
Vietnam's Electricity Generation Planning in the Absence of Nuclear Power: The Need for Adjustment towards Sustainable Development

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Preamble: *In recent years, Vietnam's economy has grown rapidly with annual GDP growth rate of 6% to 7% - The fastest growth in Asia. As a result, within 20 years, Vietnam has moved from a low- income country to the middle income nation. It is supported by the fact that the country's poverty rate was reduced from 60% in the late 1990s to less than 20 % at the moment and Vietnam has become one of the most dynamic economies in the East-Asia Pacific Region¹.*

However, the economic take-off in combination with urbanization and rapid population growth has boosted demand for energy in general and electricity in particular. Under that circumstance together with particular economic and technical characteristics of the sector, the planning of electric system development shall have to be implemented in a sustainable fashion in order to harmonize socio-economic development and environmental protection targets while balancing short, medium and long-term targets.

By the end of 2016, shortly after Vietnam's National Assembly adopted a resolution cancelling the implementation of nuclear power projects, the revised 7th Power Master Plan, was approved with important adjustment for more contribution of coal in the total generation mix due to its simplicity and available experience from implementing the coal-based power projects in Vietnam. However, it is scientifically proved that pollution from coal-fired plants are extremely serious to environment, the increase in coal-based power production would cause negative impacts on socio-economic development and go against the world's energy development trend. Therefore, we believe that it is necessary to continue adjusting the "Revised 7th Power Master Plan" in a more sustainable and appropriate approach for the "transition period" before moving towards to the development of renewable energy sources for green growth in response to global climate change.

1. RAPID INCREASE IN POWER DEMAND

Vietnam's energy sector is now under a big pressure of meeting increased demand for electricity consumption, especially since the country's economy has shifted from a centrally planned to a market economy. For the past few years, electricity consumption grew at 13% and 11.7 % per year for the period 2006-2010 and 2006-2017, respectively (see Table 1). According to the data in the 7th Power Development Plan data (Revised Version) show that to meet the nationwide demand for electricity to ensure the socio-economic development targets with an average GDP growth of approximate 7.0% per year over the period 2016 - 2030, commercial power output would have to reach about 235 - 245 billion kWh by 2020; 352 - 379 billion kWh by 2025, and 506-555 billion kWh by 2030. In order to meet those demand, power supply, including production and import by 2020, 2025 and 2030 shall be about 265 - 278 billion kWh; 400 - 431 billion kWh and 572 - 632 billion kWh, respectively. Based on these figures, the Ministry of Industry and Trade (MOIT) has developed a low scenario with slow growth of electricity demand in which electricity consumption increased by 10%, 8% and 6% was predicted for the periods from now up to 2020, 2020-2025 and 2025-2030, respectively².

¹ Reference: Vietnam National Data 2017 posted on World Bank website at <http://www.worldbank.org/vi/country/vietnam>

² Decision No.428 of the Prime Minister (2016): Approval on the National Power Development Planning in the 2011-2020 period with the vision to 2030.

Table 1: Power consumption and its growth of Vietnam & the World in the period 2000-2017

Power consumption	2000	2005	2010	2014	2015	2016	2017	2006-17
Vietnam (TW hour)	26.7	52.1	91.7	142.3	159.7	174.6	190.1	
Annual growth rate (%)		12.7	13.7	14.3	12.3	10.0	9.2	11.7
World (TW hour)	15510.5	18430.6	21561.7	23844.0	24215.5	24816.4	24816.4	
Annual growth rate (%)		4.3	6.4	1.9	1.6	2.5	2.5	2.8

Source: BP Statistical Review of World Energy 2018

The increase in power consumption is considered to be very different, even Vietnam is in a fast-growing stage. It indicates that the use of energy especially electricity in Vietnam is not really efficient due to poor Demand-Side Management programs (DSM) and huge losses in transmission and distribution. It should be emphasized that if the current trend of power consumption growth rate at 7% per year is allowed, the annual electricity consumption of Vietnam will be double in ten-year time. For comparison, let take France case as an example, the annual power consumption growth of this country in the 1930s, when its industry was in the prosperous period was about 7% only. Therefore, power supply in Vietnam is now under a big pressure to meet rapid increase in power demand, especially in the condition that the balance between supply and demand must be maintained all the time.

