The Energy Transition Towards Low Carbon Economy In Vietnam

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Abstract: The transition to a low-carbon economy is an inevitable trend of most countries in the world. According to the committed roadmap, the transition from fossil energy to renewable energy is also an urgent requirement for countries in achieving the emission reduction target. Vietnam is transitioning from fossil energy to renewable energy with the development of solar power, wind power, and hydroelectricity to replace the current coal power source. Until 20121, the output of solar power, wind power, and hydroelectricity of Vietnam has also achieved relatively good achievements. However, to achieve the goal of zero emissions by 2050, Vietnam needs to overcome many challenges. This article will analyze Vietnam's energy transition trends and realities and provide policy suggestions for Vietnam.

Keywords: energy transition, low carbon emission, renewable energy, Viet Nam

1. INTRODUCTION

In 2019, in New York, the United Nations hosted the Climate Summit to encourage countries worldwide to come up with specific plans to tackle climate change[1]. During this Conference, the United Nations set a target to cut greenhouse gas emissions by 45% within the next ten years and reach zero emissions by 2050[1]. Emissions have increased sharply in recent years. This increase has had severe consequences for the environment worldwide, such as sea-level rise, rising temperatures, and drought. The United Nations has also outlined six areas to promote actions by countries to reduce the impacts of climate change, including energy transition, infrastructure and sustainable cities that can improve resilience, sustainable agriculture and ocean, and forest management, integration of public and private finance with a net-zero emissions economy[2]. The demand for energy in many countries will increase due to high population growth and urbanization. Multinational companies, organizations, and businesses have also committed to addressing energy needs by switching from fossil fuels to renewable energy. Many countries around the world have started to make energy transition commitments, including Vietnam. Vietnam is a developing country with a rapid growth rate accompanied by a sharp increase in energy demand. This challenge is great when primary energy sources such as coal, oil, and gas are exhausted, not enough for domestic demand. Hydropower potential has been exploited only about 2.7 GW of large hydroelectricity over 30 MW is expected to operate in 2021 -2025, and about 2.8 GW of small hydroelectricity will continue to be built[3]. Thus, renewable energy development is an inevitable trend and an important supplementary source for the power system, especially for the electricity supply to Vietnam. The UN has set a global target to reduce greenhouse gas emissions by 45.0% over the next ten years and achieve net-zero emissions by 2050[4]. The increase in emissions has already had consequences worldwide, such as sea-level rise, deforestation, heatwaves, and droughts. Solutions were promoted in six areas: global transition to renewable energy; sustainable and resilient cities and infrastructures; agriculture and sustainable ocean and forest management; sustainability and adaptation to climate impacts; and integrate public and private finance with a net-zero economy. Population growth and high urbanization, and industrialization continue to drive energy demand in many countries.

2. LITERATURE REVIEW

Climate change is one of the most important reasons driving the shift from fossil fuels to renewable energy. The energy transition is a long-term process aimed at replacing current fossil fuel-dependent systems with cleaner energy sources. The five major countries in Africa, including Algeria, Nigeria, Morocco, South Africa, and Egypt, are considered the largest consumers of fossil fuels. Governments must use clean energy and energy conversion to move towards a circular economy. Chen & Kim's study (2019) studied the circular economy and energy transition in some African countries and shows that this relationship has not been studied much in the African region[5].

Energy is considered the lifeblood of economic development in any country. It powers residential, services, transportation, manufacturing, and benefits from minerals, among many other sectors. However, growing concerns about the adverse effects of fossil fuels on the climate are prompting more significant strides towards decarbonization through the energy transition. In 2018, the Intergovernmental Panel on Climate Change (IPCC) announced 12 years left for the global energy transition[6]. More than 190 countries are part of the United Nations Framework Convention on Climate Change (UNFCCC), each committed to reducing carbon emissions.

Gielen et al. (2019) and Sovacool & Griffiths (2019) suggest that the economic characteristics of each country can accelerate the energy transition. Specifications include energy efficiency, resource accessibility, and a wide range of scalable renewable energy technologies. Economic features mainly include significant socio-economic benefits such as quality energy service to customers, job creation for workers[7].

