

## Article

# Are the Barriers to Private Solar/Wind Investment in Vietnam Mainly Those That Limit Network Capacity Expansion?

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**Abstract:** This study addresses whether the main barrier to private solar/wind investment is the network side instead of the generation side, as a hypothesis, and how the network-related barrier could be reduced to encourage a more extensive range of private investment. It mainly employs a review of the literature and semi-structured interviews with relevant stakeholders. The result showed weak grid capacity is a critical barrier in solar power projects' congested areas. Another critical barrier is policy uncertainty in that the government has not issued any alternative mechanisms for developers who failed to meet the Commercial Operation Date for approximately two years after the FITs ended. This is likely due to the fact that the Power Development Plan 8 (PDP8) for 2021-30 had been slow to be approved by the Prime Minister. In the absence of policies, the government committed to net-zero emission toward 2050 at COP26 and concluded the Just Energy Transition Partnership agreement in December 2022. These might lead the government to set its ambitious RE targets in the power mix of PDP8 approved in May 2023. In addition, amendments of the Law on Electricity which allows private firms to invest in the grid may contribute to improving quality and capacity of the grid.

**Keywords:** renewable energy; solar power; wind power; private investment; barriers; grid expansion; Vietnam



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## 1. Introduction

Vietnam relies on coal-fired plants as primary baseload power and depends on natural gas in the middle demand, and hydropower in case of the highest demand [1] (p. 60). Vietnam has installed the power capacity of 49 GW, which consists of coal thermal power plants (38%), hydropower plants (35%), gas turbines (15%), small hydropower plants (6%), and others (6%), by the end of 2018 [2]. The northern regions have a surplus of capacity from coal-based power plants, while the southern regions have faced a lack of power capacity because of various power plants' delayed construction schedules [1] (p. 60).

According to the 7th Power Development Plan Revision (PDP7rev), electricity demand will keep growing towards 2030 compared to the actual value in 2015 [3] (see Table 1). PDP7rev indicates that about USD 150 billion needs to be invested in power generation and grid expansion between 2016 and 2030, which consists of USD 40 billion in 2016-20 and nearly USD 110 billion in 2021-30. The Government of Vietnam (GoV) shows intentions to diversify the finance for power development through enhancement of capital accumulation (e.g., issuing bonds and mobilizing FDI) [4].

Vietnam is abundant in RE sources in solar radiation and wind conditions [1] thanks to geographic location and wind patterns. Through the FIT for solar power (9.35 US cent/kWh) issued in April 2017, 82 solar power plants, whose capacity corresponds to more than 4460 MW (8.28 percent of the gross electricity capacity), was connected with the grid by the Commercial Operation Date (COD) of 30 June 2019 [5]. In addition to the FIT, rapid declines in solar power's capital costs for the past five years also contributed to dramatic solar electricity growth. It has led to solar being the lowest cost option on

the levelized cost of electricity (LCOE) (The LCOE for solar PV in the Moderate Technical Potential Scenario (which excludes protected areas, water bodies, forested areas, and urban areas, but include agricultural areas and areas with a slope greater than 5%) with a capacity factor of more than 10% is 64 USD/MWh, which reflects the different quality of solar resources in the southern and northern region [6] (pp. 9–11)) among other traditional power resources [7].

**Table 1.** Power Generation Capacity in 2015, and Projected Capacity in 2020 and 2030 (unit: MW).

Electricity Sources	2015	2020 <sup>1</sup>	2030 <sup>2</sup>
Gas- and oil-fired power	8873	9000	19,000
Coal-fired power	12,903	26,000	55,300
Nuclear power	0	0	4600 <sup>3</sup>
Hydropower (small, medium, large)	14,636	21,600	27,800
Wind power	135 <sup>4</sup>	800	6000
Solar	0	850	12,000
Other, including biomass & import	2006	1750	4800
Total	38,553	60,000	129,500

<sup>1</sup> projected; <sup>2</sup> projected; <sup>3</sup> halted in 2016 after seven years of preparation; <sup>4</sup> renewable energies.

However, connecting large-scale solar power plants in the southern provinces has led to curtailment issues in the grid of 110 kV and 220 kV intermittently [5]. For example, in Ninh Thuan province, 18 projects (1180 MW), which consist of 15 solar power projects (1063 MW) and 3 wind power projects (117 MW), have been connected to the grid as of 31 October 2019; however, 10 projects (359 MW) located in southern areas of this province have had to limit their output to a maximum 60% of the full capacity [8].

According to Vietnam Electricity (EVN), a state-owned company, deploying the transmission grid takes 3–5 years. Currently, the National Power Transmission Corporation has expanded 220–500 kV transmission lines and substations in the domestic power system, aiming at delivering the full capacity of solar power generated in Ninh Thuan and Binh Thuan provinces in 2020–2021. However, it has been struggling with compensation and site clearance [9]. Furthermore, EVN has suggested a new idea to invite the private sector to temporarily invest two 220 kV substations (Vinh Tan and Phuoc Thai), which can help all solar power plants (connected to the grid before 30 June 2019) to generate in full capacity [10]. However, the Law on Electricity regulates EVN and its subsidiaries can install, manage, and operate transmission systems. This situation is almost similar to Indonesia, where the state-owned power firm, Perusahaan Listrik Negara (PLN) is responsible for the whole energy sector based on the Law on Electricity [11].

Apart from upgrading the grid capacity, the PDP7rev indicates that small-scale RE technologies could reduce transmission and distribution losses [4]. Thus, GoV expects to expand the international private investment on solar/wind power projects and to meet increasing electricity demand to reduce power losses and limited financial resources from domestic banks. Behind the success of solar power development, [7] emphasize that it is vital to eliminate barriers, including Power Purchase Agreement (PPA)'s un-bankability. There might be a perception gap in risk-taking between domestic and international investors, which are the difference between Asian countries and others.

As for financial constraints, the public debt in Vietnam has reached 58.3% of GDP in 2018, which is close to its legal public debt cap of 65% set by National Assembly in 2016. Therefore, it will be difficult for EVN to depend on GoV and borrow directly from local commercial banks and international development banks, which have required the government guarantee from the Ministry of Finance. Also, as Vietnam became a middle-income country, the percent of highly concessional loans has dramatically decreased in 2017–18. There are a few public finance options (e.g., less concessional loans and non-

sovereign loans) for EVN [12]. Thus, private investment is expected to meet increasing electricity demand [12,13]. Since 2016, the public debt has decreased and declined to 43.1% in 2021. GoV set 60% as a new cap (until 2030) in April 2023 [14].

A few academic papers on solar/wind power had focused on private investors' contributions in Vietnam when the author searched academic databases. Although some studies dealt with investment barriers, they are a bit old or have not reflected the dramatic changes in the last few years. Meanwhile, various surveys on private investment barriers are written by development partners and Western consultancy companies, law firms, and Vietnamese/Asian newspapers.

This study reviews the regulations on solar/wind in Vietnam and empirical research on its barriers for solar/wind power private investment. It discusses whether the main barrier is the network side instead of the generation side as a hypothesis and how the network-related barrier could be reduced to encourage more solar/wind power private investment to meet electricity demand in Vietnam. The paper is structured as follows. Section 2 reviews the regulations on solar/wind power, the current situation, and the past analysis on solar/wind power private investment. Section 3 explains the methods employed in this paper. Section 4 presents the findings from interviews with investors and relevant stakeholders in Vietnam. Section 5 provides conclusions and policy recommendations as well as future extensions of this research.

## 2. Regulations on Solar/Wind Power, Current Situation, and Empirical Research on Solar/Wind Power Private Investment Barriers in Vietnam

### 2.1. Policy/Regulatory Framework on RE and the Current Situation in Vietnam

This subsection provides the policy framework on RE electricity (see Table 2) followed by the regulatory framework on solar/wind power and the current situation.

**Table 2.** Relevant policy framework on RE.

2011	National Power Development Master Plan for the 2011–2020, with a vision to 2030 (PDP7)
2015	RE Development Strategy (2016–2030) with outlook until 2050 (Decision 2068/2015/QD-TTg)
2016	Revised National PDP 7 (Decision 428/2016/QD-TTg)
2019	Report 58/BC-BCT on the Implementation Progress of Power Projects in the Revised Power Development Plan 7 (by MOIT)
2020	Resolution 55-NQ/TW of the Politburo on Orientation of national energy development strategy to 2030 and outlook to 2045 (by Central Committee of the Communist Party of Vietnam)
2023	National Power Development Master Plan for the 2021–2030, with a vision to 2050 (PDP8) (Decision 500/2023/QD-TTg)

In November 2015, the Prime Minister approved the Renewable Energy Development Strategy (REDS) up to 2030 with a vision of 2050. In the REDS, the ratio of RE development capacity (including large hydropower plants) in the whole electricity generation will be 38% in 2020, 32% in 2030, and 43% in 2050, respectively [15].