2. POWER PLANNING - LESSONS LEARNED FROM NUCLEAR POWER AND DEVELOPMENT OF RENEWABLE SOURCES

To meet the rapidly increasing demand for electricity after "Doi Moi"³ period, the 7th Power Master Plan Master Plan for 2011-2020, with a vision towards 2030 has set ambitious targets for renewable energy sources and, nuclear energy particularly. Specifically, the plan has set priority for development of renewable energy sources for electricity generation. According to this plan, the share of renewable energy in the total generation mix would be increased from 3.5% in 2010 to 4.5% and 6% by 2020 and 2030, respectively. Among renewable sources, wind power will contribute 1000 MW by 2020 and 6,200 MW by 2030 or equal to 0.7% and 2.4% total power production in the same period. Also under this plan, the first nuclear power plant of Vietnam will be put into operation in 2020 and by 2030 total capacity of nuclear power plants would be 10,700 MW, generating approximate 70.5 billion kWh which is equal to 10.1% of the power generation output.

However, actual generation development does not match the targets set in the plan. Significant investment has been made in order to realize ambitious targets on nuclear power generation but finally the first nuclear power plant which is scheduled for operation by 2020 was phased out of the plan after National Assembly decision on stopping this project in 2016. Economic aspect is the first among the causes. Since Fukushima nuclear disaster in Japan in 2011, costs for nuclear power plants have risen sharply. It can be seen that a realistic nuclear program requires huge investments in human, technology and financial management which appear to be overstrain for Vietnam currently while the positive results of nuclear-based generation option are only achievable in a long term. A decision demonstrates that we lack all the resources required to achieve nuclear ambitions.

Similarly, priorities set in the 7th Power Master Plan over the planning horizon have not been realized. It is indicated by the fact that the shares of wind and solar power are far from the targets stated in the Plan. Traditional sources, including hydro, coal-fired, and gas-fired thermal power still account for largest shares in the total generation mix. In terms of installation capacity, as of October 2018, the installed capacities of hydro, coal-fired, gas-fired and oil-fired plants were 17,022 MW, 12,705 MW and 7,684 MW, 1,154 MW respectively. In contrast, these figures of the renewable sources, such as wind and biomass were negligible with about 109 MW, accounting for 0.2% of total installed capacity (see Figure 1).

³ "Doi Moi" is a famous Vietnamese expression. The "Doi Moi" is the period of Vietnam's economic transition from a planned and centralized economy to a market economy. This "Doi Moi" policy started in 1986.

