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WIND ENERGY POTENTIAL VIETNAM

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Final report





Effective Offshore Wind Solutions

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EXECUTIVE SUMMARY

Scope and aim of the report

The aim of this baseline study is to understand what business opportunities exist and to identify leads to provide services and knowledge, to export technology and materials and to invest in the Vietnamese wind energy sector. This research consists of three phases: 1) Desk study in the Netherlands, 2) Interviews with relevant stakeholders in the wind energy sector in collaboration with a local partner in Vietnam and presentation of the preliminary findings to the Dutch wind energy sector, 3) research mission by Wind Minds in Vietnam.

Wind energy and the energy market

Renewable energy targets and wind energy

Vietnam is a country with a rapidly growing economy together with an increasing energy and electricity demand. To sustain the growing electricity demand, new power plants are being built, especially coal-fired power plants. Besides fossil fuels, hydro power is also an important part of the electricity supply in Vietnam, accounting for 37,3 percent of the total installed capacity. EVN is the single buyer of electricity and holds a monopoly on transmission and distribution. Renewable energy sources are still a very small share in the total electricity production, but ambitious targets have been set by the government.

Feed-in Tariff (FiT)

In order to stimulate renewable energy production, a Feed-in Tariff (FiT) was introduced in Vietnam in 2011. The current FiT for wind energy in Vietnam amounts 7,8 US\$/ kWh with a Power Purchase Agreement (PPA) duration of 20 years. In the near future the FiT will be increased to 8.77 US\$/kWh for onshore wind projects and to 9.97 US\$/kWh for offshore wind projects.

Wind energy potential and development

Wind resources

In Vietnam, several wind measurement studies are conducted. Vietnam is considered to have the best wind resources in Southeast Asia, especially in the nearshore/offshore and onshore coastal regions in the south of Vietnam. In these areas yearly average windspeeds of 9 to 10 meters per second are measured. Generally, windspeeds are declining further inland. Noteworthy is that Vietnam is vulnerable to extreme weather events like storms and typhoons, especially in July, August, September and October.

Windfarm development onshore and nearshore

A key regulatory instrument for wind power in Vietnam are the Provincial Wind Power Development Plans (PWPDPs). These plans define priority areas for wind power development, for which wind measurement has already been conducted. Specific onshore and nearshore sites are selected, based on windspeed, topography, connection and accessibility to the energy grid, land use and buffer zones between potential areas. A total installed capacity of 2.613 MW in 2020 and 15.717 MW in 2030 are allocated in the PWPDPs. The status of these designated areas are diverse: some are under development, under construction or unknown. Currently, the

total installed wind power capacity is 186 MW, which is divided over four grid-connected wind farms with capacities ranging between 6 MW and 100 MW.

Windfarm development offshore

Offshore wind energy development - further off-coast than nearshore wind energy - is not yet occurring in Vietnam. Especially the coastline to the northeast of Ho Chi Minh City is very promising, due to the shallow water (ranging between 1 and 25 meters) within 50 kilometres from the shore and the highest offshore wind speeds of Vietnam.

Countries and companies already active at the Vietnamese wind energy market

Companies from countries that have been active in the Vietnamese wind energy sector for a long period of time such as Germany, Denmark, UK and USA have a better position for involvement in wind energy development than companies from, newcomer, the Netherlands. They can build on existing relationships with governments and relevant parties in the wind sector.

Financial resources and windfarm financing

Local Vietnamese banks appear to lack the financial capital, knowledge and trust to finance wind energy projects. That means that foreign investors and banks must account for a large part of the required capital investments of wind energy projects to support the desired wind energy development in Vietnam. Uncertainties concerning the PPA (threat of possible curtailment by EVN) and the lack of a wind energy supply chain in Vietnam have a negative effect on foreign investments.

Administrative and technical support

Currently, there is no established supply chain for wind energy development in Vietnam. That means that all specialized material, knowledge and experience must come from foreign countries. This situation could change over time. It is expected that Vietnamese government will support project developers with wind energy development. It appears that the government follows the 'first-come, first-served' principle.

Business opportunities

A brief SWOT analysis is conducted to identify the Strengths, Weaknesses, Opportunities and Threats for participation of Dutch companies in the Vietnamese wind energy sector. (See chapter 5.) The opportunities are described on the basis of different roles in the development process, namely those of developer, financial specialists and investor, technical consultant and knowledge institute, constructor and supplier.

Developers

A developer is faced with the necessary bottlenecks such as unclear and viscous procedures, missing supply chain and uncertain PPA. However in principle project developers have the possibility to obtain the right to develop wind energy locations registered in the PWPDPs. In order to develop wind energy projects, permits and an investment registration certificate have to be obtained. Key are familiarity and good connections with the Vietnamese wind energy sector, and more specifically, with national and local government authorities that are providing permits and decisions on investments.

Financial specialists and investors

Financing wind energy projects in Vietnam is a difficult enterprise because of the several uncertainties. This is a barrier for financial possibilities, but also offers opportunities for financial advisors and banks to implement smart ways of financing by mitigating these uncertainties and related risks. Acquiring contacts with project initiators and developers is needed in order to identify promising projects. Besides, knowledge of the Vietnamese wind energy sector and connections with governmental officials is important to determine the status and solidity of specific projects.

Technical consultants and knowledge institutions

Vietnam lacks knowledge on the development of wind energy projects in many fields and phases of the development process, and therefore foreign technical support and knowledge is necessary. The acquisition of technical support contracts by technical consultants and knowledge institutions requires good contacts with initiators and developers of future and existing initiatives. Knowledge of the sector and good contacts with (provincial and national) governments are important in order to assess the status of projects. It is also important that technical consultants and knowledge institutions from the Dutch wind energy sector are seen as expert parties that can make a valuable contribution to projects.

Constructors

Nearshore and especially offshore windfarms require specialized knowledge, expertise and materials. Dutch companies have a renowned reputation and a well-established international position because of their international involvement in offshore wind energy projects. Sufficient familiarity and connections with relevant stakeholders in Vietnam is important to be invited to enter into open tenders for the building of windfarms. Also direct involvement in project development as a co-investor, bringing investment capital, knowledge and experience, is well imaginable for larger construction companies.

Suppliers

As discussed before, Vietnamese wind energy sector lacks a well-established supply chain. This is an business opportunity for the Dutch several suppliers. At the moment there are only a few windfarms under construction, but this is expected to increase rapidly in Vietnam.

Recommendations

In order to seize the above described business opportunities for Dutch companies in the Vietnamese wind energy sector, the following issues are key:

- Acquire familiarity and reputation as a relevant and interesting party in windfarm development in Vietnam, with private parties and national and local governments;
- Acquire knowledge on the current status of windfarm developments in Vietnam;
- Align with existing windfarm developments by getting involved in different phases in different roles.

These matters are not achieved by one or more simple actions, but require a long term effort. To start off, the following actions are proposed on the short term.

1. Establish connections with local governments

Especially in the provinces relevant for wind energy development, it is essential to establish connections with the provincial authorities because they are key stakeholders in windfarm

development. It is advised to visit the right local government authorities with a small delegation as a good first step.

2. Establish and strengthen connections with national governments

On the national level there are already some contacts established with relevant Vietnamese authorities like MOIT and EVN. These contacts are to be enhanced and extended by organising targeted meetings. Instead of formal introductions, it could be more effective to organize meetings where the Netherlands present their distinguishable expertise, for example in the areas of offshore wind energy and the effects of large scale renewable energy and grid stability.

3. Acquire familiarity with private parties

Besides establishing contacts with local and national government officials it is relevant to get acquainted with private parties involved in the wind energy sector of Vietnam. These parties are for example large Vietnamese construction companies and developers and developers from other Asian countries like South Korea and Japan. Contacts could be established with these parties in an exploratory trade mission.

Planning of the activities

Wind energy is still in an early phase of development. The ambitions and the potential for wind energy in Vietnam is huge, but there is still little development in terms of concrete wind energy projects. Meanwhile, many international parties are interested in participating in the wind energy sector of Vietnam. Currently, some countries like Denmark, Germany, USA and the UK, are already active in Vietnam. Therefore, it is advised not to wait too long to take the first steps. Ideally the above mentioned actions should be undertaken this year.

1 INTRODUCTION

1.1 Scope and aim of the report

On behalf of the Netherlands Embassy in Hanoi, Vietnam, Netherlands Enterprise Agency (RVO) requested Wind Minds to perform a baseline study in order to gain knowledge on the (potential) wind energy sector in Vietnam.

The Netherlands is a frontrunner in the technical development of wind energy. Since the 1980's manufacturers and turbine and blade designers developed cutting edge wind turbine technology. Also the expertise of project development and implementing wind energy in densely populated areas was growing. The current developments in offshore wind energy in the Netherlands show a leading position in planning, procurement and stakeholder management, as well as the ability to enhance the reduction of the costs of wind energy.

The aim of the baseline study is to understand what business opportunities exist and to identify leads to provide services, knowledge, to export technology and materials and to invest in the Vietnamese wind energy sector. Insight in developments, business leads and funding opportunities facilitate increased business activities between Dutch and Vietnamese companies.

To gain understanding of business opportunities this baseline study examines the following aspects:

- The current Vietnamese (renewable) energy market (chapter 2)
- Potential of wind energy in Vietnam (chapter 3)
- The development of wind energy projects (chapter 4)
- Opportunities and limitations in Vietnam's wind energy sector (chapter 5)
- Dutch business opportunities in Vietnam's wind energy sector (chapter 6)

This research consists of three phases: 1) Desk study in the Netherlands, 2) Interviews with relevant stakeholders in the wind energy sector in collaboration with a local partner in Vietnam and presentation of the preliminary findings to the Dutch wind energy sector, 3) research mission by Wind Minds in Vietnam. The research mission consists of interviews with relevant stakeholders in the wind energy sector, participation in a renewable energy congress and other meetings; see Text Box 1. An overview of the interviewed parties can be found in appendix A.

1.2 Introduction to Vietnam

Vietnam is the easternmost country on the Indochina Peninsula in Southeast Asia, bordered by China, Laos and Cambodia (see Figure 1.1 Political map of Vietnam).

Table 1.1 Country comparison Vietnam and the Netherlands¹

		Vietnam	The Netherlands
Area	km ²	331.230	41.543
Population	million	94,6	17,2
Population density	person/km ²	276	414
GDP (nominal per capita)	US \$	2,305	44,654

¹ Source: Wikipedia (2016/2017)

With an estimated 94,6 million inhabitants, it is the world's 14th most-populous country. Vietnam has a population density of 276 residents per square kilometre, ranking as the 46th country in terms of population density (in 2016). Vietnam was a colony of France until France's defeat in the First Indochina War and the proclamation of Vietnam's independence in 1954. North and South Vietnam was unified under a communist government in 1975. Its capital city has been Hanoi since the reunification, with Ho Chi Minh City as the most populous city. After political and economic reforms in 1986, Vietnam's economic growth rate has been among the highest in the world, averaging 6.4 percent a year in the last 2000's. In 2017, Vietnam's nominal GDP per capita reached US\$ 2,305.

Figure 1.1 Political map of Vietnam



1.3 Dutch – Vietnamese relations

Vietnam and the Netherlands have a very good historical and traditional relation. The Netherlands was one of the first Western European countries to establish diplomatic relations with Vietnam after the end of the Vietnam War in 1973. Vietnam and the Netherlands are both delta countries and built up intensive partnerships in the field of coastal and water management. In this field, the use of Dutch expertise in developing the 2013 Mekong Delta Plan acts as an inspiring example. Furthermore, other international cooperation between Vietnam and The Netherlands are in the field of energy, marine economy, logistics and agriculture.

Text Box 1

Research mission by Wind Minds in Vietnam and presentation to Dutch wind sector

Research mission

From 8 to 15 April 2018 Wind Minds (in person of Eric Arends) performed a research mission in Vietnam, in close collaboration with local advisor Mr. Nguyen Trinh Hoang Anh, Energy Economics and Policy Advisor at the Vietnam Initiative for Energy & Climate, University of Science and Technology of Hanoi (USTH). The extensive network of Mr. Hoang Anh enabled us to contact many relevant stakeholders. The findings of the mission have been used to verify and complete this baseline study.

Part of the mission was participation (chair of the wind show) in the conference Power and Electricity World Vietnam (10 & 11 April 2018, Ho Chi Minh City). The conference, specifically aimed at solar and wind developments in Vietnam, enabled to get a good impression of developments and involved parties in the solar and wind energy sector, within a short period of time. The presence of many foreign interested parties, from Western and Asian countries, was striking.

In addition to the Conference, many meetings were held with representatives of private companies and governmental institutions in order to obtain as much information as possible. We very much thank all those who have made time free to share their insights with us. To mention some of the institutions, persons and meetings specifically:

- Ministry of Industry & Trade, Electricity & Renewable Energy Authority - MOIT/ERAV (mr Bui Quoc Hung, Le Anh Duc, Nguyen Ngo Phong, Nguyen the Huu);
- Electricity Vietnam – EVN (Mr Tran Dan Khoa, Phan Thi Bich Hong, Nguyen Ti van Ly)
- Vietnam Institute of Seas and Island (Mr. Du van Toan)
- Institute for Urban Planning & Sustainable Development – IUPSD (mr Nguyen Viet Thang)
- Hanoi University of Science and Technology – IAES/VEEA/USTH (Prof. Tran Dinh Long)
- Consulate General of the Kingdom of the Netherlands (Mr Carl Richter, Ms Le Thi Huong Giang);
- Embassy of the Kingdom of the Netherlands (Ms Pauline Eizema, Mr Marc van der Linden, Ms Pham Minh Uyen).

An overview of (almost all) contacts in Vietnam (mission April 2018) in Ho Chi Minh City and Hanoi is enclosed in appendix 1.

Presentation to Dutch wind sector

On May 31. 2018 at the Maritime Museum Rotterdam, findings of the baseline study were presented to an audience of members of the trade associations of HHWE, NWEA and IRO. In discussions afterwards, several people expressed great interest in participating in the wind energy developments in Vietnam. The slides of the presentation are enclosed in appendix 4.

2 OVERVIEW OF VIETNAM ENERGY SECTOR

2.1 Energy market

2.1.1 Electricity supply and demand

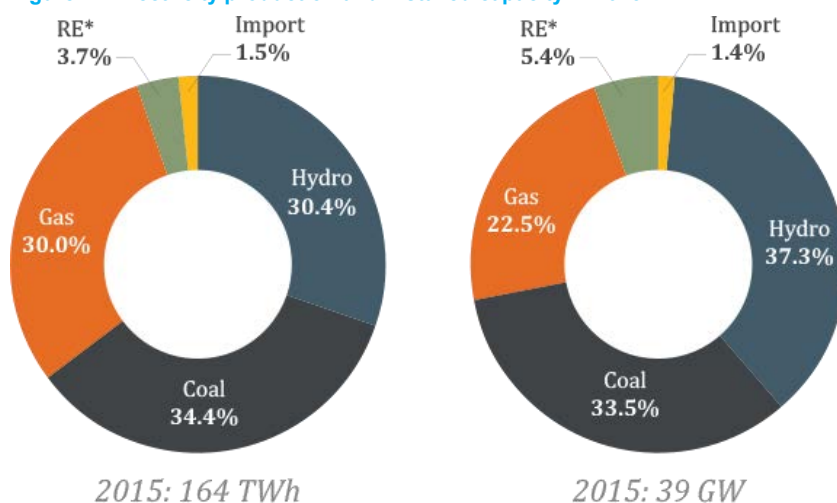
Electricity demand in Vietnam is rapidly annually increasing with 10 percent. Table 2.1 shows key indicators with respect to power demand, production, and consumption for the period 2005–2014.

Table 2.1 Electricity Demand and Supply²

	2005	2009	2014	2017
Annual Demand (TWh)	46	76	128	174
Annual Generation (TWh)	54	87	146	197
Per Capita Consumption (kWh)	549	873	1415	1852

In 2015 the electricity production is dominated by coal with a share of 34,4% in electricity generation, followed by hydropower with 30,4% and natural gas with 30,0% (see Figure 2.1). Due to limited domestic coal and gas resources, Vietnam's imports of fossil fuels are increasing. The country turned to a net energy importer by 2015 after being net energy exporter for a long period. Except for hydropower, markets for renewable energies such as for wind and solar power are in a very early stage of development. However, the surging energy demand together with limited natural resources (coal, gas and oil), presents an important opportunity for renewable energy production in Vietnam.

Figure 2.1 Electricity production and installed capacity in 2015³



2.1.2 Energy Forecast

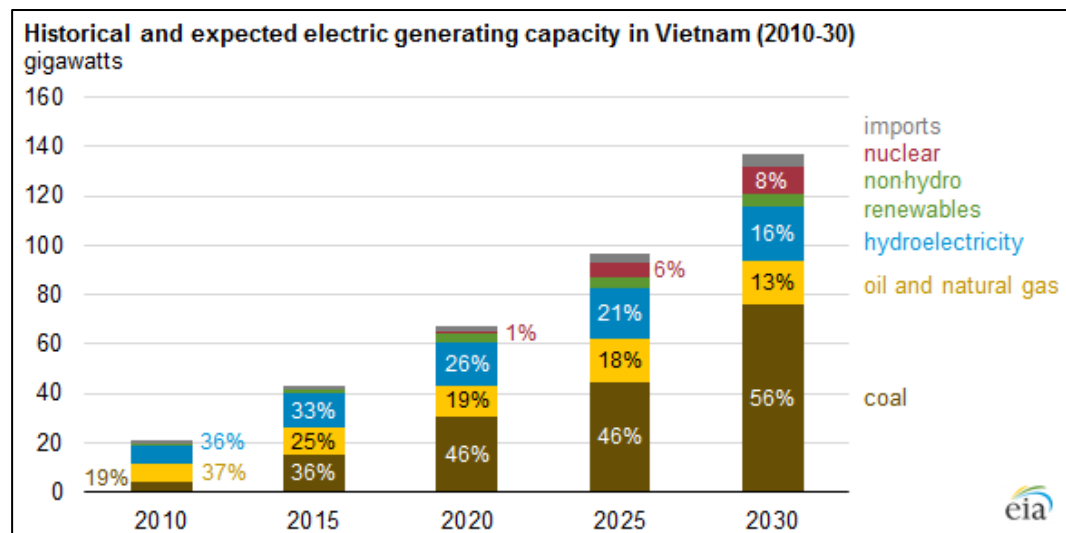
Due to both rapid industrialisation and remarkable economic growth, domestic energy consumption levels have increased with almost double the speed of Vietnam's already high

² Vietnam Energy Assessment, Strategy and Roadmap. Asian Development Bank, 2015; MOIT, 2018.

³ <http://gizenergy.org.vn/en/about/what-we-do/programme-background>

GDP growth levels, growing on average by approximately 12% per year between 2006 and 2016.⁴ Different estimations of energy demand in Vietnam vary from increasing threefold to eightfold from 2015 to 2030. Vietnam's General Statistics Office estimates that electricity demand will continue to grow at recent annual growth rates of 10%-12%, rising from 169.8 terawatt hours (TWh) in 2015 to 615.2 TWh by 2030. Figure 2.2 shows the historical and expected electric generation capacity in Vietnam. Coal and hydro will continue to be major sources of electricity but, the share of renewable energy, especially solar and wind, will be increased in total electricity production. However, the share of the solar and wind energy remains relatively limited. According to the revised 7th Power Development Plan of the Vietnamese government from 2016, the share of renewable electricity production will be 6 percent in 2020 and 27 percent in 2030.

