

A Study of the Development Strategy of the Wind Power Sector in Vietnam

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ABSTRACT

Nowadays, the wind power market is growing rapidly, while the cost of wind power equipment is decreasing, so Vietnam is currently building many wind power projects to ensure green energy development in its power system. However, some barriers in price mechanisms, and economic and technical conditions have also caused disadvantages in the process of developing wind power projects. This paper studies the SWOT-TOWS analysis to evaluate in greater detail the strengths, weaknesses, opportunities, and threat factors linked to it. Then the former compares the internal and external factors influencing the wind power industry on the way it exploits potential strategies. In general, Vietnam has satisfactory wind power development potential, and the wind power sector has been supported by a number of strong but unstable policies in the past. The rapid development of wind power capacity in recent times has also led to great challenges for investors and managers in actual operating conditions. Currently, investment costs for wind power plants are still quite high, Feed in Tariff (FIT) prices are not stable, transmission grid capacity is limited, and environmental treatment issues during construction and operation have not been fully considered.

Keywords-wind power; policy; SWOT; TOWS

I. INTRODUCTION

The growing demand for energy [1] and the prospect of the depletion of fossil energy sources [2] have increased the interest in alternative energy sources around the world [3]. The latter, need to ensure sustainability, affordable prices, and environmental friendliness [4]. Limited exploitation potential and environmental pollution are the main reasons for the increased use of renewable energy sources, so conventional fossil fuels will gradually be replaced by them [5]. The wind power market is also growing rapidly, while the cost of wind power equipment is decreasing. Thus, wind power technology is considered to be the economic pillar of the world's energy transition [6].

Vietnam is currently implementing many wind power projects, mainly onshore and nearshore, due to its wind power potential [7] and a number of other advantages these projects entail. After the FIT policy of the wind power, which ended in 2021, the total capacity of wind power in Vietnam was 4.126 MW. Vietnam approved new price caps for "transitional projects" (previous projects did not meet the old FIT deadline) in 2023, and helped to add 822 MW of onshore and offshore projects. The government also issued the Power Development Plan VIII (PDP 8) in May 2024 as the country's energy strategy for the period 2021-2030 and a vision up to 2050. The target is set with an onshore wind capacity of 21.8 GW and offshore wind capacity of 6 GW by 2030.

However, some barriers in price mechanisms and economic and technical conditions have also caused difficulties in the process of developing wind power projects. Therefore, to assess the development of the wind power industry, it is required to analyze information and decide on investment strategies for wind power projects in the near future in Vietnam.

One of the solutions to help analyze information for strategic decisions is the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis [8]. During the strategic planning process, SWOT is used to analyze and evaluate factors that benefit or hinder the success of the target strategy of a business, company, or project. Then, TOWS analysis [9] can be employed in cases where further analysis is needed to find out how to apply the factors discovered in the SWOT matrix to future development strategies.

SWOT analysis was performed in [10] to evaluate the application of wind energy. Authors in [11] developed a value chain model for the South Asian wind power industry, scrutinizing internal and external factors to analyze the viability of current conditions and future roadmaps for promoting the wind energy industry with the help of the SWOT model. The internal and external environment of the wind power industry in China was analyzed by authors in [12] to identify SWOT. In [13], SWOT was utilized to sketch an overview of the use of renewable marine energy sources, including offshore wind power at the European level, to identify possibilities for exploiting the marine energy potential. Authors in [14] applied TOWS analysis to analyze EU's renewable energy legislation.

SWOT-AHP-TOWS analysis was implemented in [15] to evaluate the private investment behavior in China's biogas sector.

Authors in [7, 16-17] have adopted the SWOT method to preliminarily evaluate some relevant basic factors related to the wind power in Vietnam. However, Vietnam currently lacks SWOT analysis research to apply TOWS analysis and therefore the factors discovered in the SWOT matrix to promote development strategies of wind power in Vietnam.

This paper studies SWOT-TOWS analysis to evaluate in more detail the strength, weakness, opportunity, and threat, then seeks to compare the internal and external factors of the wind power industry to exploit potential strategies. Finally, necessary policy strategies are recommended to move towards a sustainable growth strategy for the wind power industry in Vietnam.

II. METHODOLOGY

The methodology process of the present study is introduced in Figure 1. Firstly, the data are collected on the current status of wind power industry's development in Vietnam.

Secondly, the SWOT method is applied to evaluate strength, weakness, opportunity, and threat in detail. Strengths and Weaknesses are considered two internal factors in Vietnam's wind industry that can be altered. Opportunity and Risk are two external factors that are difficult to control.

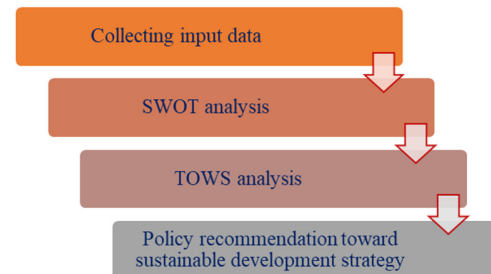


Fig. 1. Methodology process of the study.

