

HUMAN RESOURCE DEVELOPMENT FOR NUCLEAR POWER PROGRAMME IN VIETNAM

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Fukui International Meeting on Human Resources
Development for Nuclear Energy in Asia

Nuclear Power Programme in Vietnam

**Human Resources Development for
Nuclear Power Programme in Vietnam**

Nuclear Power Programme in Vietnam

Development Planning Orientation for Nuclear Power in Vietnam up to 2030 (Approved by PM in 2010)



No	Nuclear Power Unit	Capacity (MW)	Year of Commercial operation
1	Phuoc Dinh Unit 1	1000	2020
2	Phuoc Dinh Unit 2	1000	2021
3	Vinh Hai Unit 1	1000	2021
4	Vinh Hai Unit 2	1000	2022
5	Phuoc Dinh Unit 3	1000	2023
6	Phuoc Dinh Unit 4	1000	2024
7	Vinh Hai Unit 3	1000	2024
8	Vinh Hai Unit 4	1000	2025
9	Central Region Unit 1 and 2	2 x 1000	2026
10	Central Region Unit 3	1.300 - 1.500	2027
11	Central Region Unit 4	1.300 - 1.500	2028
12	Central Region Unit 5	1.300 - 1.500	2029
13	Central Region Unit 6	1.300 - 1.500	2030
Total capacity		15.000 - 16.000	



Resolution by the National Assembly on the Investment on Ninh Thuan Nuclear Power Project (25 November 2009)

- **Ninh Thuan 1:** Phuoc Dinh, Ninh Thuan
 - Capacity: 2 units x 1,000 MWe
- **Ninh Thuan 2:** Vinh Hai, Ninh Thuan
 - Capacity: 2 units x 1,000 MWe



Development of Nuclear Power Infrastructure

- Establishment of the National Nuclear Safety Council (4/2010)
- Establishment of the Vietnam Atomic Energy Agency (2/2010)
- Establishment of the State Steering Committee of the Ninh Thuan Nuclear Power Project (5/2010)
- Establishment of the Ninh Thuan Nuclear Power Project Management Board (EVNNPB) (4/2011)
- Establishment of the Directorate of Energy, MOIT (2011)
- Establishment of the National Steering Committee on Human Resource Development in the Field of Atomic Energy (6/2011)

- Atomic Energy Law 2008, being amended
- Participation in most of the relevant international instruments
 - 1982: Non-Proliferation Treaty (NPT)
 - 1987: Convention on Early Notification of a Nuclear Accident (accessed)
 - 1987: Convention on Assistance in Case of Nuclear Accident or Radiological Emergency (accessed)
 - 1989: Safeguards Agreement with IAEA
 - 1996: Bangkok Treaty on Southeast Asian Nuclear Weapon Free Zone 1996: Comprehensive Nuclear-Test-Ban Treaty (CTBT, signed, ratified 2006)
 - 2007: Additional Protocol (AP, signed, ratified 9/2012)
 - 2010: Convention on Nuclear Safety (CNS, accessed)
 - 2012: Convention on Physical Protection of Nuclear Materials and its Amendment (in force since 3 Nov. 2012)
 - Access the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

