Role of TSO organizations in Romania

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1. Introduction

- Nuclearelectrica operates 2 CANDUs 700 MWc Reactors at Cernavoda Site. Units 3 & 4 under construction;

- Unit 1 Commissioned in 1997 – type of external contracts (3 license agreements):
  Engineering Support Agreement (ESA);
  Main Equipment Manufacture;
  Canadian supply procurement services.

- Unit 2 Commissioned in 2007 – type of external contract - Management contract;

- C 3 & 4 in preservation. Full E,P,C Completion Contract Tender Process terminated unsuccessfully in 2013;

  Actual status: Negotiations with an interested investor to acquire the majority share package. To be completed this month;

- Local infrastructure to support NPP Operation: Heavy Water Plant, nuclear fuel factory, components manufacturing capabilities, engineering and research available.

2. TSO currently involved in direct support of the nuclear program

1. Center for Technologies and Engineering for Nuclear Projects (CITON Bucharest) - engineering and R & D

   - Technical Support for operating nuclear facilities in Romania: NPP, Interim Spent Fuel Repository, Heavy Water Plant, Nuclear Research Reactor and testing facilities, Uranium Ore operations, Tritium Removal Facility and others;
   - R & D: Participant in the national nuclear R & D program in 12 out of 18 generic topics.

2. Nuclear Research Institute (ICN Pitesti) - R & D

   - Operates a 10 Mw TRIGA Reactor plus various testing facilities and labs.
   - Coordinates all 18 generic topics of the R & D NNP;
   - Member of 12 on going international R & D projects in EU and international.

2. TSO currently involved in direct support of the nuclear program (Cont.)

3. National Research and Development Institute for cryogenics and Isotopic Technologies (ICSI Rm. Valcea)

   - Technology developer of heavy water pilot
   - Tritium removal pilot installation
   - Participant in 4 large research projects in EU.

4. Horia Hulubei National Institute for Research and Development in Physics and Nuclear Technologies (IFIN-HH-Bucharest)

   - Material Testing capabilities, Nuclear Waste Treatment technologies developer, decommissioning of nuclear installations.

3. Role of the national TSO of a technology user country in the nuclear program implementation

Phase 1 of the IAEA milestone approach under the coordination of the Committee of Nuclear Energy (CSEN)

- Studies for the introduction of the Nuclear Power in the national strategy (advantages, benefits, issues, consequences);
- Research on cooperative basis with technology vendors regulators on the required legislative and regulatory frameworks used in the countries with Nuclear Power Programs;
- Definition of the required national Nuclear Infrastructure to be developed and implemented.

Phase 2 under the coordination of CSEN

- Analyses of the NPP technologies available on the market;
- Establishment of a national specification for the first NPP (nuclear safety requirements, nuclear fuel cycle, special qualification, etc.);

3. Role of the national TSO of a technology user country in the nuclear program implementation (Cont.)

- NPP sites selection and qualification;
- Implementation of the relevant international legal instruments;
- Improvement of the existed regulatory framework (specific for the nuclear research reactor);
- Establishment of a competent and effectively independent Nuclear Safety Regulatory Body (by expanding the existed regulatory body) to license and regulate the design and operation of nuclear facilities;
- Development and implementation of the specific national programs (safeguards for nuclear materials, radiation protection, environmental protection, etc.);
- Establishment the policy for national and industrial participation in the nuclear program;
- Initiation of the program for the development of the required human resources;

3. Role of the national TSO of a technology user country in the nuclear program implementation (Cont.)

Phase 3

- Specific research for the assimilation in Romania of the production of CANDU 6 nuclear fuel (in ICN Pitesti) and heavy water (in ICSI Valcea);
- Preparation of the different testing methodologies for the nuclear equipments and materials in the TRIGA nuclear research reactor and performance of these tests;
- Fabrication and supply of the different equipment and devices dedicated to Cernavoda Unit 1 (radiation protection and dosimetry laboratory equipment, radiation detectors, airborne and radioactive gases measurement devices, neutrons detectors, etc.).
- Participation in the Cernavoda Unit 1 Project Management Team for the preparation of the commissioning procedures for nuclear island of the plant (especially for CANDU 6 nuclear reactor).
- Contribution to the revision of the Preliminary and Final Safety Analyses Reports of Cernavoda Unit 1, based on the commissioning results.

3. Role of the national TSO of a technology user country in the nuclear program implementation (Cont.)

- It should be noted that, in some cases, when a particular nuclear research institute was not involved in performance specific works for Cernavoda Unit 1, it was requested and used as an independent consultant (Technical Support Organization –TSO) of the Regulatory Body;
- Utilization of the nuclear research entities during the NPP operation is subject of the NPP Owner/Operator management policy and strategy;
- Existing Romanian nuclear research organizations played the role of Technical Support Organizations (TSO) for the Romanian Nuclear Operator and/or for the Romanian Nuclear Regulatory Body (National Commission for Control of Nuclear Activities – CNCAN);
- Nuclear TSO were used as consultant in the technology transfer from the NPP Vendor (specific software for accident analyses, Probabilistic Safety Assessment-PSA tools and specific methods, Plant Life Management-PLIM program, etc.);
- Research works for the Government or national authorities decisions preparation, like second site for NPP in Romania, radioactive waste management and final disposal and decommissioning of the nuclear facilities.

