Drivers and Impediments for Regional Cooperation on the Way to Sustainable Nuclear Energy System

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1. Status of nuclear power programme in Vietnam (1)
- Studies on the Introduction of Nuclear Power -

- Since 1996, studies on the introduction of nuclear power in Vietnam have been being carried out in many programme and projects:
  - National Programme on Sustainable Energy Development (1996-2000);
  - Project on General Study on the Introduction of Nuclear Power into Vietnam (1996-1999);
  - Project on Study and Elucidation of the Aspects of Nuclear Power Development in Vietnam (2002-2004);
  - Project on Pre-Feasibility Study for Construction of the First Nuclear Power Plant in Vietnam (2002-2009); and
  - Project on Feasibility Study for Ninh Thuan NPPs (2011-now ongoing) .

1. Status of nuclear power programme in Vietnam (2)
- Factors considered on the Pre-FS -

Pre-FS Report consists of 14 chapters:

1. Necessity of nuclear power development
2. Nuclear power Technologies
3. Site selection
4. Technical Solutions
5. Radioactive Waste
6. Building and Organizing Construction
7. Operation, Maintenance, and Training
8. Nuclear Safety
9. Environment impact assessment
10. Total preliminary investment
11. Investment and Financing
12. Public Communication and Relation
13. International Cooperation
14. Ensuring security

1. Status of nuclear power programme in Vietnam (3)
- Ninh Thuan Nuclear Power Project -

- November 2009, the Vietnam's National Assembly approved Ninh Thuan Nuclear Power Project;
- The project consists of two component projects called *Ninh Thuan 1* and *Ninh Thuan 2 NPPs.*
- *Ninh Thuan 1 NPP* consists of 4 units x 1000 MW. At present, preparatory works for construction of first 2 units have been being conducted; Foreign Partner is Russia/Rosatom with VVER reactor type
- *Ninh Thuan 2 NPP* consists of 4 units x 1000 MW. At present, preparatory works for construction of first 2 units have been being conducted; Foreign Partner is Japan. But reactor type and vendor have not been decided yet.

1. Status of nuclear power programme in Vietnam (4)
- Ninh Thuan Nuclear Power Project -

- **Ninh Thuan 1 NPP**

  Phuoc Dinh Commune

  Ninh Phuoc District

  Ninh Thuan province

- **Ninh Thuan 2 NPP**

  Vinh Hai Commune

  Ninh Hai District

  Ninh Thuan province

2. Driving forces and impediments (1)

Driving forces

- Diversification of primary energy sources, reduce dependence on fossil energy, reduce fuel imports, minimize the impact of their price crisis, increase security of energy supply;
- Enhancement of national potential on science and technology, and develop infrastructure not only in the nuclear energy and power sector but also to promote development of other industrial and economic sectors;
- Reduction of environmental pollution (dust, CO_2, SOx, NOx ...) from the fossil fuel uses;
- Strong commitment of the Government;
- Public acceptance; and
- Favorable international cooperation.

2. Driving forces and impediments (2)

Impediments

- National infrastructure is still at low level, especially legal framework, education and training system, capabilities of R&D organizations, TSOs, as well as domestic industries;
- Shortage of human resources in almost aspects relevant to NPP project implementation;
- Large investment capital with a long-time construction period, while financing is mainly based on preferential loans from partners;
- Radioactive waste and spent fuels management and storage;
- Requirement on ensuring nuclear safety, especially after Fukushima accident; and
- Implementing two projects with two partners of different technical regulations and standards on sitting, technologies, operation…

3. Nuclear energy system may look like in 2030 (1)
- Projection on Electricity Demand -

	2009	2010	2015	2020	2025	2030
High Scenario						
Com. Elect. (GWh)	70,046	86,756	184,284	318,511	494,126	739,928
Elect. Gen. (GWh)	87,109	100,007	210,852	361,945	561,506	833,817
Capacity (MW)	13,867	16,048	33,426	57,180	88,401	132,201
Base Scenario						
Com. Elect. (GWh)	70,046	86,756	169,821	289,882	430,867	615,205
Elect. Gen. (GWh)	87,109	***100,007***	***194,304***	***329,412***	***489,621***	***695,147***
Capacity (MW)	13,867	***16,048***	***30,803***	***52,040***	***77,048***	***110,215***

