has joined the Nuclear Energy Agency (NEA) within the Organization for Economic Cooperation and Development (OECD) in June 2017. NEA represents the intergovernmental agency that facilitates the cooperation between the countries that use nuclear technology and aim to achieve the highest standard of nuclear safety, corroborated with the performance in environment protection, technological and economic development.

European Nuclear Installations Standards (ENISS): brings together policy makers and specialists in the nuclear industry, along with representatives from nuclear regulatory bodies to establish together security targets, regulations and security measures that will ultimately become a common set of European safety standards for the nuclear installations.

The European Atomic Forum (affiliation to the Romanian Atomic Forum): represents a non-profit European organization with the following purposes: supporting the role of the nuclear energy at a European level by active involvement in the energetic policy of the European Union, adopting support positions for member states operating Nuclear Plants and involving specialists in the work groups at European level in order to centralize different points of view and measures. The results of active attendance within different international organisms is directly reflected in the performance indicators associated to the fields: operation, radioprotection and radioactive waste management.

The nuclear industry, both at European and international level, is dedicated to contribute to overcoming the difficulties that Europe is experiencing. That is: To provide the required volume of nuclear capacity on time and at a competitive cost, in compliance with the latest estimates related to the share of nuclear energy in the energy combination with low carbon emissions. To perform research, development and innovation activities in Europe, in order to identify areas where the nuclear industry may contribute to the decarbonization of other areas, such as industry, heating and transports. To contribute to ensuring energy security: by implementing appropriate nuclear fuel policies in line with Euratom requirements, joining its forces (where relevant) to develop new leadership and partnership agreements in the EU and global distribution networks and also encouraging cooperation with energy regulators in order to further optimize the contribution of nuclear power plants to the stability of the EU's electricity grid.

To continue to set the standard for safety in the energy field, to continue to manage used nuclear fuel and radioactive waste in a responsible manner and invest in research in order to identify additional solutions for such waste. These include technologies to reduce the volume and toxicity of such residues, to reuse spent fuel or generated residues, to reduce radioactive life and ultimately to eliminate any residual waste. To invest in and maintain human capital. SNN is actively involved, by means of its specialists, at international level in everything that means information exchange, technological innovation, good practices, research and development. Hence the non-binding MOU with Nuscale for the exchange of information in the development of small modular reactors, the involvement of personnel in global organizations dedicated to nuclear energy in different working groups.

This context has also opened the way for Romania's accession to the CEM and implicitly our support for NICE Future, a global initiative to position nuclear energy as an important solution in decarbonization. We also have the same involvement within the European Atomic Forum. Recently, within the European nuclear industry, a Manifesto was signed on the role, the actual, concrete potential of nuclear energy at EU level in the medium and long term.

Another recent international cooperation from July is the conclusion of a MoU with Nordion Canada, the largest global supplier of Cobalt 60. This MoU is non-binding and intends to assess the potential of producing Cobalt 60 in the reactors from Cernavoda NPP. This isotope is produced in nuclear reactors from Cobalt 59. Currently, there are 22 reactors producing Cobalt 60 worldwide, of which 10 CANDU, in Canada, Argentina and China. The production technology of Co 60 was developed by Nordion and AECL Canada.

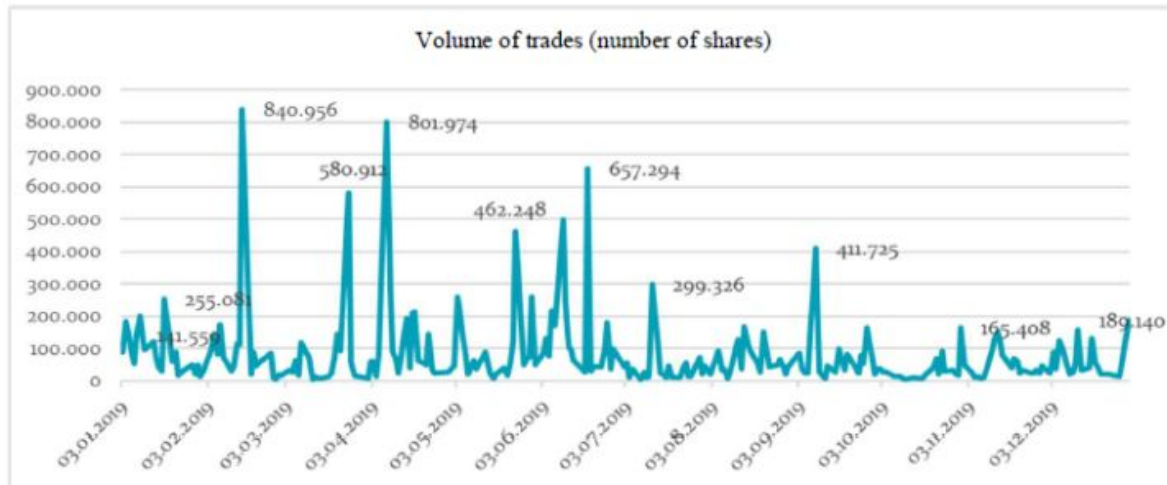
Exploring the possibility of producing this isotope at Cernavoda is a great step forward for the Romanian nuclear industry, in order to leverage yet another of the beneficial effects of the operation of nuclear plants, in this case for the medical system. We would like to become part of the international Co 60 community because we understand the importance for health that this isotope has. Furthermore, it represents a diversification for SNN and implicitly yet another source of income.