3. TRENDS AND STATUS OF RENEWABLE ENERGY DEVELOPMENT IN VIETNAM

3.1. Viet Nam's renewable energy trending

The development of renewable energy sources is considered an inevitable trend today, making an important contribution to limiting greenhouse gas emissions, protecting the environment, and reducing dependence on fossil fuels. The world is recording many positive signals in restructuring the energy industry, in which the strong development of "green energy" sources is considered a prominent bright spot.

In recent years, Vietnam's energy industry has become a dynamic economic sector, making an essential contribution to promoting socio-economic development and ensuring national defense and security in many localities in the country. Vietnam. According to aggregated data, in 2020, Vietnam's energy consumption will increase significantly, the energy consumption structure is shifting towards energization[8]. The economical use of energy has positively influenced the energy industry's transformation into a market-based operation, mobilizing enormous human resources for development investment with the participation of many sectors. The core economy is state-owned enterprises. Vietnam is one of the six countries most affected by climate change, according to the report on the global climate risk index 2020. Over the years, Vietnam has always been active in implementing its commitments of the 2030 Agenda for Sustainable Development and actively participating in the Paris Agreement under the United Nations General Convention on Climate Change (COP 21)[9]. One of the important requirements that Vietnam needs to fulfill when participating is promoting a solid energy transition to reduce greenhouse gas emissions, investment decisions, and policies to decarbonize the energy sector.

3.2. The status of Vietnam in the energy transition

Rooftop solar power systems

Vietnam is prioritizing the development of rooftop solar power in the direction of self-use. Regulation of the rate of self-consumption of electricity on-site (it can be about 80% self-use, 20% of excess output allowed to be sold or another reasonable rate depending on capacity scale), connected to the grid from 35 kV or less without the need to improve the load capacity of the existing grid[10].

On the other hand, 2019 also witnessed the rapid development of renewable energy sources, especially solar power. From 2018 with only 86 MW, solar power has increased by more than 54 times, to 4,696 MW in 2019, and power output reached 4.932 billion kWh (in 2018, output was only 22 million kWh). Along with electricity generated from wind power sources (723 million kWh), biomass electricity 410 million kWh, non-hydro renewable energy sources have contributed 6.065 billion kWh to the system.

According to the Electricity of Vietnam (EVN) summary, in 2016 - 2018, the trend of power transmission from the North to the Central region and from the Central to the South is still the primary trend of inter-regional transmission. However, by 2019, when the South of Viet Nam was supplemented with a large number of new power sources, especially renewable energy sources, the transmission power on the inter-regional 500 kV transmission line decreased significantly, especially in the summer months of 2019[11]. In 2019, when the North and Central region of Vietnam increased the load due to extremely hot weather and the high mobilization of solar power plants was put into operation, there was a time when the transmission trend was in the direction from the South to the central and northern regions.

Renewable energy sources are focused on developing in the South with a total solar capacity of 3,491 MW and wind power of 288 MW in 2019, making an important contribution to compensating for the shortage of electricity due to delayed power sources. However, due to the rapid development of solar power, power grids in some areas could not keep up, causing transmission congestion and difficulties in operating the system at times of high or low point. The system has to reduce the generating capacity, only releasing 4,200/4,880 MW of renewable energy sources put into operation[12].

By the end of 2020, the total installed capacity of power sources of the whole system will reach 69,300 MW, an increase of 14,000 MW compared to 2019, of which renewable energy sources will increase 11,780 MW. The electricity output of the whole system reached 247.1 billion kWh, an increase of only 2.9% compared to 2019. National commercial electricity reached 216.95 billion kWh, a rise of 3.42% compared to 2019. In 2020, non-hydro electricity renewable energy sources contributed 12.203 billion kWh, accounting for 4.9% of the electricity produced in the whole system, of which solar PV has 10.877 billion kWh, accounting for 4.4%. For the South of Viet Nam, the total commercial electricity in the 21 provinces of EVNCPC will reach 75.438 billion kWh in 2020, only increasing by 3.8% compared to 2019[13].