In March 2016, GoV revised its Seventh Power Development Plan (PDP7). In the revised plan (PDP7rev), the average economic growth rate and the total electricity output were revised downward. Also, the PDP7rev decreases the targeted amount of coal-fired power plants and increases RE (including small hydropower), which accounts for 21% of the whole power development by 2030 [4]. GoV also regulated the national/provincial solar power development plans (master plans) and has continuously altered them by adding new projects [16]. Since 2019, the Ministry of Industry and Trade (MOIT) has initiated to develop PDP 8 with relevant ministries and stakeholders. In Report 58 (June 2019) and Resolution 55 (February 2020), GoV showed an actual and future shift in planning away from coal

power, even compared to PDP7rev [16,17]. In May 2023, GoV approved its PDP8 which reflected the outcome of numerous drafts and revisions for nearly three years [18] (See Table 3). Comparing to the sources of PDP7rev and the actual value in 2020 [19], the ratio of gas and wind power significantly increases, while that of coal decreases. For development of PDP8, GoV also took into consideration the COP26 commitment to net-zero emissions by 2050 and the agreement made under the Just Energy Transition Partnership (JETP) which was signed between GoV and International Partners Group in December 2022 [20,21].

**Table 3.** Power Generation Capacity in 2020, and Projected Capacity in 2030, and 2050 (unit: MW).

Electricity Sources	2020		2030 <sup>1</sup>		2050 <sup>2</sup>	
	MW	%	MW	%	MW	%
Gas- and oil-fired power (2050: LNG)	9030	13	37,630	25	14,930	2.6–3
Coal-fired power	20,431	29.5	30,127	20	0	0
Converted coal (biomass, ammonia etc.)	0	0	0	0	25,632–32,432	4.5–6.6
Hydrogen	0	0	0	0	20,900–29,900	4.1–5.4
Hydropower	20,685	30	29,346	19.5	36,016	6.3–7.3
Onshore wind power	630	0.9	21,880	14.5	60,050–77,050	12.2–13.4
Offshore wind power	0	0	6000	4	70,000–91,500	14.3–16
Solar power	16,640	24	12,836	8.5	168,594–189,294	33.0–34.4
Biomass	570	0.82	2270	1.5	6015	1.0–1.2
Stored power	0	0	2700	1.8	30,650–45,550	6.2–7.9
Cogeneration	0	0	2700	1.8	4500	0.8–0.9
Imports	1272	1.83	5000	3.4	11,042	1.9–2.3
Flexible power sources	0	0	0	0	30,900–46,200	6.3–8.1
Total	69,258	100	150,489	100	479,229–569,499	–

<sup>1</sup> Projected; <sup>2</sup> Projected.

GoV promulgated regulations for development of wind power projects (see Table 4). GoV regulated the FIT (7.8 US cents/kWh) for 20 years in June 2011 [22] and issued the regulations relating to the standardized PPA [23] and the tax exemption of imported goods and land use [24]. However, 7.8 US cents/kWh could not attract investors' interest because of a very low investment guarantee [25]. After GoV issued the revised FIT (FIT2) for onshore wind power projects (8.5 US cents/kWh) and offshore (9.8 US cents/kWh) in November 2018, the number of projects has increased, aiming at the COD (1 November 2021) [26,27]. The installed capacity of wind power plants is 4126 MW (as of July 2022) based on report of EVN and localities [28].

In March 2020, MOIT proposed the Report 1931 to the Prime Minister (PM) to add more wind energy activities in the PDP as well as enhance transmission lines to absorb additional projects, considering the priority of the latest electricity development strategy (Resolution 55) and the probability of insufficient electricity (2021–24) [29]. In April 2020, MOIT submitted the Report 2491/BCT-DL to the PM for consideration to extend to use the FIT to 31 December 2023, considering issues such as the building period of onshore/offshore wind power plants and disruption of supply chain and international experts caused by the Coronavirus disease [30]. For transitional wind power plants which did not comply with the COD stipulated in Decision No. 39, MOIT showed the formulation method for the tariff range in Circular No. 15; however, uncertainty remained in determining the tariff [31]. In January 2023, MOIT notified the FITs for onshore wind power plants (6.8 US cents/kWh) and nearshore (7.8 US cents/kWh) in Decision No. 21 [32]. However, in May 2023, the Deputy Prime Minister requested MOIT to promptly revise and complement

Circular No. 15 and Decision No. 21 for investors of transitional wind power plants to receive the profitable FIT and immediately connect to the grid [33].

**Table 4.** Incentive mechanisms on wind power.

2011	Decision 37/2011/QD-TTG dated 29 June, on approving the supporting mechanism for the development of wind power project in Vietnam (by Prime Minister) (FIT1)
2012	Circular 32/2012/TT-BCT dated 12 November, issuing the Regulations on the implementation of wind power project development and standardized Power Purchase Agreement (PPA) for Wind Power Projects (by MOIT)
2012	Circular 96/2012/TT-BTC dated 8 June, guiding the financial mechanism of supporting electricity price for grid-connected wind power projects (by MOF)
2013	Circular 6/2013/TT-BCT dated 8 March—Regulation on content, order and procedures for formulation appraising and approving wind power development planning (by MOIT)
2018	Decision 39/2018/QD-TTg issued on 10 September, amending and supplementing articles of Decision 37/2011/QD-TTG dated 29 June 2011 (FIT2)
2019	Circular 2/2019/TT-BCT—issued on 15 January; on wind power project development and power purchase agreement
2020	Report 1931/BCT-DL dated 19 March, submitted by MOIT to the Prime Minister for consideration of supplementing wind power projects to PDP
2020	Report 2491/BCT-DL dated 9 April, on the proposal to extend the wind FIT mechanism in Decision 39/2018/QD-TTg issued by MOIT
2022	Circular 15/2022/TT-BCT dated 3 October, on method for formulating power generating tariff ranges for transitional solar and wind power plants
2023	Decision 21/2023/QD-BCT dated 7 January, on promulgation of the transitional framework for electricity prices of solar power plants wind power plants
2023	Circular 1/2023/TT-BCT issued on 19 January, annulling a number of provisions of Circular 2/2019/TT-BCT

GoV also initiated the solar FIT and a net metering mechanism for residential PV (see Table 5). In April 2017, GoV adopted 9.35 US cents/kWh to all types of solar power projects for 20 years under the standardized PPA. It set the COD by 30 June 2019 [34,35]. As a result, 4460 MW of solar power facilities were connected to the grid by the deadline [5]. According to the Report No. 127/BC/DL dated 31 July 2019, cited by [36], the PM has requested MOIT to reexamine to balance between solar power generation and transmission grid upgrade, to start an auction scheme for solar as a pilot from 2020 to be implemented broadly from 2021 and to present a structure for the private sector to invest in transmission grids.

Concerning renewed incentive mechanisms for solar power adopted after 1 July 2019, GoV issued new FITs (Decision 13/2020), which consist of 7.69 US cents/kWh for floating solar, 7.09 US cents/kWh for ground-mounted solar, and 8.38 US cents/kWh for rooftop solar power (RSP), which are 10–24 percent lower than previous tariff, in April 2020. The new FITs and standardized PPA apply for the projects that received approval before 23 November 2019 and reach their COD by 31 December 2020 [37,38]. Also, MOIT applied a unique scheme for solar power projects generated in Ninh Thuan province, which has contemplated as the RE center of Vietnam [39]. This province had made construction preparations for a nuclear plant; however, the national assembly decided to cancel the nuclear option on 22 November 2016 because of several reasons [40]. According to reports of EVN and localities, cited by [28], the installed capacity of solar power plants is 16,564 MW which consists of 8904 of concentrated solar and 7660 MW of rooftop solar power projects (as of July 2022).