Figure 2.2 Energy production forecast in Vietnam⁵



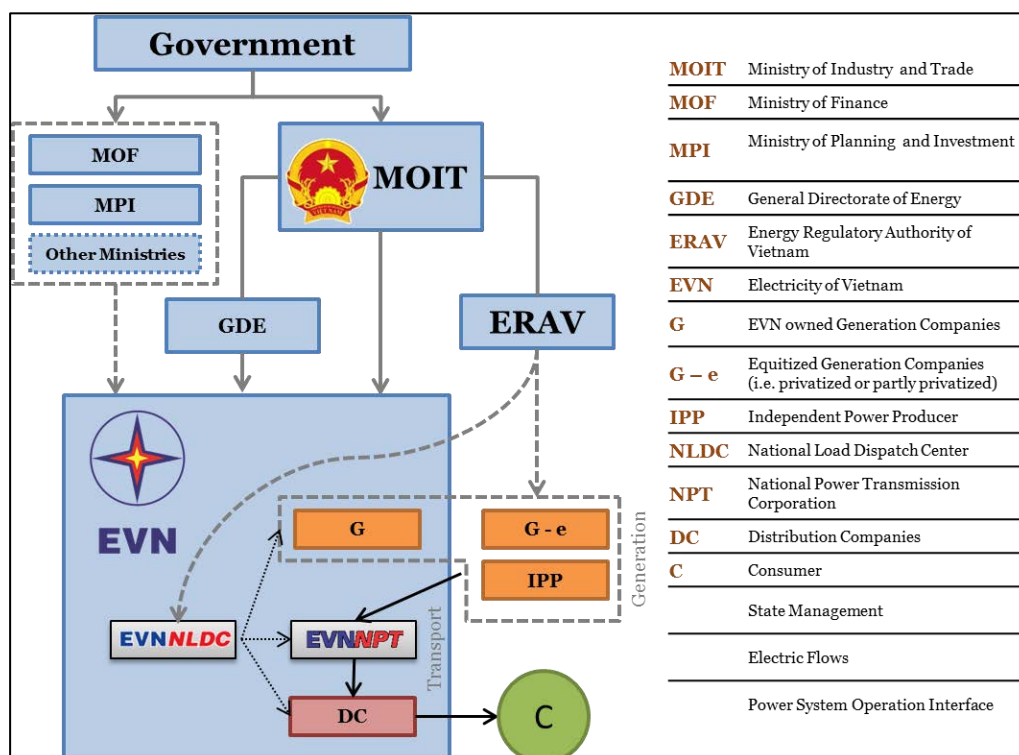
2.2 Current Energy system

2.2.1 Institutional framework of the energy system

The Vietnamese electricity market is monopolistic, dominated by the state-owned-enterprise EVN, which is supervised by the Ministry of Industry and Trade (MOIT). Figure 2.3 shows an overview of the organizations involved in the energy (electricity) sector of Vietnam. The ERAV (Electricity Regulatory Authority of Vietnam) was set up in 2005 under the MOIT. Components of the responsibilities of ERAV include developing regulations, compliance and electricity tariff setting.

⁴ Renewable Energy in Vietnam. Embassy of the Netherlands in Hanoi, 2017.

⁵ <https://www.eia.gov/todayinenergy/detail.php?id=22332>

Figure 2.3 Institutional framework of Vietnam's electricity sector⁶ (see Note)

Note: The General Directorate of Energy (GDE; in the centre of Figure 2.3) is recently split up in three departments (Department of Electricity and RE, Department of Coal, Oil and gas, Department of Energy efficiency and Sustainable Development) and is part of Ministry of Industry and trade (MOIT).

EVN was formed in 1995 as a vertically integrated, state-owned corporation responsible for Vietnam's power subsector.⁷ In mid-2006, EVN was transformed into a holding group. EVN is still the main actor in the power subsector with wholly owned subsidiaries: three power generation corporations (G); the National Power Transmission Corporation (EVNNPT) responsible for power transmission; the five regional power corporations responsible for power distribution; National Load Dispatch Center (EVNNLDC), which serves as the system and market operator. Finally, EVN owns the majority of power plants in Vietnam.

Thus, in the electricity production sector, EVN is single-buyer of electricity, and power transmission and distribution systems are exclusively operated by subsidiary companies of the utility. Moreover, 61 percent of the installed capacity is owned by EVN⁸, while the rest is owned by domestic (state-owned companies and private companies) and foreign Independent Power Producers (IPP, see Figure 2.3). However, the goal of the government is to develop a competition-based generation, wholesale and retail market until 2023, in particular in order to attract private and foreign investments in the energy sector. Despite this intended transition, there is not yet any clear legal basis for a direct power purchase agreement between renewable energy generators and customers, such as factories and industrial parks. In fact, the regulations

⁶ Overview of the Vietnamese Power Market - A Renewable Energy Perspective. GIZ, 2015.

⁷ Vietnam Energy Assessment, Strategy and Roadmap. Asian Development Bank, 2015.

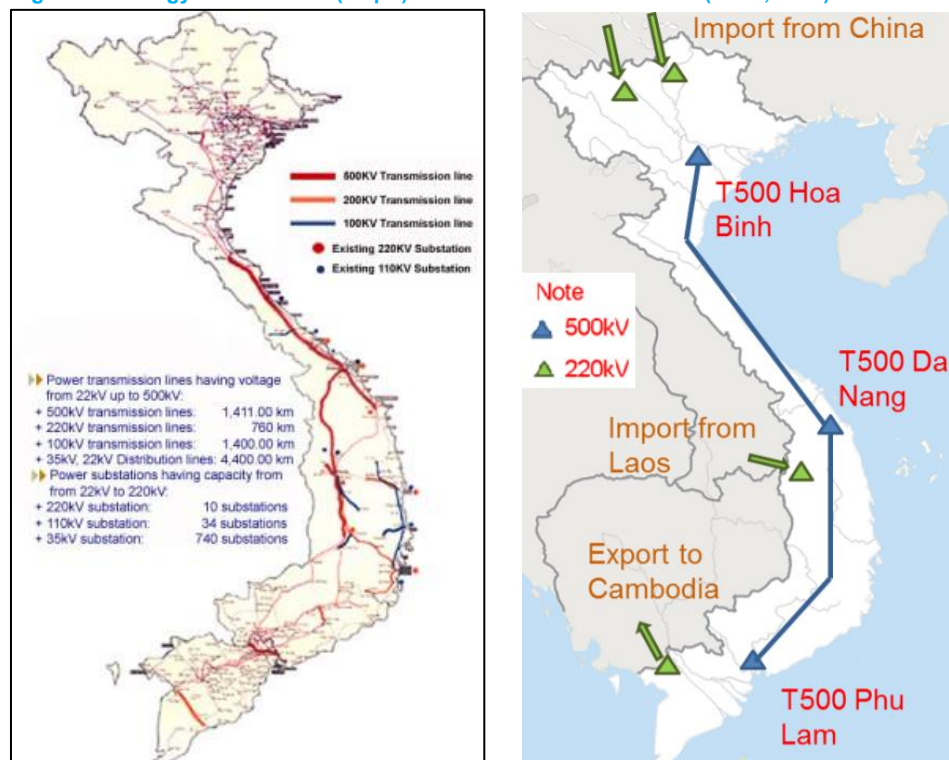
⁸ Vietnam Electricity Annual Report. EVN, 2016

provide that EVN will be the sole buyer responsible for purchasing all power generated from renewable sources.

2.2.2 Energy grid

The national energy grid of Vietnam is operated by Electricity of Vietnam (EVN). EVN is the single buyer of electricity and holds a monopoly on transmission and distribution. According to EVN's Annual Report in 2016, 100 percent of the districts were connected to electricity, 99,59 of the communes and 98,22 percent of rural households have access to the power grid. In rural areas however, power shortages and blackouts are occurring frequently. The national transmission and distribution grid is being extended and upgraded in synchronization with increasing power demand and generation capacity in order to reduce power outages, losses and increase the quality of supply. The National Vietnam Power Development Plan (PDP VII, 2011) plans for an investment in the extension and upgrading of the transmission system of \$6.7 billion and distribution system of \$6.6 billion during 2014-2020. Figure 2.4 displays a visualization of the national energy grid of Vietnam⁹. Clearly, the national energy grid is centred around the two major cities of Vietnam, Hanoi and Ho Chi Minh City.

Figure 2.4 Energy Grid Vietnam (map¹⁰) and schematic visualisation (MOIT, 2017)



Sub-companies of EVN own, manage and operate the power transmission and distribution system. The National Power Transmission Corporation operates the high voltage grid (500 and

⁹ For a more recent (World Bank October 2016, last updated: August 30, 2017) and very detailed map, see: <https://energydata.info/dataset/2101c751-cce0-4d4f-bde8-dab7a83b45d5/resource/5a74f409-ddba-4059-b5c9-69bdbbe55222/download/vietnam500220110kv-final-15102016-model.pdf>.

¹⁰ <http://www.geni.org/globalenergy/library/energy-issues/vietnam/index.shtml>

220 kV). The power distribution network (110 kV, Medium and Low Voltage) is divided into regions and operated by the Northern Power Corporation (NPC), Central Power Corporation (CPC), Southern Power Corporation (SPC), Hanoi Power Corporation (HNPC) and Ho Chi Minh City Power Corporation (HCMPC).¹¹

2.2.3 Governmental targets on renewable energy and wind energy

Although there is potential for renewable energy in Vietnam, the renewable energy market is still very limited in size. The Vietnamese government is committed to the promotion of renewable energy and energy efficiency. The two major governmental renewable energy policies targets will now be elaborated upon.

Power Development Plan VII¹²

The Ministry of Trade and Industry revised its 7th Power Development Plan (PDP7) for 2011 to 2030 on March 2016. In this plan the government of Vietnam placed a stronger emphasis on renewable energy. Under this plan, the proportion of electricity generated from renewable energy sources (excluding large-scale, medium-scale and pumped storage hydro power) will increase up to around 7% in 2020 and above 10% in 2030. Sub-targets regarding the share of electricity production and installed capacity are set for wind energy, solar energy, biomass and hydro power. The total capacity of installed wind power is declared to reach 800 MW in 2020, 2000 MW in 2025 and 6000 MW in 2030, which account for 0.8% of the share of produced electricity in 2020, 1% in 2025 and 2.1% in 2030. The Power Development Plan also indicates an increase in the share of coal for electricity production. According to the Power Development Plan, the proportion of coal-based electricity production, will account for over more than 50 percent in 2030 of the total electricity production. Therefore, renewable energy remains to be a minor competitor in the electricity sector of Vietnam. Table 2.2 shows the differences between power capacities from each type of renewable energy in PDP7 and the revised PDP7 of 2016.

Table 2.2 Changes in renewable power capacity

		PDP7	PDP7-revised		PDP7-revised
(Medium and large) Hydro	GW	17.4	20.4		25.4
Pumped storage hydro	GW	1.8	1.2	5.4	2.4
Wind	GW	1.0	0.8	6.2	6.0
Biomass	GW	0.5	-	2.0	-
	TWh	-	2.7	-	12.0
Solar	GW	-	0.85	-	12

Renewable Energy Development Strategy 2016 - 2030

In November 2015, the government of Vietnam adopted a Renewable Energy Development Strategy 2016 - 2030 with an outlook until 2050, which came into force in 2016. The Strategy guides renewable energy development in the country, setting clear medium and long-term

¹¹ Overview of the Vietnamese Power Market - A Renewable Energy Perspective. GIZ, 2015.

¹²http://gizenergy.org.vn/media/app/media/legal%20documents/GIZ_PDP%207%20rev_Mar%202016_Highlights_IS.pdf

goals. Special focus herein is set on wind, biomass and solar technologies. The Renewable Energy Development Strategy presents an ambitious set of renewable energy targets, with the intention of raising the share of renewable energy to 44 percent of total primary energy consumption in 2050. The total electricity generated from wind power is set to increase from 140 MW as present up to 800 MW in 2020. The strategy also states that Vietnam will promote onshore wind energy until 2030 and assess the potential for offshore wind energy for after 2030.¹³

Although both the Power Development Plan and the Renewable Energy Development Strategy are overlapping, the Renewable Energy Development Plan includes a higher level of ambition for renewable energy deployment.

2.2.4 Financial instruments and funding for renewable energy projects

Power projects typically require significant capital investment and, as a result, are often financed with a significant portion of debt capital. The project developer must bear the costs and risks of constructing a power plant and the connection of the plant to the transmission grid. There are a few noteworthy financial instruments available in Vietnam to support renewable energy projects.

National state funding

Subject to satisfaction of the relevant conditions, investors in renewable energy projects may be able to obtain loans from the Vietnam Development Bank (VDB) or the Vietnam Environment Protection Fund (VEPF), or obtain interest support from the VEPF. VDB, directly supervised by the Vietnamese Ministry of Finance, has various options for renewable energy projects including medium and long-term loans, and on-lending Japanese and U.S. Official Development Assistance (ODA) funds. Owners of renewable energy projects can obtain loans of up to 70% of the total investment cost from the VDB at an interest rate equivalent to that of a 5-year government bond plus 1% per year. Wind power projects in particular, may seek for debt from the VDB up to 85% of the project cost with a tenure up to 18 years and grace period up to 5 years.¹⁴

The Vietnam Environmental Protection Fund (VEPF) is a state financial institution that receives public funding in addition to funding from a number of sources, including environmental fines, damages, and protection charges related to resource exploration.¹⁵ The VEPF also administers a subsidy scheme for renewable electricity generated from solar, wind, geothermal, tidal, or methane sources where production costs exceed the sale price. However, even though the VDB has injected capital, and the VEPF given some subsidies for a few renewable energy projects, it remains to be seen how easily future funding and subsidies can be obtained from these entities¹⁶. Finally, part of the Renewable Energy Development Strategy 2016 - 2030 is to establish a Sustainable Energy Promotion fund. This fund will be financed by state budget and revenue from environmental fee levied on fossil fuels.

¹³ IEA (2016). *Vietnam Renewable Energy Development Strategy 2016-2030 with outlook until 2050 (REDS)*

¹⁴ *Wind power investment guidelines. Volume 2: wind power financing in Vietnam*. GIZ, 2016.

¹⁵ *Financing mechanisms for energy efficiency and renewable energy in Vietnam*. USAID, 2013.

¹⁶ *Renewables in Vietnam: Opportunities for Investment*. Allens, 2017.

Public debt ceiling

Relevant in the light of the opportunity to obtain loans from the Vietnam government is Vietnam's public debt ceiling to ensure state budget balance and socio-economic development. Vietnam is targeting keeping public debt, comprising central government debt, government-backed loans, and local government debt, below 65 percent of GDP between 2016 and 2018. Under the newly approved plan to manage public debt, the central government will not provide guarantees for new domestic and external loans. Large investments or guaranties to underpin large privately-financed infrastructure, like wind farms, are therefore not likely to be provided by Vietnam's government. This means attracting private investment is crucial for development of large wind energy initiatives.¹⁷

International funding

It is unlikely that the domestic Vietnamese banks alone will be able to provide sufficient funds to finance projects to meet the Government's targets¹⁸. Therefore, International funding is very important for the success of renewable energy projects in Vietnam.

There are a few international financial institutions currently funding renewable energy projects in Vietnam. The World Bank launched the Renewable Energy Development Project for Vietnam. This 318 million dollar project aims to increase the supply of electricity to the national grid from renewable energy sources. Moreover, the government of Vietnam, Asian Development Bank, World Bank and other stakeholders developed an investment plan to tap 250 million dollars from the Clean Technology Fund for targeting low carbon investments in the power, transport and industrial sectors. Another international financial institution active in Vietnam is the European Investment Bank (EIB). In 2012 the EIB launched a 250 million euro program for financing energy efficiency and renewable energy projects in Vietnam. Candidate renewable energy projects can be any small-scale project in the fields of hydropower, wind power, solar, geothermal and biomass to energy. The total investment amount of an eligible project must be less than €25 million, of which the equity accounts for at least 30%. A few other financial institutions active in Vietnam are the KfW development bank, Japan International Cooperation Agency, Asian Development Bank, Dragon Capital and the Export-Import Bank of United States¹⁹.

Certain renewable energy projects for the reduction of emissions in Vietnam are suitable for purchasing certified emission reductions (CERs) under the Clean Development Mechanism (CDM). These saleable credits can be used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. The buyers sign an agreement with local project owners in order to obtain rights to CERs from the project. There are a few examples of hydro, bio and wind energy projects in Vietnam, with registered CERs in Vietnam²⁰. The already operating Thuan Nhon Phong and the Tuy Phong (see paragraph 4.1.2) windfarms are also part of the CDM model.

¹⁷ For more information, see for example: United Nations ESCAP, *Infrastructure Financing Strategies for Sustainable Development in Viet Nam, National Study / Paper*, 15 September 2017; <http://english.vietnamnet.vn/fms/business/177203/vietnam-s-public-debt-ceiling-set-at-65-of-gdp-for-2016-2018.html>; <https://blogs.duanemorris.com/vietnam/2017/10/25/public-debt-puts-the-squeeze-on-government-guarantees-stifling-project-finance-projects-in-vietnam/>.

¹⁸ *Renewables in Vietnam: Opportunities for Investment*. Allens, 2017.

¹⁹ *Financing mechanisms for energy efficiency and renewable energy in Vietnam*. USAID, 2013.

²⁰ <https://blogs.duanemorris.com/vietnam/2015/04/16/vietnamese-clean-development-mechanism-cdm-market-the-perspective-of-an-emission-certificate-buyer/>

2.2.5 Electricity price, FiT and tax exemptions

Currently the national utility, Electricity of Vietnam (EVN), through its subsidiaries, holds the monopoly on the transmission and distribution of electricity, and acts as the only wholesale purchaser of electricity from generators. The Government has set out its vision for a competitive power market, which should be fully implemented at the wholesale level by 2021 and at the retail level by 2023. The government strictly regulates the retail price, recommended by Ministry of Industry and Trade (MoIT) and requiring approval by the Prime Minister. A unified tariff is applicable across the country and is low in comparison with other countries in the region. For example: the electricity price in Vietnam is 6-10 US cents/kWh, compared to 15-21 US cents/kWh in Cambodia.²¹

In order to stimulate renewable energy production, a Feed-in Tariff (FiT) was introduced in Vietnam in 2011. FiTs are proposed by the Ministry of Industry and Trade and decided on by the Prime Minister. The FiT is a crucial element in building a bankable proposition for new renewable energy projects. The current FiT for wind energy in Vietnam amounts 7,8 US\$/ kWh with a Power Purchase Agreement duration of 20 years. Currently, MOIT is drafting a new Decision to increase the FiT for wind energy in Vietnam (see paragraph 4.2).

In addition, all renewable energy power projects can also benefit from tax exemption for import duties for imported goods to establish project fixed assets, materials and semi-finished products that are not domestically produced. Moreover, renewable energy projects can benefit from a reduced corporate income tax.²²

²¹ https://en.wikipedia.org/wiki/Electricity_pricing#Global_comparison

²² Status of wind power development and financing of these projects in Vietnam. GIZ, 2012.