The decision, made following the technical studies and analyses, for the production of Cobalt 60 will in no way affect nuclear safety and production. Its collection will be done during the planned outages.

Any international cooperation comes with clear advantages for the company, different environments, energy system, employees. Islandisation and self-sufficiency are completely counterproductive.

# XI. ACTIVITY OF SNN AT BSE

Evolution of SNN shares in December 1 - 31, 2019:



The activity performed by SNN in 2019, as an issuer of securities on the capital market in Romania, is as follows:

- In 2019, a total of 28,740 transactions with SNN shares took place, with a daily average number of 115.42 transactions;
- The total volume of SNN traded shares was 19,428,075 shares;
- The value of transactions with SNN shares in 2019 was 214,150,886.88 lei;
- In 2019, two "Deals" transactions were performed, 90,000 shares in total;
- The price of one share in 2019 was between a maximum value of 14.66 lei and a minimum value of 7.6 lei, an increase compared to the values registered in 2018, when the maximum value was 9.89 lei and the minimum value was 7 lei;
- The stock capitalization on the last trading day of 2019 was 4,299,687.51 lei, an increase compared to 2,460,353,024 lei, at the end of 2018.

## XII. DIVIDEND POLICY

SNN is a national company with a majority state capital. Thus, the allocation of the net profit complies with the provisions of Government Ordinance no. 64/2001 ("GO 64/2001") regarding the profit distribution in national entities, national companies and companies with total or majority state capital, and autonomous administrations, as further amended and supplemented. Thus, according to the provisions of GO no. 64/2001, the minimum dividend distribution share is 50% of the net profit remained after the distributions provided under art. 1 par. (1) let. a)-e) from O.G. no. 64/2001. The legislative framework could be amended in the future by amending the legislation in force, so that the minimum dividend distribution share would be changed.

The provisions of GO 64/2001 establish a minimum mandatory dividend distribution share. Thus, as long as the provisions of GO 64/2001 remain unchanged, the Company may propose to the shareholders a dividend distribution share between 50% and 100% of the distributable profit. The profit share to be distributed annually by the Company in the form of dividends is subject to approval within the General Meeting of Shareholders. Thus, SNN registers and pays dividends distributed from the net profit, only after the approval of the annual financial statements by the General Meeting of Shareholders and the profit distribution proposal.



The due dividends and payments, respectively, during the last 3 years were as follows:

Indicator [lei]	2019 <sup>1)</sup>	2018	2017
Retreated net profit <sup>2)</sup> (a)	-	-	306,542,912
Effect of correcting accounting errors (b)	-	-	(2,666,644)
<b>Net profit (c) = (a) + (b)</b>	<b>535,667,264</b>	<b>410,611,215</b>	<b>303,876,268</b>
Distribution to the legal reserve (d)	(31,563,785)	(28,631,164)	(17,845,334)
Other reserves representing tax facilities stipulated by law (e)	(5,682,083)	(3,065,741)	(7,721,372)
<b>Net profit distributable to the dividend (f) = (c) + (d) + (e)</b>	<b>498,421,396</b>	<b>378,914,310</b>	<b>278,309,562</b>
Employees' participation in the profit (g)	(18,700,000)	(16,000,000)	(13,265,000)
<b>Net profit calculation base, dividend distribution (h) = (f) - (g)</b>	<b>517,121,396</b>	<b>394,914,310</b>	<b>291,574,562</b>
<b>Proposed dividends (i)</b>	<b>498,421,396</b>	<b>378,914,310</b>	<b>271,362,466</b>
Allocated dividends	498,421,396	378,914,310	271,362,466
Additionally distributed dividends <sup>3)</sup>	-	-	485,437,300
Dividends paid until 31.12.2019	-	378,696,423	756,418,732
<b>Profit distribution rate (%) = (i)/(h)</b>	<b>96.38%</b>	<b>95.95%</b>	<b>93.07%</b>
<b>Profit distribution rate ^2 (%) = (i)/(f)</b>	<b>100.00%</b>	<b>100.00%</b>	<b>97.50%</b>



