



NUCLEARELECTRICA

Translation from Romanian

**Approved,
Board of Directors
Chairman**

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NOTE

on approving the initiation of Phase 1 of the Strategy regarding the Refurbishment Project for Unit 1

I. Introduction

Any nuclear unit has a limited lifetime, set by design. For units with CANDU technology, designed life is 210,000 hours of operation at rated power, which at a capacity factor of 80% means a 30 years economic operational life. The main life-limiting components and structures are fuel channels, feeders and nuclear reactor tire.

Cernavodă NPP Unit 1 was put into commercial operation on December 2, 1996. According to the estimates by the moment, because it has been operated at a capacity utilization factor of 90% since its commissioning, which is higher than the designed one (80%), Unit 1 will reach the limit of 210,000 hours of operation at rated power in late 2023, after approximately 26.6 years of operation since its commissioning namely about 3.4 years before reaching the designed lifetime of 30 years provided that the capacity factor is similar to that achieved to date for the remaining period. Operation at a higher capacity factor of about 10 percentage points was made possible by design improvements implemented over time and the judiciously performed operation and maintenance.

Given the major costs involved by the development of new large production units using nuclear technology, refurbishment is an attractive alternative for the owner of a nuclear unit. The main advantage of such option is that at the end of the refurbishment process, the owner will be in possession of a nuclear unit capable to operate within the designed parameters for another cycle of life (25-30 years), the costs representing approximately 40% of those supported for building a similar new unit. Additionally, refurbishing is more advantageous than building a new capacity since the time required for the actual refurbishment work is significantly shorter estimated based on information available at this time, between 24 and 30 months. The process of obtaining agreements, permits and authorizations, including authorization from the regulator in the nuclear field (CNCAN) is less laborious and involve less risk given that the site is already authorized, this phase being a difficult one when it comes to new units to be built on new sites.

A number of owners of CANDU nuclear units have already implemented refurbishment projects: Canada - POINT LEPREAU (with a period of achievement of 55 months, excessively extended due to organizational and commercial matters), Korea - WOLSONG (28 months). Unit 2 at DARLINGTON - Canada and EMBALSE - Argentina began the refurbishment process in 2016 and units at Bruce - Canada are scheduled for refurbishment in 2020.

II. Extension of the number of operation hours for Unit 1

In recent years, due to the fact that several CANDU units are approaching the 210,000 hours limit of rated power operation, the nuclear industry has made a number of researches on the behaviour of fuel channels over time and the aging mechanisms that affect them, in order to extend their lifetime beyond the estimated designed limits, more than 30 years ago. Based on studies in the group of owners of nuclear units using CANDU technology after completion of inspections, tests and measurements of fuel channels, including pressure tubes, regulators have approved extending the life originally designed to 210,000 hours as follows (period 2014 -2016)

- Bruce - Canada, up to 247,000 hours of operation at rated power (+37,000 hours);
- Pickering - Canada, up to 247,000 hours of operation at rated power (+37,000 hours);
- Darlington - Canada, up to 235,000 hours of operation at rated power (+25,000 hours);
- Embalse - Argentina, more than 225,000 operating hours at rated power (+15,000 hours).

Using the recent international experience, as described above, would allow operation of Unit 1 for the entire lifespan established by the project - 30 years, given the that specific studies to be carried out on Unit 1 will conclude that this is possible for Unit 1 provided that CNCAN - the regulator in the nuclear field – agrees with it.

Regular researches and inspections on the over-time behaviour of Unit 1 components and monitoring of degradation mechanisms associated to the "time - limiting" components namely the reactor pressure tubes allowed at the end of 2015 an estimation to be done by Candu Energy: the life expectancy for these components at Cernavodă NPP Unit 1 could reach at least 220,000 – 230,000 operating hours at the rated power.

Extending the number of hours of initial operation of Unit 1 requires, first of all, the carrying out of studies and analyses concluding the number of operation hours at rated power that the unit can reach, in full compliance with the requirements and the rules of nuclear safety.

Such studies and analyses mainly target those components whose lifetime has been estimated at 210 kEFPH (fuel channels), but equally if they are found to work beyond the initial limit, they must confirm that the other components for which there are no explicit limitations but who contributes to the entire nuclear safety paradigm can perform their functions properly for the new duration. At the same time, to the extent that in order to achieve such an extension installation works or measures to assist the extension are required, these must be identified, evaluated, planned and prepared.

A second component of the mentioned work is the actual accomplishment of the works mentioned in the previous paragraph. It is worth mentioning that this approach implies the intensive use of information resulting from life management and preventive maintenance programs, and it is also essential to rebuild time dependent security analyses.

We emphasize that the extension of the unit's operation over the 210,000 hours of operation considered as design hypothesis, does not condition the commencement of re-tubing and refurbishment, except the case where the extension automatically leads to postponing the moment of the actual start of shutdown for re-tubing/refurbishment.

In this context, we mention that a higher operating period has positive effects on the preparation and conduct of the refurbishment works through:

- Extending the period of accumulation by the company of the own funds needed for the project;
- A better preparation of the project and better organization of the works that will take place during the shutdown.

Current estimates indicate that there are all positive premises in order to extend the number of operating hours for Unit 1 over 210,000 hours in order to achieve the operational lifetime of 30 years at rated power.

Thus, on the request for clarification from shareholders on *The results of inspections in 2015 and 2016 leading to the preliminary view that life of Unit 1 Reactor could reach at least 220,000 – 230,000 operating hours at rated power should be detailed and substantiated with documents*, the following clarifications must be done:

A comprehensive program aimed to ensure the proper functioning of equipment and maintenance of the operational life, especially for major plant equipment and components, was implemented within Cernavodă NPP. Thus, within the preventive maintenance programs and the management of life (Plant Life Management – PLiM) ones, specific activities of maintenance, checks and measurements, including periodic inspections of the fuel-channels and the (according to the Canadian Standard CSA N 285.4) are carried out.

Measurements and reports following the regular inspections conducted by SNC Lavalin - Candu Energy, which is the plant designer and owner of CANDU technology, for the main components of nuclear part limiting the lifetime (fuel channels, calandria tubes, feeders, and the reactor building) have highlighted the fact that until now the effect of the degradation mechanisms does not limit the lifetime to the 210,000 hours and that it is possible to operate above this limit. These conclusions are contained in the documents:

- **Fuel Channels Lifetime Assessment and Lifetime Management Plan - document no. 79-31110-LA-001;**
- **Assessment of the lifetime of the reactor building of Unit 1 – document 79-21000-LA-001;**
- **Assessment of the distance between calandria tubes (CT) and stopping system's tubes equipped with Liquid Injection (LIN)¹ - document 79-31100-ASD-011.**

Besides, the **Report on the Assessment of Lifetime of Feeders included in the Primary System for Heat Transport – document no. 79-31100-ASD-011** determines that it is possible to run them over 210,000 hours and in Section 14.2 named the "**Management Plan for the Lifetime in order to allow their extension**" a series of measures to be considered in operation for this purpose are recommended.

We mention that 30 years of operation can be achieved at about 230,000 – 235,000 hours, taking into account a slight gradual decline in capacity factor achieved for the remaining life up to 30 years, due to aging of the unit.

