

## Energy cooperation among Vietnam - Russia and asian countries, status and prospect

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### 1. OPENING

Energy system in Vietnam consists of 3 major energy sectors are coal sector, petroleum sector and electricity sector. Currently, the other energy sectors are renewable energy (wind, solar, geothermal) and nuclear energy only shape and have proportion is negligible, etc. Up to now, Vietnam is a country exports energy. After 2015, Vietnam will be a country imports energy. National power development strategy of Vietnam to 2020, the vision to 2050 [1] has confirmed the national energy development in accordance with the trend of international integration ..., strengthen international cooperation in energy sector. Expanding cooperation with countries in the region.

### 2. OVERVIEW OF FUEL - ENERGY COMBINED OF VIETNAM [2]

*a. Coal resource:* The total coal reserve in Vietnam has been surveyed, explored and searched approximately 5.8 billion tons up to 01.01.2005, these reserves are concentrated (over 3.8 billion tons ) in Quang Ninh coal basin. Forecast of estimated coal reserves in Northern delta to 3.500 m depth with an area containing coal of 3.500 km<sup>2</sup> is 210 billion tons.

Exploiting and producing coal increase averagely 9.6% per year in the period 1991-2000, and 16.7% in the period 2001-2008. As the coal industry development plan in the period 2005-2010 and forecast to 2020, raw coal output in 2010 is 42.44 million tons and in 2020 will be 54.385 million tons. Coal outputs in the period 2003-2008 (million tons) are presented in Table 1.

TABLE 1. PRODUCING COAL IN THE PERIOD 2003- 2008 (MILLION TONS)

Year	2003	2004	2005	2006	2007	2008
Output	17,5	20,05	18,5	16,8	15,9	14,85

*b. Petroleum Source:* Based on the research results at the continental shelf of Vietnam, has identified six sedimentary basins including the Red River basin, Phu Khanh basin, Cuu Long Basin, Nam Con Son basin, Malay-Tho Chu basin, Truong Sa basin, Hoang Sa area does not have figures to determine. Drilling work has focused in three main oil tanks, most likely: the Red River, Nam Con Son and Cuu Long with the number nearly 70 wells (excluding exploration and exploitation wells in the Bach Ho, Rong and Dai Hung). Preliminary assessment of reserves was approximately 3.31 to 4.4 billion m<sup>3</sup> of converting oil, ratio of gas is 55% - 60%. Up to now, the total amount of gas can be exploited in the continental shelf of Vietnam (bring to shore) is 150 billion m<sup>3</sup>. Estimated future may discover more about another 100-160 billion m<sup>3</sup> of gas, increase gas reserves on the continental shelf region up to 200 - 250 billion m<sup>3</sup>.

Output of exploitation crude oil grewed respectively 19.7% in the period 1990-2000 and decreased 1.2% in the period 2000-2008. Full exploitation of crude oil were mostly for export, in 2008 used 800 thousand tons of crude oil for production testing of oil refineries. Changes in crude oil during the period 2003-2008 presented in Table 2.

TABLE 2. EXPLOITATION CRUDE OIL IN THE PERIOD 2003 - 2008 (MILLION TONS)

Year	2003	2004	2005	2006	2007	2008
Output	19,3	27,3	34,09	38,9	43,2	39,8

Average growth of exploitation of gas (natural gas and concomitant gas) in the period 2001-2005 was 43.7% per year. In 2004, a part of gas production capacity (1.549 billion m<sup>3</sup>) supplied to Malaysia because Vietnam did not has gas pipeline system from the PM3 mine to shore. Changes in gas exploitation in the period 2003-2008 are shown in Table 3.

TABLE 3. GAS EXPLOITATION IN THE PERIOD 2003 - 2008 (MILLION M<sup>3</sup>)

Year	2003	2004	2005	2006	2007	2008
Exploitation	3720	6252	6890	7520	6860	7944
Gas for electricity	2983	4218	4460	4950	5050	5410

c. *Hydro energy:* Energy reserves on the 2.200 theory of rivers with a length of 10 km or more and is divided into 11 major river basins across the country are assessed at about 250-260 billion kWh per year, of which, energy reserves of the northern river system is 120 billion kWh and energy reserves of the South is 140 billion kWh.

Technical reserves (evaluated according to technical level in now allows them to be exploited) are evaluated about 120 billion kWh respectively with a capacity of about 30.000 MW. Economic performance during 15-25 years of 100 medium and large hydro plants have been and are expected to build on the basin was identified as 13.931 MW and annual electricity was 68.917 billion kWh.

d. *Uranium Resources:* Potential uranium fuel for nuclear power in Vietnam was assessed approximately 218.000 tons of U<sub>3</sub>O<sub>8</sub> in 2003. Nong Son area is industry uranium mining with forecasts over 199 thousand tonnes of U<sub>3</sub>O<sub>8</sub>.

e. *The sources of new and renewable energy* are evaluated with great potential, but data was insufficient and lack certain facilities, should be evaluated according to a uniform level of technology and techniques at the present.

