# Study on Nuclear Power Introduction into Vietnam

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The report presents main results of the study on nuclear power introduction into Vietnam which have been carried out at Vietnam Atomic Energy Commission in collaboration with Ministry of Industry of Vietnam and other countries like Japan, Canada and Korea. The study covers all topics related to the nuclear power introduction into Vietnam such as electricity demands and supply, economics, finance, technology, safety, manpower, site selection etc.

## I. Introduction

In the year 1986, the Government of Vietnam began launching an economic reform with the aim of shifting centrally planned economy to socialist-oriented market one with regulation of the State. As a result of the reform, the Vietnamese economy developed significantly in the period of 1989-1997 (see Table 1).

Since the year 1997, however, because of financial crisis in Asia the Vietnamese economy has been facing many difficulties, especially in foreign direct investment and export sectors. GDP growth rate in the year 1998 reduced to below the planned targets. The Government of Vietnam has reviewed and adjusted some targets of economic development in the period of 1999-2020.

Table 1: GDP Growth Rate in Vietnam in the Period of 1989-2000

| **Year** | **89-90** | **91-94** | **95** | **96** | **97** | **98** | **99-2000*** |
|---|---|---|---|---|---|---|---|
| GDP growth rate (%) | 6.8 | 8.5 | 9.5 | 9.6 | 8.2 | 5.8 | 5-6 |

* estimated

The population of Vietnam is now about 76.3 million, of which around 80% is in the rural area and the remaining 20% in the urban area. The annual population

growth rare, now, is 1.7% against 2.2% in the beginning of this decade.

During recent years, Vietnam has been conducting a national development strategy of industrialization and modernization with the aim of creating a quantum leap in the economy, at the same time strengthening potential of the country. Together with economic growth, energy and electricity production have been increased remarkably (see Table 2).

Table 2: Energy Production in Vietnam in the Period of 1995-2000

| **Type** | **Unit** | **1995** | **1996** | **1997** | **1998** | **1999*** | **2000*** |
|---|---|---|---|---|---|---|---|
| Coal | MT | 8.35 | 9.80 | 11.40 | 10.70 | 11-12 | 11-12 |
| Crude oil | MT | 7.60 | 8.80 | 10.91 | 12.60 | 14.50 | 16-18 |
| Natural gas | $Gm^3$ | 0.22 | 0.30 | 0.53 | 1.10 | 1.50 | 2.5-3.0 |
| Electricity | TWh | 14.64 | 16.96 | 19.15 | 21.65 | 23 - 25 | 25 - 27 |

* estimated

*Main targets in the policy of electricity development in Vietnam are:*

- Increasing effectiveness of electricity use;
- Conducting rural electrification;
- Constructing a sound policy on electricity price;
- Encouraging private investment;
- Diversifying electricity production sources;
- Minimizing environmental impacts caused by electricity production sector;
- Studying possibilities of the introduction of nuclear power into Vietnam;
- Ensuring energy supply security.

For the time being, two chief duties of the electricity production sector in Vietnam are:

1) To concentrate very effort on upgrading and enlarging some existing hydropower, coal-, oil- and gas-fired power plants, in the meantime on building new ones in order to meet increasing electricity demand and to reduce hydropower percentage in the sources structure to below 50% after the year 2003.

2) To conduct long-term planning of electricity supply sources development up to the year 2020, in which possibilities of the introduction of nuclear power into Vietnam need to be thoroughly considered.

Realizing the important role of the energy, especially, electricity in the

national economy, although the economy is facing many difficulties, the Government continues to give high priority in investment for renovating and upgrading some existing power plants, as well as for building new ones. The Government has also formulated a national energy programme "*Strategy and Policy of Sustainable Energy Development (1996-1999)*" aimed to define an energy policy in the future.

In order to evaluate the role of nuclear power in the national electricity supply structure, the Government has assigned the Ministry of Industry (MOI) and Vietnam Atomic Energy Commission (VAEC) to jointly conduct the project "*Overview Study on Possibilities of the Introduction of Nuclear Power into Vietnam (1996-1999)*". In the meantime the International Atomic Energy Agency (IAEA) supported the VAEC in carrying out the technical co-operation project "*Pre-feasibility Study on the Introduction of Nuclear Power into Vietnam (1996-1999)*".