The impact of such an extension is highly positive on SN Nuclearelectrica S.A. (SNN) given the following main considerations:

- It ensures the functioning of Unit 1 for the initially designed duration of 30 years, given that the electricity production is higher than the estimates of the economic model used in the initial (historical) determination of the feasibility of the CANDU project for Romania under conditions of nuclear safety and meeting all environmental requirements.
- Preliminary cost-benefit analyses (which took into account the positive, favourable impact of this extension on the refurbishment of Unit 1) have shown that such an extension extends by about 3 to 4 years, with relatively low costs, the period of accumulation of internal financial

¹ This is one of the ageing phenomena affecting the maintenance in operation, and leading, as a last consequence, to the perforation of calandria tube/tubes which are affected and the immediate shutdown of unit in order to put a remedy.

flows generated by SNN, leading to a significant reduction in the need for bank financing of refurbishment (loans).

A set of measures must be implemented for SNN can demonstrate that Unit 1 can be operated under nuclear safety conditions beyond the 210,000 operating hours at rated power:

- Elaboration by Candu Energy of the nuclear safety report on extending the operating hours at rated power;
- Getting the comfort letter from CNCAN;
- Contracting of some supporting studies, preparation of the authorization documentation, obtaining the authorization from CNCAN for the operation of Unit 1 for more than 210,000 hours of rated power operation.

We mention that the preliminary informative discussions, which experts from SNN and Candu Energy have had with CNCAN, indicate that the regulator has shown openness on steps aimed at operation of Unit 1 beyond the number of hours of operation originally designed at rated power, before re-tubing of the active area, subject to full compliance with the nuclear safety requirements.

In addition to the aforementioned positive aspects, the extension of the number of hours of operation at rated power over the initially estimated 210,000 hours has an important contribution and a positive impact on the refurbishment program, and represents an important milestone in the project of refurbishment of Cernavodă NPP Unit 1, in the sense of obtaining an additional period of about 3 - 4 years available for the careful organization and the thorough preparation of the actual refurbishment works and also to accumulate the financial resources necessary for financing the refurbishment works (own contribution of SNN) SNN and to support the activity during refurbishment, an only unit being operable in that period (Unit 2).

III. The strategy and the plan for the refurbishment of Unit 1

In December 2013, the SNN Extraordinary General Meeting of Shareholders ("EGM") approved by Decision No. 27/23.12.2013 (Appendix 2), the Refurbishment Strategy and Plan for Unit 1 at CNE Cernavodă, in order to extend its lifetime, the first step thereof, respectively, namely employment and development of economic and technical studies and those on nuclear safety, authorization documentation necessary to define the final goal (object) of the project, informatively defined with an estimated budget of about 80 million lei.

According to this strategy, which included as a first step a preliminary list of studies/documentations (this issue being mentioned to the shareholders), completion of goal related to this major investment project for SNN will be carried out in a further phase by developing the Feasibility Study (issue also mentioned to the shareholders).

According to the Decision 27/23.12.2013 made by the Extraordinary General Meeting of Shareholders, since 2014 SNN has begun to implement its Strategy and Plan approved by shareholders, namely the first stage of it, by contracting and completing a series of documentations, totalling approximately 25.7 million lei, on technical evaluations of fuel channels, reactor building, feeders, turbine, electric generator and their additional systems as well as probabilistic assessments for nuclear safety.

In order to respond to the clarifications requested by the shareholders, the situation relating to the implementation of the Refurbishment Strategy and Plan for Unit 1, approved by the General Meeting of Shareholders in December 2013, namely *the degree of fulfilment of the plan of refurbishment, highlighting the causes of delays in preparing the refurbishment project*, is presented below.

1. Extending the life of Unit 1 at Cernavodă NPP by 25 years compared to the designed lifetime (Feasibility Study). The Feasibility Study was postponed until 2021. The reasons for this postponement are set out below.

During the years 2014 and 2015 Cernavodă NPP specialists were informed through the research/development programs as well as the COG discussions on the progress made by the Canadian industry in researching the reactor components performance over the designed lifetime (210,000 EFPH²) by AECL (CANDU reactor designer). This research has been exploited by the operators of the nuclear power plants in Canada by obtaining authorizations to operate beyond the 210,000 EFPH with obvious economic advantages. Besides, it is worth noting that the results of this research were embedded in the 2015 edition of Canadian standard CSA 285.8 governing Fitness for Service³ for reactor pressure tubes.

It is also worth mentioning that in 2015 a group of Cernavodă NPP specialists conducted a benchmarking at Embalse - Argentina plant, which was being prepared for refurbishment and which, before starting this process, extended the operating time of 15,000 EFPH, up to 225,000 EFPH.

This information was considered by the CNE experts who consequently revised the strategy approved in 2013, the main reasons being the following ones:

- a. Extending the lifetime for channel allows the achieving of the calendar lifetime of 30 years, **as it is provided with the depreciation period for nuclear reactors in applicable accounting law**. Thus, one of the important problems for which there were no solutions before, namely that the operational life of the units is less than the 30-year period, becomes solvable, situation in which, at the end of the active period the objective was not fully depreciated.
- b. Extending the lifetime has a clear positive impact on the technical and economic indicators of the objective, allowing for an increase in the economic efficiency of the unit.

For this reason, the document-basis for the Strategy and Plan on Refurbishment was revised in 2015. The document was submitted to the Technical, Economic and Scientific Board of SNN, who approved it in January 2016. It is noted that this Strategy review set two major goals for 2016:

- Initiation of elaboration of a preliminary study on the extension from 210,000 actual hours of operation at rated power effective;
- Initiation of elaboration of a study on the optimal organization of refurbishment project.

The study on the extension will be completed by the end of this year, while the study on the project's organization has been already completed.

It is important to emphasize that unlike the 'traditional' approach, applicable in most investment projects, for the refurbishment of Unit 1 the Feasibility Study stands for a very complex document and it must include all the results of technical studies and analyses in terms of nuclear safety in such a way as to allow defining the best possible project, both technically and financially; in this sense, most of these technical and nuclear safety-related studies and analyses can only be objectively carried out by specialized nuclear engineering firms, often only on specific "segments", which goes beyond the competencies of firms that, usually draw up feasibility studies for investment projects (in other words, specialized inputs from specialized nuclear engineering firms are required for the Feasibility Study, which is why the project approach is divided in two stages/phases and in this context, the drafting of the Feasibility Study at a later stage is an objective necessity); such as a series of LA/CA studies⁴ are still ongoing, relevant data on some of the equipment/structures of systems or components covered being only obtainable during shutdowns of Unit 1, initiation of Feasibility Study before having all input data

² EFPH – Operation hours at rated power

³ Fitness for service – confirmation that the component concerned can successfully perform the function

⁴ LA/CA- Life assessment/condition assessment

available will lead to the elaboration of an incomplete and insufficiently substantiated document and which, for these reasons, will not achieve its purpose and end.

2. Elaboration of "Lifetime Assessment" studies for each type of power transformer at Cernavodă NPP, from U0 and U1, without power exchanging transformers. This activity is ongoing and will be completed this year. The delay in implementing this program is due to the procurement process that lasted longer than estimated (the Agreement was signed in 2015).

3. Life Assessment study for Fuel Channels U1. This activity is carried out based on the information obtained so far from the inspections carried out within the planned stops. It follows that in 2018 the study will be revised as planned.

4. Life Assessment study for Reactor Building U1. This activity is carried out according to the plan (the study was conducted in 2016).

5. Life Assessment study for feeders U1. This activity is carried out according to the plan (the study was conducted in 2015).

6. Life Assessment Evaluation & Life Extension Detailed Planning Document for Cernavodă NPP Unit 1 - Turbine, Generator And Auxiliaries Systems. This activity has been completed.