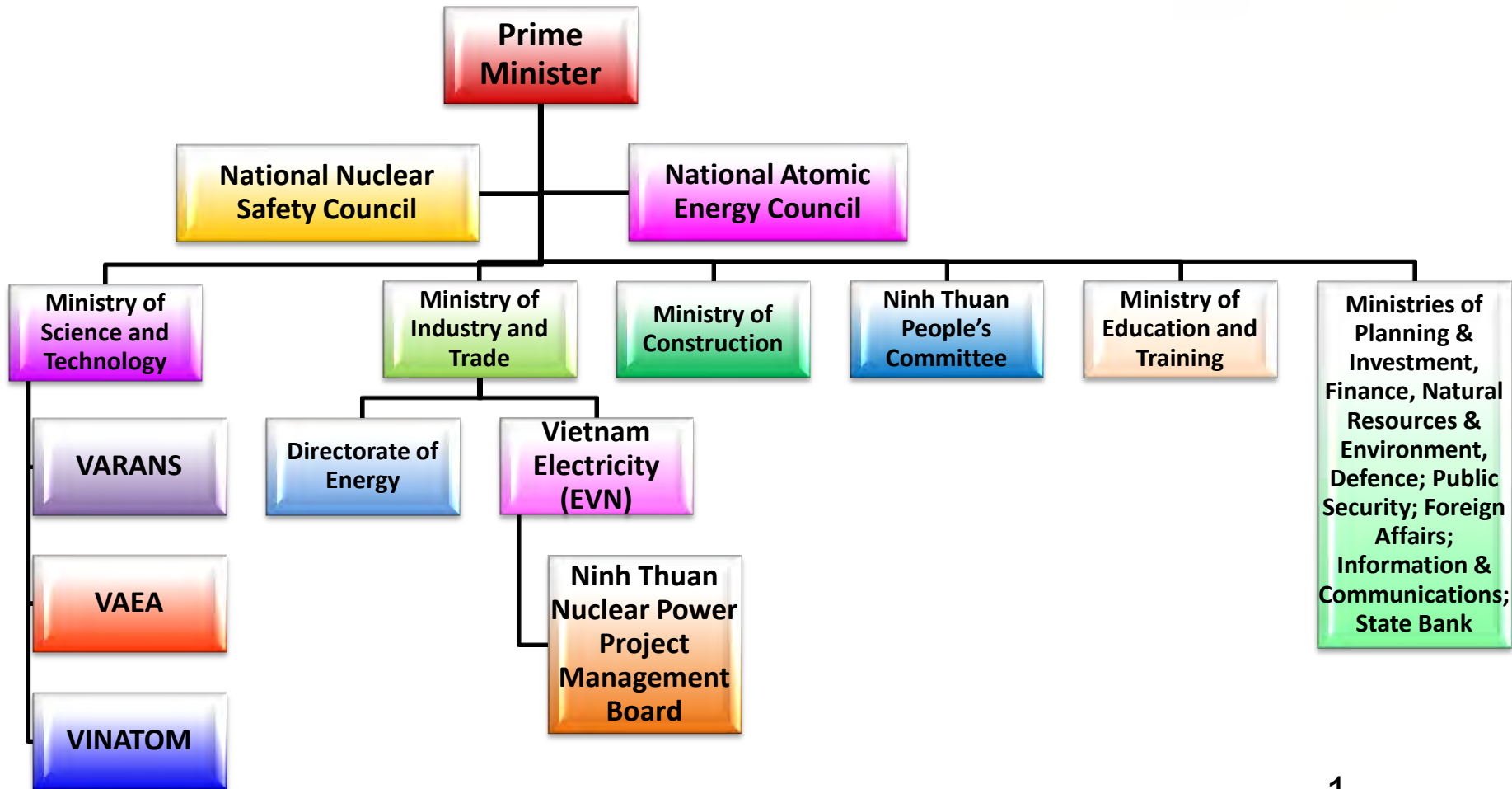
- **Cooperation with partner (vendor) countries: Russia, Japan**
 - Inter-Governmental Agreement between Vietnam and Russia on the construction of the Ninh Thuan 1 NPP Project (10/2010)
 - Inter-Governmental Arrangement between Vietnam and Japan on the construction of the Ninh Thuan 2 NPP Project (1/2011)
 - Inter-Governmental Agreement between Vietnam and Russia on the credit loan for the construction of nuclear power plant in Vietnam (11/2011)

❖ Cooperation with IAEA:

- 2009-2011: 3 TC Projects related to the development of nuclear power infrastructure
- 2011: Establishment of the Integrated Work Plan for the development of nuclear power infrastructure
- 2012-2013: 5 TC Projects related to the development of nuclear power infrastructure
- IAEA's EM on Review of Vietnam's Strategic Planning on HRD for Nuclear Power to be held in 2014

❖ Cooperation with other experienced countries in nuclear power development: USA, EU, Russia, France, Japan, Republic of Korea, etc.

Development of Nuclear Power Infrastructure



Development of Nuclear Power Infrastructure



Roles and responsibilities of Members of the State Steering Committee are defined in the *Regulation of Operation of the National Steering Committee of the Ninh Thuan NPP Project* (Decision No. 93/QĐ-TTg dated 17/01/2011) and the *Decision Amending and Supplementing Some Articles of the Regulation of Operation of the National Steering Committee of the Ninh Thuan NPP Project Promulgated along with the Decision No. 93/QĐ-TTg dated 17 January 2011 by the Prime Minister* (Decision No. 717/QĐ-TTg dated 14/06/2012)



The IAEA INIR Mission in Hanoi, Vietnam, 5 – 14/12/2012

- Draft of the Master Plan for developing the national nuclear power infrastructure in Vietnam up to 2020 revised considering the recommendations of INIR Mission and based on practical situation in Vietnam; the Master Plan submitted to PM for approval in Dec.2013
- List of legal documents to be promulgated up to 2020 approved by the Prime Minister (2/2013)
- Approval of the National Project on PI&C for nuclear power programme (2/2013)
- Establishment of the National Atomic Energy Council (5/2013);
- Establishment of the Technical sub-committees of the State Steering Committee;
- FSs and Site Approval Dossiers for 2 Projects basically completed and submitted for appraisal by relevant organizations (late 2013)

Human Resources Development For Nuclear Power Programme in Vietnam

I. Vietnam National Scheme on Human Resource Training and Development



2009

- Resolution No. 41/2009/NQ-QH12 by the National Assembly on the Investment Policy of the Ninh Thuan Nuclear Power Project.

