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# Vietnam Nuclear Power Development – Vietnam Nuclear Power Program (VNPP)

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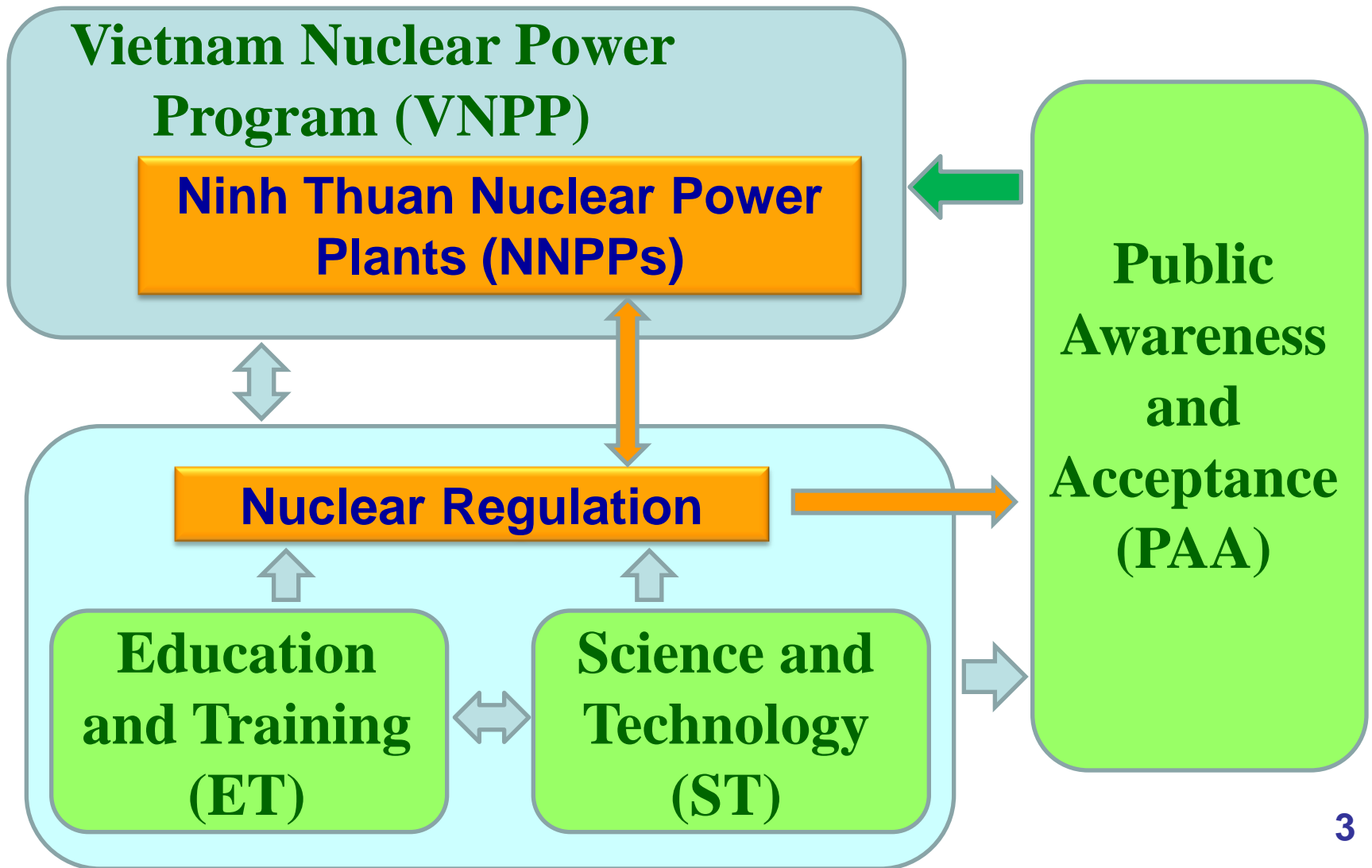
*Vice-president of VINATOM*

- 1) *Introduction*
- 2) *Nuclear Power Plant (NPP) Projects*
- 3) *Nuclear Human Resource Development (HRD)*
- 4) *Strengthen the R&D capability*
- 5) *The Center for Nuclear Energy Science and Technology (CNEST)*
- 6) *Concluding Remarks*