**Table 5.** Incentive mechanisms on solar power.

2017	Decision 11/2017/QĐ-TTg—issued on 11 April 2017 and expired on 30 June 2020; implementation of a FIT mechanism
2017	Circular 16/2017/TT-BCT—issued on 12 September on project development and standard form of power purchase agreement for solar power projects
2018	Resolution 115/NQ-CP (support mechanism for Ninh Thuan province in 2018–23)—solar power projects will be implemented until the time to reach the full capacity of 2000 MW or the end of 2020
2019	Decision 2023/QĐ-BCT (promotion program for the development of rooftop solar power in Vietnam)
2020	Decision 13/2020/QĐ-TTg dated 6 April 2020 on mechanisms to promote the development of solar power projects in Viet Nam
2020	Circular 18/2020/TT-BCT on Stipulating project development and standardized power purchase agreement for both grid-connected and rooftop solar power projects (effective from 31 August 2020)
2022	Circular 15/2022/TT-BCT dated 3 October, on method for formulating power generating tariff ranges for transitional solar and wind power plants
2023	Decision 21/2023/QĐ-BCT dated 7 January, on the framework of electricity generation prices for the transitional solar and wind power plants
2023	Circular 1/2023/TT-BCT issued on January 19, annulling a number of provisions of Circular 18/2020/TT-BCT

Furthermore, MOIT announced two regulations (Circular 15 and Decision 21) for transitional solar power plants in the same way as wind ones and indicated the FITs for ground solar plant (5.1 US cents/kWh) and floating solar plant (6.5 US cents/kWh) which cannot operate by 31 December 2020. However, MOIT must amend two regulations which can provide investors with proper profit in accordance with Deputy PM’s request (May 2023) [33].

For the recent few years, MOIT has considered an auction and direct PPA (DPPA) scheme; however, it has not officially announced them as official policies yet. In March 2023, the GoV requested MOIT to finalize the study in developing the draft scheme for the pilot DPPA [41].

## 2.2. The Literature Review of the Empirical Research on Barriers for Solar/Wind Power Private Investment in Vietnam

This subsection describes the outcomes of a review of the literature of the empirical research on barriers to solar/wind power private investment in Vietnam. Based on the analysis, 24 barriers were determined through the literature review and the first semi-structured interviews; furthermore, the analysis was divided into five categories: policy/regulatory, financial, technical, institutional, and social and environmental aspects. Through the references, the author added policy recommendations briefly in the column, though some of the literatures were old.

### 2.2.1. Policy and Regulatory Barrier

GoV has formulated regulations for RE for the past decade. The author takes up six barriers (see Table 6).

In ref. [7,42], there are concerns about whether GoV continues some incentive mechanism for solar power generation after July 2019. Multiple experts indicate that Vietnam’s standardized PPA includes un-bankable terms, which are quite risky for international investors to accept [7,12,43,44]. As examples of un-bankable terms, they list up “off-taker risk,” which hinders investors from canceling out risks in cases of curtailment [7,13], “termination risk,” which could occur in the event of early termination of the PPA (for EVN default) without compensation [12,13], “absence of government guarantee” which makes

international private investors recognize high risk [7,12,13,43], “no international arbitration” which entitles Vietnamese authorities to dispute resolution [13,45], and “lack of force majeure” [7]. In other words, [45] argues that the present PPA does not enable international bankers to undertake risks and provide loans to developers. This FIT prevents international financiers from taking collateral assets if (local) investors default on the loans.

**Table 6.** Summary of policy and regulatory barrier.

Summary of Identified Barriers	References	Recommendations by the Author
Vague whether FITs remain in the future	[7,42]	Improve the policy predictability
Un-bankable PPA terms	[7,12,13,43–45]	Correspond to international standards
Slow and inadequate issue of technical regulations	[46]	Timely issue key regulations
Lack of clarity and delays in project approval process	[46]	Increase transparency for the procedure
Delays/ risks in land acquisition processes	[43,47]	
Allegations of misconduct by officials, collusion, and corruption	[43,46]	Maintain fairness in regulations

Regarding procedures, it takes time for GoV to issue technical regulations such as the standardized PPA after the decision was issued. The project approval process to obtain a project license consists of time-consuming steps because developers need to interact both with relevant departments of Provincial People’s Committee [46] and with the central government agencies; however, it depends on the project size (>30 MW or >50 MW). Land acquisition processes also contain risks [43,47]. “Allegations of misconduct by officials, collusion and corruption” are reported by the media [43,46].

#### 2.2.2. Financial Barrier

The financial barriers may influence investors’ decisions. One of the significant issues in Vietnam is limited access to finance to cover upfront initial investments. The seven barriers are discussed as follows (see Table 7).

**Table 7.** Summary of financial barrier.

Summary of Identified Barriers	References	Recommendations by the Author
The high initial investment cost for solar/wind power plants	[46,48]	Regulate land acquisition for RE development to mitigate high transaction cost
Low-regulated price of electricity	[45,46,48,49]	Refer to other developing countries and simulate the electricity price range (Vietnam’s electricity price is lower than other Asian countries)
Lack of clarity in future electricity retail price	[46,50,51]	
Non-preferential/still low FITs	[45,46,49]	Discuss appropriate level with stakeholders if GoV plans to issue FITs or other pricing mechanisms
Limited capital/financial channels for attracting long-term loan	[12,42,45,46,48,49,52]	Consider revising the PPA terms for international investors and banks to be able to accept
Lending VND-based loans to RE projects	[12]	Secure flexibility for exchange rate
The burden for developers to pay for the prompt connection costs to substation/110 kV line	[12,45,48,53]	It is common to connect to 110 kV line in other countries, unless developers update transmission infrastructure

In ref. [48], the author argues that Vietnam’s solar/wind power cost is about twice as high as the Indian one because real developers need to buy land licenses from local developers or provide 10–20 percent as the local ones’ equity. They must also borrow loans (typically 10 percent interest for 10 years) from local commercial banks, which is because of a high risk of curtailment built into EVN contracts, which eliminate lower-cost international

loans. Furthermore, RE generators need to bear the charge of connecting their plants to the transmission lines, and its cost and risks may be increasing, depending on the conditions of areas where a line is connected through land inherited by landowners [12,45,48,53].

In ref. [49], the authors suggest that the low-regulated price of electricity based on fossil fuel subsidies has prevented the private sector from investing in RE projects because it does not guarantee the required returns, which can offset the generation cost, even though GoV has provided the FIT.

In ref. [46], the authors comprehensively analyze the energy transition in Vietnam. GoV still severely controls the electricity retail tariffs whose increases have followed nearly the inflation rate and CPI of Vietnam for a decade or so, comparing constant prices [50] (pp. 4–5), [51] (pp. 20–21), and they are caused by different tariff schemes among sectors. It is unclear when the tariff increases. The wind FIT (7.8 US cent/kWh) set in 2011 is very low, and the solar FIT (9.35 US cent/kWh) is still not appealing to investors because (a) the costs for large-scale solar/wind power projects remains proportionately high; (b) the ability and enabling environment is undeveloped; and (c) the solar/wind FITs are higher than the normal retail price, which might discourage EVN subsidiaries from purchasing RE. In ref. [45], it is indicated that Vietnam's FITs are not competitive, considering lower retail electricity prices and neighbors' FITs.

Concerning limited capital and financial channels, national commercial banks have difficulties providing long-term loans for high initial investment in RE projects regarding their deposits' short-term feature [12,46]. They also have limited internal professionals to assess RE projects [12,49,52]. In addition, they have 15 percent cap on their equity capital to provide debt to each borrower [42]. Regarding the financing structure, local commercial banks require developers to apply for corporate finance instead of project finance [45], which requests divergent long-term loan credit appraisal [42]. Also, the present PPA, including unacceptable terms for international financial institutes (IFIs) (see Section 2.2.1 in detail), has made it difficult for Vietnamese developers to acquire debt finance from IFIs. IFIs can offer a cheaper lending rate and longer duration loans than Vietnamese lenders, whose shorter-term rate is 7.5–9.5 percent/year [12]. As the above description is based on the secondary sources, it is essential to interview investors.

As other barriers, domestic financial institutions have provided VND-based loans to solar/wind power facilities because most projects have been deployed by local investors [12].

### 2.2.3. Technical Barrier

Solar/wind power technologies at utility-scale are relatively recent compared to traditional electricity sources in Vietnam. There are technical barriers are six, as follows (see Table 8).