2010

- Decision No. 1558/QD-TTg of the Prime Minister, approving the National Scheme for Training and Development of Human Resource in the field of Atomic Energy (**Scheme 1558**)

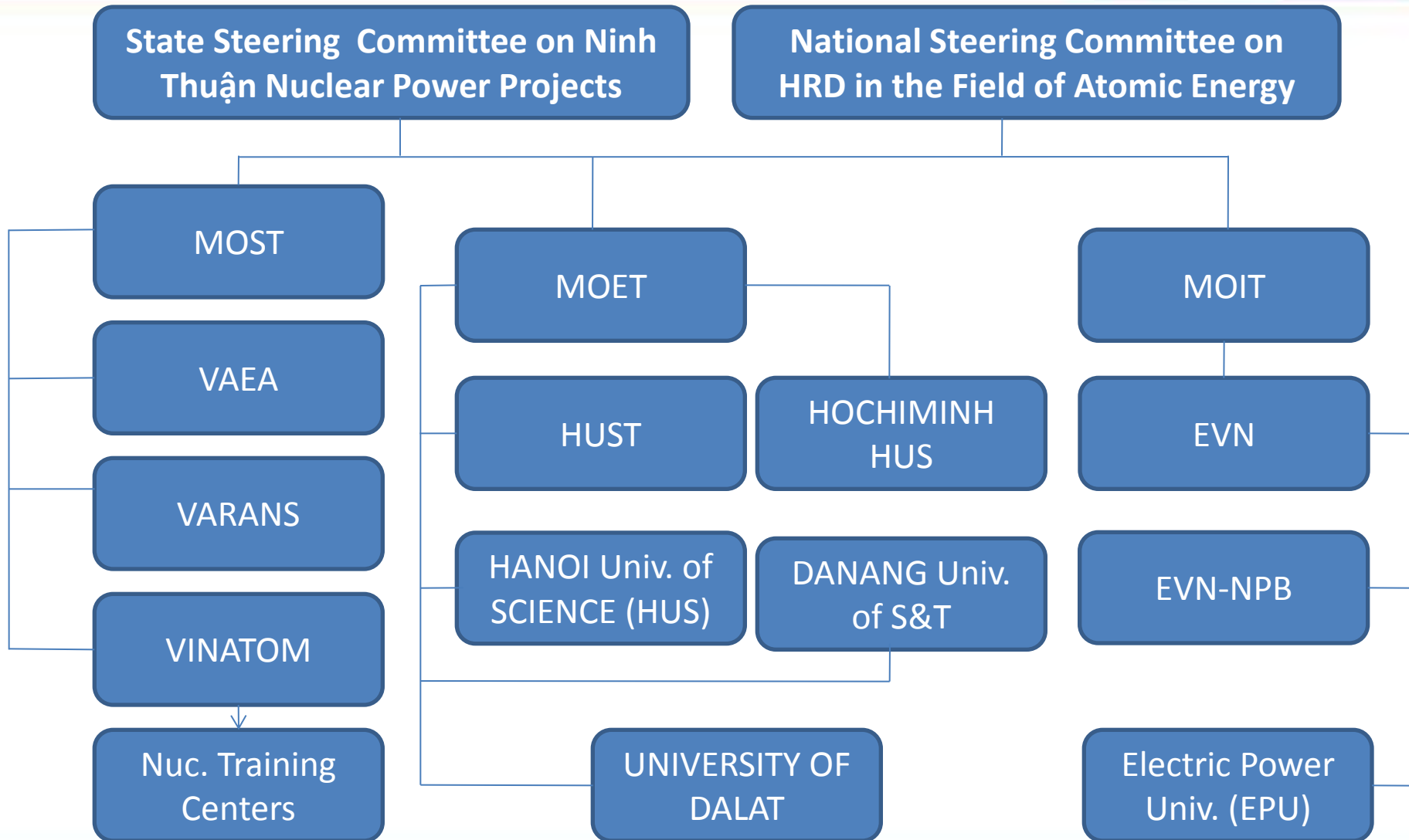
2011

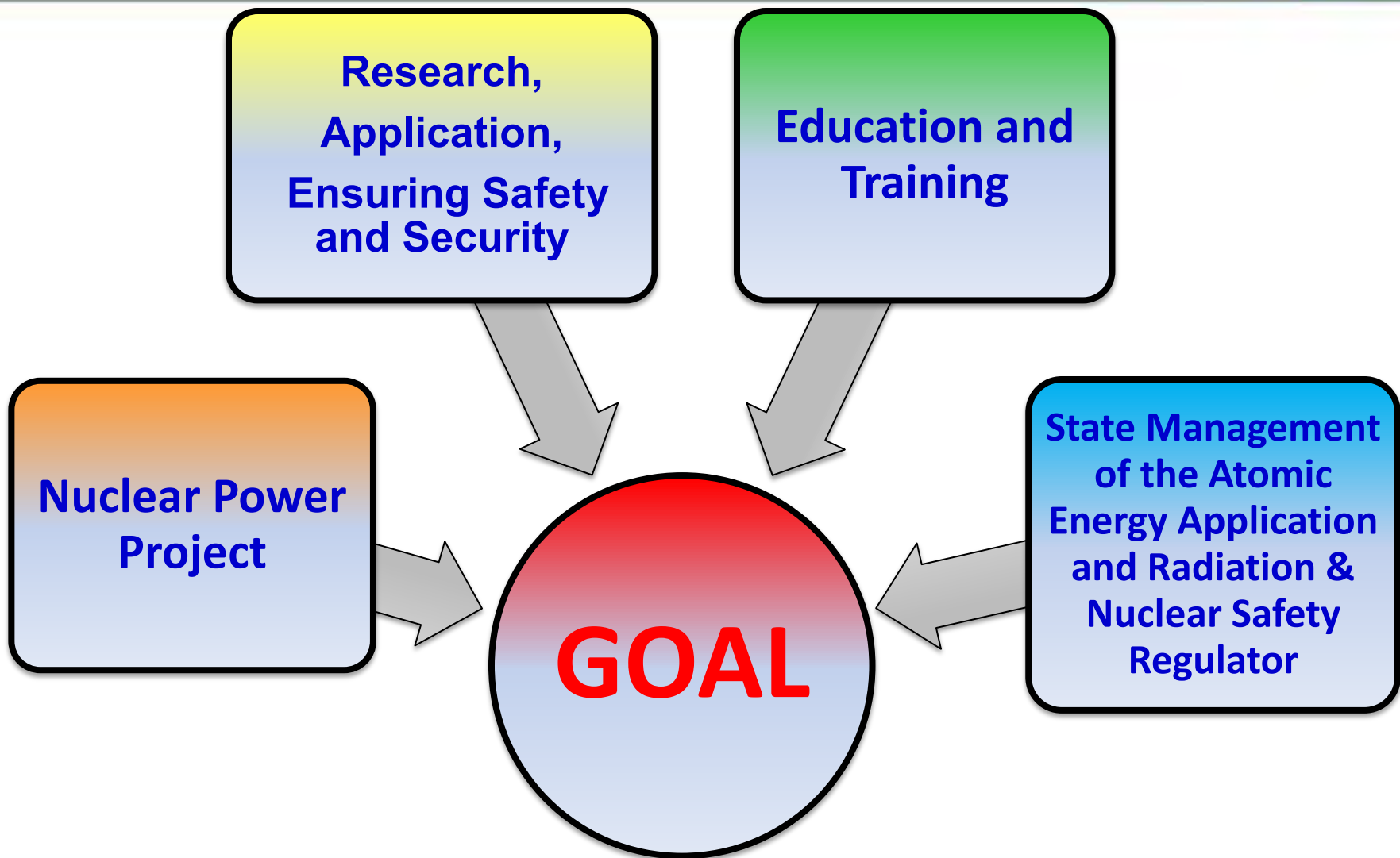
- Decision No. 940/QD-TTg of the Prime Minister, establishing the National Steering Committee on Human Resource Development in the field of Atomic Energy.

- **National HRD Scheme in the Field of Atomic Energy up to 2020:**
- **Approved:** 16/8/2010 (Prime Minister's Decision No. 1558/QĐ-TTg)
- **Total Investment:** 3,000 bil. VND (~150 mil. USD)
- **For nuclear power projects:**
 - **Each year:** 240 engineers, bachelors, 35 masters and PhDs (including 20 foreign-trained engineers, bachelors, 15 masters and PhDs)
 - **Up to 2020:** 2,400 engineers, 350 masters and PhD specialized in nuclear power (including 200 engineers, 150 masters and PhD trained abroad)
- **For other applications of atomic energy:**
 - **Each year:** 65 engineers and bachelors, 35 masters and PhDs (including 30 foreign-trained engineers, bachelors, 17 masters and PhDs)
 - **Up to 2020:** 650 engineers, 250 masters, PhDs (including 150 engineers, 100 masters and PhDs trained abroad)

- **Chairman:** Deputy Prime Minister
- **Permanent Deputy Chairman:** Minister of Education and Training
- **Members:**
 - Deputy Ministers of Science and Technology; Industry and Trade; Agriculture and Rural Development; Health; Finance; Planning and Investment; Internal Affairs
 - CEO of EVN
- **Direction Board of the National Planning (established: 8/2011)**
 - **Head:** Deputy Minister of Education and Training

Stakeholders involved in HRD





II. Current Status and the Needs of Human Resources for Nuclear Power Program



- In 2012, MOST conducted a survey on the current status and further needs of human resources development in the field of atomic energy.
 - Collecting information of existing staff with undergraduate and postgraduate degree of each related organization;
 - Forecasting manpower needs and training needs of each related organization.
- MOST reported the results to National Steering Committee, and sent a report to MOET for drafting the master implementation plan of **Scheme 1558**.