## 2. IMPORT AND EXPORT OF ENERGY

Up to now, Vietnam is the country exports energy. Changes of import and export of energy in the period 2004-2008 are shown in Table 4. After 2015, Vietnam will be the country imports energy.

## 3. COOPERATION AMONG VIETNAM - RUSSIA AND ASIAN COUNTRIES IN ENERGY SECTOR

National power development strategy of Vietnam to 2020, the vision to 2050 [1] has confirmed the national energy development in accordance with the trend of international integration ..., strengthen international cooperation in energy sector. Expanding cooperation with countries in the region and the world in the search, exploration of coal, petroleum and other forms of energy. Striving in 2010-2015, implementing the power grid linking in the region (with voltage 500 kV), since 2015-2020, implementing to link the natural gas system in the region. Preparing the necessary conditions to bring the first nuclear power plant operates in 2020 and then increase the proportion of nuclear power in the national energy structure. In 2050, nuclear energy occupies about 15-20% of the total national commercial energy consumption. In the field of renewable energy, increasing the proportion of new and renewable energy sources up to about 3% of the total commercial primary energy in 2010, about 5% in 2020 and 11% in 2050 [1].

TABLE 4. IMPORT AND EXPORT OF ENERGY IN THE PERIOD 1990 - 2008 (THOUSAND TONS)

Year	2004	2005	2006	2007	2008
Import oil	9115	9636	11894	13651	13665
Export crude oil	19501	17967	16442	15062	13908
Export coal	11636	17987	29308	31948	19699
Import electricity (GWh)		383	966	2630	3220

### 3.1 Cooperation links power grids and gas pipeline in the region:

At present, Vietnam and the countries in the region have been cooperating to link regional electricity grid. Grid link among Vietnam with Laos, Cambodia, China has been implemented. Vietnam has 35 kV

lines to supply power to some areas near the border of Laos. Vietnam will import hydropower from Laos with the scale increases approximately 1500 MW in 2015 and will increase gradually up to 5000 MW in two main directions by 500 kV lines: the first direction from Southern Laos (Ban Sok) to Pleiku (180 km), to receive power from the hydropower plant on the Sekong River to supply electricity to Vietnam. With plans import electricity to Vietnam from hydropower projects Se Kaman 1 (290MW), Se Kong 4 (450MW), Se Kong 5 (250MW) and Nam Kong 1 & 2 (70 +100 MW) ... total capacity will reach nearly 1600 MW. Later, this line will connect with power system of Thailand through regional U Don region.

The second direction from Northern Laos (Luang Prabang hydro power plant - 1410 MW) to Nho Quan 500 kV station (North Vietnam) has length is about 400 km.

Power grid link program with Cambodia and Yunnan: To import electricity from Vietnam with the scale is 100 MW, increasing gradually up to 200 MW in the period from 2009 to 2010, double circuit 220 kV line Thot - Chau Doc - Tinh Bien - Takeo - Pnom Penh completed. In 2020, Vietnam will import about 1.000 MW of electricity from Cambodia, in 2030 will increase gradually up to 2.000 MW.

In Northern Vietnam, Yunnan Province (China) has great potential of hydroelectric power with the scale more than 400 billion kWh. In 2008 we have imported over 500 MW by 110 and 220 kV grids [4]. Currently, the cooperation researchs to link power grid through 500 kV are being conducted, Vietnam can import about 2000-3000 MW from up to 2020.

Via power grid linking with Laos and Cambodia, Vietnam's power system can exchange electricity with the ASEAN countries like Thailand, Malaysia.

In 1997, the governments of Thailand and Myanmar signed a memorandum about Thailand imports electricity from hydropower plants and thermal power plants of Myanmar with the capacity was 1500 MW in 2010.

Between Thailand and Malaysia have completed the link between 2 power system (электросистема) by super-high pressure one-way transmission system (HVDC) with the scale was 300 MW, completed in 2001. Cable 230 kV links between power grid of Singapore and Malaysia is operating with a capacity of 400 MW.

Research projects link ASEAN Gas Pipeline (TAGP) is also developing. The length of gas pipeline is approximately 4200 km with 7 system connected to the oil and gas fields in Vietnam, Philippines, Indonesia, Malaysia and Thailand on sea areas: the East Sea, Andaman, Kalimantan, Sumatra and Thailand Bay. Total capital investment building this pipeline is about 7 billion USD.