Thirdly, TOWS analysis is performed after completing SWOT analysis to find ways to compare internal and external factors. Strengths and weaknesses are internal factors while opportunities and risks are external factors. Thus, potential strategies that promote the importance of these factors can be identified. The four TOWS strategies are Strengths/ Opportunities (SO), Weaknesses/ Opportunities (WO), Strengths/ Threats (ST), and Weaknesses/ Threats (WT).

Finally, sustainable development strategies for the wind power industry in Vietnam are proposed.

III. RESULT AND DISCUSSION

A. SWOT Analysis

The SWOT matrix that analyzes the strength, weakness, opportunity, and challenge of Vietnam's wind power industry is shown in Table I.

TABLE I. SWOT ANALYSIS FOR VIETNAM'S WIND POWER SECTOR

Strengths	Weaknesses
<ul style="list-style-type: none"> - Good wind energy potential. - Support policy mechanisms were issued to serve the development of the wind power industry in Vietnam. - Some organizations provide capital and technical support. - Contribute to reducing greenhouse gas emissions when producing electricity 	<ul style="list-style-type: none"> - Investment costs are still high. - Impact during the construction and operation of wind power. - The local power grid system has limited transmission capacity. - There is no solution to treat wind power waste.
Opportunities	Threats
<ul style="list-style-type: none"> - Load demand increases in Vietnam. - COP26 conference on global emissions. - Opportunity to use clean energy. - Contribute to promoting local economic development with wind power projects. 	<ul style="list-style-type: none"> - Support policies are not stable and consistent. - Risks when investing in wind power - Operate the power system. - Infrastructure and businesses in Vietnam are still weak to gradually localize wind turbine parts.

1) Strengths

According to the Global Wind Atlas, Vietnam has a total wind power potential of 512 GW and 110 GW in areas with annual average wind speeds of more than 6 m/s and 7 m/s, respectively [18].

In Vietnam, the Government has encouraged businesses to invest in the field of renewable power. The wind power sector also had preferential policies [19, 20] for grid-connected wind power plants with commercial operation dates before November 1, 2021. Accordingly, the price of onshore wind power was 8.5 US cent/kWh, while the price of offshore wind power was 9.8 US cent/ kWh. The Government stipulated that the electricity buyer is responsible for purchasing all electricity output from wind power projects at the price decided at the electricity delivery point as above. This price was calculated within 20 years. Vietnam's wind power market has received technical support projects from international organizations, such as the World Bank, which supported wind energy potential calculations [17], the Danish Energy Agency (DEA) in cooperation with The Ministry of Industry and Trade of Vietnam through the Danish Energy Partnership Program (DEPP) [21], which covered the fields of energy efficiency in the industry, the integration of renewable energy into the power grid, and designed a long-term scenario model for the energy sector. The German Development Cooperation Organization has provided consulting projects to identify the necessary policy as well as the technical and financial issues in the field of wind power in Vietnam.

Wind energy development has an important potential to reduce greenhouse gas emissions caused by traditional power sources in Vietnam. Coal-fired power plants are one of the largest sources of air pollution, with millions of tons of nitrogen oxides, carbon dioxide, and sulfur dioxide emitted into the environment each year. Furthermore, developing wind energy not only reduces greenhouse gas emissions, but also eliminates air pollution, contributing to the sustainable improvement of environmental quality.

2) Weaknesses

Investors must spend several million USD to invest 1 MW of wind power capacity. The current wind power purchase price policy is unclear and makes it difficult for investors to calculate effectively the project capital recovery.

Wind farms are built in places far from residential areas, along the coast or offshore. However, these projects also affect landscape and topography, so there are regulations for nature conservation areas, protected monuments, forests, or other residential areas to keep the necessary distance from the turbine location [22]. In addition, it is also necessary to calculate the impact of the power grid system on the landscape as well as the influence of the reflection of the protective paint or plastic layer when the turbine operates under sunlight. Renewable energy sources, including wind power, are being developed very rapidly, with more and more large-capacity wind power plants being connected to the power system. Thus, there are some challenges in operation, stable control of the system, and ensuring power quality [23]. In areas with many wind power plants, grid congestion is caused by the local grid system's limited transmission capacity. Wind power progress can increase the amount of waste [24], which mainly occurs in Vietnam during the operation and after the project life cycle ends [25]. For instance, wind turbine blades are the most susceptible to damage, because they are constantly moving parts during operation. However, Vietnam currently has no plans or solutions to treat waste generated from wind power projects.

3) Opportunities

From the beginning of 2024, the electricity demand increased dramatically compared to the same period in the year 2023 [26]. Therefore, ensuring sufficient electricity supply and improving economic efficiency are important issues. One of the solutions that needs to be implemented to tackle the latter, is to mobilize electricity from wind power projects. At the COP 26 Conference on climate change, Vietnam committed to bringing net emissions to zero by 2050 [27]. Therefore, to certify energy security as well as price competitiveness, Vietnam can switch to renewable energy sources including wind power through the development of support solutions, gradually avoiding dependence on imported coal and gas. Renewable energy sources, such as wind power, are clean energy sources. Using wind power is a solution to help reduce greenhouse gas emissions, save energy, contribute to environmental protection, and combat climate change. Furthermore, green energy transformation [28] is a mandatory requirement to meet international standards and move towards a sustainable development future in Vietnam.