7. Assessment Services for Life of Heat Exchangers at Cernavodă NPP Unit 1. This activity has been partially conducted:

- Life Assessment Studies for turbine condensers was completely conducted (2013);
- Nuclear heat exchanger studies (NSP HX) have been postponed to 2020 because of technical problems with their inspection. It is worth mentioning that, from the point of view of their operation, these exchangers behave well and no operation problem is likely to occur.

8. Nuclear Safety Analysis Services for updating EPSN Level 1 and conducting EPSN Level 3. This activity has been completed.

9. Update Services for the Final Report on the Nuclear Security at Cernavodă NPP Unit 1. This activity has been completed.

10. Environmental studies necessary to obtain approvals, agreements and environmental permits related to U1 refurbishment. This activity was scheduled to take place between 2014 and 2018. Although the term has not been exceeded yet, there are some delays in achieving these studies due to problems encountered in the procurement process (cancellation of the procurement procedure due to non-compliant bids that have been received).

11. Other supporting documentation for authorization/approval required by the regulatory authorities and unforeseen documentation. In addition to the studies and analyses presented in the Information List in Appendix 3 (positions 1 to 10), the following activities were carried out within the refurbishment training program:

- Specialists from Cernavodă NPP carried out a benchmarking in 2015 at Embalse nuclear plant in Argentina, which was in the final stage of preparing the shutdown for refurbishment;
- A Life Cycle Assessment study was developed for the Process Computers (DCC).

Besides, within the refurbishment training program, studies have been contracted and they are in progress for:

- Condition Assessment for buried pipes;
- Condition Assessment for pipes vibrations;
- Condition Assessment for snubbers;
- Condition Assessment for power transformers;

- Organizing the refurbishment project;
- Preliminary assessment in terms of engineering and nuclear safety of the possibility of extending the operation of Unit 1 over the 210,000 hours of operation considered as a design hypothesis.

The degree of completion of the project preparation program is about 32% relative to the total activities included in the entire program⁵ respectively about 76% in relation to what was scheduled to happen until this time (according to the original strategy, approved in 2013).

We mention that because the project was readjusted due to the newly appeared information relating to extending the life of the fuel channels over 210,000 operating hours at rated power (discussed in section II) the start of refurbishment will move to the end of 2026 (based on preliminary data available on the possibility of extending the life) compared to 2022 - the date previously set by the strategy approved in 2013; this makes the delay to be accommodated totally on the new approach proposed.

In parallel with the implementation of the Plan approved by the shareholders, SNN monitored the international experience in the field and analysed the studies conducted by other nuclear power plants in order to extend the life, and concluded that this operation requires additional costs to substantiate it (studies, inspections) lower than the profit obtained. Therefore, taking into account as follows:

- the reasonable opportunity to extend the number of initial operating hours at rated power over the 210,000 hours set by designers, based on the operating experience and the international one for similar nuclear units in terms of technology;
- the need to acquire important information on planning and running of the refurbishment from other owners/operators of CANDU units from other countries (Canada, South Korea, Argentina);
- the need to update the activities scheduling related to the assessment of the feasibility of the refurbishment project and the environmental impact assessment,

It is required to updating the strategy and plan of actions and the schedule for preparing and conducting the Unit 1 refurbishment project.

In accordance with the Study on optimal organization of the project, developed by the association formed by SC AMEC Foster Wheeler Nuclear RO SRL and AMEC NSS Limited under a consulting agreement awarded by bidding aiming how best to organize the project of refurbishment, the actual refurbishment project (second step) is divided in three phases:

- i. Phase 1 - Project definition
- ii. Phase 2 - Preparation of implementing
- iii. Phase 3 - Stopping the unit and actual conduct of the refurbishment project.

The mentioned study aimed at identifying both the needs and how SNN must be organized in order to prepare and implement the project, being conducted by a contractor with experience in such projects in Canada. The organizational chart proposed takes into account the actual possibilities of SNN – Cernavodă NPP and the possibility of local industry, including skilled labour available. It covers the following main areas of interest:

- **Organizational chart (flowchart) of the project and the key positions;**
- **Personnel mobilization plan;**
- **Requirements for personnel qualification for key positions;**
- **Infrastructure needed to operate the organization for the three phases;**
- **IT infrastructure and computers required;**

⁵ The program set in the strategy approved in 2013 is to be conducted until 2020.

- **Control of documents and spaces required for archiving documents;**
- **Accommodation requirements.**

The study also considers the reasonable and prudent strategies for contracting refurbishment works, based on the experience of other refurbishment projects of some CANDU type plants (full turnkey contracts, EPC contracts or contracts with the management of beneficiary). It is envisaged that the main activity of the project of refurbishment, the replacement of fuel channels, replacement of the calandria tubes and feeders, to be in charge of a specialized contractor with proven experience in the field, under an EPC type contract.

In **Phase 1** is to be developed primarily the activities aimed at organizing the project; in early 2018 the organizational and logistical changes resulted from the study above-mentioned are to be done.

Preliminary, for Phase 1 of the project, based on what has already been discussed in the meetings with the developer of the study, there is an organization chart with about 50 positions, headed by a Refurbishment Director, directly subordinated to SNN CEO.

Besides, in Phase 1 it will be carried out the completion of the supporting documents (see Section III above) required for the preparation of the feasibility study (last activity related to phase I), including drafting and submitting it for approval by the shareholders in 2021.

In the same Phase 1 the necessary activities required for Unit 1 operation for a period of 30 years shall be accommodated - the main items are presented in section II - "Increasing the number of hours of Unit 1 operation" - above. In this context, we mention that SNN concluded in February 2017 a contract (amounting to CAD 615,280) with the company CANDU Energy, as design authority; by the end of 2017 (i) the report indicating the number of hours of operation at rated power exceeding the 210,000 hours estimated by the project and that can be sustained under operating conditions complying with high nuclear safety standards, and (ii) a plan of measures and activities necessary to achieve this target shall be completed. Subsequently, it is necessary to discuss this report and to obtain the agreement from the CNCAN regulator.

The estimated budget for phase 1 of the project amounts to about 250 million, based on the evaluations of the study AMEC (about 3-5% of the costs associated with the project - 1.5 billion euros).

The increase by about 170 million lei of the amount previously mentioned, under EGM Decision No. 27/23.12.2013, is due mainly to the following reasons:

- clarification by the above-mentioned Study that in the Phase 1 a series of infrastructure and logistics preparation activities required for Phase 2 must be initiated,
- inclusion in the preparation stage of the refurbishment project of the amounts necessary to extend the number of the operational hours for Unit 1 over the 210,000 hours in order to achieve the operational lifetime of 30 years;
- considering the additional costs due to the fact that by extending the initial operation by about 3, 5 years, a number of the initially foreseen activities - assessment of the fuel channels conditions, etc. - are accordingly extended.

Note: Compared to the previous version of the strategy, which foresaw an increase in the overall lifespan of the unit from about 26 years to about 51-52 years, it is very important to note that the revised Strategy is taking into account to increase the life at about 60 years. Such an increase equates to an additional amount of energy (compared to the strategy proposed in 2013) of about 5.5 TWh * 8-9 years, which is about 44 to 49.5 TWh.

Phase 2 of the project - Preparation of implementation (2021-2026), subsequent to the approval of the Project's Feasibility Study, will mainly target:

- Development of engineering packages related to project modifications;
- Procurement of equipment and components with long manufacturing cycle;
- Awarding the engineering, procurement and construction agreement (EPC);
- Obtaining from CNCAN the authorization to commence the refurbishment works.