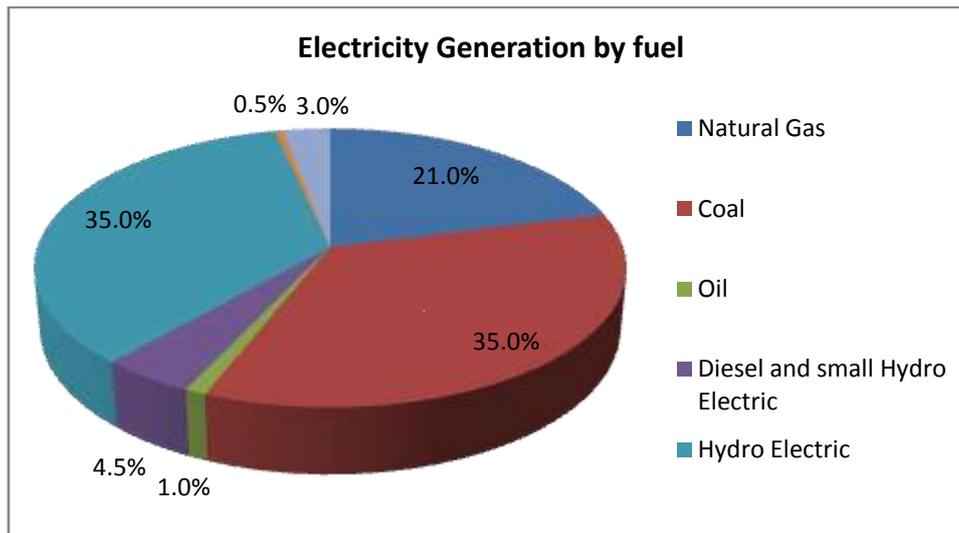


Figure 1: National Electricity Structure by Primary Energies in 2018

Source: Electricity Regulatory Authority of Vietnam (ERAP)

It is clear that estimated investment costs for renewable energy sources at the planning stage, actual commitment to priorities for environmental protection in the country's socio-economic development and support from the government are not enough to develop the renewable energy sources as stated in the 7th Power Master Plan. The lessons learned from nuclear and renewable-based power in the 7th Power Master Plan indicate that there is a urgent need to balance socio-economic and environmental targets, resources mobilization and benefits from energy activities over the planning horizon. The planning targets should not be overambitious and must conform to resource mobilization. If those issues are not taken into consideration in the power planning activities, the plan would fail to meet the set targets and the consequences are far-reaching in all economic, social and environmental, etc., aspects.

3. ADJUSTED PLANNING OPTION AND THE COME-BACK OF COAL POWER

The cancellation of nuclear power plants and unsuccessful implementation of renewable power planning have forced Vietnam to immediately seek new alternative power sources to meet the increasing demand for power which is predicted to be triple by 2030, as compared to the current demand. What types of alternative primary energy that have been considered in the 2016 adjusted 7th Power Master Plan? Hydro and renewable are ideal options but the first one has been over-exploited while the second has developed too slowly. Therefore, it is essential to build new coal-fired power plants as soon as possible to meet demand for power from the economy.

Despite being cut by 5.3% in the 7th Power Master Plan, however, coal thermal power still plays a leading role in the total power structure for many coming years. It is expected that coal-fired power plants will account for 49.3% and 55% of the country's total electricity by 2020 and by 2025 respectively⁴. In the revised 7th Power Master Plan, the Government removed 18 coal-fired power plants due to its huge environmental pollution. However, while alternative sources of electricity have not been found, the coal-fired thermal power is a proposed option with restrictions in the North.

Selection of coal-fired power in the adjustment plan seems to be a secure option in ensuring power supply for economic development targets. Indeed, with EVN's advantages in stable sources of supply, technology control ability, many years of experience in coal-fired power generation, this solution will help address power shortage in the coming time due to phasing out the nuclear power generation. However, there are some critical issues that need to be discussed in the adjusted 7th Power Master Plan, e.g., Too much emphasis laid on the role of coal-fired

⁴ Decision No. 428 of the Prime Minister (2016): Approval on the National Power Development Planning in the 2011-2020 period with the vision to 2030.

thermal power generation in the coming period, Hasty adjustments with focus on targets to ensure immediate economic benefits, rather than aggregated ones and lack of sustainable energy development roadmap, etc.

First and foremost, when targets for environmental protection and especially climate change response are integrated into the national energy policy, it is certain that the role of coal-fired power shall be rapidly reduced because too much dependence on this fossil fuel sources would lead to serious environmental pollution at both, country and global scale. Current amount of CO₂ emissions generated by electricity sector is recorded at 75 MtCO₂, which is equal to half of the country's total emissions and it can be three or four times higher under the coal-based scenario of the revised plan by 2030. This is an unacceptable option as Vietnam has signed a Paris Agreement on reduction of GHG emissions.