1. Current Status of Human Resources for Nuclear Power Program



❖ VIETNAM

- Current nuclear power workforce: **300** personnel (204 BSc/Engineers, 77 Masters and 19 PhDs).
- Only about 100 people specialized in nuclear reactor technology, safety and nuclear power installations, mainly from MOST.

Organization	Current nuclear power workforce (2012)			
	Bsc/Engineer	Master	PhD	Total
MOST	134	47	14	195
VAEA	17	3	1	21
VARANS	30	21	4	55
VINATOM	87	23	9	119
EVN	70	30	5	105
Total	204	77	19	300

1. Current Status of Human Resources for Nuclear Power Program



❖ MOST

- In the field of atomic energy: 587 people of undergraduate and postgraduate degree. (VAEA: 27, VARANS: 75, VINATOM: 485);
- Nuclear power workforce: **estimated** at about only 195 staff working *in specialties/jobs that serving directly for the development of nuclear power* (VAEA: 21, VARANS: 55, VINATOM: 119).

❖ EVN

- 105 personnel, mainly from Ninh Thuan Nuclear Power Projects Management Board (EVNNPB):
- Only 7 personnel specialized in nuclear reactor technology, safety and nuclear power installations.

Current personnel in the field of nuclear power of MOST (approximately)



Specialty/ Job	Number of staff	Qualification		
		BSc/ Engineer	Master	PhD
Environment Radiation Monitoring	27	17	8	2
Instrument and Control of reactor	5	4	0	1
International Relationship and Enforcing International Convention in the field of Atomic Energy	11	7	4	0
Legislation, Regulation, Polycy and Mechanism in the field of Atomic Energy	7	5	2	0
License, Inspection of Radiation and Nuclear Safety	16	8	7	1
Nuclear Fuel Technology	12	9	1	2
Nuclear Safety	28	17	11	0
Operate Nuclear Research Reactor	6	5	1	0
Power Reactor Technology	2	2	0	0
Project Management (Nuclear power, Science and Technology..)	17	6	6	5
Public Relationship, Information and Communication about Nuclear Power	9	8	1	0
Physics and Dynamics of Reactor	11	7	2	2
Radiation and Nuclear Emergency Preparedness and Response	5	5	0	0
Radiation Dispersion Calculation	2	0	2	0
Radiation Safety	38	30	6	2
Radioactive Mine Processing Technology	13	9	3	1
Radioactive Waste Processing Technology	21	16	2	3
Reactor Chemical	1	1	0	0
Reactor Thermohydraulics and Safety Analysis	4	2	1	1
Safeguard and Nuclear Security	4	2	1	1

2. Human Resources Needs for Nuclear Power Program Forecast up to 2020



❖ MOST

- **2020:** Nuclear power workforce: 855 personnel: VAEA: 79, VARANS: 304, VINATOM: 412 and NSTC: 60.

Organization	Number of staff needed (2020)			
	Nuclear power workforce			
	BSc /Engineer	Master	PhD	Total
<i>VAEA</i>	<i>44</i>	<i>26</i>	<i>9</i>	<i>79</i>
<i>VARANS</i>	<i>67</i>	<i>195</i>	<i>42</i>	<i>304</i>
<i>VINATOM</i>	<i>244</i>	<i>112</i>	<i>56</i>	<i>412</i>
<i>NTSC</i>	<i>27</i>	<i>19</i>	<i>14</i>	<i>60</i>
Total	382	352	121	855

2. Human Resources Needs for Nuclear Power Program Forecast up to 2020



❖ EVN

- **2020:** About 2761 staff: 1301 BSc/Engineers, 127 Masters, 12 PhDs, 922 technicians and 394 workers.
 - EVNNPB: about 400 staff during the peak period of construction (180 people will then work for NPPs).
 - Design and Inspection Consultant: about 300-400 staff from electrical design consultant companies.
 - Each NPP will need 1100 personnel, including 442 engineers, 461 technicians and 197 workers.