Phase 3 – Stopping the unit and refurbishing it is the effective implementation phase of the project, scheduled to take place between December 2026 and December 2028 given that the minimum duration estimated currently for the project's implementation is 24 months.

In the Appendix is a first level Gantt graph for the entire refurbishment project, as detailed above.

We mention that deadlines and budgets are indicative; they are likely to change according to the further development of the refurbishment project.

This investment effort, priority for SNN, will be analysed in the future, by reference to all other targets investments of the company (e.g. construction of a detritiation installation), taking into account the debt service associated with the long-term loans in foreign currency contracted for the construction of Unit 2, which will continue to be reimbursed gradually, until 2024 (included).

In this context, on the request for clarification of *the conditions for starting works: (1) extension of the number of hours of initial operation of Unit 1, (2) construction of the detritiation installation, (3) refurbishment of Unit 1, by extending its operational life by another 30 years*, the three major works listed are presented below and the main applicable constraints to and/or interacting-constraints are explained:

1. Extension of the number of hours of Unit 1 initial operation

In addition to the studies and analyses mentioned in section II, this work may also require carrying out some works required in the plant or taking measures to help extension; they must be identified, assessed, planned and prepared.

As shown, by the end of 2017, the technical study for preliminary assessment of the possibility of extending the operation of Unit 1 over the limit of 210,000 hours, aiming to achieve a 30 calendar years life for Unit 1, developed by SNC Lavalin-Candu Energy will be completed. The analysis in this study will consider the effects of degradation mechanisms, with the current condition of the fuel channels, feeders, reactor building and other main equipment of the unit; besides, (i) the contents of the security report, (ii) the authorization schedule and (iii) the supporting studies and analyses program that will take place later in order to obtain the authorization to operate during extended are to be set.

2. Construction of detritiation plant

Currently the technical design of the detritiation plant is fully developed. The nuclear safety documentation drawn up on the basis of the technical design is completed and approved by CNCAN which issued a comfort letter confirming that the project is authorized.

The main conditions for the construction of the detritiation plant are the following ones:

- Obtaining the approvals from the decision makers for the transition to the project implementation (Board of Directors and AGM).

- Conducting the procedure for obtaining the environmental permit (in the absence of approvals issued by the environmental decision makers, the environmental procedure started before for the project was cancelled by the Ministry of Environment).
- Preparation of the tender documents for selection of EPC contractor (engineering, procurement, construction) and conduct of the tender.

The execution works (including commissioning) are estimated to take about 60 months - December 2024.

After commissioning of the facility a period of about six months (trial run) is provided for. In this 6-month period the rated operation is expected to be reached - June 2025.

Linking all of the above issues is likely to enable the completion of the facility and bringing it to operational status about two years before stopping the unit for refurbishment.

Construction and commissioning of the plant by about two years before the date planned for the start of the refurbishment works would bring a number of major advantages to the refurbishment project, both in terms of radiological safety of the personnel involved in work and in terms for money. Thus, detritiation of heavy water (moderator and primary circuit) and decreasing of its activity are to provide:

- reducing of radiation fields and doses received by staff working effectively in nuclear systems and circuits;
- reducing of radioactive emissions in the environment (water, air);
- reducing of use of radiation protection equipment (masks, filters, plastic suits) and of the amount of radioactive waste;
- facilitation of the handling activities (emptying and filling the circuits) of heavy water and its temporary storage during the refurbishing works.

Since the detritiation facility is not a mandatory requirement for the refurbishment project, the decision relating to its construction as support to the refurbishment of Unit 1 will be founded by the refurbishment team.

3. Refurbishment Unit 1, with extension of the operational life for another 30 years

As already mentioned, the moment for starting the refurbishment of the unit is very dependent on the maximum operational life of the unit that can be achieved in the first cycle of operation.

The main elements that conditions (meaning that, in terms of time they should be conducted in advance) the effective start of the refurbishment are:

1. Approval of the new strategy by shareholders. This action is of utmost importance, conditioning the entire subsequent ongoing project preparation.
2. Defining the project scope (the refurbishment works to be executed in addition to the re-tubing of the reactor and replacing of feeder) correlated with estimation of costs associated with these works. During this stage a number of extensive assessments of unit's systems and structures (other than the pressure tubes, calandria tubes and feeders) will be conducted to confirm the functionality of their next life cycle, i.e. to identify those changes, upgrades and improvements aimed at bringing them into the condition "fit for service" for the second life cycle.
3. Obtaining the necessary permits and agreements (environment, CNCAN, European Commission)

4. Preparing the documentations for contracting supplies with high production duration - in particular pressure pipes, calandria tubes and feeders. Development of detailed design and start of contracting required for implementation.
5. Preparation of related facilities on site and outside it (workshops, clean room, offices, accommodation for staff to be involved in refurbishing).

It is worth mentioning that Cernavodă NPP has developed and is currently reviewing a long-term investments plan (currently at revision 8), which is structured to highlight as clearly as possible all projects which are linked in one way or another by the refurbishing of unit 1, plan representing an extremely useful and valuable instrument in ensuring directing of capital resources to works absolutely necessary to ensure a second life cycle for the unit.

IV. In conclusion to all of the above we shortly present to you all three phases of the second stage of the refurbishment project and the priority objectives of phase one:

Phase 1 Project definition

This phase includes the following main activities:

1. Establishing a Refurbishment Directorate as organizational structure dedicated to the project of refurbishment;
2. Starting the employment process according to the flowchart for the refurbishment project, phase 1;
3. Starting the activities of personal exchanges (for gaining professional experience) and training for Phase 1;
4. Continuing of carrying out all necessary activities (studies, analyses and, if necessary, changes of the project) to extend the operation of Unit 1 reactor over the 210,000 hours of operation, up to 30 years of life.
5. Carrying out further, the assessments necessary to identify all activities that will be included in the object of the project of refurbishment (noting that this activity is of utmost importance to build a well-balanced object/goal – thus, stopping for refurbishment should not be overburdening with activities that can be accommodated in the normal shutdowns of the unit, but on the other hand, the activities to be carried out within the shutdowns for refurbishment should not be postponed for later because it would lead to stops relatively long after the refurbishment with negative effects upon the unit's performance.
6. Preparing the documentation for creating the infrastructure for the project (IT, offices, preparation of the additional spaces and accommodation facilities) starting with Phase 2.
7. Development and approval by the general meeting of the feasibility study for refurbishment of unit 1.

Step 2 - Preparation of the project

This phase includes the following main activities:

1. Elaboration of engineering packages relating to the project changes;
2. Procurement of equipment and components with long manufacturing cycle;
3. Awarding of contracts for engineering, procurement and construction (EPC);
4. Obtaining the approvals and permits necessary, including the authorization by CNCAN to start the works of refurbishment.

Phase 3 - Implementation of the project

1. Unit shut-down and fuel unloading.
2. Drainage of systems.
3. Carrying out the planned works.

4. Alignment of systems for restart.
5. Fuel loading.
6. Commissioning activities.
7. Restart of unit.
8. Closing the project - reception and demobilization.