Therefore, if the energy-economy-environment interactions are taken into consideration for sustainable development, the coal-based option for power generation may not be feasible. Pham Chi Lan- a famous Vietnamese economic expert said in the Renewable Energy Week 2017: "Vietnam has consumed too much energy for growth and under the name of "growth" for energy development, especially coal-fired thermal power generation. That is the way to the "deadlock door"⁵.

Secondly, in the adjusted version of 7th Power Master Plan, the role of renewable energy sources was not probably recognized as it should be in almost power development plans from developed to developing countries with the aim to achieve emission reduction and sustainable development. Especially, thank to advanced technologies, previous barriers to development of the renewable resource, such as high investment costs and technical difficulties in maintaining stable power supply have already resolved. That would make renewable energy more competitive as compared to traditional fossil fuels in power generation. As indicated in Figure 2, the investment cost in wind power and especially solar power has fallen sharply (see Figure 2) and the trend shows that solar and wind power tariff will compete fairly with coal power by 2025.

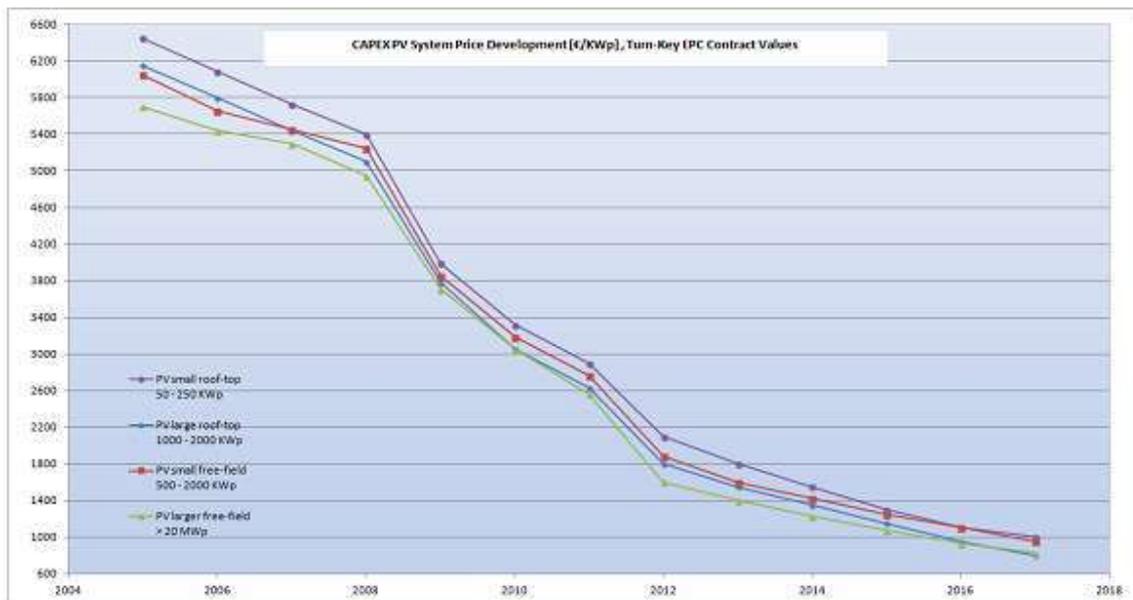


Figure 2: Reduction of investment costs of solar plant in the 2004-2017 period

Source: Syntegra Solar 2017

Up to now, it is impossible to immediately adjust generation mix to allow renewable energy have more important role to play. With the existing technological infrastructure, levels of technology control and government policies related to renewable energy development, Vietnam has not been yet ready to develop energy sources massively and quickly from the view of electricity businesses as well as the state management authorities. Under such conditions,

⁵VSEA Renewable Energy Week 2017 in Vietnam, CanTho City, 21-24 August 2017.

the 7th Power Master Plan still needs to be adjusted in the direction that could reduce the share of coal power by alternative sources while waiting for the strong development of energy sources–The power supply structure for transition period.