Specialty	Number of staff needed
Related to Nuclear power	282
Nuclear power	210
Nuclear physics and Nuclear engineering	40
Chemical engineering	32
Others	160
I&C	11
Electrical engineering + Mechatronics engineering + Mechanical engineering	8
Information technology	8
Other	71

Engineers needed for each NPP

Example of Human Resources Needs for a 2-unit NPP

(Source: IAEA – Workforce Planning for New Nuclear Power Programme)



Admin/clerica	42	Management support	2
ALARA	4	Materials management	4
Budget/acctin	9	Mods engineering	33
Chemistry	26	Nuclear fuels	7
Communications	2	Nuclear safety review	6
Computer engineering	4	Operations	122
Contracts	3	Operations support	20
Decom/radwaste	12	Outage management	7
Design/drafting	7	Plant engineering	47
Document control/records	12	Procurement engineering	6
Emergency preparedness	5	Project management	11
Environmental	3	Purchasing	7
Facilities	27	QA	11
Fire protection	2	QC/NDE	7
HP applied	28	Reactor engineering	5
HP support	10	Safety/health	3
Human resources	4	Scheduling	15
Information management	14	Security	128
Licensing	9	Technical engineering	31
Maintenance/construction	186	Training	43
Maintenance/construction support	39	Warehouse	14
Management	35	Total	1012

2. Human Resources Needs for Nuclear Power Program Forecast up to 2020

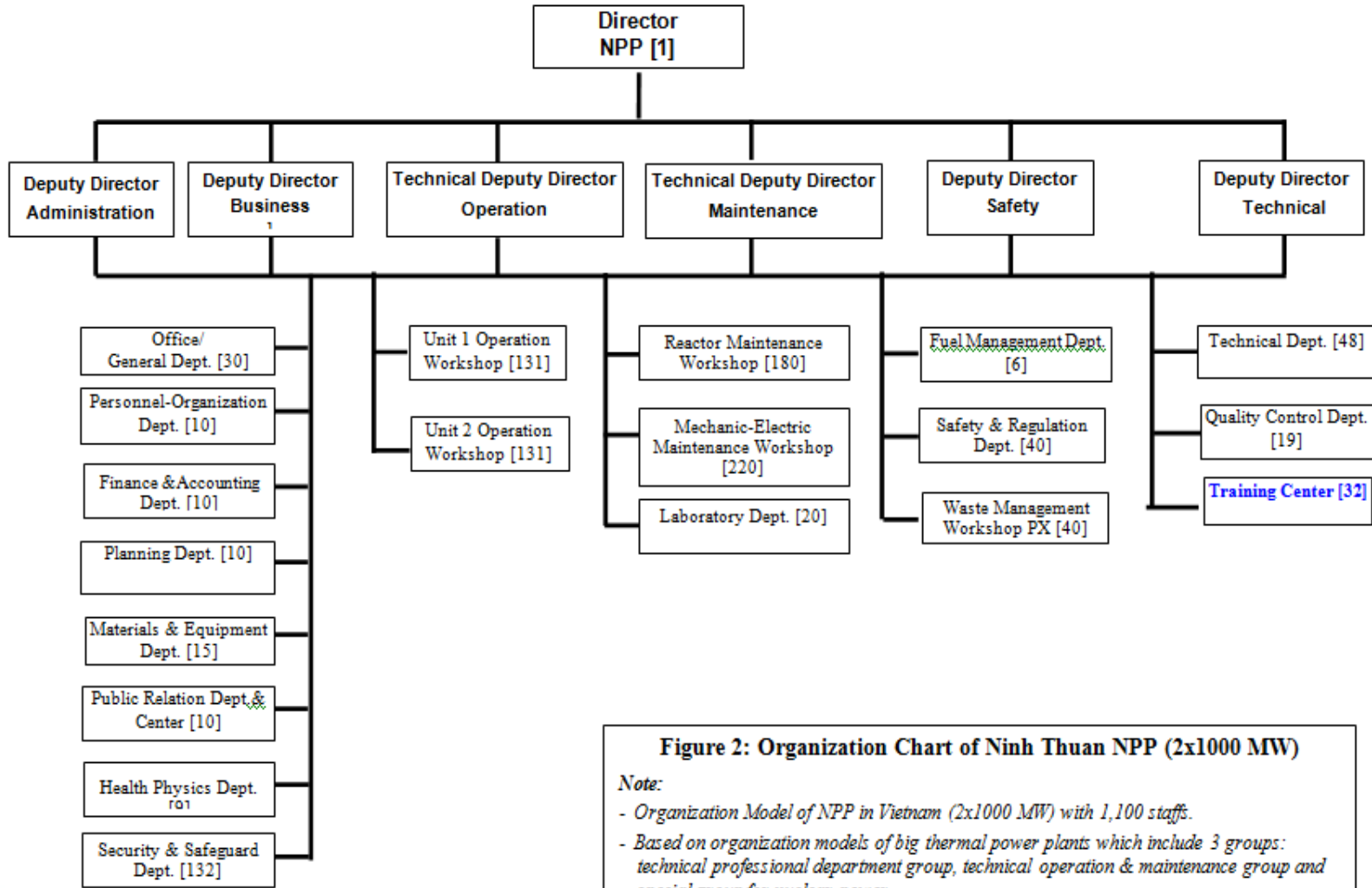


Figure 2: Organization Chart of Ninh Thuan NPP (2x1000 MW)

Note:

- Organization Model of NPP in Vietnam (2x1000 MW) with 1,100 staffs.
- Based on organization models of big thermal power plants which include 3 groups: technical professional department group, technical operation & maintenance group and special group for nuclear power.