3 WIND ENERGY POTENTIAL OF VIETNAM

3.1 Wind resources and available space

3.1.1 Onshore

Vietnam is considered to have the best wind resources in Southeast Asia. Located in the monsoon climate zone, and shaped by its over 3,000 km long coastline, Vietnam's potential to develop and generate wind power is substantial. MOIT, with the support of the World Bank, released the Wind Resource Atlas in 2011 (see Figure 3.1). This report identified great potential for harnessing wind energy in Vietnam's south central regions and the Mekong Delta. Estimations the Wind Atlas cite around 24 GW of potential. Wind potential in Vietnam concentrates mostly in the southern central coastal region (Binh Thuan Province) and the southern coastal region (Tra Vinh, Bac Lieu and Soc Trang provinces) with average windspeeds of 7 m/s or higher. These windspeeds are comparable with the average windspeeds in the Netherlands.

Table 3.1 gives an overview of wind energy theoretical potential based on the Wind Resource Atlas of Vietnam (source WB report 2011). Areas with mean wind speeds of 6-7 m/s and up can be considered as especially suitable for wind power development.

Table 3.1 Provincial Wind Power Development Plan's

Mean Speed at 80 m Height (m/s)	Estimated Developable Land Area (km ²)	Percentage of Developable Land	Approximate Megawatt Potential
<4	95,916	45.7%	959,161
4-5	70,868	33.8%	708,678
5-6	40,473	19.3%	404,732
6-7	2,435	1.2%	24,351
7-8	220	0.1%	2,202
8-9	20	0.01%	200
>9	1	0.00%	10
Total	209,933	100.00%	2,099,333

Noteworthy is that Vietnam is vulnerable for extreme weather events like storms and typhoons. Due to the geographical location along the South China Sea, many tropical typhoons surge over the coastline between May and December. These extreme weather events have negative impact on wind energy potential in Vietnam, because the wind turbines are required to temporarily shut down and there is the possibility of storm damage to wind turbines.

Currently, 9 (mostly southern) provinces in high potential wind energy areas, drafted a so-called Provincial Wind Power Development Plan (see paragraph 4.1.3). These plans define priority areas for wind power development, for which wind measurement has already been conducted.

These potential areas are selected following certain criteria like windspeed, topography, connection and accessibility to the transmission grid, land use and buffer zones between potential areas. Table 3.2 gives an overview of the planned capacity in the divers provinces.

Table 3.2 Provincial Wind Power Development Plan's

No.	Name of province	Capacity (MW)	
		2020	2030
1	Bình Thuận	700	1.570
2	Ninh Thuận	220	1.429
3	Sóc Trăng	200	1.470
4	Quảng Trị	110	447
5	Trà Vinh	270	1.608
6	Bến Tre	150	1.520
7	Bạc Liêu	401	2.507
8	Cà Mau	350	3.607
9	Thái Bình	40	70
10	Đắk Lắk	138	1.382
11	Bà Rịa Vũng Tàu	34	107
	Total	2.613	15.717

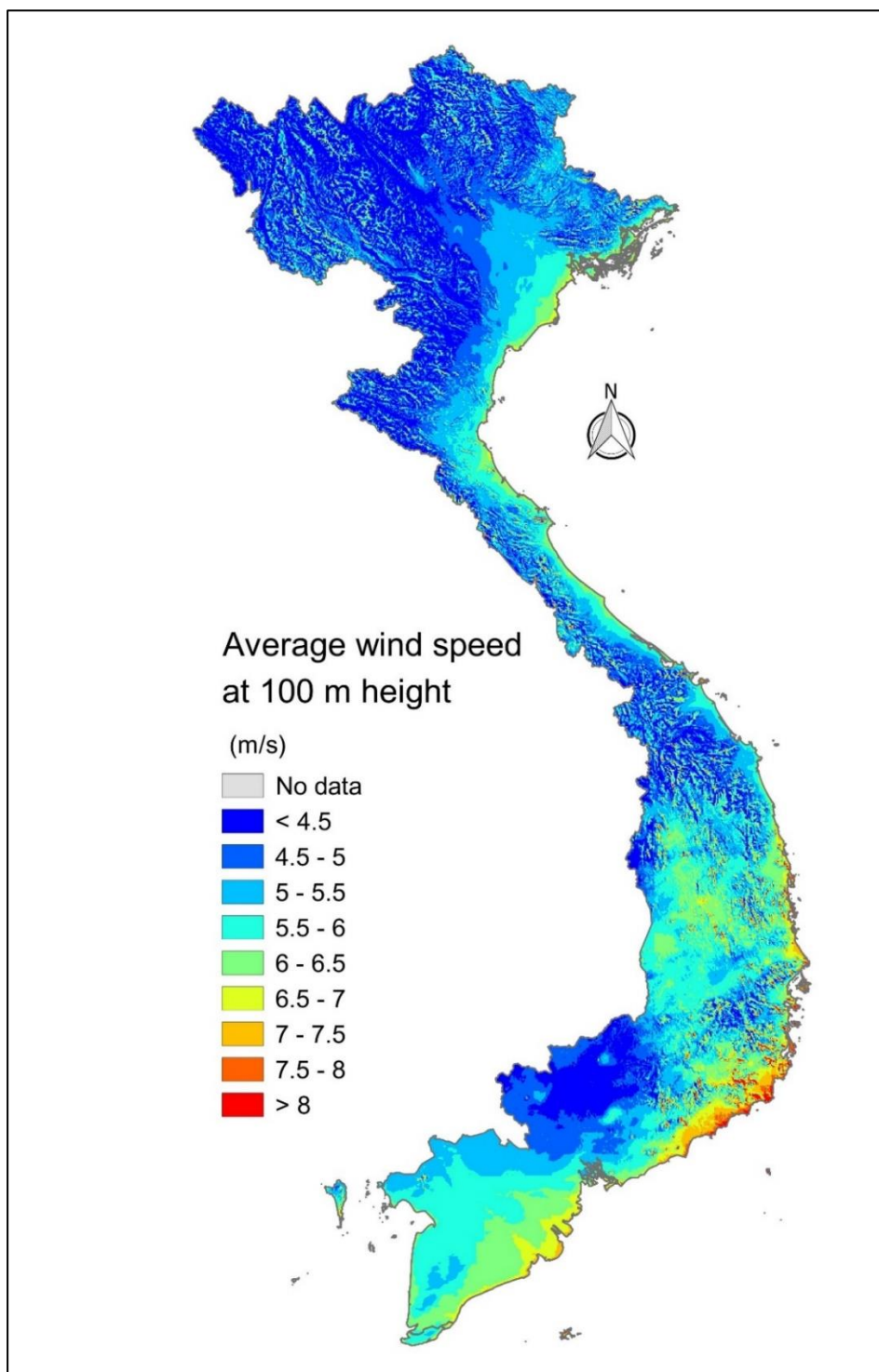
The Wind Resource Atlas of 2011 (see Figure 3.1) gives a first impression of the wind resources. Further study and wind measurements are necessary to obtain a better and more detailed picture of the wind resources of specific locations in Vietnam.

Due to the demand for more reliable wind data, the GIZ²³ project 'Support to the Up-scaling of Wind Power in Vietnam'²⁴ implemented a wind measurement campaign at ten sites in the Central Highlands, as well as Central and Southern Vietnam from December 2011 to July 2015, measuring wind speeds at 80m, 60m and 40m height. Data from this wind measurement campaign is available on the World Bank Energy Open Data Platform. In order to further improve the accuracy of wind data in the country, the World Bank and GIZ are continuing their efforts in revising the wind atlas. GIZ continues to measure wind data for another 2 years in 5 locations, including Hai Ninh (Quang Binh), Da Loan (Lam Dong), Thanh Hai (Ben Tre), Kon Dong (Gia Lai) and An Ninh Dong (Phu Yen). The World Bank will obtain data over two years from six met mast sites and one Light Detection and Ranging (LIDAR), in cooperation with Denmark Technical University's Wind Energy Department (DTU Wind). A new Vietnam Wind Power Atlas is expected to be available in 2018.

²³ GIZ: Deutsche Gesellschaft fuer Internationale Zusammenarbeit

²⁴ [https://energypedia.info/wiki/Support_to_the_Up-scaling_of_Wind_Power_in_Vietnam_\(GIZ\)](https://energypedia.info/wiki/Support_to_the_Up-scaling_of_Wind_Power_in_Vietnam_(GIZ))

Figure 3.1 Average Wind Speed Vietnam²⁵

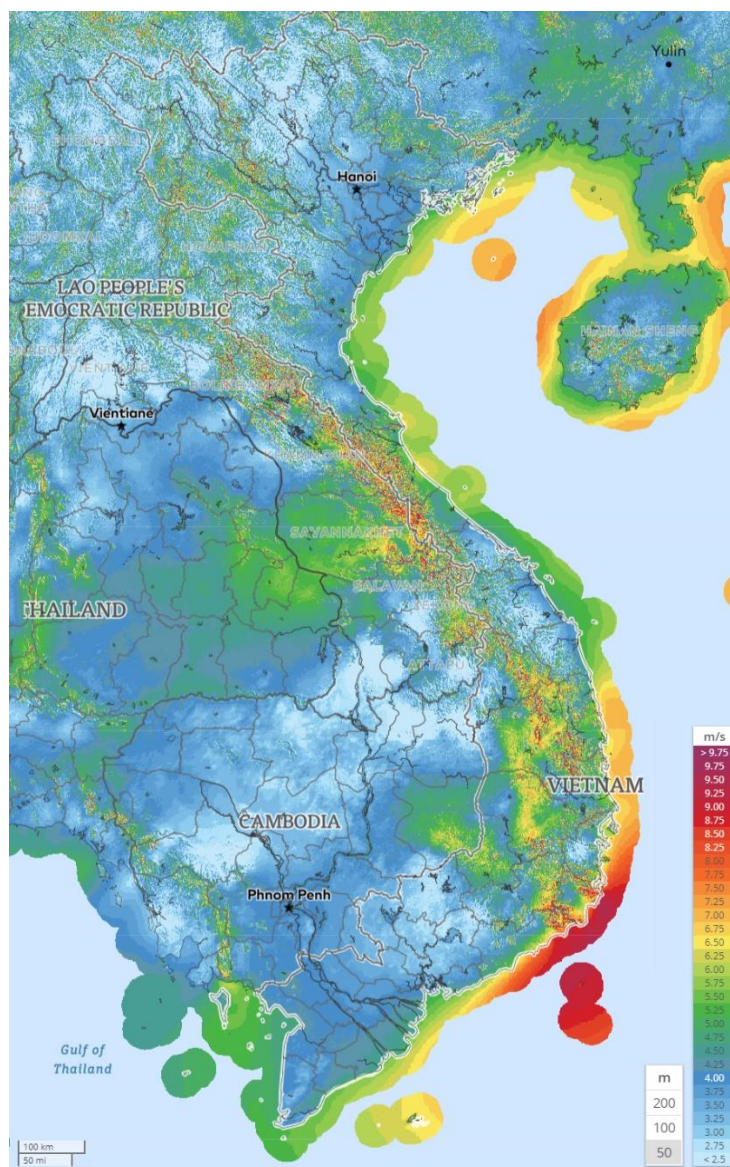


²⁵ Wind Resource Atlas of Vietnam, 2011

3.1.2 Offshore and nearshore

As discussed in previous chapters, offshore wind energy is a relatively new and emerging market in Vietnam, with huge potential. Currently the first nearshore windfarms are in operation and under development along the coast in southern Vietnam. Figure 3.2 shows the average wind speed along the coastline of Vietnam at a height of 50 meters. The south-eastern region of Vietnam has the highest windspeeds along the coast of Vietnam (see Figure 3.3). The region from the coastal city of Qui Nho'n to the coast near Ho Chi Minh city has wind speed of 7-11 meter per second on average, making it one of the areas with the highest potential of generating electricity from wind energy in the world²⁶.

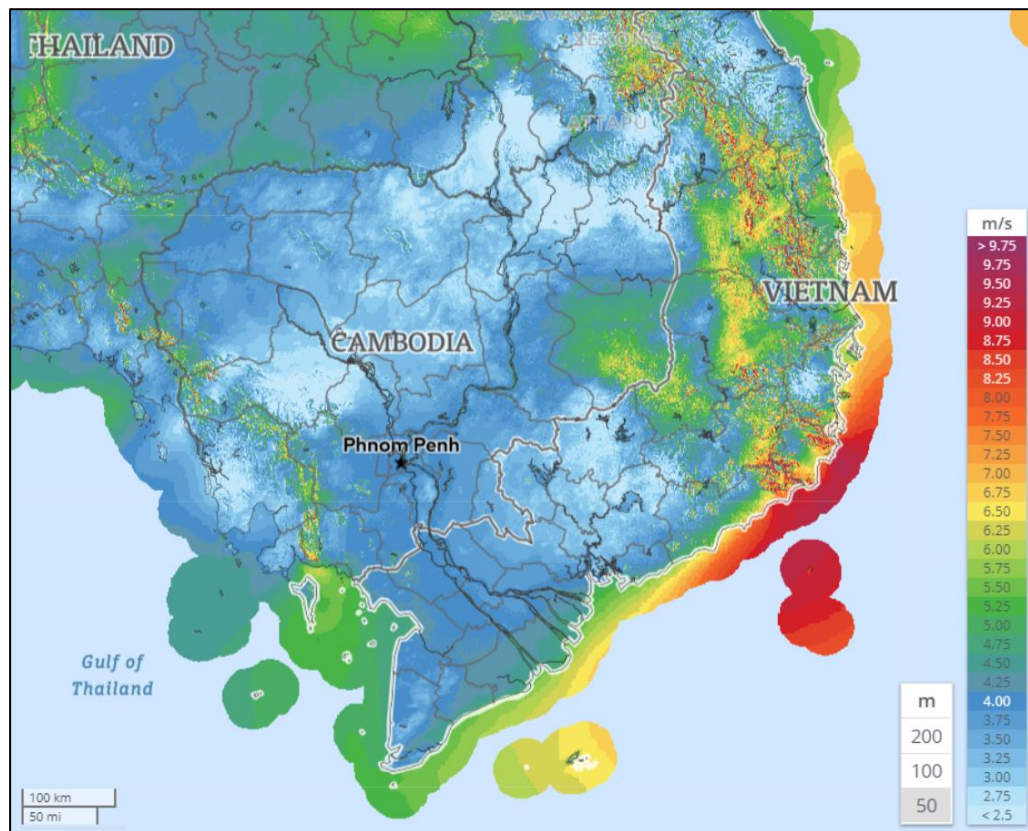
Figure 3.2 Average offshore windspeed Vietnam



Source: Wind Minds

²⁶ <https://www.evwind.es/2017/07/13/vietnam-has-large-wind-power-potential/60444>

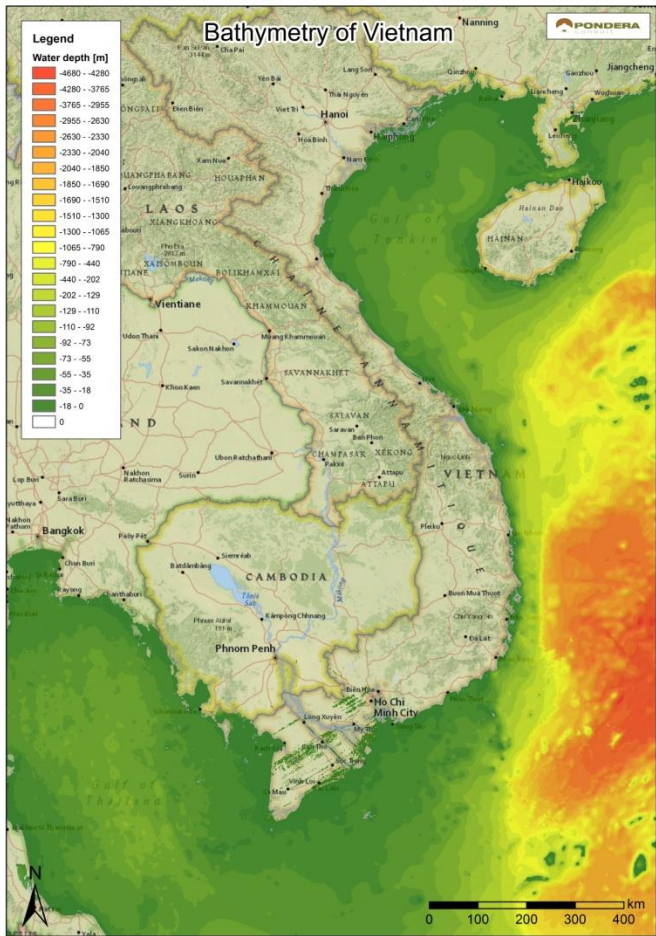
Figure 3.3 Average offshore windspeed in South Vietnam



Source: Wind Minds

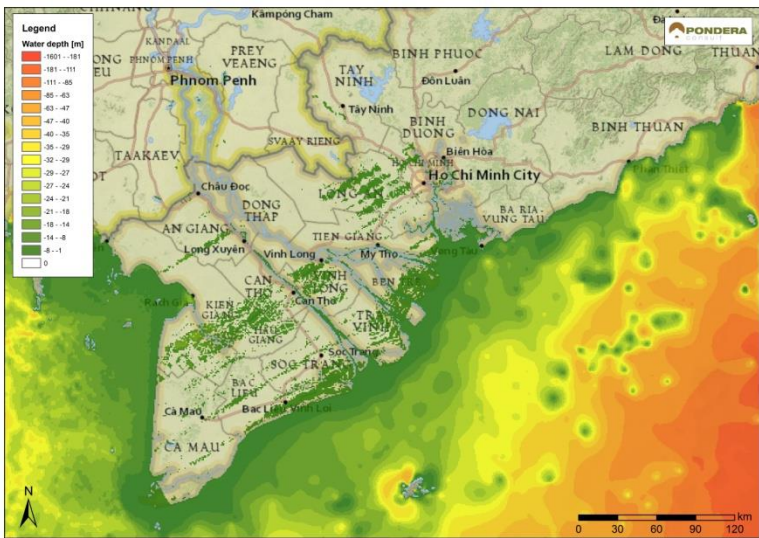
The depth and consistency of the seabed has a major impact on the windfarm design in terms of turbine and foundation selection, size and construction. Especially the water depth plays an important role with regards to foundations options and costs. Moreover, developing offshore wind energy further away from the coastline requires more costs in terms of logistics and grid connection. Figure 3.4 shows the depth of the seabed in the South China Sea bordering Vietnam. The seabed along the coastline in the north, as well as in the south of Vietnam can be characterized as relatively shallow and consistent. The seabed at the height of central Vietnam is much deeper at a short distance from the shore. Figure 3.5 zooms in to South Vietnam, which has a higher potential in terms of windspeed. Clearly visible is the relatively consistent and shallow plateau along the coastline near Ho Chi Minh City. Therefore, in combination with high windspeeds (see figure 3.3), the coastline is a high potential zone for offshore wind energy. Especially the coastline to the east of Ho Chi Minh City is very promising, due to the shallow water and the highest offshore wind speeds of Vietnam within 50 kilometres from the shore.

Figure 3.4 Sea depth of Vietnam



Source: Wind Minds

Figure 3.5 Sea depth of South Vietnam



Source: Wind Minds

Political dispute South China Sea

Since 1947, the South China Sea has been a major area of dispute in Asia Pacific. While China lays claim to roughly 80% of these oil and gas rich waters, there are overlapping areas of dispute with the Philippines, Vietnam, Taiwan, Brunei, and Malaysia in the South China Sea (see Figure 3.6)²⁷. With regards to the wind energy potential in Vietnam, offshore windfarms are not likely to be built in sea areas with competing claims in the South China Sea, because of the large distance from these disputed areas from the shore.