# 1. Introduction



*Vietnam needs sustainable development of nuclear power*

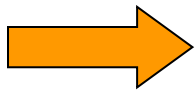


# 1. Introduction

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**The Vietnam Nuclear Power Program  
(VNPP) is ambitious**



**BIG CHALLENGES**

# 1. Introduction



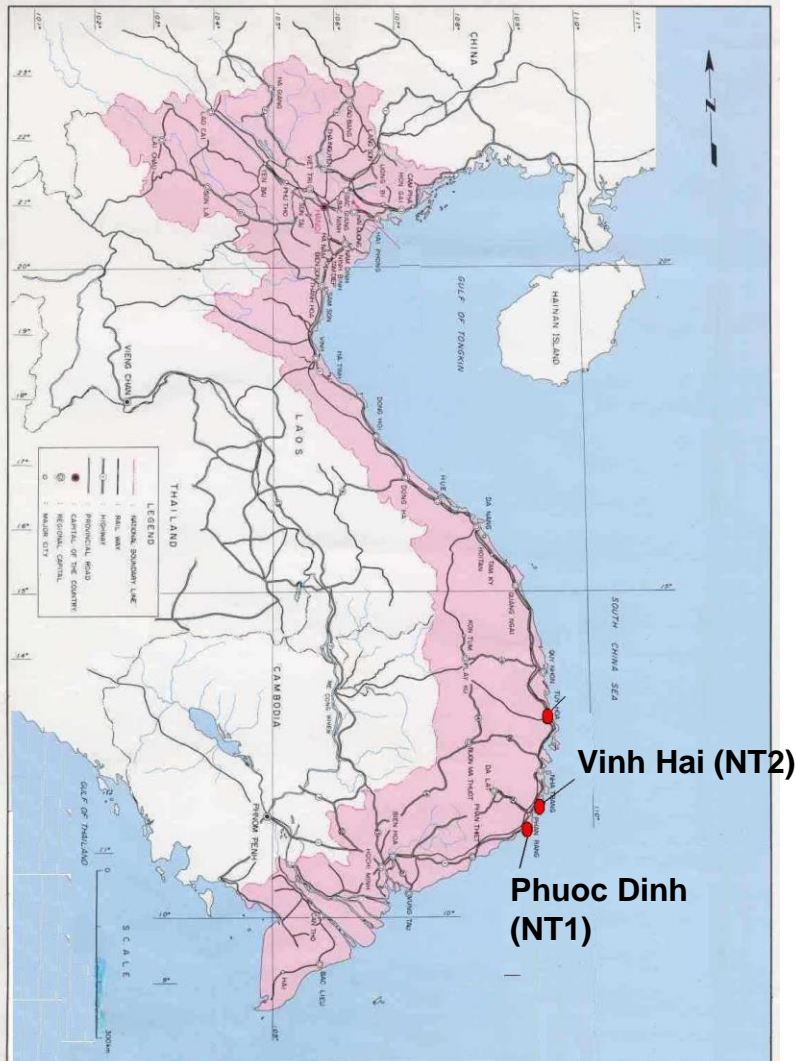
*Nuclear power requires **high quality human resources**, not depending on the implementing nation/country is poor or rich*

**High quality human resources are key for successful implementing the nuclear power program**

## *5 Main Issues for Vietnam Nuclear Power Program*

- 1. Nuclear Power Plant (NPP) Projects*
- 2. Nuclear Regulation System*
- 3. Development of R&D to support the VNPP*
- 4. Nuclear Human Resource Development (HRD)*
- 5. Public Information*

## 2. Nuclear Power Plant Projects



### *The First 2 NPP Projects*

- ✓ *Pre-FS: 2002-2009*
- ✓ *Ninh Thuan 1 – NT1:  
2x1000 MWe + 2x1000 MWe  
(Construction: 2017-2023)*
- ✓ *Ninh Thuan 2 – NT2:  
2x1000 MWe + 2x1000 MWe  
(Construction: Unclear)*
- ✓ *Location:  
300 km from Ho Chi Minh City,  
140 km from Dalat*