Priority Objectives of Phase 1:

1. Establishing a Refurbishment Directorate as organizational structure dedicated to the project of refurbishment;
2. Starting the employment process according to the flowchart for the refurbishment project, phase 1, as described in the documentation prepared by AMEC FW;
3. Starting the activities of personal exchanges (for gaining professional experience) and training for Phase 1, as described in the documentation prepared by AMEC FW;
4. Approval of contracting other necessary studies, as appropriate, on extending the operation life of Unit 1 reactor over the 210,000 hours of operation; review of the strategy and actions plan for the refurbishment of Unit 1 at Cernavodă NPP, based on the studies carried out; further elaboration of supporting studies and technical and nuclear safety related analysis required as inputs to substantiate the feasibility study of the project of refurbishment of Unit 1;
5. Development of the critical path related to the necessary operations (actions, studies, approvals, contracting of supplies with long manufacturing cycle, etc.) to finalize the preparation of Unit 1 refurbishment within the prescribed period to be submitted to the Ministry of Energy, for processing of the impact on the SEN safe operation and updating the inputs for Romania's energy strategy.
6. Development and approval of Feasibility Study for the Refurbishment Project for Unit 1.

V. Proposals

Given all above-mentioned and the issues below:

- i. The refurbishment project for Unit 1 Cernavodă represents a strategic investment for SNN whose total estimated value exceeds half of the book value of the assets belonging to the Company;
- ii. The fact that, in terms of estimated costs of the investment project Refurbishment of Unit 1 Cernavodă NPP, the shareholders must express their consent to the strategy and plan related to this project, including the costs associated with implementing this plan, costs that are included in the estimated total value of project;
- iii. The fact that according to Art. 153 of Law No. 22 index. 31/1990 concerning the Companies, conclusion of legal acts whose value exceeds half of the book value of the company's assets is the responsibility of the EGM of shareholders;
- iv. The fact that under Art. 17 paragraph (3) Articles of Incorporation of SNN, the EGM of shareholders approve any other resolution requiring the approval of the EGM of shareholders;
- v. The fact that according to Art. 13 paragraph (4) and Appendix to the Articles of Incorporation of SNN, the EGM of shareholders approve the commitments/legal documents involving important obligations for the Company on investment projects where those commitments exceed EUR 50 million;
- vi. The fact that the implementation of the strategy and the revised actions plan for the investment project Refurbishment of Unit 1 Cernavodă NPP involves actually implementing a project with an estimated investment value of EUR 1.5 billion; we mention that this value is an indicative – budgetary estimate based on the information available from similar projects completed or being implemented for the CANDU nuclear plants; the investment value required will be known only after completion of all necessary studies (including the Feasibility Study) according to the schedule assumed (Appendix 4).

We submit to the approval of the Extraordinary General Meeting of Shareholders the initiation of Phase I of the Strategy and Actions Plan for the Refurbishment Project of Unit 1 Cernavodă NPP, according to those detailed in this Note, with a total budget of RON 250 million (including the budget originally approved by the Extraordinary General Meeting of Shareholders no. 27/23.12.2013 Stage 1)

Appendixes:

Appendix 1 - Action Plan Refurbishment Project for Unit 1 Cernavodă NPP;

Appendix 2 - EGM Resolution no. 27/23.12.2013;

Appendix 3 - List of studies and their status, including the amount spent up to 31.12.2016;

Appendix 4 - Level 1 graph for the Refurbishment Project of Unit 1 Cernavodă NPP.

Cosmin Ghita
CEO

Marian Serban
CNO

Mihai Darie
CFO

Laura Constantin
CO of Legal and Corporative Affairs Department

Vlad Chiripus
Head of Department in charge with documents legality approval

Romeo Urjan
CO of Technical and Nuclear Safety Department

Adrian Cojanu
Engineer Chief - Development and Investments

*Stamp: SOCIETATEA NAȚIONALĂ NUCLEARELECTRICA S.A. – CEO – No. 3885 of
March 31, 2017*

Stamp: Cernavoda NPP – March 31, 2017 – No. 239

Logo: NUCLEARELECTRICA

**To: S.N. Nuclearelectrica S.A.
Attention of: Mrs. Daniela Lulache – CEO
Ref.: Top SNN Priorities – Development of U1**

According to the engagements made during the meetings at the level of SNN as far as the Top SNN Priorities for the period 2018-2022, we send you in advance as compared to the agreed term, the Action Plan U1-PA-17-0017, addressing the problem of the development of U1.

The plan may be presented for the endorsement at the working group in the next meeting, which is to be planned, through the care of M. Dima, in May 2017.

**Marian Serban
Manager of Cernavoda NPP**

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Signature illegible*

cc: A. Cojanu / S. Ghelbereu / D. Bigu – M. Dima – SNN

SOCIETATEA NAȚIONALĂ NUCLEARELECTRICA S.A.

ACTION PLAN

System: N/A	BSI: N/A	Unit: 1	U1-PA-17-0017	Ed. 10	Page 1 of 5
TITLE/SCOPE: Assuring the operation of Unit 1 throughout the 30-year projected period at a capacity factor of 90% and the preparation of the development project with a view to a second life cycle.					
OVERVIEW OF THE PLAN:					
1. INTRODUCTION					
<p>According to the standard of the 60's-70's, the nuclear power plant CANDU600 were designed for a 30-year life cycle, at a capacity factor of 80%. For this purpose, tests have been performed to show that the most sensitive components, i.e. the fuel channels may operate for the same life time, i.e. 210,000 EFPH (Effective Full Power Hours), without setting a life time for them.</p>					
<p>Normally, at the end of the first life cycle, a complex project may be developed to have in mind the development of the unit (replacement of the fuel channels, as well as other replacements, adjustments or improvements) so that at the end of this project the developed unit enters a second 30-year lifecycle. Thus a relatively new reactor is obtained at 40% of the costs for a new reactor.</p>					
<p>Due to the improvements made in the latest period, the capacity factor has continued to grow, reaching in Unit 1, over 90%. On these conditions, it results that in the summer of 2023, after about 26.5 years from the commissioning, the fuel channels of Unit 1 reach the life term of 210kEFPH, as considered by the initial project, although the other plant structures and systems might assure the operation until December 2026, when the first 30-year life cycle of Unit 1 ends.</p>					
<p>It is worth mentioning that the subsequent research regarding the lifetime of the fuel channels and the resume of the initial analyses have shown the possibility for this lifetime to be considered large. This research has already been implemented in Canada and Argentina where it has been shown that the lifetime of the fuel channels may reach circa 245,000 EFPH.</p>					
<p>The implementation of this international experience in CernavodaNPP would allow for the operation of the unit for the whole projected 30-year period, but in association with a capacity factor about 10% more than that considered in the project. The exploitation of this direction is more advisable and necessary considering the problem of commencing the development of Unit 1 in 2023. CernavodaNPP would not have the time necessary to prepare this project, considering the fact that based on the international experience in the field, it would have to start 10 years before the actual implementation (only the term for the manufacturing of the channels would be 4-5 years).</p>					
2. Strategy					
<p>Considering those exposed in the introduction, at CernavodaNPP there is a strategy based on two major action directions, complementary, that we appreciate provide ion the present conditions and based on the present knowledge, the optimum solutions for SNN, from the technical, financial and necessary human resources point of view.</p>					
<p>The first direction of action, which will be treated in section of this document, is the commencement of the necessary activities for the operation of Unit 1 for a period of 30 years on the conditions of a capacity factor of 90%. For this purpose, it is necessary to have complete analysis to confirm that the exceeding of the 210 kEFPH may be on nuclear security conditions.</p>					

This project will deploy over two phases. In first phase, the nuclear security documentation will be established (including its contents) as it is necessary for the approval of the extension of the lifetime and it will detail the authorization strategy, and then there is the second phase to elaborate the support analyses.