3. Nuclear energy system may look like in 2030 (2)

- According to Master Plan on Electricity Development, period 2011-2020 with vision to 2030, NP capacity will increase from 1,000 MW (1.5%) in 2020 to 6,000 MW (6.2%) in 2025 and reaches 10,700 MW (7.8%) in 2030.
- NPP Sites: 8 potential sites have been identified;
- Technologies: the Generation III or III+ Light Water Reactor;
- Nuclear fuel (NF): Vietnam intents to rely on existing international markets for nuclear fuel services. Policy on NF from now to 2030, even to 2050:
  - One-through fuel cycle;
  - Import NF supplied by vendors, through the integration of the NF supply contract in the NPP construction contract ; and
  - In addition, diversification of suppliers to secure NF supply in the long-term.

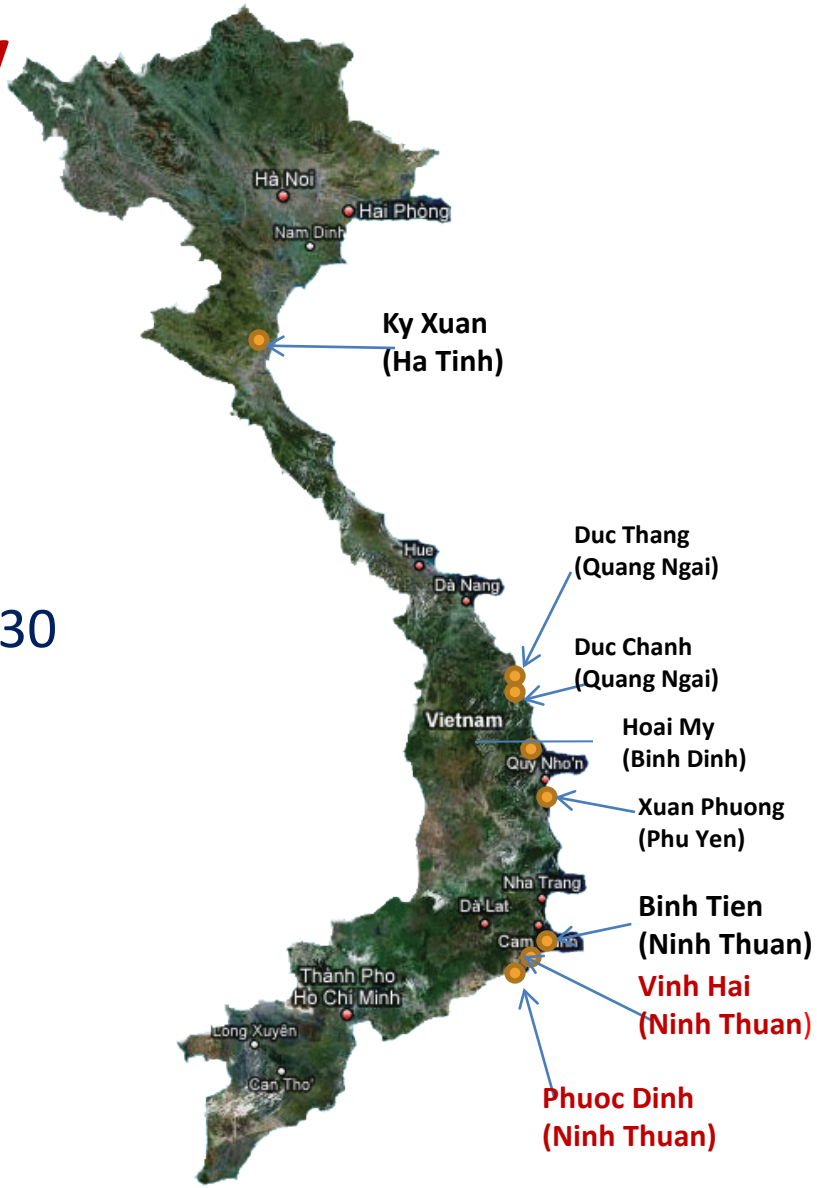
3. Nuclear energy system may look like in 2030 (3)
- Installed Capacity Structure, Base Scenario (MW) -