## 2. Nuclear Power Plant Projects



### *Feasibility Study (FS) for Ninh Thuan NPP Projects*

*Ninh Thuan 1:*

- **Consultant:** *E4 (Moscow EnergoPromTechnology -- EPT and Kiev EnergoProject – KIEP, Ukraine) + **AES-Buran***
- *FS start: November 2011*
- *Full FS first submission: December 24, 2013*
- *Technology selection: 4 technologies AES-91, AES-92, **AES2006** (design **V392M** of Moscow and design V491 of S.Peterburg)*



## 2. Nuclear Power Plant Projects



### *Feasibility Study (FS) for Ninh Thuan NPP Projects*

*Ninh Thuan 2:*

- **Consultant:** *Japan Atomic Power Company (JAPC)*
- *FS start: September 2011*
- *Full FS first submission: May 2013*
- *Technology selection: ABWR, MPWR+, **AP1000**, ATMEA1*

## 2. Nuclear Power Plant Projects

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### *Next Tasks*

Ninh Thuan 1 and Ninh Thuan 2 NPP Projects:

- Completion of FS reports
- Technology selection
- Review of the FS reports and design aspects
- Formulation of technical tasks for the Technical Designs
- Preparation for Contracts
- Licensing (construction and operation)
- Preparation for NPPs construction
- Other tasks

### 3. Nuclear Human Resource Development



**Near-term (5-10 years) focus:** *(in order of priority)*

- 1) *Develop a core expert group to support high-level nuclear energy R&D policy/decision-making*
  - *Identify weakness/specificity in infrastructure, institutional, human, culture*
  - *Plan items (ii)-(v) below*
- 2) *Develop capability to enable technical functions that review/oversee/react to actions taken now (0-2 years) that have lasting impact on **Safe, Economical and Sustainable (SES)**;*
- 3) *Develop capability to enable technical functions that support SES-significant decisions/operations expected in coming 3-5 years*
- 4) *Develop capability to support licensing, construction, and long-term SES operation*
- 5) *Develop nuclear energy S&T (quality R&D), and public trust/acceptance*

➡ **HUMAN RESOURCE DEVELOPMENT**

### 3. Nuclear Human Resource Development



#### *Current status of Vietnam HRD*

Utilities: EVN/NPB = 126

Students in Russia = 169 + 90 (2013)

Trainees in Japan = 15

Regulator: VARANS - 90

Management: VAEA (MOST) – 30;  
GDE (MOIT) - very few people

R&D, TSO, Consulting:

VINATOM: 810; Universities: N/A

Consultants: Few

A diagram showing three colored boxes on the left pointing to a central light blue circle labeled "HRD". The top box is light blue, the middle is light green, and the bottom is orange. Arrows point from each box to the circle.

**HRD**

# Cooperation with Russia in HRD

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- VINATOM organized Russian training course for professional staff to send to Russia for training
- VINATOM proposes Russia to continue receiving staff for long-term training to serve CNEST

- Constructive cooperation in electron beam accelerators at VINAGAMA (completed in 2012)
- Cooperation in fuel conversion of Da Lat nuclear research reactor (started in 2007 and completed in 2013)
- Consider cooperating with Rosatom in project of Da Nang research facility (first phase is Da Nang irradiation Center)

### 3. Nuclear Human Resource Development



#### ***Challenges in education and training***

- Education system focuses on nuclear physics, nuclear technique and radiation technology
- Long term education abroad has been limited
- Training courses on nuclear power were mainly short courses (IAEA, Japan, Korea, Russia, other countries)
- Training has been inefficient due to:
  - *Lack of a good plan for training, lack of good trainees, courses abroad were spreading to many groups*
  - *Trainees were lack of background in nuclear power and NPPs, therefore they could not understand intricated and sophisticated problems*
  - *Lack of sufficient English (Russian)*