S.N. Nuclearelectrica S.A.
Cernavoda NPP

ACTION PLAN

System: N/A	BSI: N/A	Unit: 1	U1-PA-17-0017	Ed. 10	Page 2 of 5
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TITLE/SCOPE: Assuring the operation of Unit 1 throughout the 30-year projected period at a capacity factor of 90% and the preparation of the development project with a view to a second life cycle.

The second direction of action, which will be the object of sections 2 and 3 of the plan, is the preparation and execution of the project for the development of Unit 1, project consisting mainly of replacing the fuel channels and feeders. On this occasion, some other replacements, adjustments and improvements of systems so that the operation of the plant over the next period is as efficient as possible. All these aspects have been documented in several Information Reports on the development of Unit 1, approved by CTESSNN and/or approved by the board of director of SNN, where the necessary resources have been allotted for the analyses regarding the evaluation of the state of the equipment important for the operation of the plant and the establishment of the actions for the improvements of its operation.

It is worth mentioning that, given the size of the project, for a good organization, it is necessary to contract an assessment by the specialists experienced in management positions for these projects and after the analysis of the current organization of CernavodaNPP to forward a proposal for the organization considered optimum for the development of the project. These activities are treated in section 2.

Section 3 of the plan models the three main phases of the development project, respectively the solutions and the engineering documentation and its implementation.

Considering all of the above, the present plan was structured in the following three sections:

- Assuring the operation of U1 for the designed 30-year period until the development (extension of the lifetime from 210 k EFPH for the fuel channels);
- Preparing the development project from the optimum organization point of view;
- Defining the necessary documents, the approval and the implementation of the project.

Note: Section 3 may be modified after the finalization of the actions in section 2, as well as of the result of the studied to be held in 2017. Depending on its impact, the action plan hereby will be revised accordingly, to reflect reality in a faithful manner.

Special constraints: The finishing of the clastic system at CNE (Cernavoda Tritium Removal Facility) whose commissioning in 2023 would allow, in around 3 years of operation, for the decrease of the tritium concentration to values to decrease the special conditions the manipulation and the storage of the heavy tritium water would impose during the development.

S.N. Nuclearelectrica S.A.
Cernavoda NPP

ACTION PLAN

System: N/A	BSI: N/A	Unit: 1	U1-PA-17-0017	Ed. 10	Page 3 of 5
TITLE/SCOPE: Assuring the operation of Unit 1 throughout the 30-year projected period at a capacity factor of 90% and the preparation of the development project with a view to a second life cycle.					

No.	ACTION	Inter conditions	A/R No.	In charge	Term
Section 1 - Assuring the operation of U1 for the designed 30-year period until the development (extension of the lifetime from 210 to 245 k EFPH for the fuel channels and the feeders)					
1.1	Elaborating the procurement documentation for phase 1 regarding the security report for the operation of U1 by the end of the 30 years since the Commissioning extension of the lifetime from 210 k EFPH to 245 KEFPH –phase 1)			A. Cojanu	Done
1.2	Contracting the elaboration of the security report mentioned in section 1.1.			A. Cojanu	Done
1.3	Security kick-off meeting report			A. Cojanu	Done
1.4	Development of the contract – analyses and tests: meetings with CNCAN and establishing the common objectives			A. Cojanu	September 30, 2017
1.5	Accepting the security report phase regarding the extension of the lifetime over 210000 EFPH			A. Cojanu	October 2017 2017
1.6	Obtaining the CNCAN Letter of Comfort			A. Cojanu	December 2017
1.7	Elaborating an approving the cost-benefit analysis (business case) and the budget approval for phase 2			A. Cojanu	March 2018
1.8	Contracting the support studies necessary for the Extension of the Lifetime of CernavodaNPP Unit 1 over 210,000 EFPH phase 2			A. Cojanu	October 2018
1.9	Elaborating the studies regarding the operation of U1 for the projected period of 30 years (extension of the lifetime of the channels over 210,000 EFPH) phase 2.			A. Cojanu	December 2020
1.10	Planning and performing, if necessary, the activities/works necessary for the extension to 245 k EFPH phase 2			A. Cojanu	December 2022

1.11	Sending the documentation for the CNCAN authorization			A. Cojanu	October 2022
1.12	Obtaining the extended authorization by the end of 2026			A. Cojanu	March 2023

S.N. Nuclearelectrica S.A.
Cernavoda NPP

ACTION PLAN

System: N/A	BSI: N/A	Unit: 1	U1-PA-17-0017	Ed. 10	Page 3 of 5
TITLE/SCOPE: Assuring the operation of Unit 1 throughout the 30-year projected period at a capacity factor of 90% and the preparation of the development project with a view to a second life cycle.					

Section 2 - Preparing the development project (finishing the organization study)					
2.1	Elaborating the procurement documentation for the study regarding the optimum organization of the development project			A. Cojanu	Done
2.2	Development of the procurement procedure and contracting the study regarding the organization of the project			A. Cojanu	May 2017
2.3	Approving the study for the organization of the project			A. Cojanu	December 2017
2.4	Implementing the resulting organizational and logistic modifications				January 2018
Section 3 - Defining the necessary documents, the approval and the implementation of the project					
3.1	Scoping and project approval				
3.1.1	Scoping: Condition Assessment, life assessment, establishing the list of modifications and improvements necessary with the retubing				January 2019
3.1.2	Elaborating the feasibility study (including the scope of work)				January 2021
3.1.3	Approving the project by the Board of Director and the General Meeting of the Shareholders				March 2021
3.2	Finishing the documentation				
3.2.1	Commencing the procedure to obtain the Environmental Impact Permit				April 2021
3.2.2	Elaborating the PSR				April 2021
3.2.3	Elaborating the documentation for the logistic support of the project and contracting the connected				April 2023

	works				
3.2.4	Elaborating the necessary detailed engineering documentation of the modifications				May 2024
3.2.5	Reviewing the feasibility study				July 2024
3.3	Contracting				
3.3.1	Signing the long-lead contracts (retubing, feeders)				March 2022
3.3.2	Contracting the execution works				July 2025
3.4	Implementation				
3.4.1	Organization and logistic previous to the commencement of the works				December 2025

S.N. Nuclearelectrica S.A.
Cernavoda NPP

ACTION PLAN

System: N/A	BSI: N/A	Unit: 1	U1-PA-17-0017	Ed. 10	Page 3 of 5
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TITLE/SCOPE: Assuring the operation of Unit 1 throughout the 30-year projected period at a capacity factor of 90% and the preparation of the development project with a view to a second life cycle.

3.4.2	Authorizing the resume of the implementation of the development project				December 2026
3.4.3	Discharging the fuel from the reactor				December 2026
3.4.4	Development of the project implementation				December 2028
3.4.5	Commissioning the development of U1 for a new life cycle of 30 years (operation of 100 days without refueling)				December 2028
3.4.6	Commencing the commercial exploitation of the upgraded U1				December 2028

ASSOCIATED NECESSARY DOCUMENTS:

REFERENCES:

PERSON IN CHARGE:

MADE/DATE:	VERIFIED/DATE:	APPROVED/DATE:	PROCESSED/DATE:
A. Cojanu <i>Signature illegible</i> March 30,2017	S. Ghelbere <i>Signature illegible</i> March 30,2017	M.N. Serban <i>Signature illegible</i> March 31,2017	



**Decision no. 27 of December 23, 2013
of the Extraordinary General Meeting of Shareholders of Societatea Națională
Nuclearelectrica S.A.**

Registered office: Strada Polona nr. 65 sector 1, 010494, Bucharest, registered with the Trade Register under number J40/7403/1998, taxpayer number: RO 10874881

This December 23, 2013, 12.00 pm, the shareholders of Societatea Națională Nuclearelectrica S.A. (hereinafter referred to as the "Company" or "SNN") have met for the Extraordinary General Meeting of Shareholders ("EGMS") of SNN, at the National Institute of Statistics – Blue Hall, in Bd. Libertatii nr. 16, sector 5, Bucharest, the EGMS meeting being opened by the meeting President, Mr. Alexandru Sandulescu, as Chief Executive Officer.