❖ Policy, staffing and recruitment

- Policy and mechanism that encourage and attract young people to pursue careers in the nuclear energy field should be issued as soon as possible;
- There should be a persistent effective communication with the public contributing to attract people to study and pursue their careers in the field of nuclear power;
- Relevant organizations need to be provided necessary personnel to fulfill their functions. They should be staffed simultaneously and adequately in number, specialty and qualification, and in a timely manner consistent with nuclear power program's requirements.

3. Main Measures to Satisfy Human Resources Needs



❖ Domestic education and training

- Implement undergraduate and postgraduate nuclear engineering program in domestic universities;
- Extensive research and educational collaborations between the domestic educational institutions, the laboratories of R&D organization and partners in several other countries, including Japan, Russia, etc.;
- Permanent and obligated training courses to enhance competence of staff;
- A system of collaboration among educational institutions and recruitment organizations for hiring and curriculum development.

3. Main Measures to Satisfy Human Resources Needs



❖ Overseas education and training

- **Priority:** send trainees to countries with advanced nuclear power industry (U.S. Russia, Japan, etc.) to take undergraduate or postgraduate program in specialties directly related to reactor and nuclear power.
- Focus on sending staff abroad for training in particularly specialized areas that Vietnam lacks qualified teachers, training supporting facilities and curriculum such as reactor safety analysis, nuclear fuel technology, etc.

❖ Responsibility for HRD

- **Ministry of Education and Training (MOET):**
 - Drafts a master implementation plan the Scheme 1558 and develops detailed plan for each year;
 - Implements undergraduate and postgraduate education plan for relevant organizations;
 - Implements investment project on enhancing facilities for domestic educational institution;
 - Develops the incentives and supporting policy for people to be sent for training, and for people teaching in the field of atomic energy.

❖ Responsibility for HRD

- **MOST:**

- Assesses human resource needs of all relevant organizations;
- Determines principles and resources of domestic and overseas education and training;
- Implements the training plan specialists for R&D institutions and human resources for state management agency, nuclear regulation body.
- Develops the professional incentives regulations for people working in the field of atomic energy;

❖ Responsibility for HRD

- **Ministry of Home Affairs (MoHA):**

- Develops the plan on necessary personnel supplement for relevant organizations consistent with their needs of nuclear workforce.

- **EVN:**

- Implements its “Project on Training human resources for Nuclear power plants project at Ninh Thuan Province” (approved at Decision No. 584/QD-TTg dated 11/4/2013);
- Assesses technicians and workers needs for the construction and operation of NPPs.

MOST

- Training specialists for R&D institutions and human resources for state management agency, nuclear regulation body

EVN

- Human Resource Training Program for Nuclear Power Plant Project

MOET

- Implements education plan for relevant organizations except EVN

❖ MOET

a) Domestic education

- Upgrades the existing nuclear physics curriculum in domestic universities to meet higher standards;
- Implements **undergraduate and postgraduate** nuclear engineering programs in 6 domestic universities and 1 training center under VINATOM.
- Implements a train-the-trainer program and recruits domestic and international experts to prepare teaching staff for 6 domestic universities;
- Focus on **5-year-nuclear-engineering bachelor program** and **2 year-master program** at HUST; **2-year nuclear-engineering master program** at Dalat University (in cooperation with NRI);
- Promotes the use of Dalat research reactor and current training facilities.

Responsibilities of the E&T Institutions



Hanoi University of Science

- **Nuclear Physics and Radiation Application**

HCMC University of Science

- **Nuclear Physics and Radioactive Waste Management**

Danang University of Science and Technology

- **NPP Equipment and Installations**

Hanoi University of Science and Technology

- **Nuclear Engineering and Nuclear Reactor technology**

Electric Power university

- **Control and Automation of NPPs**

Dalat University

- **Basic Training on Nuclear Physics**
- **Nuclear Engineering**

Nuclear Training Centre

- **NPP Operators**

❖ MOET

b) Overseas education

- Implements the overseas education plan for relevant organizations through agreements with international partners.
- From early 2010 up to now: 258 students sent to Russia University on “*Equipment and installation of nuclear power plants*”.
- Staff in relevant nuclear E&T institutions sent to Hungary for training.

❖ EVN

EVN implements its “Project on training human resources for Nuclear power plants project at Ninh Thuan Province”.

a) Domestic education

- During 2013 – 2016:
 - 182 students attend 4-5 years course on nuclear power, nuclear physics, nuclear engineering and chemical engineering (46 students each year);
 - 320 students attend 4-5 years course on automatic and control engineering, electrical, mechatronics and mechanical engineering, information technology and others.
- During 2013 – 2017: 922 students attend 3 years technician course at Electric Power College of Ho Chi Minh City and Electric Power College of Central Region.