4. GAS –KEY ALTERNATIVE FOR TRANSITION PERIOD FROM COAL-POWER TO RENEWABLE POWER SOURCES.

According to Economic expert Pham Chi Lan, in addition to improvement of the load management measures to reduce losses, there is a need to study options for adjusting power plan in the direction that could promote the role of gas and gas-fired power in the transitional period from coal to renewable sources. Although gas is fossil fuel and it is also a source of greenhouse gas emissions but in term of sustainable development gas-fired power generation is preferable alternative as compared to the coal-based generation option. This could be justified as follows:

Firstly, in the short term, power generated by Combined Cycle Gas Turbine (CCGT) -a modern combined process has relatively low investment costs (economical). Moreover, control and management of technology, equipment and electricity are not new in Vietnam. In other words, we can master the gas-based power generation technology as we do with coal. In terms of air pollution, CO₂ emissions intensity of gas-based power generation is much lower than the coal-based one. It is about 400 g of CO₂ per Kwh for the gas-based plant as compared to 900 g of CO₂ per Kwh emitted by the coal-based power plant (see Table 2). Therefore, it is worthy of studying gas-based generation in the adjusted plan, instead of focusing on coal-based power even in the short-term.

Table 2: CO₂ emission intensity from power plants

Type of power plant	Hydro-power	Atomic power	Wind power	Solar power	Closed-cycle gas	Thermal oil-fired	Coal-fired power
CO ₂ emission intensity (g/kwh)	4	6	3-22	60-150	427	891	978

Source: Green it

Secondly, in the medium term, when renewable sources, especially wind and solar power, have developed at a large scale, gas power plants are still very useful as they can become a viable solution and help address the intermittence of the wind and solar-based generation. That is because gas-based power generation is much better than the coal-based power plants in term of stability and grid connection capacity. Therefore, the gas alternative is still very necessary and apparently better than coal power even when the renewable sources have already developed at the large scale.

Finally, in the long term, as the inputs of power plants, natural gas fuels (fossil fuels) can be replaced by "green gas or biogas" – a by-product of the methanol production process. This alternative would be far more efficient than the closure of polluting coal plants. The development of environmentally friendly bio fuels along with renewable energy sources will certainly be the world's preferable direction. Therefore, in dealing with tween challenges, including security of power supply for socio-economic development and environment protection from pollution caused by electricity generation, gas is ideal fuel to replace coal that is likely lead to a deadlock in the long run.

5. VIETNAM'S POWER GENERATION PLANNING: KEEP BEING ADJUSTED

In order to compare the advantage of gas power over the coal power in the case of Vietnam, based on electricity demand forecast, CO₂ emission intensity of gas-fired and coal-fired generation, two scenarios could be developed: The first one is a combination of renewable and gas sources and the second one is a mix of renewable and coal sources. The calculation results from two scenarios indicate that the renewable and gas combination scenario could help reduce CO₂ emissions from electricity generation by 25% and 50% in 2025 and 2050, respectively as compared to the renewable and coal scenario. This advantage of gas power could help avoid the "deadlock" of coal power in the long-term and certainly is worthwhile for fast-growing economies like Vietnam where the electricity sector has to respond quickly to increasing demands.

For further adjustment of the 7th Power Master Plan in the transition period from polluted fossil fuels to renewable energy, it is necessary to have more research on the socio-economic and environmental impacts of the two above mentioned scenarios in the short-term, medium-term and long-term so that the decision on replacing coal power with gas power could be supported by solid scientific grounds. Looking around the world, there are strong evidences to support to clean energy in power generation. For example: Replacement of coal with gas is a central factor of the US government's "energy-climate" policy; Coal-free energy policy is applied in Germany; In France, it is expected that by the year 2022, most of the coal power plants will be shut down and replaced by gas power plants; And in China – a neighbor country of Vietnam, a series of coal power plants is being closed and replaced by gas power plants. These could be regarded as lessons learned that should be taken into consideration in replacing coal power by gas power in the direction towards more sustainable development in Vietnam.

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