**Table 8.** Summary of technical barrier.

Summary of Identified Barriers	References	Recommendations by the Author
Lack of qualified experts	[46,52,54]	Identify which types of experts are insufficient
Too small RE manufacturing businesses in Vietnam	[46,52]	Consider balance between cost and development of domestic industry
Inadequate infrastructure for solar and wind power plants	[42,46,52]	Manage to upgrade transmission infrastructure to meet progress of solar/wind power development
Weak grid capacity/ Unreliability and instability of the grid	[1,42,55–57]	
Poor quality and data for RE (e.g., available locations, infrastructure capabilities, etc.)	[52]	Update the latest situation (because of old reference)
Lack of information on wind energy potential and wind measurements	[1,52]	



In ref. [52], major obstacles are classified for future wind power deployment, indicating a lack of qualified experts who can complete the whole activities after building wind turbines. Lack of accurate data on wind power resource maps of the whole country is also a barrier because of insufficient wind measurements. However, as this research was published in 2015, it is necessary to justify it by interviews.

In ref. [46], the authors show there are barriers such as weak human resources for facility management, construction, and O&M in different levels of public and private sectors and insufficient infrastructure including grids and smart grid systems. In addition, there are a limited number of manufacture and assembly factories in Vietnam, which focus on different components of solar PV systems and wind towers, but they function mainly for exports. They suggest that policy support for the expansion of national RE manufacturing businesses is needed.

In ref. [54], it summarizes possible solar competitive bidding schemes in Vietnam. It indicates that solar PV modules are jointly produced with Chinese and American companies in Vietnam. For example, 5 GW PV panels for exports were produced in 2017, which accounts for seven percent of the international market. The report stresses the importance of fostering PV's supply chain in Vietnam.

In ref. [42], the authors analyze substantial problems in encouraging the private sector to invest in the electricity sector, including insufficient progress of transmission grid upgrade, considering the unplanned situation that numerous solar power plants were connected to the grid by the end of June 2019. EVN is the exclusive buyer for RE plants; however, it might not take risks when curtailment issues occur under the present PPA.

In ref. [55], the authors are concerned with insufficient grid lines in the south and south-central regions in absorbing increasing solar and wind power generation. They suggest that MOIT examines whether private sectors (solar and wind power developers) invest in grid infrastructure, especially their transmission of 220 kV and 500 kV.

In ref. [1], it indicates that it has been hard to deploy the transmission lines in being in time for the COD of solar and wind power projects because of the lag of the construction procedure and finance alignment of the transmission network. To connect a large-scale solar/wind power to the transmission grids, GoV should prioritize upgrading the transmission grids on a short-term basis before considering other measures that enable the electricity system to be flexible.

In ref. [56,57], research shows the optimization model's simulation outcome to minimize the investment and operation costs in integrating solar and wind power into power systems for 2020–30. The previous paper suggests that upgrading the transmission grids should be simultaneously conducted in developing electricity sources, particularly RE.

#### 2.2.4. Institutional Barrier

Institutional barriers are two as follows (see Table 9).

**Table 9.** Summary of institutional barrier.

Summary of Identified Barriers	References	Recommendations from the Author
A remarkable large amount of stakeholder involvement with a variety of government agencies	[7,58]	Clarify the necessary steps/process in national and provincial levels in regulations or develop a one-stop agency
Lack of effective coordination among central and local authorities	[52,58,59]	

In ref. [58], RE's financial potentiality for power generation in Vietnam for 2010–30 by utilizing a bottom-up Integrated Resource Planning model is studied. To promote RE deployment, GoV should improve insufficient coordination among different agencies inside the government.

In ref. [59], the authors argue that smooth connection and simplification of roles among central and provincial government agencies diminish high transaction cost that RE

developers need to submit similar papers to multiple organizations at different times. GoV should clarify each agency's responsibility to make investors understand clearly.

In ref. [7], the authors indicate that project approval process needs an incredible number of stakeholder involvement with different government institutions. If this process is streamlined, it may attract international investors to join the market. And [60] introduces how Thailand enacted the Energy Regulatory Commission (ERC) as an independent administrative institution in 2007, regulating and supervising the overall energy industry such as tariff calculation, procurement operation, and fair competition suitably and transparently. The ERC is an excellent example of one-stop agencies.

### 2.2.5. Social and Environmental Barrier

Social and environmental barriers are three as follows (see Table 10).

**Table 10.** Summary of social and environmental barrier.

Summary of Identified Barriers	References	Recommendation from the Author
Minimal public consultation relating power-sector strategies, plans and other policies	[46]	Increase opportunities for general public to understand social and environmental aspects of RE comparing conventional power sources
Lack of appreciation of the advantages of RE and the risks of fossil fuel energy	[46,61,62]	
Social/community acceptance	[46]	

In ref. [46], the authors argue a few public consultations on the power sector except the compulsory announcement of final drafts for comments before the approval of strategies and other policies. In addition, various benefits of RE and the danger of fossil fuel energy in terms of environmental and health aspects may not be fully acknowledged in Vietnam. Meanwhile, they introduce several communities, such as the Vietnam Energy Partnership Group (VEPG), which MOIT has invited development partners and other stakeholders (e.g., business and NGOs) for technical working groups and policy dialogues to help sustainable energy deployment, as a useful vehicle of consultations.

There are a few examples that several provinces have rejected to build new coal power plants against the plans approved by the central government, because one of the reasons why alternative options such as RE sources and LNG are being pushed forward [61,62].

## 3. Methods

This paper aims at identifying barriers to solar/wind power private investment in Vietnam, and then, examines as a hypothesis whether the main barrier is the transmission grid instead of generation as well as how grid-related barrier could be improved to promote solar/wind power private investment to meet increasing electricity demand in Vietnam.

In ref. [63], the author emphasizes how communication with stakeholders such as manufacturers, suppliers, plant owners, consumers, experts, policymakers, and professional associations “through structured interviews and questionnaires” is pivotal to identifying the barriers. First, the author searched keywords such as RE/solar/wind, barriers/issues, and Vietnam through Google and academic databases (e.g., Web of Science and Scopus) for empirical studies, and then identified barriers that are broadly categorized into (1) policy and regulatory, (2) financial, (3) technical, (4) institutional, and (5) social and environmental aspects. In categorizing barriers, the author referred to several academic papers on barrier analysis [64–66]. Secondly, the author developed questionnaires and conducted interviews with stakeholders in Vietnam and neighboring countries to verify barriers and narrow down the number of barriers or add some crucial barriers. In this study, the author regards “stakeholders on solar/wind power projects” as private investors for solar or wind power and others who have supported the generation from different positions. Interviewees were asked to present their views on barriers of five categories, and which barrier(s) is/are

considered to be more important or less influential in making the investment decision in solar or wind power projects in Vietnam. In August 2019, the author visited Vietnam to interview mainly international and local experts, who work at international development agencies and research institutes to verify the barriers identified by the literature review and to collect the information of investors and relevant stakeholders.

Based on the first site visit outcomes, the author narrowed down the number of barriers and elaborated the description (see Appendix A). The author reached out to investors and relevant stakeholders through the introduction from the past interviewees, company websites and professional social networks. The number of interviewees' appointments was increased by a snowballing method. The second site visit in Vietnam and neighboring countries was conducted in November and December 2019 to interview investors and relevant stakeholders. The detailed descriptions of the interviewees are shown in Table 11. The interviewees' names and their organizations (locations) are kept confidential due to the information's sensitivity. There is no stringent ruling on the sample size of the interview for qualitative research; it is 20 as minimum [67], and between 20 and 30 on average [68]. An amount of 41 is enough for qualitative analysis.

**Table 11.** Summary of the interviewees conducted between August and December 2019.

Category	Description of Interviewees	Number
International	Developer, investor (including private equity), supplier and EPC <sup>1</sup>	20
	Development agency, NGO, consultant, and researcher	5
Local (Vietnam)	Developer, investor, commercial bank, and EPC <sup>1</sup>	8
	Consultant, researcher, and legal adviser	8
Total		41

<sup>1</sup> Approximately two-thirds of interviewees have engaged in solar power projects. Less than 10 interviewees have worked on wind power projects, while some interviewees are involved with both types of power projects.

To update the situation after the COVID-19 calmed down, the author conducted interviews with stakeholders (number: 13) in Vietnam in March 2023. There were no major changes from the results of the interviews conducted in 2019 in terms of no announcement of new support policies, however, the author reflected updates in the following sections.