The additional power capacity in 2020 is mainly from renewable energy sources, of which solar power in 2020 has reached 16.700 MW, accounting for 24% of the total system source capacity. In 2019, the whole country had only 272 MW of rooftop solar power, but by the end of 2020, the rooftop solar power source has been over 7.780 MW, accounting for nearly half of the total capacity of solar power sources. The total capacity of rooftop solar power sources in Southern Electricity Corporation (EVNSPC) is 5.658 MWp, the highest in the country; Ho Chi Minh City Electricity Corporation has a total capacity of nearly 365 MWp.

By the end of August 2020, 52 solar power plants in the southern region have been energized and put into operation, with a total installed capacity of 2584 MWp and over 2.26 billion kWh of closed output. The contribution of solar power plants in the South (in the first eight months of 2020) accounts

for 4.43% of the total electricity output of the entire Southern power system.

In 2020, the load growth rate was the lowest in more than a decade, mainly due to the Covid-19 epidemic. At the same time, businesses and individuals have massively developed solar power sources to keep up with the time limit for enjoying the incentive mechanism for solar power (according to Decision 13/202020/QD-TTg of the Prime Minister). The amount of new capacity put into 2020 is concentrated in the last months of the year so that the main impact will occur in 2021. It is a year with a slow increase in electricity demand, in the South, due to the transmission of electricity. The other system is insignificant, so the amount of renewable energy power input has played the role of supplementary power supply, especially at high load times.

Developing solar and wind power in the South of Viet Nam by 2021

The installed capacity of non-hydroelectric renewable energy sources nationwide has reached over 18,000 MW and may reach 23,000 MW by the end of 2021. Regarding wind power, according to EVN, by July 2021, businesses have signed a power purchase agreement (PPA) with EVN, including 144 wind power plant projects with a total capacity of more than 8,144 MW. According to the progress reports of the investors to the beginning of August 2021, 21 wind power plants with a total capacity of 819 MW have been put into commercial operation. One hundred six wind power plants with a total capacity of 5,655.5 MW will be put into commercial operation before October 31, 2021. Regarding rooftop solar power, as of July 24, 2021, there are 104,282 installed projects with a total capacity of 9,580 MWp, generating 3,074 billion kWh to the grid, and according to calculations, the emission reduction is 3,263,122 tons of gas. CO2. Most rooftop solar PV is installed in the South, where there is a source of solar radiation and a high number of sunny hours.

The total number of customers installing rooftop solar power operating on the grid under EVNSPC by the end of June 2021 is 54,062 customers, with a total installed capacity of photovoltaic panels of 5,523 MWp (equivalent to 4,417.6 MW). The cumulative output of rooftop solar power from customers in the first six months of 2021 purchased by EVNSPC is 3,189 billion kWh. Ho Chi Minh City is also a locality that strongly develops rooftop solar power installations. The output of rooftop solar power generated by customers on the grid and accumulated by EVNHCMC in the first six months of 2021 is 135 million kWh.

Farm solar power plant

By the end of June 2021, 66 farm solar power plants have been energized, with a total installed capacity of 3,281.35 MWp in 9 provinces: Binh Thuan, Tay Ninh, Long An, An Giang, Ba Ria - Vung Tau, Ninh Thuan, Binh Phuoc, Hau Giang, Vinh Long. Power output received from solar power plants in June 2021 was 396.03 million kWh, down 3.36% compared to May 2021, up 61.73% over the same period (244.87 million kWh), and accounted for 5.92% of the total power output of the system (excluding self-use and rooftop solar power). The total electricity output received from solar power plants in the first six months of the year is 2,452 billion kWh, accounting for 6.01% of the electricity received in the entire Southern system[14].

Wind power plant

By the end of June 2021, 15 wind power plants have been energized, with a total installed capacity of 754.13 MWp in 4 provinces: Binh Thuan, Ninh Thuan, Bac Lieu, and Ben Tre.

