Collaboration on the R&D Capacity Building in Viet Nam

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1. Ninh Thuan NP Project
1. Ninh Thuan NP Projects (1)

- On 3rd Jan. 2006, Viet Nam launched the Strategy for Peaceful Uses of Atomic Energy up to 2020, which determined objectives and tasks for both radiation application and nuclear power development.

- On 25th Nov. 2009, Viet Nam National Assembly approved the policy on investment in Ninh Thuan NP Project, including Ninh Thuan 1 (NT1) and Ninh Thuan 2 (NT2) NPPs.

- Russia and Japan are partners of NT1 and NT2, respectively.

- SAD and FS Reports for the NT1 (Consultant: E4 (EPT, KIEP) and AES – Buran) and NT2 (Consultant: JAPC) were finalized and under review of Vietnamese side.

- Viet Nam implements the Atomic Energy Strategy and Nuclear Power Project in the context of low developed infrastructure, including human resources development and R&D capacity.
1. Ninh Thuan NP Projects (2)

- **Ninh Thuan 1 NPP**
  - Site: Phuoc Dinh Commune, Ninh Phuoc District
  - Capacity: 2 units x 1000 MW
  - Partner: Russia

- **Ninh Thuan 2 NPP**
  - Site: Vinh Hai Commune, Ninh Hai District
  - Capacity: 2 units x 1000 MW
  - Partner: Japan

- **Distance**
  - 300 km from HCM City
  - 140 km from Da Lat
2. R&D Capacity: Current Status and Some Major Solutions
2. R&D Current Status (1)

- R&D activities in the field of nuclear energy field have been carried out at some institutes and universities, but mainly at the Vietnam Atomic Energy Institute (VINATOM).

- VINATOM is a R&D institution under the MOST has functions to conduct scientific research and technological development in the field of nuclear energy; and provide technical support for the development of nuclear energy application in a manner of safety and security.

- The main R&D directions of VINATOM in the nuclear power area:
  1. Research on reactor technology, nuclear equipment and radioactive waste treatment;
  2. Development of technical support capacity for ensuring nuclear safety, security and environmental protection for nuclear power development.
2. R&D Current Status (2)

- VINATOM consists of 9 R&D subsidiary units, of which 3 major institutes are: Dalat Nuclear Research Institute (DNRI), Institute for Nuclear Science and Technology (INST), and Institute for Technologies on Radioactive and Rare Elements (ITRRE).

- VINATOM has 810 employees (6 professors and associate professors, 40 doctors, 112 masters, 577 engineers or bachelors).

- VINATOM/DNRI manages and operates an unique Research Reactor in Viet Nam - DNRR (Pool-type, water-cooled, water moderated, original TRIGA MARK-II 250 kW). The DNRR was shutdown during Vietnamese War. With the assistance of the Former Soviet Union, DNRR has been restored, upgraded to 500 kW and safely operated since 1984.

- VINATOM's technical infrastructure for R&D remains at a low level.
2. R&D Current Status (3)

- About the overall picture on R&D capacity in the field of nuclear energy of Viet Nam, we can say that:

1. Human resources are short of both quantity and quality;
2. Educational and training institutions are in the situation of shortage of highly qualified lecturers, advanced laboratories, and other necessary conditions;
3. In universities, disciplines related to nuclear energy have not yet attracted excellent students. Meanwhile, R&D institutions need to recruit highly qualified experts;
4. Technical facilities and equipment necessary to conducting R&D activities are insufficient, even backward.

- In summary, Viet Nam’s R&D capacity is still weak in terms of manpower, technical and educational infrastructure. Therefore, Viet Nam has to overcome many challenges to meet requirements of the sustainable nuclear power development.
2. Some Major Solutions (1)

- The Vietnamese Government has issued and implemented many policies and mechanism for promotion and support for R&D activities:
  - The Prime Minister approved:
    - *PM’s Decision on National Project on Training and Developing Human Resource in the Field of Atomic Energy (Aug. 2010)*;
    - *PM’s Decision on National Project on Enhancing Capacity on R&D and Technical Support Served to Atomic Energy Development and Ensuring Safety and Security (March 2012)*;
    - *PM’s Decision on Project on Human Resources Training for NPPs in Ninh Thuan Province (April 2013)*;
    - *PM’s Decision on Regime of Allowances of Career Incentives for State Employees Working in the Atomic Energy Organizations belonged to the MOST (Aug. 2014)*;
2. Some Major Solutions (2)


- At present, the Prime Minister has instructed the formulation of:
  - *Plan for Training Specialists and Managers in the Field of Nuclear Energy*;
  - *Policy for Preferential Treatment to Attract Highly Qualified Professionals Working in the Field of Nuclear Energy*.

- At the same time, Viet Nam implements a comprehensive strategy on international collaboration in all aspects related to the nuclear energy, including R&D capacity building.
3. Collaboration on R&D Capacity Building
3. Collaboration (1)

- In the past, almost nuclear manpower of Viet Nam, including leading scientists and managers, were mainly educated and trained at the former socialist countries, especially in the former Soviet Union. The R&D institutions of Viet Nam mainly cooperated with the R&D institutions of the former socialist countries.