# XIII. ROLE OF NUCLEAR ENERGY IN THE DECARBONIZATION PARADIGM

2019 was characterized by increasing concerns regarding climate change and focusing on decarbonization targets and long-term energy policies that configures the role of nuclear energy, globally, regionally and nationally. At global level, interest in nuclear power remained mostly stable, especially in developing countries. Approximately 10% of the world's electricity is generated by the 440 nuclear reactors, with nuclear power being the second source of low-carbon electricity. In addition, more than 50 countries use nuclear energy in approximately 225 research reactors, which are also used for the production of medical and industrial isotopes as well as for training. There is a clear need for new nuclear capacities all over the world, in order to replace old power stations that use fossil fuels, especially coal, and which produce significant emissions of carbon dioxide, and in order to satisfy the high demand of electricity, especially in emerging states. Currently, approximately two thirds of the electricity of the world comes from burning fossil fuels. Until 2050, if the climate change objectives are achieved, 80% or more of electricity will have to be produced with low-carbon emissions. Nuclear energy is already reducing carbon dioxide emissions by approximately two gigatons a year, the equivalent of removing the emissions of over 400 million cars. A decrease in the production of energy from nuclear sources would seriously threaten the energy security and the achievement of environment targets and would inevitably lead to the release of billion of tons of carbon dioxide into the atmosphere, resulted from the replacement of nuclear energy with other generation sources, according to the International Energy Agency.

28 countries are considering introducing nuclear energy. Two of them - Belarus and the United Arab Emirates - are close to operating their first nuclear power stations, while Bangladesh and Turkey have started building their first nuclear power plants. These states need electricity for their economic growth, and this energy must be clean, in order to achieve the climate objectives. One of the best options at their disposal is nuclear energy, thus contributing to the global objective of decarbonizing the energy sector.

Extending access to energy and, at the same time, drastically reducing greenhouse gas emissions that cause global warming and climate change are among the central challenges of mankind in the 21st century. Nuclear power is a major part of the solution to produce carbon-free energy in many parts of the world, such as the United States, the European Union, South Korea, making an important contribution to reducing greenhouse gas emissions, while providing increasing quantities of electricity necessary to develop the global economy. Increased demand for electricity is particularly rapid in emerging countries, especially in Africa, where demand will increase by 100%- 450% until 2050. While today most people without access to electricity live in rural areas, most of the population growth by 2030 will take place in cities. Achieving the goal of securing access to electricity for an additional 1.3 billion people globally by 2030 will require a combination of less polluting power generation solutions. In this scenario, nuclear power will be part of the solution, due to the advantages it holds, such as stability in national systems, clean energy, baseload production. The contribution of nuclear energy to avoiding short-term CO2 emissions will be achieved by nuclear power plants in operation, under construction and in preparation.

At European Union level, in order to achieve the goal of decarbonising the economy by 2050, a quarter of the electricity produced in the European Union needs to be from nuclear sources. In the European Union, nuclear energy ensures 26% of the primary energy sources and represents more than half of the energy with low carbon dioxide emissions that is produced. Currently, half of the nuclear electricity of the European union is produced in a single country - France, while 53 nuclear units that operate in three countries outside the European Union (Russia, Ukraine and Switzerland) represent approximately 17% of the electricity from the rest of Europe. The nuclear industry in the member states ensures 1.1 million jobs and generates a turnover of 102 billion euros a year. The most recent manifesto adopted by the European Group of Leaders from the Nuclear Industry, which S.N. Nuclearelectrica S.A. is a part of, signed in Bucharest on June 26, 2019, provides the longterm support of nuclear projects that directly involve initiatives of cooperation and alignment of interests between the industry and authorities. Regarding the prospects of nuclear energy in Central and Eastern Europe with the target of 2050, Romania supports the idea of a balanced and efficient energy mix in which nuclear power has a significant share and an important contribution to achieving the decarbonisation targets and the strategic objectives assumed by Romania. SNN, through the strategies and measures it has adopted, will continue to play an essential role in ensuring the stability and security of the energy system, both through its current capabilities and in the long run, through its major investment projects.