The electricity output received from wind power plants in June 2021 is 69.73 million kWh and accounts for 1.04% of the system's total power output. Accumulated in the first six months of 2021, the electricity output received from wind power plants is 588.53 million kWh, accounting for 1.54% of the total electricity output received by the whole system (excluding self-consumed electricity from customers).

Accumulated in the first six months of 2021, according to EVNSPC, the South's electricity consumption reached 39,666 billion kWh, an increase of 8.98% compared to the same period in 2020 (electricity consumption in the first six months of 2020 reached 36.40 billion kWh). Notably, electricity production from renewable energy reached more than 6,229 billion kWh (from wind power plants is 588.53 million kWh, rooftop solar power is 3,189 billion kWh, and farm solar power plants is 2.452 billion kWh)[15].

Thus, solar and wind power account for 15.7% of the total electricity consumed in the first six months of 2021 of EVNSPC. Renewable energy has contributed a significant amount of electricity to the electricity supply in the South.

According to EVN, accumulated in the first six months of 2021, the electricity produced and imported by the whole system reached 128.51 billion kWh, up 7.4% over the same period in 2020[15]. In which, the proportion of the mobilized output of some main types of power sources on the total electricity output of the whole system is as follows:

- Hydroelectricity reached 30.46 billion kWh, accounting for 23.7%.

- Coal thermal power reached 66.67 billion kWh, accounting for 51.9%.

- Gas turbines reached 15.66 billion kWh, accounting for 12.2%.

- Non-hydroelectric renewable energy (wind power, solar power, biomass power) mobilized reached 14.69 billion kWh, accounting for 11.4%. In which the southern region alone contributes 6.364 billion kWh.

- Imported electricity reached 624 million kWh, accounting for 0.5%.

- Mobilized oil-fired thermal power is insignificant, reaching 2 million kWh.

When a series of wind power plants are put into operation by the end of this year, bringing the total capacity of renewable energy sources to 23,000 MW. This trend will continue until the hot season when hydroelectric power plants' reservoirs are stored at the lowest water level (preparing for the water storage period), not generating enough capacity.

The contribution of renewable energy to the electricity supply for the Southern region is an increasingly important factor. Only as of the first six months of 2021, the electricity output from wind and solar power sources in the South is 6.364 billion kWh, accounting for 43.3% of the electricity production from renewable energy (non-hydro electricity)) of the whole country. By October 30, 2021, 119 wind power plants will be put into operation with a total capacity of 5,655.5 MW to enjoy preferential prices (according to Decision No. 39/QD-TTg dated September 10/3/QD-TTg 2018 of the Prime Minister on the mechanism to support the development of wind power projects in Vietnam). The percentage of electricity produced from renewable energy in the South will increase a lot.

4. SOME POLICY SUGGESTIONS FOR VIETNAM TO SHIFT ENERGY FOR SUSTAINABLE DEVELOPMENT

The implementation of new generation FTAs also poses requirements to promote energy transition. Resolution 55-NQ/TW dated February 11, 2020, of the Politburo of Vietnam on the strategic orientation of Vietnam's national energy development in 2030 - 2045 has also identified the views, goals, and objectives of meaningful solutions on energy transition in Vietnam in the coming time. The structure of global primary energy consumption has changed significantly in recent years, especially since the outbreak of the covid pandemic.

According to the IEA statistics, due to the impact of the Covid-19 pandemic, primary energy demand will decrease by nearly 4% in 2020, global energy-related CO_2 emissions will decrease by 5.8. Fossil fuel consumption dropped sharply (in 2020, oil fell by 8.6%, coal decreased by 4%) while renewable energy and electric vehicles were hardly affected. Low-carbon fuels and technologies, especially solar and wind, posted the highest share of annual growth ever in the global energy mix (up more than 1%).

In 2020, the world's renewables added 261 GW of capacity (82% of total global additional generating capacity). Many studies have suggested that the energy development trend of the world will follow the direction of gradually replacing fossil energy sources (coal, oil) with green and cleaner energy sources (wind, solar, etc.) biomass, green hydrogen, methanol. In it, natural gas acts as an intermediate step for this transition.