Considering:

- The summons for the EGMS published in the Official Journal of Romania, Part 4, number 6444 of November 22, 2013, in "Adevarul" newspaper *no. 124 of November 22 – 24, 2013* and on the Company's site;
- The amended summons for SNN S.A. EGMS published in the Official Journal of Romania, Part 4, number 6970 of December 12, 2013, in "Adevarul" newspaper *no. 7044 of December 12, 2013* and on the Company's site;
- The provisions of the Memorandum of Incorporation of the Company in force ("Memorandum of Incorporation");
- The applicable legal provisions;

The meeting President confirms upon opening the meeting, that the procedure is legal and statutory, 24 shareholders are present and represented, holding a number of 259,849,647 shares, representing 92.25179% of the subscribed and paid-in share capital, representing 92.25179% of the total voting rights. The requirement regarding the quorum is fulfilled according to the provisions of art. 15 of the Memorandum of Incorporation and of art.115 par. 1 and 2 of the Law on companies no. 31/1990 ("Law no. 31/1990"). The meeting President confirms the EGMS is statutory and legally constituted and that it may validly pass decisions on the problems on the agenda.

Pursuant to the debates, the Company shareholders decide as follows:

1. Electing the Secretary of the Extraordinary General Meeting of Shareholders.
According to the provisions of art. 129 of the Law no. 31/1990, the SNN shareholders choose as EGMS secretary Mr. Dan Valentin Gheorghe and the Company appoints Mrs. Letitia Hrebenciuc as technical secretary of the EGMS.

Societatea Națională Nuclearelectrica S.A.

Strada Polona nr. 65 sector 1, 010494, Bucharest, Ph.: +4021 203 82 00, Fax: +4021 316 94 00; office@nuclearelectrica.ro; J40/7403/1998, RO 10874881 – BCR Sector 1
www.nuclearelectrica.ro



In the presence of the shareholders representing 92.2519% of the share capital and 92.25179% of the total voting rights, this item is passed with 259,949,647 votes representing 100% of the total of voting rights held by the present or represented shareholders, according to the provisions of art. 15 of the Memorandum of Incorporation in corroboration with the provisions of art.115 par. 2 of the Law no. 31/1990. The votes registered as follows:

- 259,949,647 votes “for”;
- 0 votes “against”;
- 0 votes “abstention”;
- 0 “unexpressed” votes.

A number of 0 votes were annulled.

2. The approval of the decision regarding the extension of the Investment Agreement made by SNN with Arcelor Mittal and Enel for the Cernavoda NPP’s Units 3 & 4 Project, only based on the report regarding the results of the negotiations of the Investment Agreement for the Cernavoda NPP’s Units 3 & 4 Project approved by the management of the Energy Department according to the mandate granted to the renegotiation committee approved by the order of the delegate minister for energy. The mandate to the executive management of SNNS.A. to purchase the shares held by Enel and Arcelor Mittal, considering the notifications of Enel and Arcelor Mittal Galati exercising their put option, respectively authorizing SNN to purchase their shares at a price per share of 80% of the par value of the share according to the Addendum no. 6 to the Investment Agreement, thus the Investment Agreement for the Cernavoda NPP’s Units 3 & 4 Project ceases. The project company SC Energo Nuclear S.A. is to continue to operate and work as a branch owned entirely by SNN, by the end of 2014.

In the presence of the shareholders representing 92.2519% of the share capital and 92.25179% of the total voting rights, this item is passed with 231,331,314 votes representing 88.9902% of the total of voting rights held by the present or represented shareholders, according to the provisions of art. 15 of the Memorandum of Incorporation in corroboration with the provisions of art.115 par. 2 of the Law no. 31/1990. The votes registered as follows:

- 231,331,314 votes “for”;
- 27,846,836 votes “against”;
- 771,497 votes “abstention”;
- 0 “unexpressed” votes.

A number of 0 votes were annulled.

3. The approval of Upgrade Strategy and Plan of Cernavoda NPP’s Unit 1, in order to extend its lifetime.

Societatea Națională Nuclearelectrica S.A.

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www.nuclearelectrica.ro



In the presence of the shareholders representing 92.2519% of the share capital and 92.25179% of the total voting rights, this item is passed with 259,949,647 votes representing 100% of the total of voting rights held by the present or represented shareholders, according to the provisions of art. 15 of the Memorandum of Incorporation in corroboration with the provisions of art.115 par. 2 of the Law no. 31/1990. The votes registered as follows:

- 259,949,647 votes “for”;
- 0 votes “against”;
- 0 votes “abstention”;
- 0 “unexpressed” votes.

A number of 0 votes were annulled.

4. The approval of the purchase of legal assistance/consultancy services and/or representation services in relation to the development of Cernavoda NPP’s Units 3 & 4 Project.

In the presence of the shareholders representing 92.2519% of the share capital and 92.25179% of the total voting rights, this item is passed with 231,331,349 votes representing 100% of the total of voting rights held by the present or represented shareholders, according to the provisions of art. 15 of the Memorandum of Incorporation in corroboration with the provisions of art.115 par. 2 of the Law no. 31/1990. The votes registered as follows:

- 231,331,349 votes “for”;
- 27,469,181 votes “against”;
- 771,462 votes “abstention”;
- 0 “unexpressed” votes.

A number of 0 votes were annulled.

5. The approval of the date of **January 15, 2014** as date for the registration according to the provisions of art. 238 of the Law on capital market no. 297/2004, i.e. the date serving for the identification of the shareholders on which the EGMS decisions will impact.

In the presence of the shareholders representing 92.2519% of the share capital and 92.25179% of the total voting rights, this item is passed with 259,949,647 votes representing 100% of the total of voting rights held by the present or represented shareholders, according to the provisions of art. 15 of the Memorandum of Incorporation in corroboration with the provisions of art.115 par. 2 of the Law no. 31/1990. The votes registered as follows:

- 259,949,647 votes “for”;
- 0 votes “against”;
- 0 votes “abstention”;
- 0 “unexpressed” votes.

A number of 0 votes were annulled.

Societatea Națională Nuclearelectrica S.A.

Strada Polona nr. 65 sector 1, 010494, Bucharest, Ph.: +4021 203 82 00, Fax: +4021 316 94 00; office@nuclearelectrica.ro; J40/7403/1998, RO 10874881 – BCR Sector 1
www.nuclearelectrica.ro



6. Empowering Mr. Alexandru Sandulescu, as Chief Executive Officer to sign on behalf of the shareholders the decision of EGMS and any other documents related to it and to fulfill any act or formality required by the law for the registration and fulfillment of the EGMS decisions, including the publicity formalities and their registration with the Trade Register or any other public institution. Mr. Alexandru Sandulescu may delegate all or part of their powers given above to any individual competent to fulfill this power of attorney.