4. Positive example of collaboration between technology holders and technology users in first of-a-kind NPP

Following the decision of the selected technology a working group called Cernavoda Joint Technical Committee (CJTC) was established to address technical issues. CJTC members were Canadians and Romanians. It was coordinated by a steering committee. Its members were project directors, GMs, ministers. There were 9 working groups. CJTC worked for about 2 years, at the peak about 40 people, with 25 AECL staff. Main functions:

- Certification of CITON as license user (Minister of Energy was the license holder);
- Approval of Cernavoda Project system design specifications prepared by CITON as plant designer;
- Equipment fabrication technology transfer supervision;
- AECL representatives in CJTC coordinated AECL Home Office function of Design Authority.

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations

- **CANDU Owners Group (COG**), located in Toronto, Canada, is an organization of CANDU nuclear operators that provide a framework for cooperation, mutual assistance and exchange of information in order to support and develop CANDU technology. COG members are the CANDU operators in Argentina, Canada, Korea, China, India, Pakistan and Romania as well as the CANDU system designer, AECL- Canada.

- COG provides services in the following domains:
  - "Information Exchange"
  - "Joint Projects & Services"
  - "Regulatory Affairs"
  - "Research & Development"

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations (Cont.)

- The annual members' fee shall provide funding for basic activities within the information, projects and services exchange program.
- Within the other programs, participation is elective and is funded by members who wish to participate on the basis of sharing the associated costs.
- SNN is a member of the information, project and services exchange program.

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations (Cont.)

- The R&D program of COG is a program targeted to solve operational problems in nuclear power plants and cover mainly the following areas:

  - Improving performance of nuclear equipment and systems;
  - Lifespan management of major components;
  - Solving problems and questions raised by regulatory bodies that own CANDU plants;
  - Maintaining technical capability in areas specific only to CANDU reactors;
  - Creating and maintaining relationships with institutes specialized in research and development ;
  - Improving operational/Nuclear Safety limitations;
  - Plant aging management;
  - Improving the reliability and competitiveness of CANDU reactors.

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations (Cont.)

- The works prepared within the program aimed at solving major problems common to program participants encountered in the nuclear equipment and components that are found only in plants with CANDU reactors.

- The R&D program of COG is based on research and development strategic plans for five years and has an annual budget of about 30-35 million CAD for the next five sub-programs:

  - Fuel channels,
  - Chemistry, Materials and Components
  - Dosimetry, Radiation and Environmental Protection
  - Nuclear Safety and Licensing
  - Standardized computer codes

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations (Cont.)

- ***The Fuel Channel Program*** aims to increase the confidence of staff members participating in the program in the operability of fuel channel and the development of improved standards and methodologies for assessing the integrity of pressure tubes and their lifespan, respectively.

- ***The Chemistry, Materials and Components Program*** covers a wide range of issues impacting on the reliability and efficiency of nuclear power plant operation, such as:
  - analysis of the effects of different chemical impurities on the degradation of the primary circuit components,
  - development and qualification of new technology of non-destructive assessment for steam generators and heat exchangers tubes
  - development of improved models for predicting the rate of degradation of the major components in the plant

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations (Cont.)

- ***The Dosimetry, Radiation and Environmental Protection Program*** includes topics related to internal and external dosimetry and radiation protection as well as risk assessment studies of exposure to radiation and radioactive effluents of the plant workers, public and environment.
- ***The Nuclear Safety and Licensing Program*** addresses both generic issues and specific issues related to design basis, operating and design limits of member CANDU power plants. Some of the papers relate to nuclear safety assessments of projects for new plants and the involved organizations provide scientific expertise and basic infrastructure for further research programs in nuclear safety.
- ***The Standardized Computer Codes Program*** has as its major objective the development, maintenance and validation of computer codes used in the following areas:
  - Containment response
  - Severe accidents
  - Fuel and fuel channels
  - Reactor physics
  - Thermohydraulics

5. Example of integrated international organizations and partnerships between industry, business and R & D organizations. (Cont.)

- The professional technical support for Technical Committees is provided by teams of specialists organized in project teams ("Project Representatives") and/or working groups ("Working Group Representatives") for each project/work in the subprogram.

- Project teams consist of specialists from member organizations with voting rights (which may even be their representatives in technical committees) or other R&D organizations with whom they collaborate, while work groups include experts from research and development organizations involved in the R&D program as contractors (AECL, NSS and other COG contractors).

Thank you for your attention !

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