The 39th ASEAN Energy Ministers Meeting (AMEM 2021) issued a Joint Statement on Energy Security and Energy Transition, affirming that all member countries will pursue

security goals and regional energy transition while providing financial solutions, attracting investment, and technical assistance to develop a low-carbon economy in the ASEAN community. Renewable energy accounted for 23% of the total primary energy supply and reduced energy intensity by 32%.

According to Resolution 55, shortly, the National Assembly of Vietnam will amend the Petroleum Law and complete specialized laws on electricity, economic and efficient energy use. And other laws related to the energy industry will serve as the basis for the development of the National Assembly more effective implementation of the market mechanism; to study and implement the law on the administration of electricity prices and some incentives for projects encouraged for investment in the energy sector; perfecting the legal framework for electricity control and coordination activities; researching, formulating and promulgating legislation on renewable energy. The Government of Vietnam is also developing and implementing the National Energy Development Strategy and development strategies for energy sub-sectors, the National Energy Master Plan, and the National Electricity Development Plan. with resolutions[16].

The energy efficiency in Vietnam is improving day by day, and the final forms of energy used in the form of electricity are increasingly developing, especially in the transportation sector due to the application of advances in science and technology, especially those of the fourth industrial revolution.

Efficient exploitation of renewable energy sources

Thanks to the policies to encourage the development of renewable energy of the Government of Vietnam, especially in the two years of 2019-2020, there has been a very rapid development of renewable energy in Vietnam, especially solar power. By the end of December 31, 2020, out of a total of 69,340 MW of installed power capacity nationwide, 16,420 MW of solar power (including 8,673 MW of concentrated solar power and 7,755 MW of rooftop solar power), 514 MW of wind power, 382.1 MW of biomass power, 9.43 MW of garbage power. The total installed capacity of solar power accounts for more than 25% of the total installed capacity of the whole system. In actual results in 2019 and 2020, respectively, the electricity output generated from renewable energy sources reached 5.242 billion kWh and 10,994 billion kWh, contributing to a significant reduction in high-priced diesel electricity. If comparing the actual mobilized oil power data with EVN's forecast, diesel electricity had decreased by 2.17 billion kWh in 2019 and 4.2 billion kWh in 2020 (saving about 10,850 billion VND - 21 trillion VND). Renewable energy had actively supported the supply of electricity to the North when there was a power shortage[15].

Remove policy bottlenecks

Resolution 55 of the Politburo of Vietnam is assessed as strategic and comprehensive, highly appreciated by international organizations, the business community, and society. The current problem is that it is necessary to soon

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institutionalize and concretize the Resolution into specific strategies and policies. Some types of renewable energy are still much more expensive than the average cost of the electricity industry. In addition, priority should be given to the development of rooftop solar power with a regulation on the rate of self-use of electricity in place (it can be about 80% selfuse, 20% of excess production allowed to be sold, or a reasonable rate). Connect to the grid of 35 kV or less without requiring improvement to increase the load capacity of the existing power grid and floating solar power projects provided that the installation of equipment on the surface water must not affect the operation of the works, reservoirs, aquaculture activities. It is advisable to develop reasonable policies for energy storage projects to encourage investors to invest in storage systems when the cost of storage systems is appropriate.

Ensuring the safety of the national power system

The development of onshore wind power needs to be controlled so that the ratio of onshore wind power and solar power is at a reasonable level based on the absorption and control capacity of the national power system at each time, by the current conditions technical. The ultimate goal is not to affect the safety of the national and regional electricity systems.

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5. CONCLUSION

Vietnam is considered a country with great potential for solar energy, especially in the central and southern regions of the country. Solar power in Vietnam is available all year round, is relatively stable, and is widely distributed across different country regions. In particular, the average number of sunny days in the central and southern provinces is about 300 days/year. Therefore, the transition to renewable energy is very potential in Vietnam. However, there are some barriers related to energy transition in Vietnam. Those barriers are those about mining and limitations in the exploitation of renewable energies. Policy institutions are also one of the fundamental barriers to hinder the development of renewable energy in Vietnam. The article also offers solutions to limit barriers in the energy transition process in Vietnam.

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