#### 4. Results: Barriers to Private Investment in Solar and Wind Power in Vietnam

This section describes the results of semi-structured interviews in accordance with barriers shown in the literature reviews. In mid-2020, the author concluded weak grid capacity was the most critical barrier for private solar/wind power investors. However, two legal advisors indicated that lack of effective policies for solar/wind power projects was the main issue in Vietnam, though the curtailment issues still remained in specific provinces (as of March 2023).

##### 4.1. Policy/Regulations on RE

Considering the interviews as of March 2023, the most critical barrier is lack of proper policies and mechanisms after the end of the FITs. During the FIT period, “un-bankable terms of the standard PPA” were the most critical for international investors to make investment decision as well as for international banks to provide long-term loans.

##### 4.1.1. Vague Whether FITs Remain in the Future

Solar power investors have not regarded the future FITs' vague situation as a barrier; however, they are concerned about the delays in new policy announcements.

Regarding solar power projects, as of August 2019, most of the interviewees showed concerns from a short-term view about whether GoV announces the next FIT (especially for solar power) or not. Though the COD of the first solar FIT was 30 June 2019, either new FIT or another incentive has not yet announced. A few experts presumed that GoV

continues to implement the FIT even in lower tariffs because it can help developers invest in solar power generation. As of November 2019, most of the interviewees expected the next solar FIT would be issued in a few months based on the announcement that MOIT submitted a draft decision to Prime Minister (PM) for consideration in September 2019 [69]. At the same time, they have worried about severe curtailment that occurred in south-central coastal provinces. In April 2020, GoV finally issued a decision on new solar FIT (FIT2), though it is limited to the short term. Only investors, who have already received approval by 23 November 2019 and reach their COD by the end of 2020, could enjoy the FIT2 (See Section 2.1). Meanwhile, wind power investors have prioritized finishing all processes by the COD (1 November 2021) without expecting the next FIT. However, they argue that GoV should have fixed the COD, considering the construction period. Considering the actual situation of wind power deployment and the business impact of COVID-19, MOIT sent the Report No. 2491 to the PM in April 2020 to request the FIT extension to the end of 2023 (See Section 2.1).

As of March 2023, several interviewees indicated that some developers could not connect to the grid due to no policies, even if developers completed power plants, and some of them were forced into bankruptcy due to loan payments, etc.

In January 2023, MOIT proposed new tariff range for developers which failed to reach the COD. However, it does not meet the profit level desired by solar/wind power producers, and PPAs between RE power producers and EVN have not progressed. It is revealed in [70] that only 23 percent of the projects which missed the COD are ready to negotiate a PPA with EVN by March 2023.

#### 4.1.2. Un-Bankable PPA Terms/Unnegotiable Terms

Most international interviewees indicate that un-bankable PPA terms are among the most critical barriers for equity investors and debt providers (e.g., banks) among the regulatory barriers. Among the terms, all interviewees stress that “off-take (curtailment) risk” is very critical. For example, in Ninh Thuan province, whose solar radiation is 1700 kWh per square meter and power transmission lines have not been constructed entirely, 10 out of 25 solar power projects (as of 5 December 2019) have been compelled to operate at only 30–40 percent of the actual capacity, corresponding to the total depletion of approximately USD 21.7 million [71]. According to [72], 35 projects for solar power (total capacity: 2412 MW) and 16 ones for wind power (850 MW) were registered in this province (as of April 2022); however, several interviewees showed serious concerns that most of RE plants still have suffered from the curtailment in Ninh Thuan as of March 2023.

Some international investors mention that the “absence of termination (payment) clause” is also a constraint because it is questionable if investors will be compensated in EVN’s default. However, other terms (e.g., absence of government guarantee, force majeure, and international arbitration, etc.) could be acceptable, though they should be improved to international standards. Therefore, half of the international investors have not concluded the PPA with EVN. Instead, some of them were/have been dedicated to conducting the Feasibility Study (FS) and Environmental Impact Assessment (EIA) to support local partners.

Other international investors think the “absence of government guarantee” as critical because they are not sure whether EVN can purchase electricity from solar/wind power for 20 years stipulated in the PPA. Instead of the government guarantee, several international investors have succeeded in obtaining the letter of credit (LC) (for debt guarantee) from local commercial banks because international banks require at least the LC to provide loans. As an exception, some of the Asian investors indicate that the guarantee is not always necessary because they can acquire equity stakes and suppliers (or EPCs)’ credit (finance) before the completion of the plants, and then can obtain financing with a lower interest rate from commercial banks of their countries or IFIs such as ADB and IFC. Several local investors point out that approximately 60–70 percent of solar power projects have been

invested, operated, and managed by Chinese firms/EPCs. Even though Thai firms have invested in solar power projects, Chinese firms have supported them as suppliers or EPCs.

Some Vietnamese medium-scale developers/investors (conglomerates) could find some international lenders because they have managed a more extensive range of businesses such as real estate and infrastructure and mobilized international finance.

To diversify a range of (non-Asian) investors in the future, EVN should think of improving some critical terms of the present PPA for solar/wind power projects.

#### 4.1.3. Slow and Inadequate Issue of Technical Regulation

This barrier is less critical for investment decisions among interviewees. In ref. [46], the authors indicated that the standard PPA issuance was delayed after the decision was announced. An international investor mentions that the issuance of the application form for wind power in Taiwan was also delayed, so this matter is not limited in Vietnam. Most local investors did not wait for the official issuance of the standard PPA for solar, and they used the same PPA for hydropower and wind power to proceed with the process smoothly.

#### 4.1.4. Lack of Clarity and Delays in the Project Approval Process

Most of the developers/investors regard lack of clarity and delays in the project approval process as a barrier, especially for the recent few years since the solar FIT started in 2017; however, it is not recognized as a severe barrier in making investment decisions. According to [73], as slow administrative procedures raise the up-front cost, the government should provide explicit guidance for project developers on licenses, permits, audits, site clearances, and all the procedures should be finalized within one year or less. Most investors in Vietnam criticize how the project approval process is complicated and time-consuming. They need to consult with various governmental agencies in both provincial and central levels for a smooth-sailing approval process, including communication with high-ranking government officials. One of the reasons is there are no clear written guidelines for approval. In addition, different processes and requirements in each province have made investors more confused. Some international investors mentioned it took more than one and a half years to receive necessary approvals, and then there was a few months to construct solar power plants by the COD. The figures (as of the beginning of 2023) indicate 87 projects whose capacity is 4200 MW for wind and 700 MW for solar cannot yet connect to the grid [70] because developers missed the COD.

To reduce the time-consuming process, some of the investors developed multiple solar power plants (e.g., less than 50 MW/plant) so that they did not need to include their projects in the list of projects that MOIT must submit to the Prime Minister (PM) as applicable plan to receive approval from the PM.

Some international investors suggest that it is useful to establish a one-stop agency, which manages the whole approval process, including assessing the FS and the impact on transmission lines. As an example of the one-stop agencies, Thailand's Energy Regulatory Commission (ERC) was established as "the authority to regulate energy industry operations in compliance with the policy framework of the government" [74], separating from the Ministry of Energy in 2007, when Thailand introduced the incentive for solar power.

#### 4.1.5. Delays/Risks in Land Acquisition Processes

Vietnam's Land Law regulates foreign developers and investors do not acquire land assets and mortgages as securities. Therefore, they need to rent land from owners or develop a Special Purpose Entity (SPE) with a local partner. Another difficulty is that it is not easy for developers to make local people, who rent the land from real owners, understand solar/wind power projects, and agree on their relocation and compensation. There are perception gaps between local governments/owners and local people living at the sites.

In the case of onshore wind power plants, some international investors indicate that appropriate land acquisition is critical because such land in Vietnam has already been



limited due to occupied solar power plants and other purposes (e.g., agriculture and forestry etc.). As two international investors have the experience to learn appropriate land for wind power plants in other Asian countries, they have made efforts to gain the land use right step by step through the negotiations with local authorities and residents. One of the international wind power developers has worried about whether it could complete all approval processes and the construction of the plants by the COD (1 November 2021) because it needs to negotiate with approximately 200 local people after getting a license. The other investor, who has engaged in several solar/wind power projects, reveals that land acquisition activities are the most critical among policy barriers. Because it has struggled to agree on resettlement and compensation with an ethnic minority group who are firmly attached to the land where they live for a long time, it has worried whether it could meet the COD for its wind power project.

International investors strongly expect GoV, primarily provincial authorities, to streamline the bureaucratic process for land clearance/acquisition for solar and wind power projects. In addition, GoV should intermediate the negotiation among project owners/investors, landowners, and local people/ethnic minority groups living at the sites to secure appropriate sites for solar/wind power plants and local people's rights.