Figure 3.6 Territorial claims in the South China Sea²⁸



Other functions offshore

Other users of the South China Sea could conflict with wind power development. Underneath some of these functions are described.

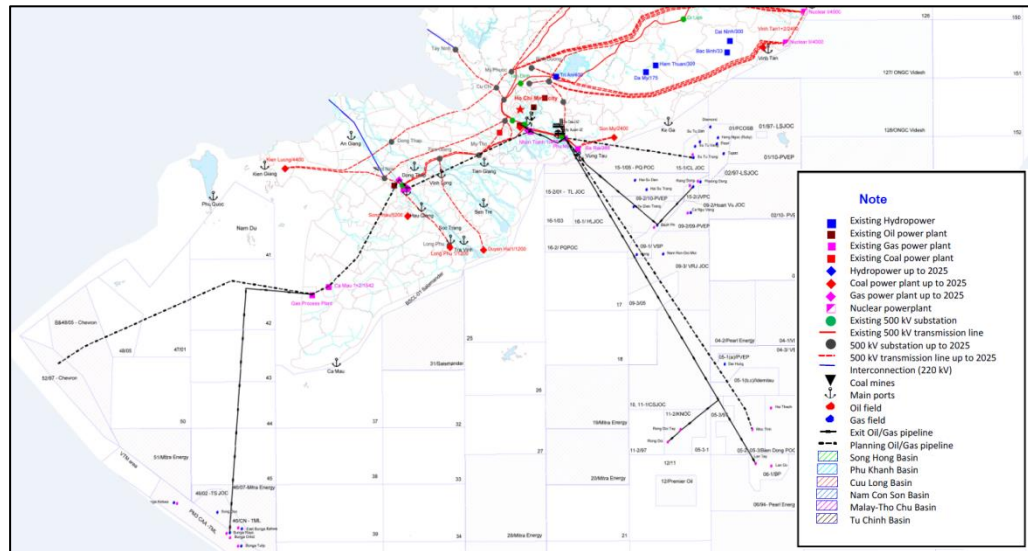
Oil & Gas platforms

Figure 3.7 displays an extract of the major power plants, oil and gas fields and pipelines and transmission lines in Vietnam. For offshore wind energy it is important to take into account the different oil and gas platforms in the region. Offshore wind energy will probably be restricted near oil and gas platforms, due to transportation to and from oil and gas platforms with vessels and helicopters. Especially around 70 kilometres from the shore, at the height of Ho Chi Minh City and Phan Thiet, there are many oil and gas platforms. Thus, although this area may be suitable for offshore wind energy in terms of windspeeds and seabed depth, the oil and gas platforms in the area one major obstacle to be taken into account.

²⁷ For background information on this issue, see for example the paper of Institute for Security and Development Policy (<http://isdip.eu/publication/understanding-chinas-position-south-china-sea-disputes/>) and recently articles in The Diplomat (<https://thediplomat.com/2018/07/asean-and-china-set-to-agree-on-single-draft-south-china-sea-code-of-conduct/>).

²⁸ <https://www.bloomberg.com/quicktake/territorial-disputes>

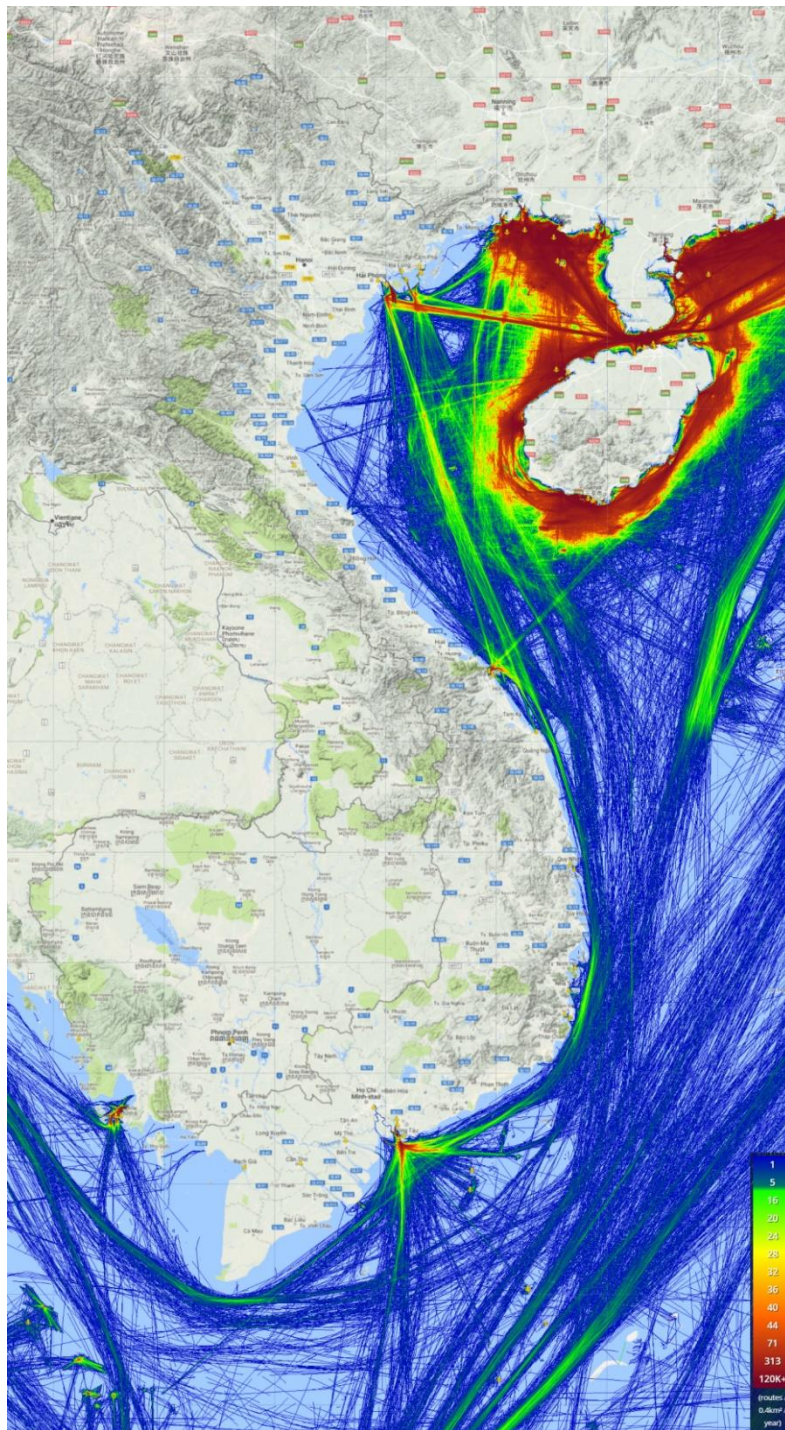
Figure 3.7 extract of oil and gas platforms in South Vietnam



Shipping traffic

Figure 3.8 displays the shipping traffic intensity along the coastline of Vietnam. You can clearly notice the 3 major harbour cities in Vietnam: Ho Chi Minh City, Da Nang and Hai Phong. Generally, shipping routes and windfarms are not functions that are easily combined and should be regulated to ensure acceptable collision risks. However, the North Sea along the Dutch coast, one of the busiest seas, made it possible to combine high density shipping traffic with large windfarms. Although the sea along the coastline of Vietnam is relatively busy, there are many nearshore and offshore areas that are not frequently used as shipping routes.

Figure 3.8 Shipping traffic Vietnam



Source: Wind Minds, Marinetraff.com

4 WIND ENERGY PROJECTS IN VIETNAM

4.1 Current renewable energy generation projects

4.1.1 Renewable energy

The market for renewable energy in Vietnam is still limited in size, but it is definitely emerging and its growth potential is high. Hydropower is currently the most mature renewable energy source in Vietnam, delivering about 43.6 percent of Vietnam's electricity in 2017. Many rivers are crossing the country, providing abundant hydropower potential. The largest hydropower plant is Son La on Da River (Son La province) with a capacity of 2400 MW. On the same river, Hoa Binh plant has a capacity of 1920 MW as the second largest hydropower plant in Vietnam.

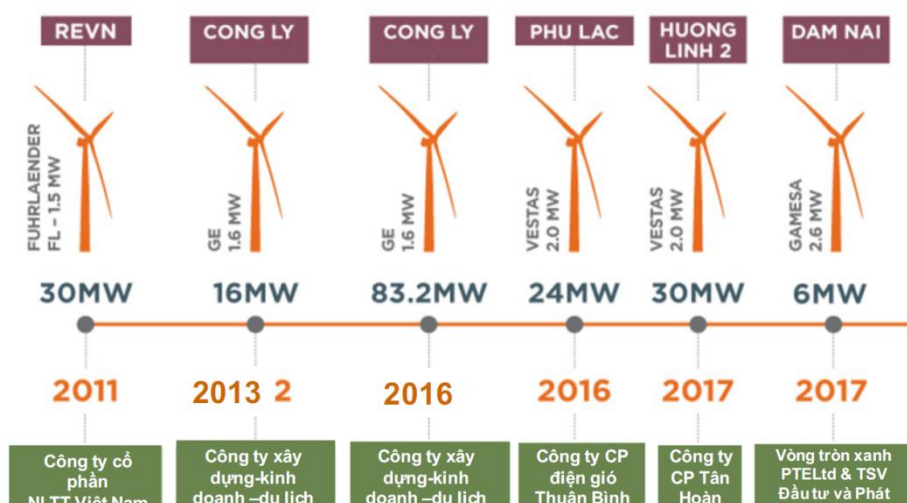
Having one of the highest number of hours of sunshine annually in the world – approximately 2,000 to 2,500 on average – Vietnam's potential for solar energy production is high. Vietnam's solar map shows that the southern regions in particular are suitable, reaching average solar intensity levels of 5 kWh per square meter per day. Currently there are more than 30 projects at under development ranging from 20-300 MW, and plans to invest a total of USD 3.3 billion into solar energy development were reported in a single province of the country.

Biomass is another important source of energy in Vietnam, and being an agricultural country, Vietnam has a high level of biomass energy potential. Moreover, biomass fuel is also an important source of energy for small industries located mainly in rural areas.

4.1.2 Operational wind energy projects

Currently, the total installed wind power capacity is approximately 190 MW, which is divided over four grid-connected wind farms with capacities ranging between 6 MW and 100 MW, see Figure 4.1 and Table 4.1.

Figure 4.1 Operational Windfarms in Vietnam²⁹



²⁹ Electricity And Renewable Energy Authority, April 2018

Table 4.1 Operational Windfarms in Vietnam³⁰

Project	Onshore/Offshore	Province	Capacity	Project developer	Construction company	Windturbine Manufacturer	Investor
Phu Lac windfarm	Onshore	Binh Thuan	50MW	Thuan Binh Wind power Joint stock company	Hydropower China	Vestas	KfW Development bank
Tuy Phong windfarm	Onshore	Binh Thuan	30MW	Vietnam Renewable Energy Joint Stock Company	CTV (France), HCE (Germany)	Fuhrlander	Agribank Vietnam
Phu Quy windfarm	Onshore	Binh Thuan	6MW	Petrovietnam Power Renewable Energy Limited Company	Petro Vietnam Power Corporation	Vestas	Local banks
Bac Lieu windfarm	Offshore (nearshore)	Bac Lieu	99MW	Cong Ly Construction and Trading Company	Huy Hoang Transport and Logistics (HTL) and GE	GE	Vietnam Development Bank; US Export Import Bank

4.1.3 Provincial Wind Power Development Plans

A key regulatory instrument for wind power in Vietnam is the Provincial Wind Power Development Plans (PWPDPs). These plans define priority areas for wind power development, for which wind measurement has already been conducted. This allows a streamlined permitting process, and prioritizes wind farm development in areas with high wind resources.

Currently, 9 provinces drafted their own PWPDP (Ninh Thuan, Binh Thuan, Soc Trang, Ben Tre, Tra Vinh, Quang Tri, Ca Mau, Bac Lieu and Thai Binh)³¹. All above mentioned provinces, (mainly southern provinces) have a high potential in terms of wind resources. On the basis of the follow criteria, specific sites were selected suitable for wind energy development in each province³²:

- Wind speed
- Topography (flatness)
- Connection and accessibility to the transmission grid
- Land use
- Buffer zones between potential areas

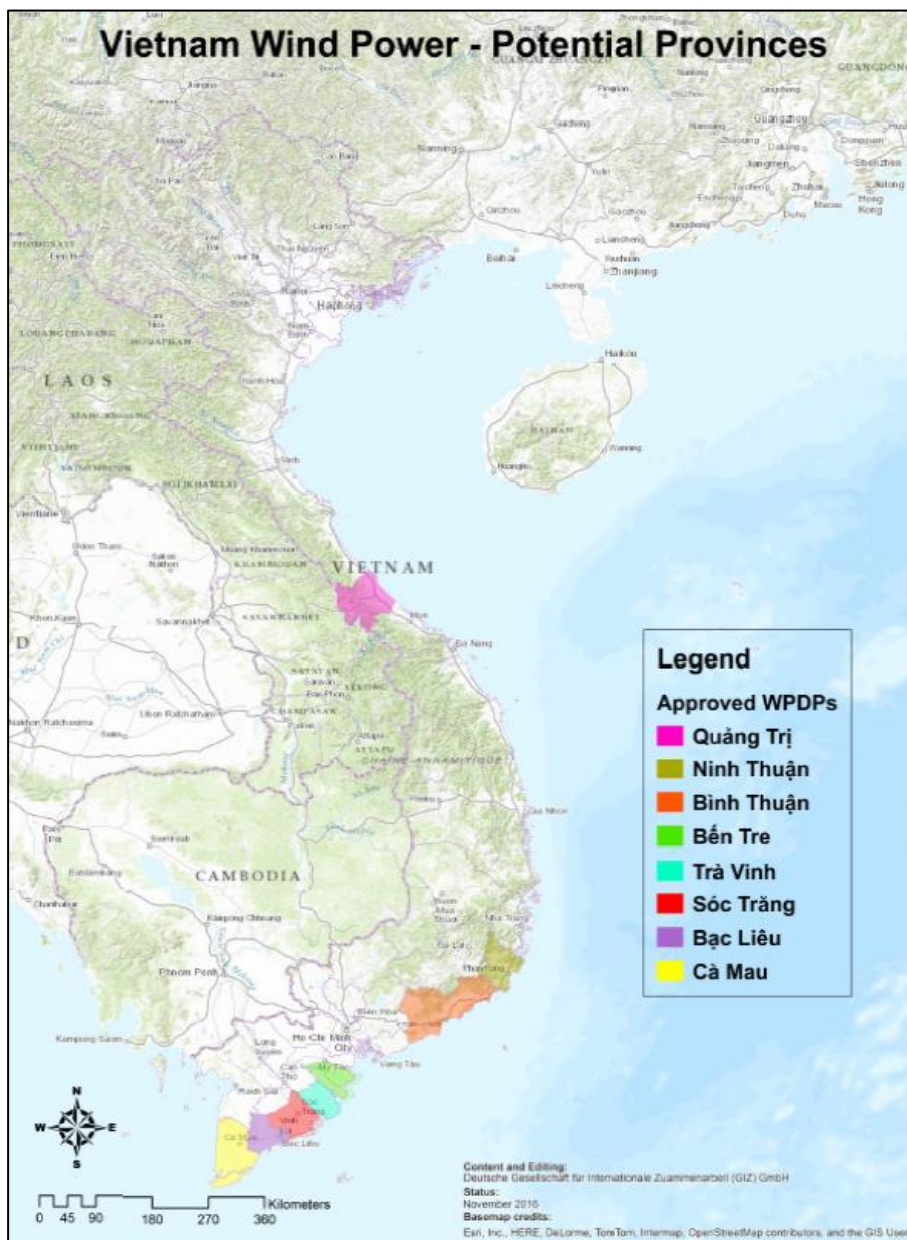
³⁰ https://energypedia.info/wiki/Wind_Energy_Country_Analysis_Vietnam

³¹ Wind power investments guidelines. Volume 1: project development. GIZ, 2016

³² Binh Thuan province wind power master plan. GIZ, 2016

Figure 4.1 displays all the provinces that submitted a PWPDP. On the website of the GIZ Energy Support Programme an interactive map of all the selected sites and windfarms under developed can be consulted.³³ The GIZ Energy Support programme is a cooperation programme between German Corporation for International Cooperation and the Vietnamese MOIT to support the Vietnamese Government in developing renewable energy and energy efficiency markets.

Figure 4.1 Map of Provincial Wind Power Development Plans in South Vietnam³⁴



³³ <http://gizenergy.org.vn/en/knowledge-resources/giz-publications/publications>

³⁴ <https://www.google.com/maps/d/viewer?mid=1iZLSizC97QyaalEbdMY5dX9IU8Y&ll=12.015989937118958%2C108.32887150287775&z=7>

4.1.4 Wind energy project in development

Many wind power projects are in development in Vietnam, with capacities ranging from 6 MW to 800 MW. A few are already under construction or in the pre-feasibility/ conceptualization stage. Most projects are located along the coastline of South Vietnam. The biggest project currently under development is the Phu Cuong Windfarm with an installed capacity of 800MW, located in the Soc Trang province. GE, Mainstream Renewable Power and Phu Cuong Group agreed in 2017 to develop this project.

Table 4.2 shows all the wind energy projects under development in the provinces that submitted a PWPDP. Not listed in the table are the designated potential locations in the PWPDP without an investment license or project developer in place. For a complete overview of designated potential locations in all the relevant provinces, the 'GIZ Maps of the PWPDP' document can be consulted.³⁵ Most data in the table origins from the PWPDP documents from 2016. Therefore, the table is not completely up to date. If possible, the table is complemented with available online information. Moreover, there are also projects being developed in other provinces of which the PWPDP's are not yet in place.

Table 4.2 Overview of wind energy projects under development in Vietnam³⁶

Project	Onshore Offshore	Province	Capacity (MW)	Status	Project developer/investor	Windturbine Manufacturer
Huong Phung	Onshore	Quang Tri	50	Investment license granted	Viet Rien Joint Stock Company	N/A
Huong Linh	Onshore	Quang Tri	60	Under development	Tan Hoan Cau Joint Stock Corporation	Vestas
Cong Hai	Onshore	Ninh Thuan	9	Under construction	EVN Genco 2	N/A
Hanbaram	Onshore	Ninh Thuan	140,3	Investment license granted	Landville Energy (South Korea)	N/A
Trung Nam	Onshore	Ninh Thuan	90	Under construction	Trung Nam Group	Enercon
Phuoc Nam Enfinity	Onshore	Ninh Thuan	124,5	Investment license granted	Enfinity Ninh Thuan Company (Belgium)	N/A
Mui Dinh	Onshore	Ninh Thuan	37,6	Under construction	EAB New Energy GmbH (Germany)	Enercon
Dam Nai	Onshore	Ninh Thuan	40	Under construction/in operation	The Blue Circle (France)	N/A
Phuoc The	Onshore	Binh Thuan	28	N/A	Asia Clean Energy Development and Investment	N/A

³⁵ <http://gizenergy.org.vn/media/app/media/wind%20power%20development%20plan/giz-maps-of-provincial-wpdps-3.pdf>

³⁶ Provincial Wind Power Development Plans. GIZ, 2016.