## 4. Strengthen the R&D Capability



### *Towards Solutions of the Problems*

- ✓ HRD:
  - *Ministry of Education and Training (MOET): HRD project 1558 → Sending Master, PhD students to other countries*
  - *Ministry of Science and Technology (MOST): To establish a national project for nuclear experts training (including the Nuclear Energy Specialists Training – NEST of the VINATOM)*
  - *International cooperation: ROSATOM, KAERI, Japan Universities, Westinghouse (Internships and Scholarships from 6 months by end of 2014)*
- ✓ Regulation: Review of Safety Analysis Reports (SARs) for Ninh Thuan 1 and Ninh Thuan 2 NPP projects
- ✓ R&D: The Reactor Safety Research Plan (RSRP) →



## 4. Strengthen the R&D Capability



### *Strategic areas to support the NNPPs and VNPP*

NPP Design &  
Construction  
(D&C)

NPP Operation &  
Maintenance  
(O&M)

Reactor Safety  
(RS)

Other  
Topics

Nuclear Fuel &  
Fuel Cycles  
(FC)

Nuclear  
Economics  
(ECO)

## 4. Strengthen the R&D Capability



	<b>Issues/ Topics (Focus on 5,6,7,8)</b>	<b>Comment</b>	<b>Area</b>
1	NPP siting and external events; evaluation of EQ and flooding	<i>All topics</i>	D&C
2	NPP construction: Quality control, inspection	<i>in the first</i>	D&C
3	Digital I&C system design, performance, compatibility, reliability	<i>batch have</i>	O&M
4	HRA: Human reliability analysis (cultural factors)	<i>strong</i>	O&M
5	<b>PSA-L1: Passive safety systems evaluation</b>	<i>safety flavor</i>	RS
6	<b>PSA-L2: Severe accident management</b>	<i>even when</i>	RS
7	<b>PSA-L3: Environmental impact and mitigation of a severe accident</b>	<i>they are not</i>	RS
8	<b>Nuclear fuel &amp; irradiated materials performance and failures</b>	<i>classified as</i>	FC
9	Fuel cycle analysis, incl. issues in nuclear proliferation and security	<i>“safety”</i>	FC
10	Energy economics, including rare event consequences		ECO

## 4. Strengthen the R&D Capability



### **Relevant Nuclear Safety Research Institutions**

- Vietnam Atomic Energy Institute (VINATOM):
  - *Nuclear Physics Center (NPC)/Institute for Nuclear Science and Technology (INST)*
  - *Nuclear Safety Center (NSC); Nuclear Energy Center (NEC)/INST*
  - *Nuclear Reactor Center (NRC)/Dalat Nuclear Research Institute (DNRI)*
  - *Nuclear Fuel Group (NFG)/Institute for Technology of Radioactive and Rare Elements (ITRRE)*
  - *Reactor Materials Group (RMG)/Non-Destructive Evaluation (NDE)*
- Hanoi University of Science and Technology (HUST):
  - *School of Nuclear Eng. and Environmental Physics (SNEEP)*
  - *Fluid Mechanics and CFD (FMC)*
  - *Int. Institute for Computational Science and Engineering (IICSE) + DASI (ANSYS Representative)*
- Vietnam Academy of Science and Technology (VAST):
  - *Mechanical Institute (MI); Institute of Physics (IP)*
  - *Material Science Institute (MSI)*