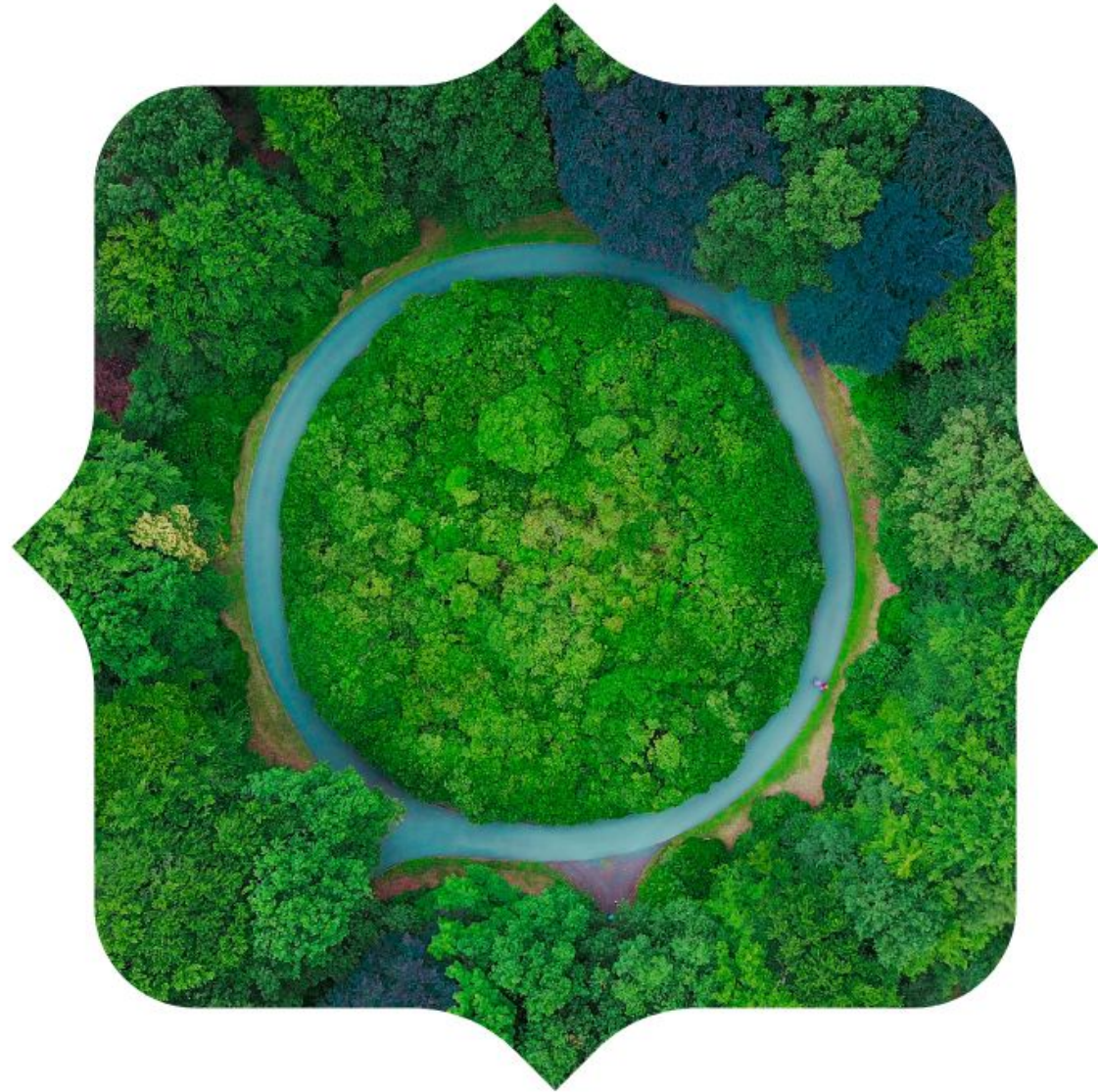
If we look at the forecasts of growth for the contribution of nuclear energy in the member states of the European Union, corroborated with the achievement of the decarbonization objectives for 2050, we notice a clear trend of invigorating the nuclear industry or of launching it in states that have primarily focused on fossil fuels: Bulgaria 36%, Poland 28%, the Czech Republic 54%, Hungary 58%, Slovakia 59%, Lithuania 53%, Slovenia 43%, Romania 27% (with the reactors of Units 3 and 4 operational).