Project	Onshore Offshore	Province	Capacity (MW)	Status	Project developer/investor	Windturbine Manufacturer
Hoa Thang	Onshore	Binh Thuan	49,5	Investment license granted	Hao Phong Clean Energy JSC	N/A
Thuan Nhen Phong	Onshore	Binh Thuan	32	N/A	Asia Renewable Energy Corporation	N/A
Ka Ga OWDZ	Offshore	Binh Thuan	600	Under development	Enterprize Energy, Renewable Energy Global Solution, PetroVietnam	Vestas
Binh Dai	Nearshore	Ben Tre	320	Under development	Thanh Thanh Cong Group	N/A
Tra Vinh 1	Nearshore	Tra Vinh	48	N/A	Tra Vinh Wind Power Corporation (South Korea), Modern Energy Management, Climate Fund Managers	N/A
Tra Vinh 2	Nearshore	Tra Vinh	96	N/A	Woojin Construction (South Korea)	N/A
Phu Coung	Nearshore	Soc Trang	800	Under development	Phu Coung Group, GE, Mainstream Renewable Power	GE
Khai Long	Nearshore	Ca Mau	100	Under construction	Cong Ly Construction-Trade- Tourism Company	GE
Tay Nguyen HBRE	Onshore	Dak Lak	28	Investment license granted	HBRE Wind Power Solution JSC	GE

Offshore development

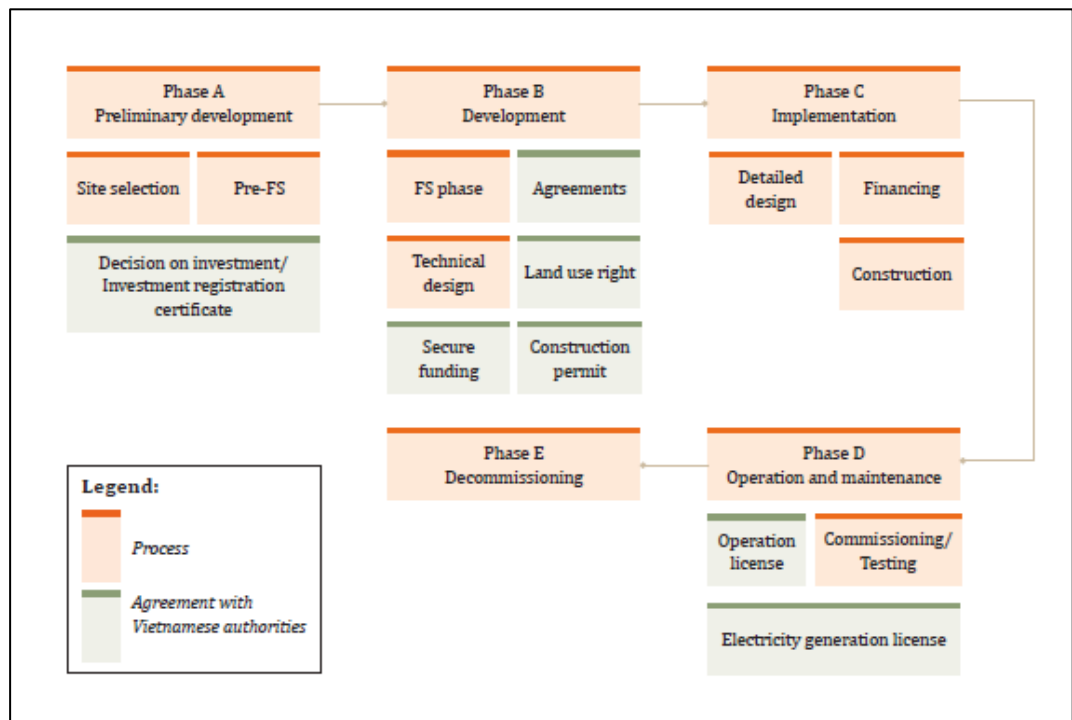
Development of offshore wind farms is taking its first steps according to some news bulletins from late 2017 and 2018. To what extent these developments are being realised and within what time frame, is hard to tell at the moment.³⁷

4.2 Development process of wind energy projects

Figure 4.2 presents a general overview of the project development process of wind energy projects in Vietnam. Many of these steps involve working with a government authority. In this respect, the Ministry of Industry and Trade and ERAV are the main authorities in charge of enforcing electricity regulations, while the provincial People's Committee is primarily responsible for project-related issues such as investment licensing, land, construction, environment, and fire protection³⁸.

³⁷ <http://www.vir.com.vn/doosan-heavy-to-develop-offshore-wind-farm-in-vietnam-57584.html>;
<http://nangluongvietnam.vn/news/en/nuclear-renewable/implementing-the-vietnam-offshore-wind-power-project.html>

³⁸ Source: Renewables in Vietnam: Opportunities for Investment. Allens 2017.

Figure 4.2 Overview of wind energy project development³⁹

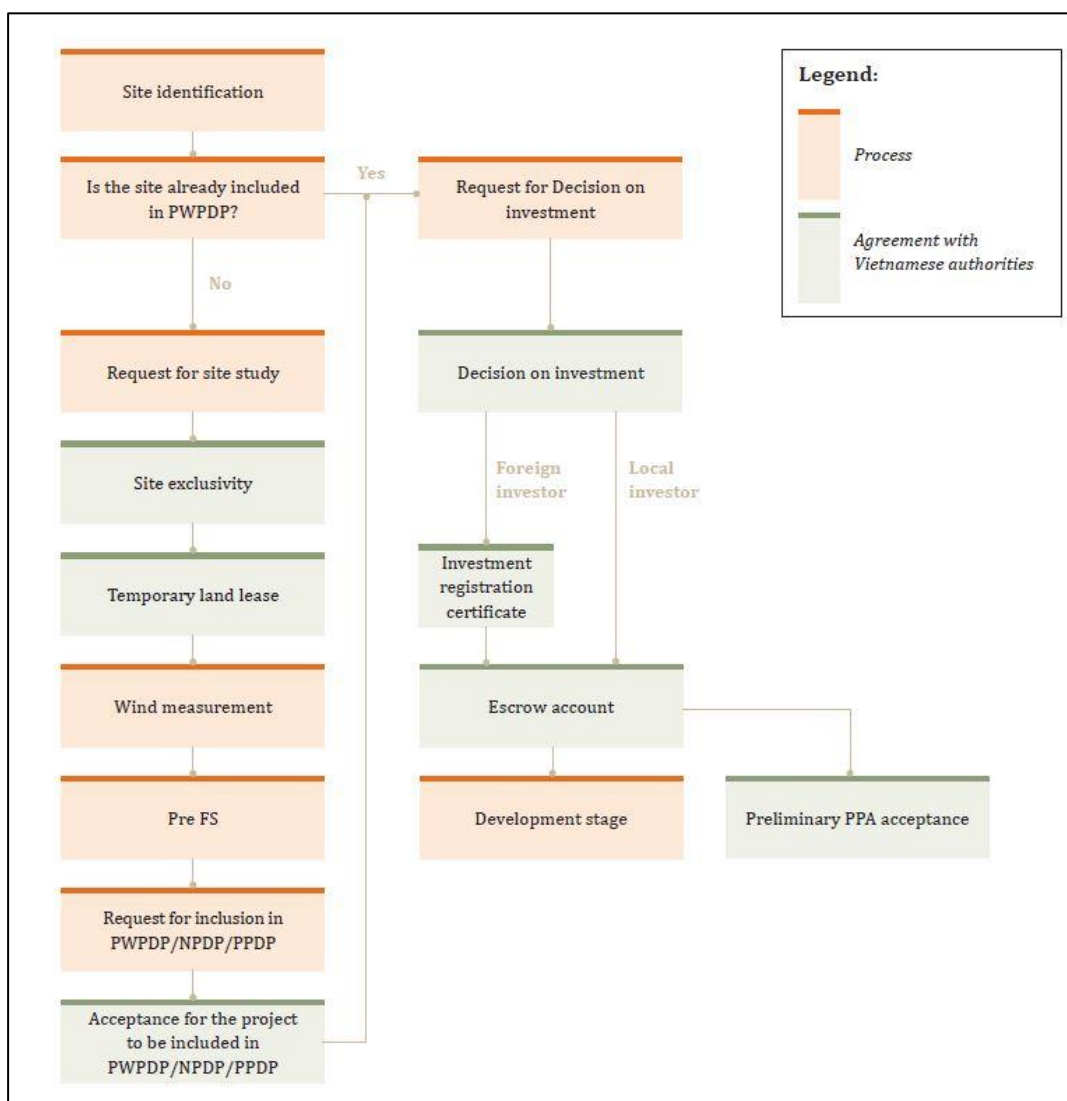
4.2.1 Preliminary development

This phase covers the preliminary development of the project, which starts with the site selection and ends when the developer/ investor opens the escrow account and obtains the decision on investment.

In the preliminary development phase it is important for the project developer to apply for inclusion of the project in the Provincial Wind Power Development Plan (PWPDP) (see also paragraph 4.1.3). If the project is not included in the PWPDP, the project developer/ investor has to submit project documents, like wind measurement reports and pre-feasibility study for the inclusion into the PWPDP (see Figure 4.3). For sites already included in the PWPDP, wind measurements might be already available. Nevertheless, it is recommendable to perform specific wind measurements on-site according to bankable standards. It is possible to obtain site exclusivity for a site already included in the PWPDP if bankable wind resource assessments are not available. Starting early with measurement activities will contribute in shortening the development period of the project. The duration of this first phase is estimated at 6 months up to 1.5 year for project sites with existing wind data and from 12 months to 24 months for sites without any wind data available (wind data is to be collected for at least 12 months).⁴⁰

³⁹ Wind power investment guidelines. Volume 2: wind power financing in Vietnam. GIZ, 2016.

⁴⁰ Wind power investments guidelines. Volume 1: project development. GIZ, 2016

Figure 4.3 Preliminary development phase⁴¹

Usually projects over 50MW must be approved by the Prime Minister and those under that threshold by the MOIT. Moreover, foreign investors require an Investment Registration Certificate and the project developer has to establish a project company by obtaining an Enterprise Registration Certificate.

4.2.2 Development, Construction & Operation

During this phase, the developer/ investor has to obtain a certain number of agreements and authorisations, like a construction permit, land use agreement and the Power Purchase Agreement with EVN. The basis for obtaining these agreements is a bankable feasibility study, which contains all necessary input and information required to approach the different administrations. The permitting process is estimated to take between 1 and 2 years, according to the current regulatory framework. However, the experiences of operational and ongoing wind

⁴¹ Wind power investments guidelines. Volume 1: project development. GIZ, 2016

power projects suggest that development times are between 2 to 4 years.⁴² In order to be operational, it is essential to facilitate the grid connection and make Power Purchase Agreements with EVN. The project developers must bear the costs and risks of connecting the plant to the transmission grid.

A study of the GIZ Energy Support Programme states that the development of wind energy projects, and especially the permitting procedures, are relatively complex and can act as a disincentive for potential investors. Moreover, the guidelines for project development work differently in different provinces of Vietnam.

The final phases of wind energy projects is the actual construction, operation and maintenance and decommissioning. Once the project is fully erected, an Electricity Generation License is granted in order to start electricity production.

4.2.3 Wind energy finance

Vietnam's government is targeting keeping public debt, comprising central government debt, government-backed loans, and local government debt, below 65 percent of GDP between 2016 and 2018. Therefore central government will not provide guarantees for new domestic and external loans. Large investments or guaranties to underpin large privately-financed infrastructure, like wind farms, are therefore not likely to be provided. This means attracting private investment is crucial for the development of large wind energy initiatives.⁴³

Most financing structures for wind power projects will involve: 1) the establishment of a special purpose vehicle (SPV or "project company"); 2) equity from one or more investors, injected directly or via the project developer into special purpose vehicle; and 3) non-recourse (project finance) or limited-recourse debt from one or more lenders, secured against the assets owned by the SPV.

Wind energy projects typically require significant capital investment and as a result are often financed with a significant portion of debt capital. Local Vietnamese banks appear to lack the financial capital, knowledge and trust to finance wind energy projects. Therefore it is unlikely that the domestic Vietnamese banks alone will be able to provide sufficient funds to finance projects to meet the Government's targets. That means that foreign investors and banks must account for a large part of the required capital investments of wind energy projects to support the desired wind energy development in Vietnam. International banks require a large degree of certainty in their investments. Uncertainties concerning the Power Purchase Agreement (PPA) such as threat of possible curtailment by EVN, and the lack of a wind energy supply chain in Vietnam have a negative effect on foreign investments. Participation of development banks (like for example the Dutch FMO) and specific funds (like for example Climate Investor One, a Dutch based fund active at the Vietnam wind energy market) can have a positive influence on financing possibilities, because of their experience with investing in developing countries and mitigating risks.

⁴² Wind power investment guidelines. Volume 1: Project development. GIZ, 2016

⁴³ For more information, see for example: United Nations ESCAP, Infrastructure Financing Strategies for Sustainable Development in Viet Nam, National Study / Paper, 15 September 2017; <http://english.vietnamnet.vn/fms/business/177203/vietnam-s-public-debt-ceiling-set-at-65--of-gdp-for-2016-2018.html>; <https://blogs.duanemorris.com/vietnam/2017/10/25/public-debt-puts-the-squeeze-on-government-guarantees-stifling-project-finance-projects-in-vietnam/>.

Independent Power Producer (IPP)

Most present wind power projects are registered in the form of Independent Power Producer (IPP) projects. IPPs are companies who develop, operate, and own an infrastructure for an indefinite time. Currently, IPPs are only participating in small power projects in Vietnam. Most of the foreign investments are currently organized in a BOT (Build-Operate-Transfer). This is a form of Public-Private-Partnership (PPP) where a foreign investor builds a power generation project, operates it for a period, and then transfers it to the Vietnamese government. There is no restriction on foreign ownership for such projects. Moreover, with a BOT project it is easier to obtain more government guarantees, especially in terms of EVN's obligation to purchase all electricity from the project.⁴⁴ Finally, with low feed-in-tariffs and high production costs, BOT or other forms of PPP, is the most effective means of entering the market to minimize risks.⁴⁵

However, even though some high-profile, foreign-invested, thermal power projects have been implemented in cooperation with the Government under the BOT, it does not appear that the Government will offer this kind of treatment for wind energy projects at large (except, perhaps, for very prominent ones).⁴⁶ Therefore, it is expected that most wind energy projects will have to be carried out as independent power projects. The main implication is there will be little room for investors to negotiate special terms or obtain Government guarantees.

With continued liberalization of policies, Vietnam has seen a steady increase in foreign investment in power projects. The total capacity of foreign-invested electric power producers (including fossil and renewable) accounted for 2,800 megawatts in 2015.⁴⁷

4.2.4 Feed-in-Tariff (FiT) for wind energy and tax exemption

The current FiT, in force since 2011, for wind energy in Vietnam amounts 7,8 US\$/kWh with a Power Purchase Agreement duration of 20 years. Although the FiT increased over the last few years, it is still too low to finance overall electricity generation costs. Moreover, neither the law nor the template power purchase agreements contain any adjustment mechanism for inflation or rising production costs, meaning the FiT may remain unchanged during the whole investment term. Therefore, the current FiT does not meet the expectation of wind power investors because it is too low to provide any profits and to guarantee bank loans. For these reasons the MOIT is working on a revision of the FiT to become more favourable for the commercial development of the wind sector.

The MOIT recently proposed to the Prime Minister a new draft Decision amending Decision No. 37 on the support mechanism for development of wind power projects in Vietnam (Draft Decision)⁴⁸. Under the Draft Decision, the FiTs are as follows: 8.77 US\$/kWh for onshore wind projects and to 9.97 US\$/kWh for offshore wind projects. This proposal is expected to attract more investors in the market as well as create incentive for current projects whose pre-feasibility reports have been approved by the MOIT to come into real operation. Nearshore wind projects can be accounted as offshore wind power projects as grid connected wind power projects that have wind turbines constructed and operated outside the average lowest sea edge over several years (18,6 years) off the coast.

⁴⁴ http://www.vietnam.ahk.de/uploads/media/5-Duane_Morris_Vietnam_LLC_Presentation_01.pdf

⁴⁵ <http://www.vietnam-briefing.com/news/vietnams-push-for-renewable-energy.html/>

⁴⁶ Renewables in Vietnam: Opportunities for Investment. Allens, 2017.

⁴⁷ <http://www.vietnam-briefing.com/news/vietnams-push-for-renewable-energy.html/>

⁴⁸ <https://www.bakermckenzie.com/en/insight/publications/2017/09/vietnam-wind-power-projects/>

Besides, wind power projects can also apply other non-tariff incentives from the government, such as import duties, corporate tax income and land use fee reductions or exemptions. Machines and materials, that are not produced domestically and imported as fixed assets of the projects, are entitled to import duties exemption. Moreover, wind energy projects are considered as projects in a special priority sector for investment and entitled to low corporate income tax rates, exemption, and reduction in accordance with the applicable corporate income tax law. Finally, wind energy operators are also subject to exemption and reduction of land use fee and rental in accordance with the regulations governing projects in special priority sectors for investment.⁴⁹

Besides stimulating renewable energy through feed-in tariff, a study on auction mechanism is carried out. A first pilot on solar PV is to be expected.

4.2.5 Direct PPA's

The mechanism of direct delivery to end-users such as factories on the basis of an individual direct PPA (DPPA) is under studying between ERAV and USAID under the V-LEEP project. DPPA opens the possibility to come to steady long term agreements between an IPP and end-user under individual conditions. Especially when energy production and usage is not at the same location, ERAV will have to agree upon this and will have to work out standards and requirements to secure grid stability. Also a fee will have to be paid for the transportation of power through national grid. Multinational companies that want to fulfil their goals on a green, renewable, production process are interested in this option of DPPA.

⁴⁹ http://www.vietnam.ahk.de/uploads/media/5-Duane_Morris_Vietnam_LLC_Presentation_01.pdf

5 BUSINESS OPPORTUNITIES IN VIETNAM'S WIND ENERGY SECTOR

In the previous chapters an overview of the Vietnamese energy sector, the wind energy potential and the current wind energy projects was provided. In this chapter the business opportunities of Dutch companies in the Vietnamese wind energy sector will be discussed.

Firstly (in paragraph 5.1), the current status of the Vietnamese wind energy sector will be elaborated upon by presenting a short overview of the previous chapters. Thereafter, the business opportunities and limitations will be identified by conducting a short SWOT-analysis (paragraph 5.2). Part of this analysis is also to identify the positions of the Netherlands, compared to other relevant countries. In result, business leads and actions will be identified for Dutch companies to exploit the opportunities of the Vietnamese wind energy market (paragraph 5.3).

5.1 Wind energy and the energy market

Renewable energy targets and wind energy

Vietnam is a country with a rapidly growing economy together with an increasing energy and electricity demand. To sustain the growing electricity demand, new power plants are being built, especially coal-fired power plants. Renewable energy sources like solar and wind energy are still a very small share in the total electricity production.