#### 4.1.6. Allegations of Misconduct by Officials, Collusion, and Corruption

Most investors acknowledge that “allegations of misconduct by officials, collusion and corruption” [46] often occurs in Vietnam and other developing countries, unfortunately. Some local developers could quickly obtain approval (e.g., less than six months), though it is unsure whether they are linked with some corruption. However, there are several clear cases that international investors continued to have dialogues with officials of provincial and central authorities tenaciously, and then concluded the PPA without any corruption, though it took a more extended period (e.g., 18 months) to obtain approval.

#### 4.2. Financial Barriers

For the FIT period, all of the interviewees agreed that limited access to finance was a very critical barrier for investment decisions. This barrier is closely linked to “un-bankable PPA terms” of the policy barrier. The ceiling price (of Circular 1) applied by MOIT in January 2023 has not met the investors' expectations. Two developers mentioned rising interest rates at local banks would also affect investors' profits as of March 2023.

##### 4.2.1. The High Initial Investment Cost for Solar/Wind Power Plants

Almost all investors think that the initial investment cost for solar/wind power plants is no barrier because it is no longer high even in Vietnam. A few investors argue that it is still expensive to consider the transaction cost of the long process for approval, license, and land acquisition, even if the equipment cost has been decreasing.

##### 4.2.2. Low-Regulated Electricity Price/Lack of Clarity in Future Electricity Retail Price

The majority of investors think that low electricity price is not a barrier in deciding on investment on solar/wind power projects in Vietnam because investors can obtain the FIT from EVN based on the PPA. Some experts show severe concerns about the low-regulated electricity price because EVN has less motivation in purchasing solar/wind power, whose FITs are more expensive than the current average electricity price [46,48,49]. Referring to the recent rise in electricity prices, some experts expect that the electricity price will gradually rise in line with the actual situation of the marginal cost of electricity in Vietnam.

An international investor mentions that the LCOE in the wind has already been cheaper than coal, oil, and gas; however, the actual situation has not been reflected in the electricity price (as of November 2019). In ref. [75], the authors analyze how the deployment of new solar/wind power plants can become cheaper than operating actual coal-fired power plants in Vietnam in 2020 and 2022, respectively. In ref. [46], the author indicates marginal costs of coal are approximately 4 US cent/kWh, including fuel and variable O&M costs;

however, the total costs increase as capacity utilization decreases since fixed O&M is spread over less output, even though the plant is paid.

Though the electricity retail price on average has remained at 1864.44 VND (0.08 USD)/kWh since 2019, the bracket of the price has been risen to 1826.22 VND (0.078 USD)/kWh for the minimum price and 2444.09 VND (0.1 USD)/kWh for the maximum price in February 2023 [76]. Several interviewees in March 2023 mentioned that increasing the retail electricity price could help EVN to reduce loss and balance the operating cash flow.

#### 4.2.3. Non-Preferential/Still Low FITs

Most interviewees indicate the FITs for solar (9.35 US cent/kWh), wind for onshore (8.5 US cent/kWh), and offshore (9.8 US cent/kWh) have attracted many private investors. Notably, the solar FIT has driven many investors to construct in power plants for a short period. A few investors suggest that GoV should have considered different technologies (farms, rooftop, and floating) and regions for the solar FIT because there is a big gap on irradiance between the northern and the southern provinces (however, the regionalization clause was removed from the final version of the FIT2 issued in April 2020). Two international investors consider that the FIT for offshore wind is a bit lower than that of other countries; however, it has not affected the investment decision.

Meanwhile, some researchers indicate that the solar FIT (even the FIT2, 7.09 US cent/kWh) is much higher than other neighboring countries that have implemented auctions. For example, the lowest bid of Cambodia's auction held in 2019 was less than 4 US cent/kWh. As it appears that GoV has a plan to shift the FIT into auction in 2021 officially, they can reflect the lesson learned from neighbors.

#### 4.2.4. Limited Capital/Financial Channels for Attracting Long-Term Loan

All of the interviewees agree that limited capital is a very critical barrier for investment decisions. It is difficult for local investors to mobilize external capital; they need to borrow loans from local commercial banks. According to local investors, Vietnamese commercial banks can provide loans (basically "corporate finance with collateral") with a higher interest rate of 10–11% for 10–12 years on average. These banks require investors to have at least 30 percent of the total investment capital as minimum equity. Another concern is that local banks have the ceiling to provide loans to each company. Therefore, some investors have severe concerns about whether local banks can provide loans with upcoming projects.

Meanwhile, middle-scale local investors (e.g., conglomerates) have succeeded in blending finance from local commercial banks and different international financial sources. Some international banks may consider lending only if project owners can obtain a loan guarantee issued by the top four state-owned banks in Vietnam; however, it is unlikely that these banks provide such a guarantee with investors because the service fee of the guarantee is small comparing to the risk that they need to bear.

As for international investors, they are categorized by three different types. The first group has mainly engaged in the project development phase, including implementing FS, EIA, and EPC contract for local partners. Even though they put a small stake of equity, they sell the equity to larger investors. The second group (e.g., Asian conglomerates and large-scale companies) has survived by putting equity and depending on Chinese suppliers' credit in the project development phase. They start to negotiate with commercial banks of their countries or multilateral development banks on loans after construction completion. The last group has started with a small amount of equity finance and struggled to blend finance from different sources such as international banks, multilateral development banks, and Vietnamese commercial banks. Some international banks have made efforts to provide capacity-development with Vietnamese commercial banks to develop "project finance with non-recourse".

International financial advisers indicate that syndicated loan schemes among local commercial banks do not exist in Vietnam. Thus, if multiple financial actors such as

local/international banks and private equities can syndicate, it might become a sustainable structure. In addition, several examples of innovative financial solutions, such as Vestas's wind project, could collaborate with the Danish Export Credit Agency, an offshore bank, and a local bank [77].

As there are limitations of local banks' capability to assess RE projects and develop new financing schemes, GoV needs to encourage international lenders and suppliers to provide capacity development with local investors and banks and amendment of the PPA.

#### 4.2.5. Lending VND Loans to Renewable Energy Projects

Lending VND-based loans to RE projects in Vietnam is typical if local banks provide loans to investors. Most international interviewees think it is not a serious barrier to making investment decisions, though the VND/USD exchange rate sometimes fluctuates, and local banks' interest rates vary.

#### 4.2.6. The Burden for Developers to Pay for the Immediate Connection Cost

Most investors indicate that the cost to connect the nearest substation or pass 110 kV line is not a barrier because project owners regard it as a part of the investment cost and think the current FIT could cover the connection cost.

### 4.3. Technical Barriers

According to the interviews with developers in March 2023, weak grid capacity is still a very critical barrier for private RE developers which have not fully delivered electricity in southern provinces, especially Ninh Thuan and Binh Thuan provinces, because EVN and its subsidiaries have not advanced transmission systems. To improve quality and capacity of the national grid, MOIT has prepared to invite private firms to invest in transmission systems through amendment of the Law on Electricity.

#### 4.3.1. Lack of Qualified Human Resources

Most of the interviewees think that the lack of qualified human resources for solar power projects is not a barrier for investment decisions. In 2017–19, local engineers have been capable of managing technical aspects of system management, construction, and O&M of solar power plants, which is not technologically sophisticated comparing to traditional power plants. Local engineers could receive the opportunity to learn from international engineers under the EPC contract. Some international solar PV system suppliers worry about the shortage of qualified local operators. The latter need to attend training sessions provided by EVN before engaging in actual plants' operation.

Conversely, international investors, suppliers, and experts emphasize that development and O&M of wind power plants require more knowledge and experience. Thus, international EPCs should engage in implementing the whole process with local engineers at first. However, a few international suppliers and technical advisers show severe concerns that as Vietnamese wind power project owners sometimes refuse O&M services from suppliers to reduce costs, some mechanical accidents might happen shortly. According to a Vietnamese newspaper [78], there was the first wind turbine fire in Binh Thuan province in January 2020 because of an electrical fault. This article introduces the other wind power project owner's voice, who mentions this fire would not have happened if workers could perform maintenance on the wind turbine rigorously. It suggests that similar incidents happen in solar power systems without proper O&M.