## II. Existing Status of Electricity Production in Vietnam

Electricity supply structure in Vietnam, now, is composed of hydropower, coal-, oil- and gas-fired power, in which hydropower and coal-fired power plants are mainly located in the North, and oil- and gas-fired power ones are chiefly situated in the South. In the year 1994, a North-South 500 kV high voltage line with a length of 1500 Km was established and brought into operation, which has contributed to better dispatching of electricity supply in the country.

Total installed capacity, so far, is 5,559 MW (of which IPP plants is 425 MW), available capacity is 5,130 MW, of which hydropower accounts for a biggest portion of 55%, coal-fired power 24% and diesel & gas turbine 21%.

In the year 1998, total amount of electricity production is 21,654 GWh, of which the shares of hydropower, coal-fired and diesel & gas turbine power are 51%, 26%, and 23%, respectively.

Annual growth rates of capacity demand and total electricity production in the period of 1990-1998 are given in Table 3.

Table 3: Historical Development of the Power System (1990-1998)

| Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Capacity Demand (MW) | 1,660 | 1,850 | 2,005 | 2,141 | 2,408 | 2,774 | 3,177 | 3,582 | 3,875 |
| Total Electricity Production (GWh) | 8,678 | 9,152 | 9,654 | 10,665 | 12,248 | 14,636 | 16,960 | 19,151 | 21,654 |
| Growth rate (%) | - | 5.5 | 5.5 | 10.5 | 15.2 | 19.1 | 15.9 | 12.9 | 13.1 |

From the Table 3, we see that the annual average growth rate of electricity production in the period 1990-1998 is 12.2%, meanwhile annual average growth rate of GDP is 8.2%, so that the elasticity on electricity is 1.5.

Projection on electricity demand of the period 1995-2020 is conducted according to the elasticity approach on electricity demand and GDP growths. Relative to the economics development scenarios, three electricity demand scenarios are forecasted as shown in Table 4.

Table 4: Projection on Electricity Production (1995-2020)

**Unit: GWh**

| **Year** | **1995** | **2000** | **2005** | **2010** | **2015** | **2020** | **Annual average growth rate** |
|---|---|---|---|---|---|---|---|
| Low Scenario | 14,636 | 26,000 | 42,409 | 64,553 | 96,906 | 142,113 | 9,5 % |
| Base Scenario | 14,636 | 26,000 | 44,230 | 70,437 | 109,439 | 167,002 | 10.2 % |
| High Scenario | 14,436 | 26,000 | 46,554 | 78,466 | 126,949 | 201,367 | 11.0 % |

## III. Electricity Generating System Expansion Planning in the period of 1995-2020

### 3.1. Projection on the capacity of the indigenous fuel resource for electricity production.

Resulting from the studies on reserves and capacity of exploiting the indigenous primary energy resources in the period 2015-2020, forecasted amounts of the primary energy productions per year are estimated as follows:

1. Coal: 15 MT (6, 7 MT used for electricity production)
2. Crude oil: 20 – 25 MT
3. Natural gas: 15 bill. $m^3$ (12 bill. $m^3$ used for electricity production)
4. Hydro power: 50 – 60 bill. kWh
5. Geothermal: 200 MW
6. Uranium: reserve 200,000 Tonne of low content, of which 50% is the economically feasible

### 3.2. Electricity generating system expansion planning up to 2020

According to energy experts, after the year 2015, the electricity yield produced from the indigenous fuel sources would not be able to meet the electricity consumption demand, and around the year 2020, the Vietnam would be short of from 30 to 90 billion kWh every year.

In order to solve that problem, Vietnam would have to import electricity from neighbor countries and fuel to produce electricity. Vietnam already concluded with Laos an agreement, under which after the year 2003 Vietnam will be able to import from Laos about 10 billion kWh every year. Another possibility of importing electricity from China about 10 billion kWh every year is also taken into account.

Possibility of importing oil and liquefied natural gas (LNG) to produce electricity is not considered because of high cost, hence not economic competitiveness.