The last few years the Vietnamese electricity grid is extended and approximately 99 percent of the population is connected to the grid. The national energy grid of Vietnam is centrally operated by EVN. EVN is the single buyer of electricity and holds a monopoly on transmission and distribution. There are a few Independent Power Producers (IPP) in Vietnam, selling their electricity to EVN. Market mechanisms and competition are not yet in place in the energy sector of Vietnam and the electricity prices are kept low. However, the goal of the government is to develop a competition-based generation, wholesale and retail energy market until 2023, in particular in order to attract private and foreign investments in the energy sector. Currently, there are some experiments with the local production, purchase and usage of electricity by companies. Particularly some international companies are interested in the direct supply of renewable energy (direct PPA). EVN is however reluctant to support the direct supply of renewable energy via the national electricity grid.

The Vietnamese government have formulated ambitious goals for renewable energy, and more specifically for wind energy. Wind energy is presented as an important renewable energy source for the future. However the targets for wind energy in Vietnam are overambitious and not perceived realistic within the indicated timeframe.

Energy pricing and Feed-in Tariff (FiT)

In order to stimulate renewable energy production, a Feed-in Tariff (FiT) was introduced in Vietnam in 2011. The current FiT for wind energy in Vietnam amounts 7,8 US\$/ kWh with a Power Purchase Agreement (PPA) duration of 20 years. In the near future the FiT will be

increased to 8.77 US\$cent/kWh for onshore wind projects and to 9.97 US\$cent/kWh for offshore wind projects.

In order to obtain a PPA with EVN, a project must comply with several requirements, like a feasibility study and obtainment of relevant permits. A downside of the PPA is the possibility of curtailment by EVN. That means that EVN is not obliged to purchase all the electricity from a windfarm in cases of oversupply or instability in the electricity grid.

Wind energy potential and windfarm development

Wind resources

In Vietnam, several wind measurement studies are conducted. Vietnam is considered to have the best wind resources in Southeast Asia, especially in the nearshore/offshore and onshore coastal regions in the south of Vietnam. In these areas yearly average windspeeds of 9 to 10 meters per second are measured. Generally, windspeeds are declining further inland. Noteworthy is that Vietnam is vulnerable to extreme weather events like storms and typhoons, especially in July, August, September and October. The possibility of a typhoon is relatively high in these months, which can have severe consequences for the exploitation of windfarms.

Windfarm development onshore and nearshore

A key regulatory instrument for wind power in Vietnam are the Provincial Wind Power Development Plans (PWPDPs). These plans define priority areas for wind power development, for which wind measurement has already been conducted. Specific onshore and nearshore sites are selected, based on windspeed, topography, connection and accessibility to the energy grid, land use and buffer zones between potential areas. An estimated total installed capacity of 2.613 MW in 2020 and 15.717 MW in 2030 are allocated in the PWPDPs. The status of these designated areas are diverse: some are under development, under construction or unknown. Currently, the total installed wind power capacity is 186 MW, which is divided over four grid-connected wind farms with capacities ranging between 6 MW and 100 MW.

For more information on the permitting process for wind energy projects, see paragraph 4.2 and appendix 2.

Windfarm development offshore

Offshore wind energy development - further off-coast than nearshore wind energy - is not yet happening in Vietnam, although some initiatives have been launched. The main reason is that offshore wind energy is generally more expensive per produced kilowatt hour, compared to onshore and nearshore wind energy. Moreover, onshore and nearshore wind energy is still upcoming in Vietnam and many suitable onshore and nearshore areas are not yet under development. Offshore wind energy has advantages in terms of economies of scale, more space and higher wind speeds. The seabed within circa 50 kilometres from the shore in North and South Vietnam can be characterized as relatively shallow and consistent. Especially the coastline to the northeast of Ho Chi Minh City is very promising, due to the shallow water (ranging between 1 and 25 meters) within 50 kilometres from the shore and the highest offshore wind speeds of Vietnam. These conditions presents opportunities for cost-effective offshore wind energy development.

At this moment some – mainly non-Vietnamese - parties are exploring the possibilities of offshore wind energy. However the status of these developments could not be traced. When asked at the Ministry of Industry & Trade, Electricity & Renewable Energy Authority, it was indicated that there is interest in further research into the possibilities of offshore wind development.

Countries and companies already active at the Vietnamese wind energy market

Companies from countries that have been active in the Vietnamese wind energy sector for a long period of time such as Germany, Denmark, UK and USA have a better position for involvement in wind energy development than companies from, newcomer, the Netherlands. They can build on existing relationships with governments and relevant parties in the wind sector. In order to catch up, it is important to build contacts and relations with a wide variety of stakeholders in the Vietnamese wind development, from national and local governments to private sectors.

Financial resources and windfarm financing

Wind energy projects typically require significant capital investment and, as a result, are often financed with a significant portion of debt capital. Local Vietnamese banks appear to lack the financial capital, knowledge and trust to finance wind energy projects. That means that foreign investors and banks must account for a large part of the required capital investments of wind energy projects to support the desired wind energy development in Vietnam. International banks require a large degree of certainty in their investments. Uncertainties concerning the PPA (threat of possible curtailment by EVN) and the lack of a wind energy supply chain in Vietnam have a negative effect on foreign investments. Participation of development banks (like FMO) and specific funds (like Climate Investor One) can have a positive influence on financing possibilities because of their experience with investing in developing countries and mitigating risks.

Administrative and technical support

Currently, there is no established supply chain for wind energy development in Vietnam. That means that almost all specialized material, knowledge and experience must come from foreign countries. This situation could change over time.

It is expected that Vietnamese government will support project developers with wind energy development. It is however unclear how government allocate wind energy locations to project developers. For now it appears that the government follows the 'first-come, first-served' principle. In order to acquire certain positions or approvals, it could be more or less necessary to provide non-registered (financial) compensations to key stakeholders or government officials. Regarding CSR principles⁵⁰, this might be an obstacle for project developers or foreign investors.

5.2 Market Potential: SWOT analysis

A brief SWOT analysis is conducted to identify the Strengths, Weaknesses, Opportunities and Threats for participation of Dutch companies in the Vietnamese wind energy sector (see table

⁵⁰ Among the 180 countries listed in the 2017 Corruption Perception Index by Transparency International, Vietnam is in 107th place, with a score for 'perceived level of public sector corruption' of 35 points out of 100 (www.transparency.org). CSR in Vietnam is improving over the years, slowly but surely.

5.1). In this analysis strengths and weaknesses relate to internal factors of Dutch companies (such as a lot of wind energy expertise) and opportunities and threats relate to the external Vietnamese context. To exploit the opportunities It is important to use the strengths, to mitigate the weaknesses and to cope with the threats. The actions resulting from this are described in the following section.

Table 5.1 SWOT analysis for participation of Dutch companies in Vietnamese wind energy sector

S Strengths	W Weaknesses	O Opportunities	T Threats
In depth knowledge and expertise of wind energy.	Unknown with the details of wind energy development in Vietnam and local stakeholders.	A limited amount of wind energy projects are already under development in Vietnam. Opportunity for Dutch companies to engage in this unsaturated wind energy market.	Other countries and companies are already well-positioned in the onshore and nearshore wind energy sector in Vietnam. At the moment Dutch businesses manage to acquire a certain position in the wind energy market, more dominant and well-established parties might be able to take over the interests of Dutch businesses in the future.
Ability to support wind energy projects in every stage of development.	Relatively late to start-up active participation and involvement in Vietnamese wind energy sector.	Many of the designated areas in the PWPDPs are not yet allocated to a project developer.	Electricity production cannot cope with the rapidly increasing energy demand in Vietnam. Therefore, the construction of fossil fuel power plants remains dominant and wind energy development remains marginal.
When offshore wind development comes in sight: experience with a proven and cost-effective tender system for offshore wind energy development.		Offshore wind energy is still not present in Vietnam. Opportunity for Dutch companies to attain a good position in the upcoming offshore industry.	Capacity of the electricity grid is and remains for a long time insufficient to grid connect new large scale wind farms.
			Uncertain PPA's have negative effects on the financing opportunities of wind energy projects in Vietnam.

5.3 Business opportunities

Several business opportunities for Dutch companies in the Vietnamese wind energy sector can be extracted from the previous paragraphs. These opportunities differ for each phase and role in project development and realisation. The opportunities are described below on the basis of different roles in the development process, namely those of developer, financial specialists and investor, technical consultant and knowledge institute, constructor and supplier. Appendix 5 presents an overview of the developing supply chain in Vietnam (companies, institutes and governmental organisations already active in wind energy development).

5.3.1 Developers

A developer is faced with the necessary bottlenecks such as unclear and viscous procedures, missing supply chain and uncertain PPA. However in principle project developers have the possibility to obtain the right to develop wind energy locations registered in the PWPDPs. In order to develop wind energy projects, permits and (amongst others) a decision on investment / investment registration certificate have to be obtained. It is also possible to develop wind energy projects on locations outside areas designated in the PWPDPs. The permitting process for such locations will be more difficult and extensive (see for example especially figure 4.3).

A project developer can chose to sell its project during the different stages of the project development process or to build and exploit the windfarm and sell the electricity to EVN. In the future it might be possible for IPP's to use mechanisms to directly deliver electricity to end-users such as factories on the basis of an individual direct PPA.

Besides starting the development of a new wind energy project, project developers can also participate in or take over an existing project development. To participate in or take over an existing project it is essential to acquire the right knowledge of current projects, projects developers and investors who already obtained a 'decision on investment'. This knowledge can be acquired by connection and familiarity with the Vietnamese wind energy sector, and more specifically, with national and local government authorities that are providing the decisions on investments.

5.3.2 Financial specialists and investors

Financing wind energy projects in Vietnam is a difficult enterprise because of the several uncertainties. This is a barrier for financial possibilities, but also offers opportunities for financial advisors and banks to implement smart ways of financing by mitigating these uncertainties and related risks. For example by using a Build-Operate-Transfer concept or to attract lenders who are willing to accept the specific levels of risks that are present in Vietnam, like development banks and funds (for example FMO). Especially the PPA with EVN requires special attention for project financiers. The PPA should include sufficient certainty to guarantee a stable electricity price for an adequate period.

Acquiring contacts with project initiators and developers is needed in order to identify promising projects. Besides, knowledge of the Vietnamese wind energy sector and connections with governmental officials is important to determine the status and solidity of specific projects.

Financial specialist and investors will make use of non-Vietnamese technical advisors with experience in wind energy projects to perform due diligence studies and to guarantee development and construction of wind energy projects is performed in a proper way.

5.3.3 Technical consultants and knowledge institutions

Vietnam lacks knowledge on the development of wind energy projects in many fields and phases of the development process, and therefore foreign technical support and knowledge is necessary. As a result, it is typical of the Vietnamese situation that projects with little involvement of Vietnamese parties are established. This can stand in the way of longer-term support for development of wind energy in Vietnam. Working together with Vietnamese parties as much as possible will have a positive effect in this matter.

The acquisition of technical support contracts by technical consultants and knowledge institutions requires good contacts with initiators and developers of future and existing initiatives. Knowledge of the sector and good contacts with (provincial and national) governments are important in order to assess the status of projects. It is also important that technical consultants and knowledge institutions from the Dutch wind energy sector are seen as expert parties that can make a valuable contribution to projects.

In addition to working on wind energy, grid connection, grid stability and integration of wind energy in the electricity system are themes that require a lot of expertise as well. Dutch technical consultants are expected to be able to acquire assignments in these fields on bases of experience gained in Europe.

5.3.4 Constructors

Nearshore and especially offshore windfarms require specialized knowledge, expertise and materials. Dutch companies have a renowned reputation and a well-established international position because of their international involvement in offshore wind energy projects. Sufficient familiarity and connections with relevant stakeholders in Vietnam is important to be invited to enter into open tenders for the building of windfarms. Also direct involvement in project development as a co-investor, bringing investment capital, knowledge and experience, is well imaginable for larger construction companies.

Currently, offshore windfarms are not being developed in Vietnam and it is not expected to emerge on the short term (5 years from now). Unlike offshore windfarms, there are currently many nearshore windfarms under development that bring good opportunities.

5.3.5 Suppliers

As discussed before, Vietnamese wind energy sector lacks a well-established supply chain. This is an business opportunity for the Dutch several suppliers. At the moment there are only a few windfarms under construction, but this is expected to increase rapidly in Vietnam.

5.3.6 Advice on activities to be undertaken

In order to seize the above described business opportunities for Dutch companies in the Vietnamese wind energy sector, the following issues are key:

- Acquire familiarity and reputation as a relevant and interesting party in windfarm development in Vietnam, with private parties and national and local governments;

- Acquire knowledge on the current status of windfarm developments in Vietnam;
- Align with existing windfarm developments by getting involved in different phases in different roles.

These matters are not achieved by one or more simple actions, but require a long term effort. To start off, the following actions are proposed on the short term.

1. Establish connections with local governments

At present, there has been limited contact with local governments involved in wind energy in Vietnam. Especially in the provinces relevant for wind energy development, it is essential to establish connections with the provincial authorities because they are key stakeholders in windfarm development. Making use of already existing contacts from other sectors, like water management (and perhaps agriculture), can be useful.

It is advised to visit the right local government authorities with a small delegation as a good first step. The delegation could consist of representatives from the Dutch national government (for example from Dutch embassy or ministry of Economic Affairs and Climate Policy, one or a few specialist in the field of wind energy and some representatives of relevant companies interested to become structurally involved in the Vietnamese wind energy sector). Afterwards it is obviously important to have contacts on a frequently basis and strengthen the relation with the local governments.

During the meetings with local governments it is useful to gain information on the current status of windfarm developments in the concerned region and to discuss opportunities on how to become involved in existing and non-existing windfarm developments. Finally, it is important to know what private parties are already working on windfarm developments in the region and to try to get in contact with them.

2. Establish and strengthen connections with national governments: workshops offshore wind energy and electricity grid.

On the national level there are already some contacts established with relevant Vietnamese authorities like MOIT and EVN. These contacts are to be enhanced and extended by organising meetings and conversations. Instead of formal introductions, it could be more effective to organize meetings where the Netherlands present their distinguishable expertise, for example in offshore wind energy.

In recent meetings with government officials of MOIT and EVN the interest has been discussed to organise workshops together with Dutch government authorities, experts and Dutch companies to identify the opportunities in offshore wind energy development in Vietnam.

Relevant subjects could be:

- Wind resource assessment;
- Tender system;
- Expected costs of offshore wind energy;
- Available space and identifying other offshore functions (like shipping, fisheries, ecology etc.);
- Bathymetry and soil conditions;
- Construction possibilities of offshore windfarms (and how Vietnamese companies can contribute);

- Discuss the opportunities to start an offshore pilot project (for example the development of a small offshore windfarm near an off-grid island).

A second theme that meets great interest by Vietnamese authorities, is the influence of fluctuating renewable energy sources, like wind and solar energy, on the stability of the electricity grid. The grid stability is perceived to become a big issue, if the share of renewable and fluctuating energy sources would rapidly increase. This could slow down the wind energy developments in Vietnam. Therefore, it can be useful to organize a workshop with relevant Vietnamese government specialists (from EVN, ERAV, MOIT) and specialists from the Netherlands (from TenneT and consultancies in the field of energy grids) to discuss this issue and to explore solutions, opportunities and possible collaborations.

3. Acquire familiarity with private parties

Besides establishing contacts with local and national government officials it is relevant to get acquainted with private parties involved in the wind energy sector of Vietnam. These parties are for example large Vietnamese construction companies. Also construction companies and developers from other Asian countries like South Korea and Japan are already involved in the Vietnamese energy market.

Contacts could be established with these parties in an exploratory trade mission. Preparation is key to make sure to become acquainted with the right parties.

5.3.7 Planning

Wind energy is still in an early phase of development. The ambitions and the potential for wind energy in Vietnam is huge, but there is still little development in terms of concrete wind energy projects. Meanwhile, many international parties are interested in participating in the wind energy sector of Vietnam. Currently, some countries, like Denmark, Germany, USA and the UK, are already active in Vietnam. Therefore, it is advised not to wait too long to take the first steps. Ideally the above mentioned actions should be undertaken this year. The order of execution of the actions is indifferent, but it is wisely that the follow-up actions are aligned with previous steps. In this regard, most value could be achieved by firstly, 1.) establish contacts with southern provincial governments of Vietnam, 2.) subsequently organise the workshops on offshore wind energy and grid stability and 3.) afterwards (or parallel) the exploratory trade mission aimed at contacting private parties.

6 CONCLUSIONS

Wind energy potential

With this baseline study a good picture has been obtained of the current situation of the development of wind energy in Vietnam, its stakeholders and future perspectives. Vietnam is considered to have the best wind resources in Southeast Asia, especially in the nearshore/offshore and onshore coastal regions in the south of Vietnam. In these areas yearly average windspeeds of 9 to 10 meters per second are measured. Generally, windspeeds are declining rapidly further inland. Vietnam is vulnerable to extreme weather events like storms and typhoons.

Vietnam is a country with a rapidly growing economy together with an increasing energy and electricity demand. To sustain the growing electricity demand, new power plants are being built, especially coal-fired power plants. Renewable energy sources are still a very small share in the total electricity production, but ambitious targets have been set by the government. Vietnamese government are expected to support project developers with wind energy development. It appears that the government follows mainly the 'first-come, first-served' principle.

Wind farm developments

A key regulatory instrument for wind power in Vietnam are the Provincial Wind Power Development Plans (PWPDPs). These plans define priority areas for wind power development, for which wind measurement has already been conducted. Specific onshore and nearshore sites are selected, based on windspeed, topography, connection and accessibility to the energy grid, land use and buffer zones between potential areas. An estimated total installed capacity of 2.613 MW in 2020 and 15.717 MW in 2030 are allocated in the PWPDPs. The status of these designated areas are diverse: some are under development, under construction or unknown. Currently, the total installed wind power capacity is only 186 MW, which is divided over four grid-connected wind farms with capacities ranging between 6 MW and 100 MW.

Offshore wind energy development - further off-coast than nearshore wind energy - is not yet happening in Vietnam. Especially the coastline to the northeast of Ho Chi Minh City is very promising, due to the shallow water (ranging between 1 and 25 meters) within 50 kilometres from the shore and the highest offshore wind speeds of Vietnam.

Finance

In order to stimulate renewable energy production, a Feed-in Tariff (FiT) was introduced in Vietnam in 2011. The current FiT for wind energy in Vietnam amounts 7,8 US\$/kWh with a Power Purchase Agreement (PPA) duration of 20 years. In the near future the FiT will be increased to 8.77 US\$/kWh for onshore wind projects and to 9.97 US\$/kWh for offshore wind projects.

Local Vietnamese banks appear to lack the financial capital, knowledge and trust to finance wind energy projects. That means that foreign investors and banks must account for a large part of the required capital investments of wind energy projects to support the desired wind energy development in Vietnam. Uncertainties concerning the PPA (threat of possible curtailment by EVN) and the lack of a wind energy supply chain in Vietnam have a negative effect on foreign investments.

Business opportunities

Companies from countries that have been active in the Vietnamese wind energy sector for a long period of time such as Germany, Denmark and USA have a better position for involvement in wind energy development than companies from, newcomer, the Netherlands. However for Dutch companies, knowledge institutions and other organizations opportunities exist in upcoming Vietnamese wind energy market:

- *Developers*

Developers are faced with the necessary bottlenecks such as unclear and viscous procedures, missing supply chain and uncertain PPA. However, project developers have the possibility to obtain the right to develop wind energy locations registered in the Provincial Wind Power Development Plans.