The Prime Minister requested MOIT to collaborate with the Ministry of Natural Resources and Environment (MONRE) and other authorities to establish a RE Center which contributes to Vietnam's commitments at the COP26. The center will have a role to educate human capital and boost technology transfer [32]. While solar/wind power plants were installed in a short period of time, it is desirable for GoV to support for O&M, such as safety measures that were pointed out in interviews.

#### 4.3.2. Too Small RE Manufacturing Businesses in Vietnam

Almost all interviewees indicate that it is not a barrier because investors can utilize global supply chains, especially Chinese suppliers, in terms of solar-power-related equipment. Some investors share examples that project owners have imported solar-power-related equipment from not only China but Germany, India, Japan, Korea, and the U.S., while they can import wind turbines from Denmark and the U.S. An international supplier mentions that most suppliers have factories for PV panels in China because of cheap manufacturing costs. Another supplier shows concerns that they cannot decide on establishing a factory in Vietnam because its market is uncertain in terms of the continuation of the regulations and the content of the future long-term RE strategy.

However, ref. [52,54] suggest that GoV should develop national RE power technologies such as modules, cells, ingots/wafers, and inverters for local solar markets, though the existing factories focus on manufacturing exports. Researchers also shared their thoughts on manufacturing parts, which means local engineers/firms can enjoy more benefits rather than Chinese and European suppliers, considering the situation of installed projects (as of March 2023).

#### 4.3.3. Inadequate Infrastructure for Solar/Wind Power Plants/Weak Grid Capacity/Unreliability and Instability of the Grid

All interviewees agree that weak grid capacity, which hinders solar/wind power from reaching its full potential in Vietnam, might be the most critical barrier to make investment decisions shortly. In Ninh Thuan and Binh Thuan provinces, where most solar power plants have been developed, most transmission grids have been overloaded, causing most solar farms to operate at only 30–50 percent of their actual capacity. According to local experts, the above two provinces need to build 500 kV substations. Several local project owners showed strong motivation to invest in upgrading transmission grids, increase their outputs, and accelerate the progress of other projects (as of August 2019). In 2022, amendment of the Law on Electricity 2004 came into effect to welcome private sectors to invest in transmission infrastructure, including RE power absorption. Several experts noted that MOIT needs to develop relevant decrees/guidelines for implementation (as of March 2023).

Meanwhile, IFIs, development partners, and investors have also considered providing non-sovereign finance and technical assistance with EVN to enhance grid capacity in southern provinces and to strengthen grid operation, which can absorb variable RE sources to improve the curtailment level. Multiple experts indicated that GoV, especially Ministry of Finance, is reluctant to borrow ODA, though the public debt has gradually decreased. Thus, either non-sovereign or private sector participation would be appropriate options (as of March 2023).

EVN has building and modernizing 21 transmission lines since the 2019 to allow RE resources to connect [79]. Several developers indicate that lots of solar power developers have still faced the curtailment issues by 20–40 percent.

#### 4.3.4. Poor Quality and Data for RE/Lack of Information on Wind Energy Potential and Wind Measurements

Recently, as it has been easier to access the data for RE from open sources (e.g., wind and solar radiation maps provided by international organizations such as ESMAP and the World Bank Group), developers can estimate potential generation capacity for their business cases by calculating wind measurement onsite for 12 months. Thus, it is not a barrier to making investment decisions in Vietnam.

#### 4.4. Institutional Barriers

Institutional barriers are linked to policy/regulation ones. Several interviewees mentioned that GoV may improve the approval process using the lesson learned from the FIT when they commence another pricing mechanisms such as auction (as of March 2023).

#### 4.4.1. A Remarkable Large Amount of Stakeholder Involvement with a Variety of Government Agencies

It is a barrier that developers need to consult with large numbers of officials of government agencies to obtain approval relating to licenses and land acquisition.

#### 4.4.2. Lack of Effective Coordination among Central and Local Authorities

Most of the interviewees argue that it is essential to transparently clarify the division of the roles between provincial and central authorities. Additionally, another problem is that responses vary by provinces due to a lack of clear written guidelines. Several international investors point out that lack of effective coordination during the project approval process might have caused curtailment issues in the southern provinces.

#### 4.5. Social and Environmental Barriers

Most of the interviewees (as of March 2023) have concerns about community acceptance, referring to actual cases in which developers had difficulty in negotiating compensation and resettlement issues with residents in the FIT period as well as in the case of transmission systems developed by EVN and its subsidiaries.

##### 4.5.1. Minimal Public Consultation Relating Power-Sector

In Vietnam, public consultations have been held frequently if local people can enjoy the economic benefits.

##### 4.5.2. Lack of Appreciation of the Advantages of RE and the Risks of Fossil Fuel Energy

A local researcher argues that the power supply from hydropower and coal, in recent years, was not stable and will become unstable in the south region unless additional capacity is installed. The FITs might be a burden compared to the average electricity retail price and the lower costs of coal and hydropower. However, the FITs are not higher than the costs of LNG or new coal if the technology level rises. It is essential to understand that RE is not an expensive option but cheaper, even with balancing the electricity system such as transmission upgrading.

As shown in Section 2.2.5, southern provinces have opposed developing new coal power plants because they have RE options in the region and severe environmental pollution caused by coal power plants. It appears that provinces, which have plans to develop new coal power plants, could acknowledge RE's advantages and the fossil fuel risks.

##### 4.5.3. Social/Community Acceptance

Social/community acceptance is not a significant barrier; however, some investors have faced difficulties in making residents of potential project sites understand the development of solar or wind power plants and agree with the relocation and compensation fee in light of international standards. This matter is closely linked to land acquisition. In case international development banks and partners provide loans, they need to organize the consultation with local people based on their own rules.

#### 4.6. Summary of Different Types of Investors

There were also findings on different tendencies among Vietnamese, Asian, and international investors. While Vietnamese middle-scale enterprises (e.g., conglomerates) and a few Asian investors have been involved with the whole process, local firms with small capital and international enterprises (engaging in most solar power projects) have collaborated by bringing complementary strengths. Local firms have a good connection with central/provincial authorities to approve project license and land clearance, while international firms can provide technical knowledge, experience, and financial options. Some local small firms sell "development package (license and land clearance)" to international firms, while local firms/engineers work under international firms to construct plants and



engage in O&M activities. Among solar power projects, approximately 60–70 percent was possessed and managed by Chinese EPCs/firms.

Regarding other international investors, private equities engage in developing FS and EIA for international lenders, while some investors join SPE by putting in equity to learn the actual market. It appears that it is difficult for international investors (except some Asian) to take the current PPA risk. Meanwhile, a few international investors are very positive in developing and managing solar/wind power plants from the long-term perspective of Vietnam's future potential, such as increasing population, GDP, and electricity demand, and geographic merits for solar/wind power and Vietnamese people's capabilities. Some of the key stakeholders which leverage private investment in solar/wind power are IFIs such as ADB and IFC that serve to fill the finance gap by providing finance with preferential conditions.

## 5. Conclusions, Policy Recommendations, and Future Research

Various barriers to solar/wind power private investment existed in the FIT period; however, Vietnam reached approximately 16.5 GW of the installed solar power capacity and about 4 GW of the installed wind power capacity under the FITs. It can be interpreted that most developers/investors could take risks relating the PPA terms, manage to mobilize the capital, and obtain approval by themselves. However, several interviewees mentioned that quite many developers (especially solar power producers) are still subject to significant curtailment since operating their plants in specific regions, especially Ninh Thuan and Binh Thuan provinces. Weak grid capacity is one of the most critical barriers, especially in the congested areas of solar power projects. When the owners made investment decisions for their solar power projects in 2017–18, they could not realize the curtailment in the approval process. If MOIT, EVN, and provincial authorities would have managed the capacity of each local grid transparently, controlled to give licenses to investors in the approval process carefully, or pushed some licenses to different provinces where capacity constraints are less severe, investors could have contributed to distributing the additional capacity before the CODs. If GoV develops relevant implementation regulations for private sector participation based on amendment of Law on Electricity, it can accelerate to upgrade its quality and capacity of the transmission grid. Thus, weak grid capacity, which is the network side issue, must be more critical than the generation side barriers for investors.