- At present, collaboration between Viet Nam and international nuclear community has been extended: Viet Nam is Member State of the IAEA, RCA, FNCA; Viet Nam signed IGAs for cooperation on peaceful uses of nuclear energy with India (1986), Korea (1996), China (2000), Argentina (2001), Russia (2002), France (2009), Japan (2011), USA (2014).

- Though cooperative scopes are different, but Viet Nam has received collaboration and assistance from IAEA, RCA, FNCA, EU, Japan, Korea, India, Russia, France, USA, Argentina, Australia, and Hungary
3. Collaboration (2)

- March 2010, MOET of Viet Nam and ROSATOM signed MOU on Training Vietnamese Specialists in the Nuclear Energy Field;
- September 2012, MOET and IAEA signed a MOU on Cooperation for Training Manpower in the Field of Nuclear Energy;
- September 2013, Viet Nam and Hungary signed the IGA on Cooperation on Education, Research, Regulation, and Technology for Peaceful Uses of Nuclear Energy;
- March 2014, MOET and MEXT of Japan signed an Arrangement for Cooperation on Manpower Training, including Training in the field of Nuclear Energy. Since 2016 about 100 Vietnamese students will be sent to study nuclear energy disciplines at the universities in Japan.
- 2010-2014: 313 Vietnamese students dispatched to Russia for undergraduate programme and 10 for graduate programme on NPP installation and equipment;
3. Collaboration (3)

- During 2012-2014 about 200 turns of lecturers and researchers from universities and R&D institutions were dispatched to attend 6-week internships at Budapest TEU and Paks NPP in Hungary;
- Under EVN’s Training Programme, 25 students dispatched to Russia, 24 engineers dispatched to Japan for training on NP project.
- In 2011, Viet Nam and Russia agreed to cooperation on the implementation of a project on the establishment of the Center for Nuclear Energy Science and Technology (CNEST);
- **CNEST is established to serve nuclear power development programme of Viet Nam, and in particular, to serve Ninh Thuan 1 Nuclear Power Project, which partner is Russia. In addition, CNEST will conduct research, development, application of atomic energy and training nuclear human resources in Viet Nam.**
4. Project on the Establishment of “Center for Nuclear Energy Science and Technology (CNEST)”
The Agreement between the Government of the Socialist Republic of Viet Nam and the Government of Russian Federation for Cooperation in Construction of Nuclear Power Plant in the Territory of Viet Nam signed on 31st October 2010 stated that Viet Nam and Russia agreed to cooperate for establishment of the CNEST;

On 21st November 2011 Viet Nam and Russia signed the Agreement between the Government of the Socialist Republic of Viet Nam and the Government of Russian Federation for Cooperation on Establishment of the Center for Nuclear Energy Science and Technology in the Territory of Viet Nam, of which:

- Competent Authorities: MOST (Viet Nam) and ROSATOM and ROSTECHNADZOR (Russia);
- Authorized (Implementing) Organizations: VINATOM (Viet Nam) and ZAO “Atomstroyexport” (Russia);
4. Main functions of the CNEST

1. Research, acquisition and adoption of the transferred technologies, moving forwards to master in design, operation, maintenance and repair of research reactors and nuclear power plants. Provide scientific service and technical support for the Ninh Thuan nuclear power project and future nuclear power plants; contribute to ensuring the safe and efficient operation of nuclear power plants;

2. Performing fundamental research with orientation to application on nuclear physics, radioactive chemistry, radioactive biology, nuclear medicine, materials science, life science, gradually enhance national potential on nuclear science and technology;

3. Implementing activities on production and supply of radioisotopes, pharmaceutical tracers for health; fabrication of semiconductor materials for electronic industry; deploy technology transfer and services on nuclear technique applications in the socio-economic field;

4. Training human resources and cadre for nuclear power development and nuclear technique applications.
4. Tasks of the CNEST (1)

1. Nuclear power
   • Research on nuclear physics and nuclear data;
   • Research on reactor physics and technology;
   • Research on hydrothermal and safety analysis and assessment;
   • Research on nuclear fuel design, reactor design, related equipment systems;
   • Research on radiation protection and environmental impact assessment;
   • Research on fuel cycle and reactor materials;
   • Research on radioactive waste treatment and management.

2. Fundamental research oriented to application
   • Interdisciplinary fundamental research;
   • Research on materials science;
   • Research on information technology and computer science;
4. Tasks of the CNEST (2)

- Research on biotechnology and radioactive biology;
- Research on biomedical engineering, nuclear medicine, medical physics;
- Research on technology of radioactive chemistry; production of radioisotopes and radiopharmaceutical.

3. Scientific and technical services

- Production of isotopes and radiopharmaceutical;
- Fabrication of semiconductor material;
- Elemental analysis and structural analysis of materials.