- *Financial specialists and investors*

Financing wind energy projects in Vietnam is difficult because of the several uncertainties. This is a barrier for financial possibilities, but also offers opportunities for financial advisors and banks to implement smart ways of financing by mitigating these uncertainties and related risks.

- *Technical consultants and knowledge institutions*

Vietnam lacks knowledge on the development of wind energy projects in many fields and phases of the development process, and therefore foreign technical support and knowledge is necessary.

- *Constructors*

Nearshore and especially offshore windfarms require specialized knowledge, expertise and materials. Dutch companies have a renowned reputation and a well-established international position because of their international involvement in offshore wind energy projects. Besides being invited to enter into tenders for the building of windfarms it might be possible to participate direct in projects as a co-investor, bringing investment capital, knowledge and experience.

- *Components suppliers*

Vietnamese wind energy sector lacks a well-established supply chain. This is an business opportunity for Dutch suppliers. At the moment there are only a few windfarms under construction, but this is expected to increase rapidly in Vietnam.

In order to seize the above described business opportunities the following actions are recommended:

1. Establish connections with provincial governments, key in the permitting process of onshore and nearshore wind farms.
2. Establish and strengthen connections with national governments (MOIT, EVN, ERAV).
3. Acquire familiarity with private parties and concrete windfarm developments.

These matters are not achieved by one or more simple actions, but require a long term effort. To start off, contacts could be established with relevant parties in an exploratory trade mission combined with one or more seminars on specific topics like offshore wind energy.

APPENDIX 1

Overview of contacts during the verification and research mission in Vietnam, April 2018, Ho Chi Minh City and Hanoi.

Overview of contacts in Vietnam, April 2018, Ho Chi Minh City and Hanoi.

Date	Name	Function	Organisation	Seated in	Type of organisation
9-4-2018	Nguyen Trinh Hoang Anh	Vietnam Economics and Policy Advisor	Vietnam Initiative for Energy & Climate	Vietnam	Research institute
9-4-2018	Nguyen Viet Thang	MA, Principal Urban and regional Planner	IUPSD	Vietnam	Research institute
9-4-2018	Le Thi Huong Giang	Senior Trade Advisor	Consulate General of the Kingdom of the Netherlands	Vietnam	Government
9-4-2018	Carol Richter	Consul General	Consulate General of the Kingdom of the Netherlands	Vietnam	Government
10-4-2018	Le Truong Thuy	Chairman of BOM and Director General	Mai Chau Hydroelectric Joint Stock Company	Vietnam	Government
10-4-2018	Hugo Virag	Director, Asia Pacific	Astis Finance	Singapore	Private company
10-4-2018	Marat Zapparov	Senior Director	Cifford Capital	Singapore	Private company
10-4-2018	Raul van Bee	Director of Project Development SEA Energy Group	CanadianSolar	Singapore	Private company
10-4-2018	Eugene Teo	Deputy Sales Director, APAC	JA Solar	China	Private company
10-4-2018	Nguyen Trung (Randy) Kien	Project Developer Vietnam	UPC Renewables	Vietnam	Private company
10-4-2018	Thinh Ngoc Tran	Investment Officer	Global Green Growth Institute	Vietnam	Research institute
10-4-2018	Hanh Le	Deputy Country Representative	Global Green Growth Institute	Vietnam	Research institute
10-4-2018	Ritesh Pathan	Senior Vice President - Business Development	Scorpius Trackers	India	Private company
10-4-2018	Le Thanh Nghi	Chief Executive Officer	Hado Group	Vietnam	Private company
10-4-2018	Linh Ho	Partner	Hyperion	Vietnam	Private company
10-4-2018	Ken Coa	Senior Associate	Uniper Kraftwerke GmbH	Vietnam	Private company
10-4-2018	Greh Prabhav	Regional Director - Asia Pacific - Energy Services	Uniper Kraftwerke GmbH	Singapore	Private company
10-4-2018	Rahul Agrawal	Investment Principal	Actis	India	Private company
10-4-2018	Vuong Quang Thai	Deputy Manager - Business Development Department	Petrovietnam Technical Service Corporation (PTSC)	Vietnam	Private company
10-4-2018	Nguyen Anh Tuan	CEO	Hoabinh construction group	Vietnam	Private company
10-4-2018	Nguyen Trinh	Business Development Manager	Australian Government	Vietnam	Government
10-4-2018	Prof. Tran Dinh Long	Full member of IAFS, Vice President of VEEA, Prof. of Hanoi University of Science and Technology	IAFS, VEEA, HUST	Vietnam	Research institute
10-4-2018	Jacky Kang	Country Business Leader - Electronics and Energy Business Group	3M	Vietnam	Private company
10-4-2018	Scott Barros	Environment Team Lead	USAID	Vietnam	Government
10-4-2018	Jon Larsen	Economic Officer	Consulate General of the United States of America	Vietnam	Government
10-4-2018	Hanh Ngo Dang Luu	Chairman - General Director	ANH Minh Global solar company	Vietnam	Private company
10-4-2018	Vu Chi Mai	Head of Component Renewables Energy Technical Advisor	GIZ	Vietnam	Government
10-4-2018	Dzung Vu	Senior Associate	LVN & Associates	Vietnam	Private company
10-4-2018	Matthew Lerner	Senior Registered Foreign Lawyer	Watson Farley & Williams	Hong Kong	Private company
10-4-2018	Alma Roxas Agula	Vice President for Project Acquisitions - Asia	HT Sustainable Development Consulting Group	Philippines	Private company
11-4-2018	Phuong Nguyen Ha	Director	CJR Renewables	Vietnam	Private company
11-4-2018	Phan Thanh Tung	Business Development Manager - APAC/Vietnam	GIZ	Vietnam	Government
11-4-2018	Soma Lloret	Principal Technical Advisor / Head of Project	Watson Farley & Williams	Hong Kong	Private company
11-4-2018	Christopher Osborne	Partner	Greenenergy Solution	Philippines	Private company
11-4-2018	Ruth Briones	Chairman / CEO	Cobra	Spain	Private company
11-4-2018	Santiago Palacios	Director of Business Development Southeast Asia	The Lantau Group	Hong Kong	Private company
11-4-2018	Sarah Fairhurst	Partner	Symbior Solar Ltd.	Thailand	Private company
11-4-2018	Florian Benhold	CEO	ENGIE	Thailand	Private company
11-4-2018	Hein Oomen	Head of Business Development ENGIE solar / Asia-Pacific	Vietnam Institute of Seas and Island	Vietnam	Research institute
12-4-2018	Du van Toan	Head, Division of Marine Resources and Climate Change Research	Green Innovation and Development Centre (GREENID)	Vietnam	Research institute
12-4-2018	Nguyen Hai Long	Project Officer	Embassy of the Kingdom of the Netherlands	Vietnam	Government
12-4-2018	Marc van der Linden	First Secretary - Economic & Commercial Affairs	FMO	Nederland	Financial institution
12-4-2018	Pedro Zwart	Investment Officer - Energy - Asia/ECA	FMO	Nederland	Financial institution
12-4-2018	Geert Fijnaut	Investment Officer - Energy	Ministry of Industry & Trade, Electricity & Renewable Energy Authority	Vietnam	Government
13-4-2018	Bui Quoc Hung	Deputy General	Ministry of Industry & Trade, Electricity & Renewable Energy Authority	Vietnam	Government
13-4-2018	Le Anh Duc	Director - Power Market Development Research and Training Center	Minister of Industry & Trade, Electricity & Renewable Energy Authority	Vietnam	Government
13-4-2018	Nguyen Ngo Phong	Director of PR and Licensing Department	Minister of Industry & Trade, Electricity & Renewable Energy Authority	Vietnam	Government
13-4-2018	Nguyen the Huu	Director of Planning and Demand Supply Balance Monitoring Department	Ailorope Partners	Canada	Private company
13-4-2018	Evan Scandling	Expert - The Power Market Department	EVN	Vietnam	Government
13-4-2018	Phan Thi Bich Hong	International Relation Department	EVN	Vietnam	Government
13-4-2018	Nguyen Ti van Ly	Director Electricity Market Department	EVN	Vietnam	Government
13-4-2018	Tran Dan Khoa	Director Electricity Market Department	EVN	Vietnam	Government

APPENDIX 2

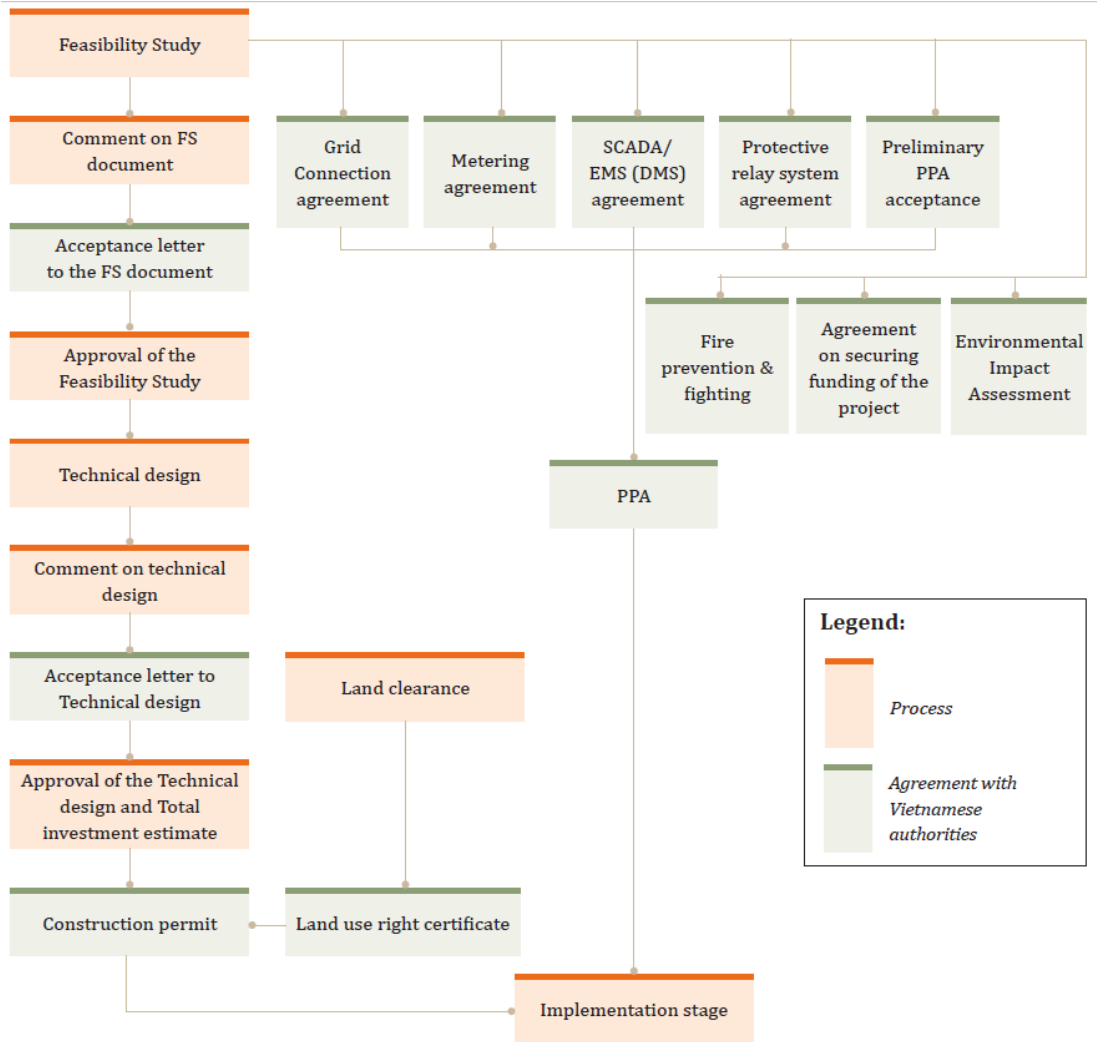
Permitting process

Phase B: Project development

This phase covers the development of the project, which starts with the decision on investment and ends with the implementation phase. During this phase, the developer/ investor has to obtain a certain number of agreements and authorisations. The basis for obtaining these agreements is a bankable feasibility study, which contains all necessary input and information required to approach the different administrations. This phase is expected to be completed in 1 to 2 years, depending on the quality and outcome of the feasibility study, which may trigger further queries and clarifications.

Source: Wind Power Investment Guidelines, Volume 1: Project Development, Technical Assistance to the General Directorate of Energy, Ministry of Industry and Trade, MOIT/GIZ Support to the Up-Scaling of Wind Power in Viet Nam, July 2016. (All requirements and requested technical documents are described in this document as well.)

Phase B: Project development



APPENDIX 3

Provincial Wind Power Development Plans

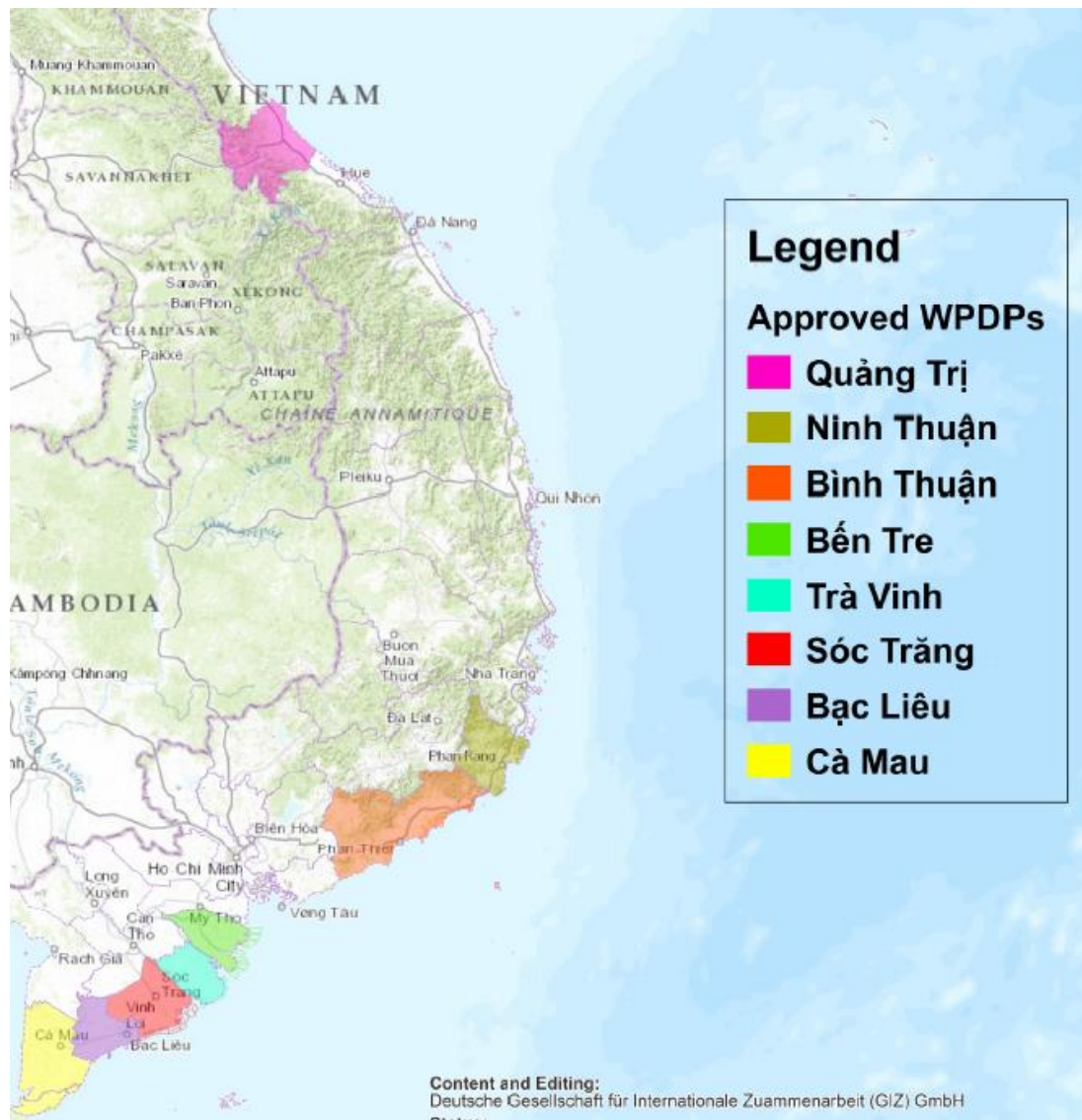
These plans define priority areas for wind power development, for which wind measurement has already been conducted. Currently, 9 provinces drafted their own PWPDP (Ninh Thuan, Binh Thuan, Soc Trang, Ben Tre, Tra Vinh, Quang Tri, Ca Mau, Bac Lieu and Thai Binh)¹. All above mentioned provinces, (mainly southern provinces) have a high potential in terms of wind resources. The maps of two provinces with appointed areas with a programmed total power larger than 1,000 MW are enclosed below (provinces of Ben Tre and Soc Trang).