4) Threats

Given that the FIT price policy expired at the end of 2021, many wind power projects did not complete electricity sale procedures on time. Therefore, the Ministry of Industry and Trade issued a power generation price framework applicable to transitional wind power projects with wind power prices much lower than the preferential price according to the Decision 39/2018 of the Prime Minister and cheaper than the price of many other types of thermal power at present [29]. Thus, wind

power projects in the transition phase will have to sell electricity at prices lower than those expected in the initial investment plan, so most projects will become economically unfeasible. This forces project owners to face many difficult choices. As of now, the new policy mechanism for wind power has not been announced. The bidding mechanism for renewable energy projects supported by the World Bank and the Asian Development Bank for many years has not been issued yet [30]. Therefore, investors will bear quite a large risk because they cannot calculate financial problems and economic efficiency for wind power projects.

Wind power also causes many difficulties in the operation of the power system [31]. Specifically, with the generation capacity characteristics fully dependent on unstable primary energy sources such as wind power, the stability of the power system will generally be affected if traditional power sources are not promptly adjusted according to the changes in load capacity and wind power sources [32]. The supply chain localization rate as well as the deep participation of Vietnamese enterprises in providing services to the wind power industry is still low [33]. This is partly due to a lack of project evaluation and development capacity, poor infrastructure, and dependence on foreign countries.

B. TOWS Analysis

The TOWS analysis matrix, exhibited in Figure 2, is a useful tool for building strategies based on a combination of internal and external factors.

	Strengths	Weaknesses
Opportunities	SO Maxi - Maxi Strategies	WO Mini - Maxi Strategies
Threats	ST Maxi - Mini Strategies	WT Mini - Mini Strategies

Fig. 2. TOWS analysis matrix.

1) Strength-Opportunity (SO) Strategies

Developing wind power and gradually forming a domestic industry in installation, construction, and equipment manufacturing to increase autonomy and reduce costs, should be identified as a major directional policy of the Government in the coming years. In addition, Vietnam's wind power industry needs to share experiences and advice from more developed countries in this field to improve the legal framework and create favorable mechanisms and policies, contributing to promoting the development of wind power development in Vietnam.

2) Weakness-Opportunity (WO) Strategies

Vietnam should develop solutions to attract foreign investors through domestic investors to participate in

investment projects and invest in the electricity industry. Large energy corporations rarely develop projects directly to avoid and reduce risks, time, and costs in the project development stage, such as compensation for site clearance and approval from government agencies. Meanwhile, domestic investors, who understand domestic laws, mechanisms, policies, orders, and procedures, should better carry out the investment preparation phase, which will have more advantages. On the other hand, foreign investors have good potential in terms of capital, technology, investment experience, and factory operation.

3) Strength-Threat (ST) Strategies

The Government has issued many legal documents in the field of renewable energy in general and wind power in particular. However, the achievements and progress accomplished are not enough for the wind power industry to overcome its low development, while Vietnam needs to research and develop a new Renewable Energy Law to institutionalize and create a legal corridor for developing renewable energy and wind power. In addition, the new incentive wind power mechanism in the coming time needs to control the development in each area, region, and region in each period. The former should avoid focusing only on locations that are convenient for grid connection, which leads to non-optimization, ineffective use, and affects the reliability of the power grid as has happened in the past.

4) Weakness-Threat (WT) Strategies

Vietnam needs to take measures to encourage and support the development of renewable energy to solve problems related to increasing economic benefits, combined with the responsibility for environmental protection, creating a competitive advantage when investing in wind power locally. The Government should consider amending and supplementing some current legal documents in the direction of creating a favorable environment for energy businesses to develop in accordance with market mechanisms. The former should additionally promote social policies in the field of wind power investment in general and processing and localized production of wind power equipment in particular. The development of power grid and power sources in localities needs to be considered and built synchronously in terms of time and investment resources to avoid the asynchronous development of the power grid and wind power sources in localities, causing dispatch work and therefore numerous difficulties.

IV. CONCLUSION

The paper studied the strengths, weaknesses, opportunities, and threats of Vietnam's wind power industry with the support of the SWOT analysis method. In general, Vietnam has good wind power development potential, and the wind power sector has been supported by a number of strong but unstable policies in the past. The rapid development of wind power capacity in recent times has also led to great challenges for investors and managers in actual operating conditions. Investment costs for wind power plants are still quite high, FIT prices are not stable, transmission grid capacity is limited, and environmental treatment issues during construction and operation have not been considered fully.

Based on the results of SWOT analysis, TOWS method is used to compare internal and external factors of the wind power industry and propose potential strategies according to the trend of promoting available advantages, strengths, and opportunities and reducing remaining weaknesses and challenges.

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