# 4. Strengthen the R&D Capability



## Reactor Safety Research Program (RSRP)



**NDE, ITRRE, MSI:**  
Materials, Fuel, Water Chemistry

**IICSE, DASI:**  
CFD, H<sub>2</sub>, Containment, Thermo-Mechanical Creep Analysis

**SNEEP, MI:**  
Two Phase Flows, Natural Convection; Exp. Facilities

**NSC/INST:**  
PSA, DBAs, SAs; Test Facilities



**NEC/INST, NRC/DNRI:**  
Reactor Physics, Core Fuel Optimization

**NRC/DNRI:**  
Reactor Physics, Burnup Calculations



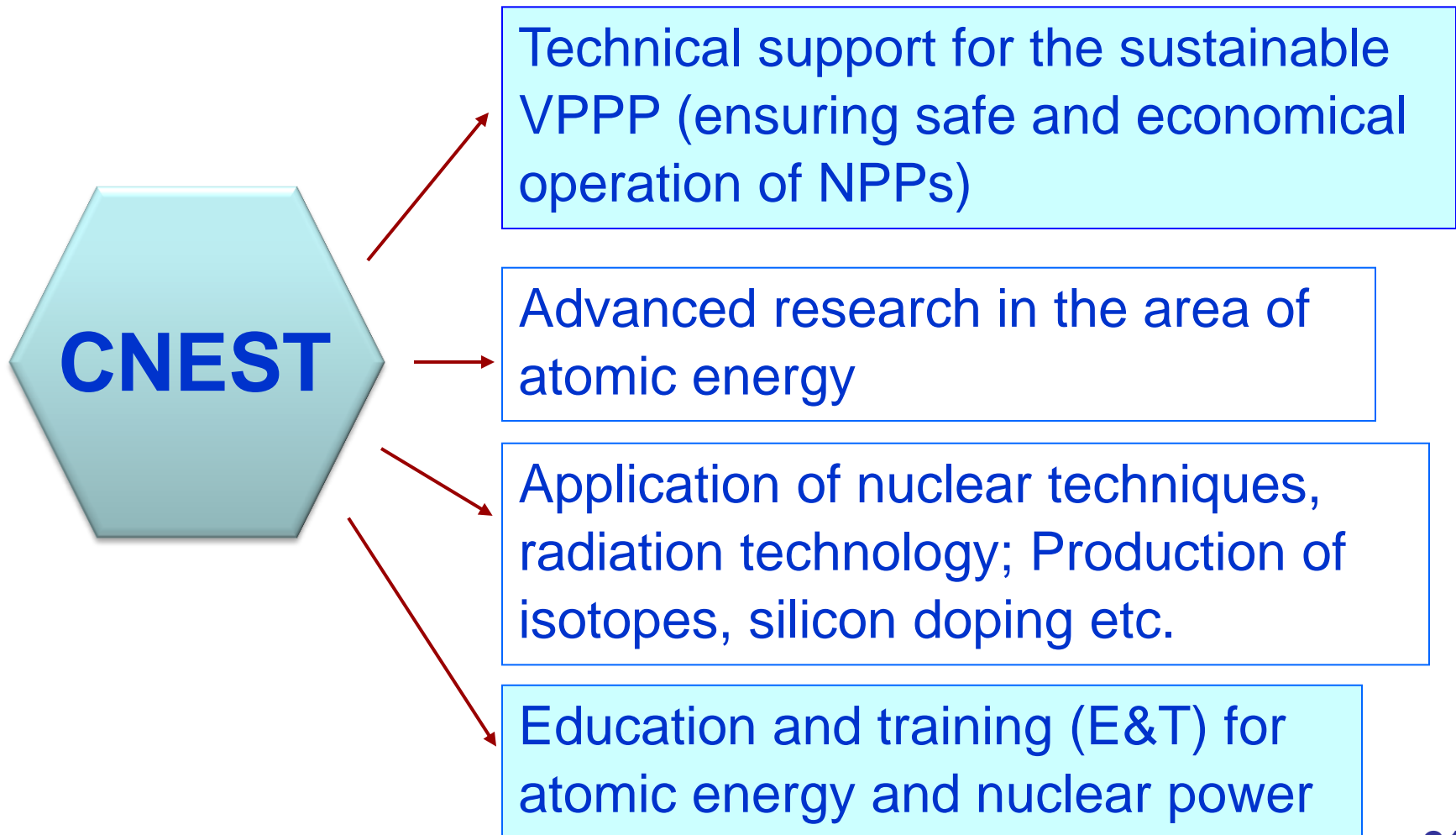
**NPC/INST/VINATOM, IP/VAST:**  
Nuclear Physics aiming at Applications



## 5. The Center for Nuclear Energy Science and Technology (CNEST)



### *The role of CNEST in the national R&D*



## 6. Concluding Remarks

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- Vietnam has introduced an ambitious nuclear power program (VNPP), the first 2 NPP projects are under consideration (FS phase)
- Vietnam needs to develop a sustainable nuclear power program (*otherwise it can be danger*), in which the human resources and R&D are essential
- Although the nuclear power program is a big challenge for Vietnam, we are moving towards to solutions of the problems
- International cooperation plays an important role in the VNPP, especially for the human resource training in the forthcoming years

*THANK YOU FOR YOUR LISTENING*