	2010	2015	2020	2025	2030
Hydro & Pump Storage	**7,416** (34.8%)	**14,006** (32.6%)	**17,701** (26.4%)	**20,401** (21.1%)	**22,501** (16.4%)
Oil & Gas – fired	**7,724** (36.3%)	**10,912** (25.4%)	**12,595** (18.7%)	**17,285** (17.9%)	**17,285** (12.6%)
Coal-fired	**3,940** (18.5%)	**15,255** (35.5%)	**30,765** (45.9%)	**44,790** (46.3%)	**76,310** (55.7%)
Import	**1,000** (4.7%)	**1,073** (2.5%)	**1,839** (2.7%)	**3,509** (3.6%)	**5,259** (3.8%)
Renewable	**678** (3.2%)	**1,679** (3.9%)	**3,129** (4.7%)	**4,829** (5.0%)	**4,929** (3.6%)
Nuclear			**1,000 (1.5%)**	**6,000 (6.2%)**	**10,700 (7.8%)**

3. Nuclear energy system may look like in 2030 (4)

- **Potential NPP Sites: 8**

(*Source:* Oriented Planning on Nuclear Power Development in Vietnam to 2030



3. Nuclear energy system may look like in 2030 (5)

Criteria for technology selection

1. Popularity and commercialization;
2. Technological systems of plant;
3. Safety systems;
4. Operability;
5. Radioactive waste management;
6. Fuel supply;
7. Technology transfer and localization;
8. Economic indicators;
9. Financial arrangement; and
10. Political and trade relations.

(*Source:* Pre-FS Report)

4. Role of country may play in deployment of nuclear power plants by foreign suppliers (1)

- **Oriented planning of nuclear power development in Vietnam in 2030 has set a goal for the local participation and technology transfer as follows:**

- **By 2015:** planning, issuing mechanisms and policies to boost and prepare capabilities of the domestic industries for participation in supplying materials, equipment, construction, installation, project management, supervision and quality control of NPPs;
- **By 2020:** perform some activities of technology transfer with foreign partners, focusing on technology of NPP design. Domestic industries will participate in supplying materials, equipment, construction and installation, transporting oversize, overweight equipment with the contract values reaching from 20% - 30% of the total construction and installation value;

4. Role of country may play in deployment of nuclear power plants by foreign suppliers (2)

- **By 2030:** master the technological design of nuclear power plants and potentially participate in the design with foreign partners; the domestic industries will be able to participate in the nuclear power plant project the contract value from 30% to 40% of the total construction and installation values.

❑ **For the Ninh Thuan NP Project**

- Domestic companies can be sub-contractors for the items, such as system of roads outside the plant; fresh water supply system; Leveling; harbor and breakwater; material supply, and construction.;
- Vietnamese companies can undertake from 35% to 40% of entire volume of the NPP construction work.

(*Source:* Pre-FS Report)

5. Vision of back-end fuel cycle services for national nuclear power programme

- So far, there is no legal provisions governing transit or return of spent fuels and high level radioactive waste to other countries;
- Through the Gov-to-Gov agreements, Vietnam will cooperate with NPP supplying countries, as well as leading nuclear power countries to find reasonable solutions related to back-end fuel cycle services;
- In fact, since 2007 Vietnam has cooperated with the IAEA, U.S., Russia to implement a Project on HEU to LEU fuel conversion for Dalat Nuclear Research Rector (DNRR). In march 2012, Vietnam and Russia signed an Agreement on return of HEU spent fuel at DNRR to Russia. All the HEU spent fuels will be returned to Russia in 2013.

6. Concept of a sustainable nuclear energy system

- As presented by the IAEA officers in the Forum, a sustainable nuclear energy is a system that meets requirements on:
  - Economic competitiveness;
  - Safety;
  - Waste management;
  - Environment;
  - Infrastructure;
  - Physical protection;
  - Proliferation resistance;
- Generally, a sustainable nuclear energy is in line with the national sustainable development targets.

7. Vision of Energy independence & Security of supply (1)

Energy independence

- **Sources**: **Energy Independence,** *by Edward P. Cross, President , Kansas Independent Oil & Gas Association* (http://www.kioga.org)

- First introduced by the US. President Richard Nixon in November 1973. “Energy independence means meeting our own energy needs without depending on any foreign energy source”.
- if energy independence is presented as self-sufficiency, then the prospects of achieving the goal of energy independence is very small. Such a goal will bring disappointment that will undermine the longer-term commitments that are required for a sound energy future. Cutting ourselves off from global energy markets is not realistic.