Another critical barrier is RE policy uncertainty, that is, GoV has not provided succession investment support mechanisms with solar/wind power developers which failed to meet the COD or planned to construct for approximately two years, after the FITs for solar and wind power ended. In addition, the tariff range (Circular 1) presented by MOIT in January 2023 has not met the profit level of developers' expectations. The delay in the approval of PDP8 might also be one of the factors. However, GoV approved its PDP8 (2021–2030) with ambitious wind power generation toward 2030 on 15 May 2023. This approval took much longer than expected; however, during this time, due to the climate commitment at COP26 and the JETP agreement, the ratio of RE sources (especially wind power) in the power mix of PDP8 has remarkably increased. The ambitious target presented by GoV will likely lead to the acceleration of the rebuilding of support mechanisms for RE deployment toward 2030. By revising un-bankable PPA terms, which was a policy barrier identified in this research and closely linked to limited access to financial channels, at least two clauses of "off-take" and "termination" that international investors clearly stated as a red line, it will be possible to attract more extensive range of investors and finance, including international (non-Asian)/institutional investors and lenders.

Regarding the importance of consistently increasing transmission grids in integrating a higher share of RE generation into the electricity system, researchers illustrate that continuous investments in increasing capacity and transmission grids could decrease curtailment risks if curtailment status surpasses more than 10 percent of RE generation, based on the reviews on international experience relating curtailment [80].

Meanwhile, there is limited evidence relating to private sector involvement in building transmission and distribution lines and reduced curtailment levels in developing countries. In ref. [81], the authors review private sector involvement in transmission/distributions in 15 developing countries and analyze several good private participation cases in transmission development. Build-operate-transfer (BOT) contracts, which resemble ones for IPPs but have more straightforward elements consisting of O&M fee and capital investment cost, were concluded by the bidding process to develop additional transmission lines in Latin America. Another case was a certain period of the concession method adopted in the Philippines. These authors illustrate that private sector involvement in power sector reform has contributed to RE growth in middle-income countries. However, most transmission grid in the power sector has been driven mainly by government expenditure and official goals because it is challenging to manage grid development and operation on an exclusively commercial basis because of low margins.

In Vietnam, as GoV has continued to control its public debt for the recent years, it appears that private sector involvement in transmission grids is needed. The BOT contracts between EVN and the private sector could be possible because EVN has already experienced to conclude the BOT contracts in building large-scale power plants. Another option, non-sovereign finance provided by IFIs and development partners, might be a possible option as capital investment for the upgrading capacity and transmission grids.

Future research can consider how Vietnam can expand/upgrade the power system to integrate higher shares of variable RE sources (solar and wind) into its electricity system and achieve net zero carbon emission by 2050 and mobilize the finance in conjunction with understanding the ownership, relevant regulations, and the cost burden relating to the power system, considering implementation plans of PDP8 which GoV will prepare. Future research will consider implementation plans which GoV will prepare based on PDP8.

There are some limitations and points of future studies. First, it was difficult to investigate the magnitude and significance of the barriers identified in this research due to the limitation of the sample size. Secondly, it was hard to obtain information and data relating to Chinese firms engaged in investing in solar power projects. Thirdly, as the number of wind power projects was not many, it was impossible to interview wind power investors. Thus, future research will focus more on wind power generation.

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## Abbreviations

ADB	Asian Development Bank
BOT	Build-operate-transfer
COD	Commercial Operation Date
EPC	Engineering, procurement, and construction
EVN	Vietnam Electricity
FIT	Feed-in Tariff
FS	Feasibility Study
EIA	Environmental Impact Assessment

GoV	Government of Vietnam
IFC	International Finance Corporation
IFI(s)	International Financial Institutes
JETP	Just Energy Transition Partnership
LCOE	Levelized cost of electricity
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
PDP	Power Development Plan
PM	Prime Minister
PPA	Power Purchase Agreement
PPC	Provincial People's Committee
RE	Renewable Energy
REDS	Renewable Energy Development Strategy
SPE	Special Purpose Entity
VND	Vietnamese Dongs

## Appendix A

### Inquiry: Investor's perspectives on barriers of private investment for solar and wind power generation in Vietnam

I would like to interview actual investors who are working in solar/wind power generation in Vietnam.

This research sets out to explore barriers that domestic and international private investors have faced in developing/investing in solar and wind energy projects in Vietnam. At this stage of the research, I have conducted an extensive literature review and identified various barriers that are broadly categorized into (1) policy/regulatory, (2) financial, (3) technical, (4) institutional and (5) social and environmental aspects (page 2–3). To validate and narrow down the barriers, we would kindly ask you to express your perception of the presented barriers.

The following are the two main questions that will be asked during the interview:

- (1) How does each barrier influence the decision of investment in Vietnam?
- (2) Which barriers are considered to be more important/less important than other barriers of each category?

#### Confidentiality

Your response will be treated confidentially (name of the interviewee and organizations will not be cited in any publicly available papers), and the results are used for academic research purposes only.

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Identified barriers for RE development/investment (As of 9 October 2019)

Categories	Summary of identified barriers
Policy/ Regulatory barriers	1 Vague whether FITs remain in the future (Solar: after 1 July 2019; Wind: after 1 November 2021)
	2 Un-bankable PPA terms/Unnegotiable terms <ul style="list-style-type: none"> <li>• Offtake (Curtailment) risk</li> <li>• Fixed FITs (inflation and exchange rate risk)</li> <li>• Absence of government guarantee</li> <li>• Absence of force majeure</li> <li>• Absence of international arbitration (dispute resolution will be made with EVN and MOIT's relevant department)</li> <li>• Absence of termination</li> </ul>

Policy/ Regulatory barriers	3	Slow and inadequate issue of technical Regulations (e.g., standardized PPAs) after the Decision was issued
	4	Lack of clarity and delays in project-approval-process (e.g., Inclusion of Provincial/National Master Plan; License)
	5	Delays/risks in land acquisition processes (Foreign developers/investors cannot acquire land assets and mortgage as securities.)
	6	Allegations of misconduct by officials, collusion and corruption

**(1) How does each barrier influence the decision of investment in Vietnam?**

**(2) Which barriers are considered to be more important/ less important than other barriers of each category?**

Financial barriers	1	The high initial investment cost for solar/wind power plants
	2	Low-regulated (artificial low) price of electricity (Existence of fossil fuel subsidy)
	3	Lack of clarity in future electricity retail price
	4	Non-preferential/still low FITs (especially near/offshore wind)
	5	<ul style="list-style-type: none"> <li>• The limited capital/ limited financial channels for attracting long-term loan</li> <li>• Limited capacity of national/domestic banks for substantial upfront investment (lack of necessary in-house technical expertise to evaluate RE projects)</li> <li>• Lack of access for cross-border financing limits</li> </ul>
	6	Lending VND loans to renewable energy projects
	7	The burden for developers to pay for the immediate connection costs (to the nearest substation/passing 110 kW line)

**(1) How does each barrier influence the decision of investment in Vietnam?**

**(2) Which barriers are considered to be more important/ less important than other barriers of each category?**

Categories	Summary of identified barriers	
Technical barriers	1	Lack of qualified human resources (system management, construction, and O&M of solar/ wind power plants (farms)) <ul style="list-style-type: none"> <li>• Mainly lack of qualified human resources for wind power plants?</li> </ul>
	2	Too small RE manufacturing businesses in Vietnam (Only for manufacturing and assembly factories for overseas exports)
	3	Inadequate infrastructure for solar and wind power plants <ul style="list-style-type: none"> <li>• Absence of smart grid</li> <li>• Lack of transmission lines (Necessary substations of 500 kV?)</li> <li>• Lack of distribution lines (especially in Ninh Thuan and Binh Thuan?)</li> </ul>
	4	Weak grid capacity/Unreliability and instability of the grid
	5	Poor quality and data for RE (e.g., available locations, infrastructure capabilities, etc.)
	6	Lack of information on wind energy potential and wind measurements

**(1) How does each barrier influence the decision of investment in Vietnam?**

**(2) Which barriers are considered to be more important/ less important than other barriers of each category?**

Institutional barriers	1	A remarkable large amount of stakeholder involvement with a variety of government agencies
	2	Lack of effective coordination among central (e.g., MOIT, MONRE) and local authorities (PPC, DOIT, DONRE, etc.)
<b>(1) How does each barrier influence the decision of investment in Vietnam?</b>		
Social and environmental barriers	1	Minimal public consultation relating power-sector strategies, plans and other policies
	2	Lack of appreciation of the advantages of RE and the risks of fossil fuel energy
	3	Social/ community acceptance
<b>(1) How does each barrier influence the decision of investment in Vietnam?</b>		
<b>(2) Which barriers are considered to be more important/ less important than other barriers of each category?</b>		

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