Supposing coal import is considered as the sole solution to the anticipated shortage of electricity, after the year 2020 Vietnam would import from 5 to 25 million tonnes of coal every year. It would not be feasible for Vietnam to import a huge amount of coal due to the problems related to poor technical infrastructure, the environment protection and energy supply security.

Despite the fact that nuclear power cost is slightly higher than that of conventional electricity production type, nuclear power would be well acceptable if strategic aspects such as diversification of energy, energy supply security, the environment protection, and development of national potential of science and technology are taken into consideration. Furthermore, nuclear power can well compete with imported coal-fired power economically.

With that approach, the projects related to possibility study on the introduction of nuclear power into Vietnam have agreed and come to a conclusion that nuclear power need be considered as an option in the future. If the Government approves the project on NPP construction in Vietnam, the first nuclear power plant would be brought into commercial operation in the year 2017. The total installed capacity of nuclear power would be able to reach from 1200 MW, accounting for 3.6% (according to Base Scenario) to 4000 MW, accounting for 10.4% (according to High Scenario), in the year 2020. Following that direction, after the year 2020 Vietnam would continue building some more new nuclear power plants.

In parallel with the long-term electricity planning studies, the site survey for NPP has been conducted. The VAEC in cooperation with IE has carried out preliminary survey and selection of 6 sites for NPP construction. These sites are mainly located in the South of Central Region of Vietnam. They are listed below (in priority order).

1. Commune VINH HAI, district NINH HAI, province NINH THUAN
2. Commune HOA THANG, district BAC BINH, province BINH THUAN
3. HON LA, commune QUAN DONG, district QUANG TRACH, province QUANG BINH
4. Commune HON ROM, PHAN THIET, province BINH THUAN
5. Commune PHUOC DINH, district NINH PHUOC, province NINH THUAN
6. Commune HOA TAN, TUY HOA, province PHU YEN

## IV. The major activities related to nuclear power development in Vietnam

On August 1999, the Ministry of Science, Technology and Environment (MOSTE) in colaboration with the Ministry of Industry (MOI) submitted to the Government the *Nuclear Power Development Plan in Vietnam (period 1998-2020*) on the basic of the research done by Vietnam Atomic Energy Commission and Institute of Energy. We suggested the Government to formulate a *Long Term Programme on Study of Nuclear Power Development in Vietnam* and to establish a *Committee for Preparation of Nuclear Power Project* belonged to the Government.

From recent years, the cooperative relation between Vietnam and several countries in carrying out the possibility study of the introduction of nuclear power into Vietnam has been developing. Japan is playing an active role in helping Vietnam in this field. The organizations, institutions and companies of Japan including STA, JAIF, JAERI, JNC, JCI, JAPC, MITSUBISHI, TOSHBA have taken part in jointly conducting site survey, workshops, seminars, and offered Vietnam the material and NPP models necessary to project activities. Several Vietnamese high rank delegations were invited to attend the conferences and forums on nuclear power organized in Japan. Every year, many Vietnamese researchers and experts have been sent to Japan to train and study in the fields relating to nuclear power. We do hope that the cooperation between two countries will be strengthened and developed continuously.

In current unfavorable economic situation, the introduction of nuclear power into Vietnam is facing with many challenges. First, it needs to be approved by the Government, ratified by the National Assembly, and accepted by the public. Then, it has to be proven to be acceptable in terms of economics, and it has to be gained strong and reliable commitment of finance arrangement. After that, it requires a necessary infrastructure together with respective capable and qualified manpower.

However, if the Asian economy, in general, and the Vietnamese economy, in particular, are soon restored, if the Vietnamese economic growth rate increases, if energy supply security and diversification of electricity supply sources are taken into consideration, and, especially, Clean Development Mechanism (CDM) is accepted and implemented worldwide, we do hope that Nuclear Power would be introduced into Vietnam in the near future.

## References


1. Report of the Government Project on *Overview Study on Possibilities of the Introduction of Nuclear Power into Vietnam (1996-1999)*.
2. Report of the IAEA TC Project on *Pre-feasibility Study on the Introduction of Nuclear Power into Vietnam (1996-1999)*.
3. Report of the National Energy Programme on *Strategy and Policy of Sustainable Energy Development (1996-1999).*