7. Vision of Energy independence & Security of supply (2)

- However, if the goal of energy independence is understood differently, then it is much more useful. We should define energy independence to be energy security i.e., more energy resilience, robustness, and reduced vulnerability.
- Energy independence as measured in energy security emphasizes diversification, encouraging investment and research and development in both alternative and conventional energy sources. Diversification of energy supplies is critical. Whether it is oil, natural gas, coal, nuclear, or alternatives, the key must be building a mix of energy that continues economic growth. Energy security also means a new push for energy conservation, higher energy efficiency, and lower energy intensity.

7. Vision of Energy independence & Security of supply (4)

- Energy independence as measured in energy security requires interdependence with other nations. How we manage our relations with other countries and other regions is a very essential ingredient for our own energy security.

Security of supply

- **Source** http://e-control.at/de/businesses/electricity/security-of-supply
- Apart from the safeguarding of supplies, the term "security of supply" includes supply quality, which in turn comprises supply reliability, power quality, operational security of supply and service quality.
- Security of supply means that electricity consumers are able to obtain electricity of defined quality when they need it, at cost-reflective and transparent prices.

8. Cooperation with other countries in energy projects, nuclear and non-nuclear

- Vietnam has cooperated with many countries, such as Russia, Japan, France, Korea, China... In many projects on hydropower, coal-fired power, gas-fired power, gas and oil exploration and exploitation, and renewable energy…
- Vietnam has had cooperative programmes with the IAEA, Canada, China, France, India, Japan, Korea, Russia in conducting studies on the introduction of nuclear power into country;
- At present, Russia and Japan have been chosen partners of the Ninh Thuan 1 and 2 NPP projects, respectively.

9. Vision of possible drivers and impediments for cooperation with other countries (1)

Factors could positively drive (motivate) cooperation

- Favorable political & diplomatic relations;
- Economic & trade benefits;
- Requirement on ensuring safety, security, and non-proliferation;
- Sustainable development in the region and in the world;

Factors are likely impede cooperation

- National laws and regulations;
- Requirements on national commitments on several international and/or regional and/or bilateral issues;
- No compromise of interests between partners;
- Uneven development on economy, infrastructure, science, and technology between partners.

9. Vision of possible drivers and impediments for cooperation with other countries (2)

How to select vendors

- Vietnamese Government requirements for cooperation partners:
  i. *Assistance in conducting feasibility study;*
  ii. *Low-interest and preferential loans for the Project;*
  iii. *Uses of the most advanced and proven technology with the highest safety standards for the Project;*
  iv. *Technology transfer and training of human resources for the Project;*
  v. *Cooperation in spent fuel and radioactive waste management and treatment for the Project; and*
  vi. *Supply of nuclear fuel for the whole life of the Project.*
- Russia and Japan have been chosen as partners of the Ninh Thuan 1 and Ninh Thuan 2 NPPs Projects, respectively.

9. Vision of possible drivers and impediments for cooperation with other countries (3)

To build strategic partnerships

- Vietnam signed Gov-to-Gov agreements on cooperation for peaceful uses of atomic energy with India (1986), Korea (1996), China (2000), Argentina (2001), Russia (2002), France (2009), and Japan (2011);
- Agreement between the Government of the Socialist Republic of Viet Nam and the Government of the Russian Federation on Cooperation in Construction of Nuclear Power Plant in the Territory of Vietnam, signed 2010;
- Arrangement between the Government of the Socialist Republic of Vietnam and the Government of Japan on Cooperation in Construction of Ninh Thuan 2 Nuclear Power Plant Project in the Socialist Republic of Vietnam, signed 2011;
- Vietnam is negotiating with the U.S. on the 123 Agreement.

10. Suggested indicators to measure benefits and disadvantages of cooperation with other countries (1)

The indicators to measure benefits can be based on its contribution to the development of:

- National infrastructure;
- National legislative framework;
- National education and training system, and human resources;
- Science and technology;
- Nuclear and other industries;
- Economy and trade;
- Political and diplomatic relations, and
- Safety, security and non-proliferation.

10. Suggested indicators to measure benefits and disadvantages of cooperation with other countries (2)

The indicators to measure disadvantages can be based on:

- Backward technology transfer;
- Low economic efficiency;
- Adverse environmental impacts;
- Affect the interests of a party;
- Cause the dependence of a party;
- Affect the interests of third parties;
- Inconsistency with international trends on safe, secure, and peaceful uses of nuclear energy; and
- Failure to comply with commitments.

Thank you for your attention