In other regions in the world, especially those with an oil tradition, such as the MENA states, there are massive investments in the development of nuclear industry in order to meet demand and diversify medium- and long-term sources. The numbers are: 15.5 GW nuclear plants under construction, 37 GW planned, 67 billion dollars in contracts already concluded in the region.



Romania acknowledges the contribution of nuclear energy, the base production source, to the decarbonization of the energy system and promotes nuclear energy as a clean primary source of energy production. An important step in this direction is promoting innovation and new nuclear technologies, including the partnership with renewable energy, in order to facilitate the transition to an economy with low carbon emissions, nuclear energy being acknowledged as a “green”, nonpolluting, stable and safe source. On national level, by the energy strategy for 2050, the development of new nuclear capabilities is provided as an essential component of maintaining medium- and longterm energy independence and ensuring the achievement of the decarbonization targets.

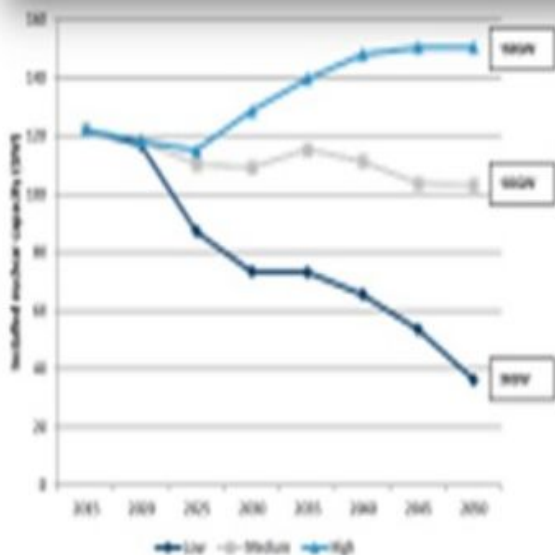
Nuclear energy on global and European level is shaping up as a firm and reliable option for ensuring the current and future energy necessities, and is supported both by governments and by the people (in Romania, for example, the acceptance degree for new nuclear projects is over 65%), a continuously evolving industry, with innovative projects and proven performance. Romania is within this European development, by the firm commitment of the nuclear program and the role of regional hub of research and innovation.



# FTI CL Study, Nov. 2018 (commissioned by FORATOM)

## Pathways to 2050: role of nuclear in a low-carbon Europe

Final report



### 3 nuclear scenarios:

1. **High** – 150 GW, share ~25% (maintaining the current one)
2. **Medium** – 103 GW, share ~15% (in line with the EC strategy)
3. **Low** – 36 GW, share ~4%

The study assesses the impact of each scenario on the key dimensions of Europe's energy policy:

1. security of supply
2. sustainability
3. economics



# FTI CL Study

## Benefits of having a 25% nuclear share in 2050

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### Sustainability

- ✓ Allowing the EU to meet its **climate goals**
- ✓ **700 million t.** of CO<sub>2</sub> avoided per year (it emits **30x** less CO<sub>2</sub> than gas, **65x** less than coal, **3x** less than solar)
- ✓ Compliance with **air quality** standards
- ✓ **No need** for vast volumes of land / raw materials

### Energy security

- ✓ **85-90%** capacity factor = a reliable source of electricity
- ✓ **Decreased dependence** on fossil fuels imports
- ✓ **System flexibility** much needed to support the RES developments
- ✓ **Limited reliance** on yet-to-be-proven technologies

### Economy

- ✓ High residual investment value (avoiding reducing the value by **€1 trillion**)
- ✓ Mitigation of the cost impact of the **low-carbon** transition on customer cost by **€350bn**
- ✓ Reducing network & balancing costs by **160bn€**
- ✓ Positive & significant impact on **jobs, GDP, revenues, etc.**