❖ EVN

b) Overseas education

- For Ninh Thuan 1 NPP: During 2013 – 2015, at Russia
 - 130 students to MEPHI or other universities during to attend 7 year courses on nuclear power;
 - 24 students to attend 7 year courses on chemical;
 - 3 students to attend 2 year master courses on nuclear power;
 - 3 students to attend 3 year PhD courses on nuclear power.
- For Ninh Thuan 2 NPP: Japan
 - During 2013 – 2017: 100 students to attend 5 year courses on nuclear power;
 - During 2016 – 2018: 3 students to attend 2 year master courses on nuclear power; 3 students to attend 3 year PhD courses on nuclear power.

❖ EVN

c) **Domestic training:** Up to 2020, EVN needs to organize for 1510 arrivals.

d) **Overseas training:** Up to 2020, EVN needs to organize for 1510 arrivals.

e) **Recruitment**

- For 160 positions of non-nuclear power related specialties for each NPP: hiring students graduating from domestic university and employees who have worked for electrical power plants of EVN.
- 922 technicians needed for 2 NPPs: will be hired after completing their education;
- 394 workers needed for 2 NPPs: will be hired from local people.

❖ EVN

e) Recruitment

- 282 personnel with specialties related to nuclear power for the maintenance and operation of Ninh Thuan 1 NPP: 141 students sent abroad has committed to work for Ninh Thuan 1 nuclear power plant project; 141 students will be sent to Russia during the period 2013 – 2015.
- 282 personnel with specialties related to nuclear power for the maintenance and operation of Ninh Thuan 2 NPP: 100 students will be sent to Japan; 182 students will be educated at domestic universities.

❖ MOST

Within the Scheme 1558, MOST implements the training plan for specialists for R&D institutions and human resources for state management agency and nuclear regulation body.

a) Domestic training

- **Implements:**
 - 9 – 12 months retraining courses for new staff;
 - 3 – 6 months training courses providing basic nuclear knowledge for management staff;
 - short term training courses (<3 months) providing advanced nuclear knowledge for experts and;
 - professional language courses;
- **Promotes the use of current facilities for training staff.**

❖ MOST

b) Overseas training

- MOST cooperates with foreign partner to organize the professional training to train team leader for specializes discipline that Vietnam has not meet requirements of facilities.

c) Use of training centers and establishment of laboratories

- MOST will use 3 existing training centers: Nuclear Training Center (NTC); NuTech under Nuclear Science and Technology Institute; Training Center under Nuclear Research Institute;
- MOST is establishing a Nuclear Science and Technology Center with the assistance of the Russian Federation;

Training activities



4 month- training course on nuclear safety at CICET (ROSATOM)



Training activities



*Vietnamese students studying in
Ozninsk, Russia*

**TRAINING IN
JAPAN**



**MOST's staff at a
JNES two-month training
course on basic nuclear
safety (2012)**



❖ MOST

c) Establishing training centers and laboratories

- MOST will establish a system of laboratories in variety field (I&C, radiation, reactor physics, nuclear thermal hydra, etc.) under R&D institution of VINATOM with following duties:
 - Recruiting staff to fulfill theirs function;
 - Selecting staff for sending abroad to attend training courses on necessary specialties;
 - Conducting R&D activities within The R&D program on nuclear power to satisfy requirements of the construction and operation of NPPs in Vietnam;
 - Conducting international cooperation for R&D.

- **Development of the integrated nuclear education and training programme for the state management agencies, regulatory body, TSO, utility.**
- **Mobilization of competent professionals to nuclear power field.**
- **Considering the modification/adjustment of the 1558 Scheme in accordance with the progress of Nuclear Power Projects.**
- **Issuance of appropriate policies, incentives, measures for HRD as soon as possible.**

6. CONCLUSIONS



- Vietnam considers HRD a key factor to ensure the success of the NPP Program in Vietnam;
- There is an urgent need to ensure/sustain competent workforce to meet the requirements of en-users: regulatory body, utilities and R&D institutions;
- Policies for human resources of the nuclear power program should be issued as soon as possible;
- More work needs to be done to finalize the detailed training requirements for staff in the different organizations/functions and to determine how this training will be provided;
- More coordination is needed between the ‘suppliers’ of human resources (MOET, Universities, Training Centers) and their ‘customers’ (EVN, VAEA, VARANS, VINATOM, etc.) to ensure that supply matches demand in a timely manner.

Nuclear Power Infrastructure, incl. HR must be built ...



Mr. Yukiya Amano, DG of IAEA on his visit to Vietnam, 1/2014



Thank you for your attention!