In the presence of the shareholders representing 92.2519% of the share capital and 92.25179% of the total voting rights, this item is passed with 259,949,647 votes representing 100% of the total of voting rights held by the present or represented shareholders, according to the provisions of art. 15 of the Memorandum of Incorporation in corroboration with the provisions of art.115 par. 2 of the Law no. 31/1990. The votes registered as follows:

- 259,949,647 votes "for";
- 0 votes "against";
- 0 votes "abstention";
- 0 "unexpressed" votes.

A number of 0 votes were annulled.

CHIEF EXECUTIVE OFFICE
Alexandru SANDULESCU

Signature illegible
Stamp illegible

Meeting secretary, Dan Valentin GHEORGHE

Signature illegible

Societatea Națională Nuclearelectrica S.A.

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Appendix 3

No.	Name	Planned implementation period	PR	Value at December 31, 2016 (Lei)	Stage	Notes
1	Extension of the life time of Cernavoda NPP's Unit 1 by 25 years as compared to the projected life time (Feasibility Study)	2015-2017	-	-	Postponed for 2019-2020	The necessary data for the feasibility study (CA, PSR, assessment of the upgrade scope) will be available in 2019.
2	Elaboration of the studies for "Lifetime assessment" for each type of power transformer in Cernavoda NPP, in U0 and U1 without the power exhaust transformers	2014-2015	26871	314,560	Ongoing	Ongoing activities; The contract was signed on August 15, 2015 and it will finish in 2017.
3	Life Assessment study for Fuel Channels U1	2013-2018	25388	2,686,364	Made in 2018 the study will be reviewed	More studies are necessary for the extension of the life time over 210000 EFPH
4	Life Assessment study for Reactor Building U1	2014-2018	26854	521,571	Made in 2016	
5	Life Assessment study for feeders U1	2013-2018	25388	707,312	Made in 2016	More studies are necessary for the extension of the life time over 210000 EFPH
6	Life assessment evaluation & life extension detailed planning document for CNE Cernavoda U1, turbine, generator and auxiliaries systems	2012-2013	25096	1,804,425	Made	
7	Assessment services throughout the lifetime of the heat exchangers Cernavoda NPP's U1	2012-2013	25434	1,001,234	Made	There was a study for condensers and it is to be contracted the study for the nuclear heat exchangers
8	Services of nuclear security analysis for the upgrade EPSN Level 1 and fulfillment EPSN Level 3	2014	26864	3,643,873	Made	Services made from the approved budgeted position for the investment objectives post Fukushima
9	Services for the update of the Final Nuclear Security Report of Cernavoda NPP's Unit 1	2012-2013	26115	3,155,110	Made	Services made from the approved budgeted position for the studies necessary for the

						investment objectives
10	Environment studies necessary for the permits, agreement and environment impact permits pertaining to the upgrade of U1	2014-2018	27596			
11	Other support documentation for the authorization/approval, requested in time by the regulatory authorities, which have not been provided before and	2014-2018		11,842,235		
11.1	Engineering services for the U1		26603	174,336	Made	

No.	Name	Planned implementation period	PR	Value at December 31, 2016 (Lei)	Stage	Notes
11.2	Services for the preparation of the Upgrade of U1		25619	1,394,447	Made	
11.3	Probabilistic Safety Assessment Level 2 U1		22174	9,948,732	Made	Services made from the approved budgeted position for the investment objectives post Fukushima
11.4	Study on the impact of the acute tritium emissions on the population		27933	129,000	Made	
11.5	Services of engineering assistance for the upgrade and extension of the life time of Cernavoda NPP's Unit 1		27789	195,721	Made	
Total:				25,676,684		

NOTA:In relation to the approved value of lei 80 million, the scope of the project was attained at 32%. The budget execution was registered as follows: 11% (lei 9 million) as an execution in the budget position corresponding to the extension of the lifetime of U1 and 21% (lei 16.75 million) as an execution in the budget position corresponding to the investment objectives resulted post Fukushima, respectively the Studies pertaining to the investments.

Data Date: 01-Mar-17			
Layout: Structure of the Action Plan			
TASK filiter: project Start Activity.			
U1 Preparation for Long Term Preliminary Summary Schedule			
Activity ID	Activity Name	Start	Finish
1 Assuring the operation of U1 for the designed 30-year period until the development at the 90% factor (extension from 210 to 245 k EFPH)		29-Apr-16 A	29-Apr-16 A
0003	Security report for the extension of the lifetime over 210000 EFPH Phase 1 - Procurement	29-Apr-16 A	28-Feb-17 A
0005	Security report for the extension of the lifetime over 210000 EFPH Phase 1 - Contract SNC Canada	01-Mar-17	06-Oct-17
0005a	Accepting the Security report for the extension of the lifetime over 210000 EFPH Phase 1	09-Oct-17	27-Oct-17
0015	Business Case elaboration	09-Oct-17	07-Dec-17
0010	Obtaining the Letter of comfort from CNCAN	30-Oct-17	13-Dec-17
0020	Preparing the procurement documentation for the Security report for the extension of the lifetime over 210000 EFPH Phase 2	09-Oct-17	07-Feb-18
0016	Obtaining the approval of the budget	14-Dec-17	15-Mar-18
0025	Procurement Security report for the extension of the lifetime over 210000 EFPH Phase 2	16-Mar-18	17-Oct-18
0035	Sending the documents for the CNCAN operating permit by the end of the year 2026		20-Oct-22*
0040	Obtaining the CNCAN operating permit by the end of the year 2026	21-Oct-22	23-Mar-23
2 • Preparing the development project from the optimum organization point of view		29-Apr-16 A	16-Jan-18
3 • Defining the necessary documents, the approval and the implementation of the project		01-Mar-17	29-Dec-28
3.1 Scoping and approval of the project		01-Mar-17	18-Mar-21
3.1.1 Condition Assessment		01-Mar-17	07-Jan-19
3.1.2 List of adjustments and improvements necessary with the new tubing		16-Nov-17	07-Jan-19
3.1.3 Feasibility Study		17-Jan-18	15-Jan-21
3.1.4 Approval of the project by the Board of Directors and the General Meeting of shareholders		18-Jan-21	18-Mar-21
3.2 Finishing the documents		17-Jan-18	15-Jul-24
3.2.1 Commencing the procedure for the environment impact permit		15-Apr-21	15-Apr-21
3.2.2 Elaborating the PSR (periodic inspection of the nuclear security)		17-Jan-18	30-Apr-21
3.2.3 Elaborating the documents for the logistic support		24-Mar-22	27-Apr-23
3.2.4 Elaborating the engineering packs for the detailed documentation of the adjustments		24-Mar-22	31-May-24
3.2.5 Revision of the feasibility study		12-Jan-24	15-Jul-24
3.3 Contracting		16-Mar-20	07-Jul-25

3.3.1 Long-Lead Contract	16-Mar-20	24-Mar-22
3.3.2 Financial arrangements	24-Mar-22	26-Dec-22
3.3.3 EPC Contract	24-Mar-22	07-Jul-25
3.4 Implementation	27-Dec-22	29-Dec-28
3.4.1 Organization and logistic previous to the commencement of the works	27-Dec-22	08-Dec-25
3.4.2 Authorization for the commencement of the upgrade	11-Jun-26	11-Dec-26
3.4.3 Starting the reactor fuel unloading	14-Dec-26	23-Feb-27
3.4.4 Development of the project implementation	24-Feb-27	28-Dec-28
3.4.5 P.I.F.	27-Dec-27	29-Dec-28
3.4.6 Commercial exploitation	29-Dec-28	29-Dec-28