### 3.2 *Nuclear power development cooperation:*

Orientations of nuclear power development planning in Vietnam to 2030 was approved [3]. According to this planning, Vietnam will complete the investment project approval, approved the location and preparing to start construction of the first nuclear power plant in 2015. In 2020, the goal is completion of the building and put the first unit of nuclear power plant in Ninh Thuan 1 generates commercial electricity, the second unit will operate in 2021. Also, we will conduct site preparation work for the construction of nuclear power plants following. By 2025, the total capacity of nuclear power plants is around 8,000 MW and will increase to 15.000 MW in 2030 (about 10% of the total power capacity). To meet the development program of nuclear power plants, planning oriented 8 construction sites of nuclear power plants in 5 provinces: Ninh Thuan, Binh Dinh, Phu Yen, Ha Tinh, Quang Ngai, and each location can build from 4 to 6 nuclear power units. The list, scale and progress of nuclear power units are summarized in Table 5.

The success of development plan in Vietnam can not lack the cooperation in every aspect from potential and experienced nations. The specific cooperation contents were signed with Japan, Korea, Russia and other countries.

TABLE 5. THE LIST, SCALE AND PROGRESS OF THE NUCLEAR POWER UNITS

No	Plant name	Capacity (MW)	Operating time
1	Phuoc Dinh 1	2.000	2020
2	Vinh Hai 1	2.000	2021
3	Phuoc Dinh 2	2.000	2023
4	Vinh Hai 2	2.000	2024
5	The Middle 1,2	2 x 1.000	2026
6	The Middle 3,4	1.300-1500	2027
7	The Middle 5,6	1.300-1500	2028
	Total capacity	15.000 - 16.000	

### 3.3 The energy cooperation prospects among Vietnam - Russia and Asian countries.

*a. Exploration and exploitation of fuel - energy:* Besides oil and gas sectors, Vietnam and Russia will develop cooperation in the field of exploration and exploitation coal of the Red River delta in the future (the current estimated reserves is 210 billion tons from a depth of more than - 300 m to -1000 m and more). The coal sample in this area shows that coal was high quality: the heat value of coal over 6.000 kCal / kg, very high volatile over 40%, sulfur content is low (approximately 0,5%), low ash content.

According to many experts, top priority exploitation technologies will be underground coal gasification technology. Underground Coal gasification technology (UCG) by Russian scientists proposed from end of 19th century, developed from 1933-1935 and completed from 1964 to now. Currently, Coal and Mineral Group of Vietnam (TKV) have a report to the Ministry of Industry and Trade to suggest bringing to the cooperation program of science and technology within the framework of Russian-Vietnamese intergovernmental Committee of sector of technology transfer and technical assistance to develop underground coal gasification technology for coal exploitation on Red River Delta. Industrial Gas Corporation (Promgaz) of Group of Russian national gas (Gazprom) is developing underground coal gasification technology in Vietnam [5].

*b. Development of nuclear power:* in 2009, Vietnam's National Assembly passed a resolution on investing Ninh Thuan nuclear power project with a total capacity is 4.000MW, including two plants are Ninh

Thuan 1 and Ninh Thuan 2. Vietnam has chosen Russia to build the first nuclear power plant with two units (1000 MW). Russia owns source of technology and has experience on nuclear power. Nuclear power technology of Russia is safe and Russia also pledged to help Vietnam treats whole nuclear waste.

*c. Development of regional associated electrical systems and gas pipelines:* survey, selection of the site, design and equipment supply and construction of large-scale energy projects (thermal power plant has unit capacity from 500MW or more, 500 kV transmission lines, refineries, gas pipelines across ASEAN, etc ...) in Vietnam and other Asian countries are also prospect fields in energy cooperation development with Russia.

*d. Scientific research and training:* Training improves the professional qualification of scientific, technological, technical manager staff to ensure developing synchronously and suitably energy system, suitable distribution of energy system according to region, territory... is the traditional cooperation direction and have more favorable conditions for development. Many units of research and training in Vietnam have got documents of bilateral cooperation with Russia. Prospect of cooperation in this field will grow in coming years when high-ranking leaders of the two countries signed documents comprehensive cooperation.

## 4. CONCLUSION

4.1. In general of traditional cooperation relation between Vietnam and Russia, cooperation in sector of energy and oil occupies a very important position, is considered one of the most exemplary and effective cooperation field. In the future, relation between Vietnam and Russia from bilateral relation will develop multilateral relation with countries in the region. Vietnam will become a great regional center in Southeast Asia.

4.2. Prospect of cooperation in energy sector among Vietnam - Russia and Asian countries will focus in the field of exploration and exploitation of fuel - energy, especially petroleum and coal, nuclear power development; Devel-

opment of regional associated electrical systems and gas pipeline; Research and training.

## 5. REFERENCE

- [1] Decision No. 1855/QĐ-TTg, December 27, 2007 by the Prime Minister approved the development strategy of the national energy system in Vietnam to 2020, vision to 2050;
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## 6. BIOGRAPHY



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