4. Manpower training

- Cadre for nuclear power development programme;
- University students, master students and graduate student in the field of atomic energy; and
- Cadre working in the field of atomic energy, in general.
4. Organizational Structure (1)

- CNEST Project consists of two component projects:
  - Component project 1 in the South (Da Lat or Dong Nai) with multi-purpose high capacity research reactor and related laboratories.
  - Component project 2 in Ha Noi with system of laboratories served to technical support for Ninh Thuan NP project and NP development programme.

- CNEST employees is estimated about 500 people.
5. CNEST Organizational Structure (2)  
(proposed by ROSATOM)

Red color – related to nuclear power
4. Organizational Structure (3)
(proposed by VINATOM)

Research reactor: 15 MWt

VINATOM

CNEST

BOARD

Dalat

Research Reactor
- Reactor operation and Engineering
- Nuclear Safety
- Experiment Engineering, Planning and Reporting
- Neutron Technologies

Material science Complex
- Nondestructive testing laboratory
- Elementary and structural analysis laboratory

Radioisotope Complex
- Radioisotope production
- Radionuclide sources

Engineering Services
- Radwaste Management
- Rad. Protection and Environment

Hanoi

Nuclear Physics & Electronics I&C

Computation Center

Irradiation & Nuclear Technologies

NPP Service

Technology & Nuclear Safety

Practical Training

Materials Science

R. protection & E. monitoring

Chemical Technology

Elect. Mech. Workshop

Radwaste management
4. CNEST Technical Infrastructure

a) Research reactor with capacity of 15-20 MW and technology systems and devices for production lines of radioisotopes; neutron activation analysis; silicon doping; safety and hydrothermal research; testing fuel and material, including fuel test loops, and capsules; operator training (simulator, computer codes, ...); research devices on horizontal channels with the thermal neutron flows, including HRPD, SANS, TAS, neutron tomography; and devices in the Complex for Materials Science Research;

b) The Complex for Material Science;

c) The Complex for Nuclear Safety Research
   • Laboratory of physically modeling hydrothermal processes;
   • Center for High-Performance Computer; and
   • Training Center equipped with simulator of operating power reactors.
4. Cooperation with ROSATOM Organizations

Ha Noi CNEST

Nuclear Technology and Safety

Nuclear Material Science

Da Lat CNEST

Gidropress – Podolsk

VNIIAES - Moscow

SNIITMASH - Moscow

Institute for Nuclear Reactor (NIIAR) -- Dimitrovgrad
4. Role of the CNEST in Viet Nam’s NPP Programme

- North Viet Nam Institutes, Universities
- Material Science
- Nuclear Power Safety
- Dalat NRI
- Dalat University
- Dalat Nucl. Research Center (DNRC)
- New Research Reactor
- South Viet Nam Institutes, Universities

NPPs along the Southern Central Region coastal Area
4. CNEST can become a Regional Nuclear Science & Technology and Education & Training Center

ROSATOM (Russia)

CNEST

Viet Nam NP Programme

South East Asia Countries

Other Countries
4. CNEST Project: Key Milestones

- 2011 Viet Nam and Russia signed the Agreement for Cooperation on Establishment of CNEST;
- 2012: Study and evaluation of the site for the new Research Reactor;
- 2013: Strategic areas for R&D, determination of the main components of the CNEST;
- 2014: Completion of the Terms of Reference for FS; and cost estimation for SAD and FS.

Next steps

- Decision of Vietnamese Government on the CNEST sites
- Negotiation on the Inter-Governmental Agreement between Viet Nam and Russia on Credit Support by the Russian Federation for the Construction of CNEST; and
- Implementation of Feasibility Study.
5. Conclusions
5. Conclusions (1)

1. Viet Nam is embarking to Nuclear Power Programme with the Ninh Thuan Nuclear Power Project from a low developed infrastructure, including R&D capacity to be developed to meet requirements for the deployment of sustainable nuclear energy system. Strengthening R&D capacity is one of the prerequisites for ensuring safe, secure and efficient uses of nuclear energy and stepwise localization of and self-reliance on nuclear technology.

2. Due to level of development of economics, science and technology, Viet Nam can not strengthen the R&D capacity without international cooperation and assistance. For this reason, Viet Nam attaches great importance to international collaboration on R&D capacity building. In fact, international collaboration has made significant contributions to the research, development, and application of nuclear energy in Viet Nam.
5. Conclusions (2)

3. Viet Nam Academy of Science and Technology (VAST) established in the years 1970's with the assistance of the former Soviet Union, now has actually become the leading Center for scientific research in Viet Nam. With this reality, we hope that the CNEST will be an advanced R&D Center on nuclear energy in Viet Nam and in the region; CNEST will make significant contributions to sustainable nuclear power development programme in Viet Nam.

4. To achieve such goal, there remain many challenges ahead, e.g. investment capital, manpower preparation, especially efficient exploitation of the CNEST after it entered into operation.

Thank you for your attention