Detailed maps can be found at:

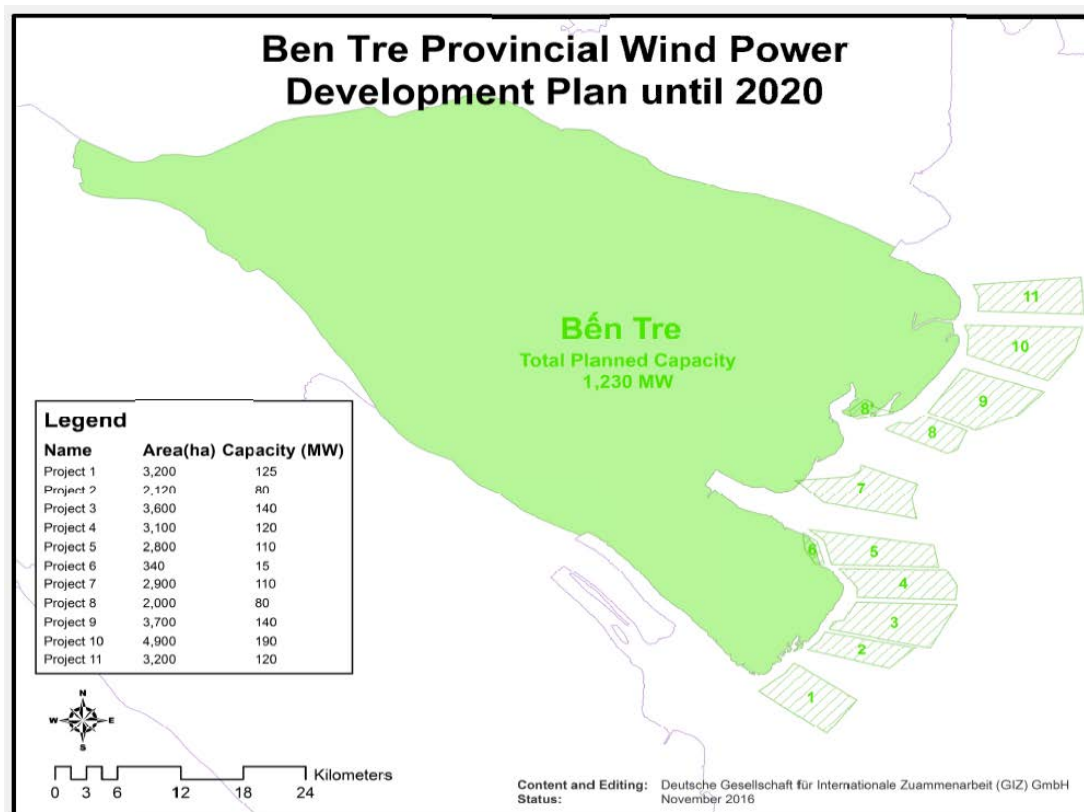
<https://www.google.com/maps/d/viewer?mid=1NHY5MwPrzOgHvKXpWl3D9aDulas&msa=0&ll=13.135654757109288%2C107.5975224893798&spn=0.044708%2C0.077162&z=6>

¹ Wind power investments guidelines. Volume 1: project development. GIZ, 2016

Overview of provinces with Provincial Wind Power Development Plans

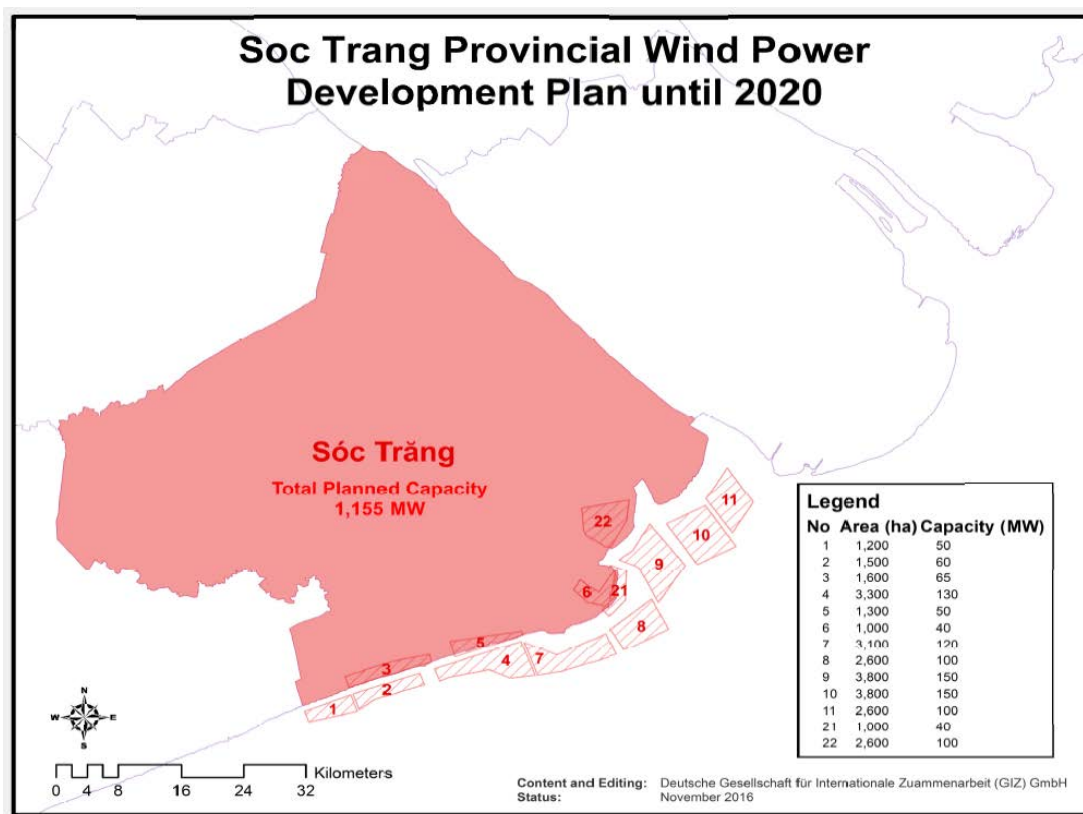


The maps and project details of two provinces (Ben Tre and Soc Trang), each with a total planned capacity greater than 1,000 MW, are included below.



Ben Tre Province - Project Data

Project Name	Capacity (MW)	Status	Project Investors/ Developers
Project 1	125	N/A	N/A
Project 2	80	N/A	N/A
Project 3	140	N/A	N/A
Project 4	120	N/A	N/A
Project 5	110	N/A	N/A
Project 6	15	N/A	N/A
Project 7	110	N/A	Woojin Construction Co., Ltd. (South Korea)
Project 8	80	N/A	N/A
Project 9	140	N/A	N/A
Project 10 (Binh Dai 1)	190 (phase 1: 6MW Phase 2: 24MW)	Under development	Thanh Thanh Cong Group (Vietnam)
Project 11 (Binh Dai 1)	120	Under development	Thanh Thanh Cong Group (Vietnam)



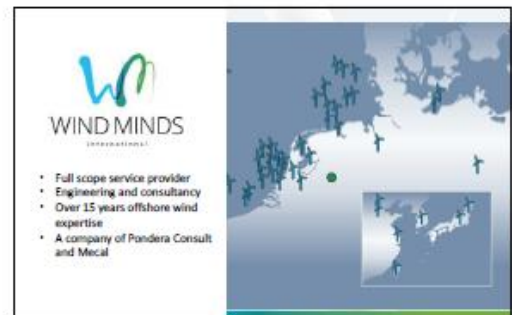
Soc Trang Province - Project Data

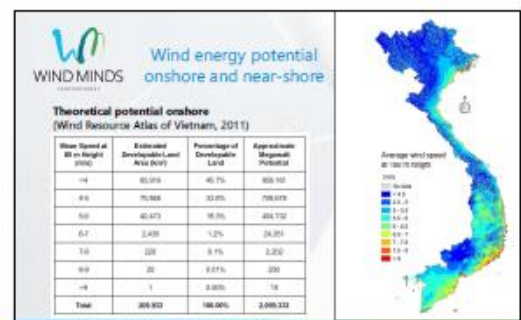
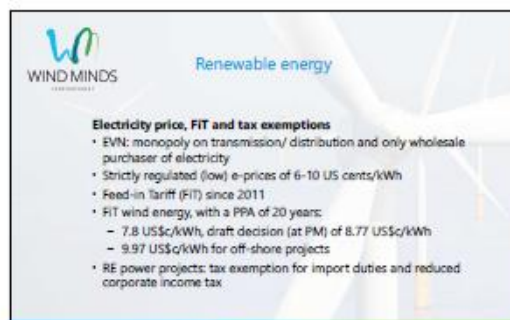
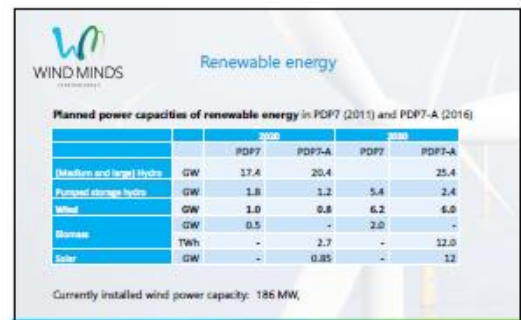
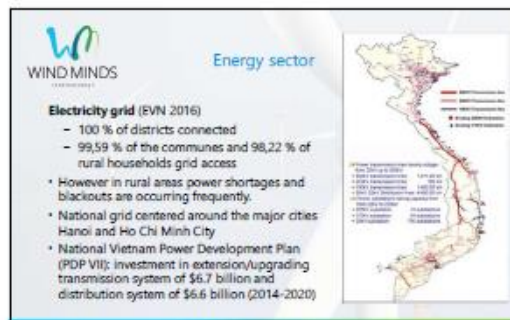
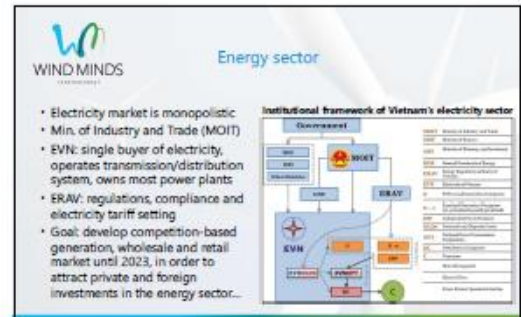
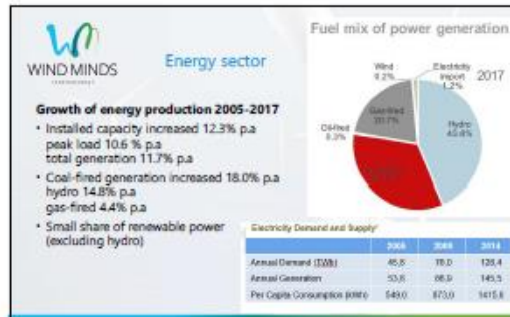
Project Name	Capacity (MW)	Status	Project Investors/ Developers
Project 1	50	N/A	N/A
Project 2	60	N/A	N/A
Project 3	65	N/A	N/A
Project 4	130 (phase 1: 30MW)	Investment License granted Feasibility Study under development	Phu Cuong Group (Vietnam)
Project 5	50	N/A	N/A
Project 6	40	N/A	N/A
Project 7	120	N/A	N/A
Project 8	100	N/A	N/A
Project 9	150	N/A	N/A
Project 10	150	N/A	N/A
Project 11	100	N/A	N/A
Project 21	40	N/A	N/A
Project 22	100	N/A	N/A

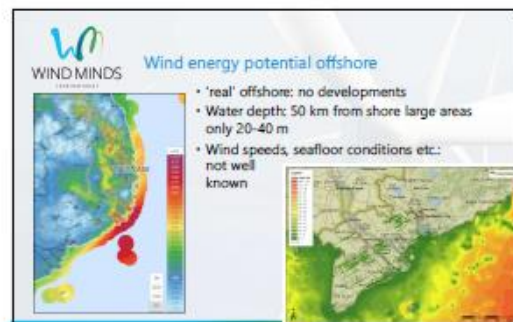
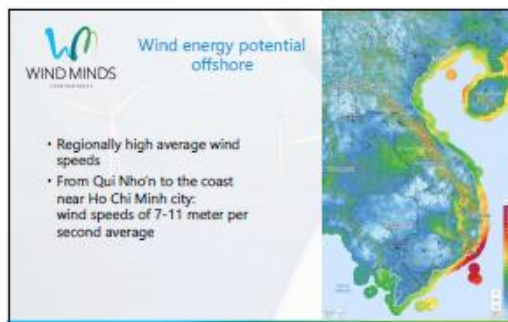
APPENDIX 4

Presentation to Dutch wind energy sector

Slides from the presentation on May 31 2018 to the Dutch wind energy sector (joint meeting of HHWE, NWEA and IRO) of the findings of the baseline study wind energy Vietnam.







Project	Onshore/offshore	Province	Capacity	Project developer	Construction company	Manufacturer	Investor
Phu Lac windfarm	Onshore	Bach Thuan	50MW	Thuan Binh Wind power joint stock company	Hydropower Class	Vestas	KfW Development bank
Do Thang windfarm	Onshore	Bach Thuan	30MW	Vietnam Renewable Energy Joint Stock Company	CTV (France), HCB (Germany)	Fuhrlander	Austrian bank
Phu Quoc windfarm	Onshore	Bach Thuan	60MW	Potential Power Renewable Energy Limited Company	Vietnam Power Corporation	Vestas	Local banks
Bac Lieu Windfarm	Offshore (nearshore)	Bac Lieu	99MW	Cong Ty Construction and Trading Company	Big Hang Transport and Logistics (ITL) and GE	GE	Vietnam Development Bank, US Export Import Bank, Import Bank

Project	Location	Capacity (MW)	Owner	Developer	Estimated completion
Sheng Ding	Guizhou	50	Government	Guo Jingguo Wind Company	N/A
Sheng Lian	Guizhou	50	Under development	Tan Shun Gao Wind Corporation	2010
Guang Kai	Guizhou	10	Under construction	WFO (China L)	N/A
Shengbin	Guizhou	100	Government	Guizhou Energy	N/A
Tangguo	Guizhou	50	Under construction	Tangguo New Group	2010
Sheng Sheng (Lian)	Guizhou	100	Government	Guizhou Wind Group (Shengbin)	N/A
Sheng Sheng	Guizhou	20	Under construction	Sheng Sheng (Shengbin)	2010
Sheng Sheng	Guizhou	50	Under construction	The Sheng Sheng (Shengbin)	N/A
Sheng Sheng	Guizhou	20	N/A	Sheng Sheng (Shengbin)	N/A
Sheng Sheng	Guizhou	50	Government	Sheng Sheng (Shengbin)	N/A



The slide features a background image of a large, stylized wind turbine. In the top left corner, there is a logo consisting of a stylized 'W' made of two overlapping loops, one blue and one green, with the text 'WIND MINDS' and 'A COMMUNITY' below it. The title 'Wind energy development' is written in a blue, sans-serif font at the top center. The main content is organized into two sections: 'Main barriers to substantial private sector investments into renewable energy' and 'Several support program's, for example:'. The first section contains a bulleted list of three items: 'complex administration structure and legal framework low capacities for commercial project development', 'lack of reliable data', and 'limited access to financing'. The second section contains a bulleted list of one item: 'MOIT/GLZ Energy Support Programme (ESP)'. The slide is framed by a thin blue border on the left and bottom.

WIND MINDS
A COMMUNITY

Wind energy development

Main barriers to substantial private sector investments into renewable energy

- complex administration structure and legal framework low capacities for commercial project development
- lack of reliable data
- limited access to financing
- low electricity price

Several support program's, for example:

- MOIT/GLZ Energy Support Programme (ESP)



WIND MINDS
www.windminds.nl

Business opportunities

SWOT

- Strengths and Weaknesses: on basis of internal factors of Dutch wind energy sector
- Opportunities and Threats: on basis of external, Vietnamese, context
- Dutch companies: developers, financial specialists and financiers, technical consultants and knowledge institutions, constructors, suppliers



WIND MINDS
Business opportunities - SWOT

Strengths

- Sufficient knowledge and expertise in wind energy.
- Ability to support wind energy projects in every stage of development
- International expertise with proven and cost-effective tender system for offshore wind energy development

Weaknesses

- Unknown with development of wind energy in Vietnam and the local stakeholders
- Relatively late to actively participate in the Vietnamese wind energy sector



WIND MINDS
Business opportunities - SWOT

Opportunities

- Limited amount of wind energy projects in development (first stage): much more to come
- Many designated areas in PWPDPs not yet allocated to project developers
- Offshore wind energy not present in Vietnam: opportunity for Dutch companies to attain a good position in offshore industry

Threats

- Other countries and companies already well-positioned in the wind sector
- Capacity of electricity grid remains insufficient to connect wind farms
- EVN not able to deal with variable wind energy production: curtailments
- Instable PPA has negative effect on financing opportunities



WIND MINDS
Business opportunities

Developers

- participate or take over an existing project development
- start developing a new wind energy project

Financial specialists and investors

- Financing difficult smart solutions (BOT) and tailor made funds

Technical consultants and knowledge institutions

- lacks of knowledge and experience in every phase

Constructors

- Especially near-shore and offshore require specialized knowledge

Other suppliers

- Wind developments just started, via Western developers/contractors



WIND MINDS
Business opportunities

In order to seize the described business opportunities

- Acquire familiarity and reputation as a relevant and interesting stakeholder in windfarm development in Vietnam with private parties and national and local governments
- Acquire knowledge on the current status of windfarm development in Vietnam and its stakeholders
- Align with existing windfarm developments by getting involved in different phases and in different roles



WIND MINDS
Proposed actions on short term

- 1. Establish connections with local governments**
 - Provincial authorities are key stakeholders in windfarm development.
 - Aim at (southern) provinces relevant for wind energy development
 - Dedicated small Dutch delegations to contact directly; ensure continuity
- 2. Establish/strengthen connections national governments (MOIT/EVN etc.)**
 - Present distinguishable expertise, for example at workshops on: offshore wind energy and renewables and the electricity grid
- 3. Acquire familiarity with private parties: 'orientation mission'**
 - Construction companies and developers from Vietnam, South Korea, Japan
 - Preparation is key to meet with the right parties.



WIND MINDS
To conclude / wrap-up

Wind energy development in Vietnam

- Promising wind potential
- Ambitious governmental wind energy goals
- At present still slowly developing
- Germany, UK, Denmark, USA, ... are ahead
- Action needed on short notice
- Stepwise approach
- Use our USP's!

APPENDIX 5

Supply chain and regulatory authorities

Within the life cycle of a wind energy project several phases can be distinguished. Figure 1. give a possible division (dismantling and abandonment could be added as phase 6). Within each phase consultants, developers, knowledge institutes and other organisations and companies can contribute. Each phase can be detailed out into many elements and aspects ranging from policymaking to building and from designing to hardware fabrication. Together all contributing parties form the supply chain for wind energy development.

Figure 1. Phases in wind energy project development



Although at the moment Vietnam lacks a well-developed wind energy supply chain, some companies and businesses that are active or want to be active in the developing wind sector in Vietnam are worth mentioning. A subdivision is chosen in in developers, financial specialists and investors, technical consultants and knowledge institutions, construction companies and suppliers. After that some of the most important regulatory authorities and governmental organisations are presented.

SUPPLY CHAIN

Developers

Developers of operational windfarms in Vietnam

- Thuan Binh Wind power Joint stock company (owned by EVN); <http://www.tbw.com.vn/en/>
- Vietnam Renewable Energy Joint Stock Company (owned by EVN)
- Petrovietnam Power Renewable Energy Limited Company (state owned company); <http://www.pvn.vn>
- Cong Ly Construction and Trading Company LTD; Ca Mau City, Ca Mau province, Vietnam

Developers of wind farms in development

- Viet Rien Joint Stock Company
- Tan Hoan Cau Joint Stock Corporation; <http://tanhoancaugroup.com/en>
- EVN Genco 2, Power generation corporation 2 (owned by EVN); <http://evngenco2.vn/>
- Trung Nam Group; <https://www.trungnamgroup.com.vn/>
- Asia Clean Energy Development and Investment
- Hao Phong Clean Energy JSC
- Asia Renewable Energy Corporation; <http://www.renergy.vn>
- Thanh Thanh Cong Group; <https://www.ttcgroup.vn>
- Phu Cong Group; <http://phucuonggroup.com/>
- HBRE Wind Power Solution JSC, HCMC, www.hbre.vn

Active foreign developers

- Landville Energy (South Korea)
- Enfinity Ninh Thuan Company (Belgium)
- EAB New Energy GmbH (Germany)
- The Blue Circle (France)
- Tra Vinh Wind Power Corporation (South Korea),
- Woojin Construction (South Korea)
- GE (USA)
- Mainstream Renewable Power (Ireland)
- Renewable Energy Global Solution (Australia)
- Enterprize Energy (Singapore)

Financial specialists and investors

Operational wind farms

- Agribank Vietnam; <http://agribank.com.vn>
- Local banks
- Vietnam Development Bank; <https://en.vdb.gov.vn/>

Active foreign investors

- KfW Development bank (Germany)
- US Export Import Bank (USA)
- Modern Energy Management (USA)
- Climate Fund Managers (Netherlands)

Technical consultants and knowledge institutions

- PECC3: Power Engineering Consulting Joint Stock Company 3 is one of four consulting companies under Electricity of Vietnam specialized in implementation of construction consultancy for power source and network projects such as: thermal power plants, hydro power plants, power transmission lines, power substations, renewable energy projects and other industrial projects.
Viet Nam (headquarters): Ho Chi Minh, 32 Ngo Thoi Nhiem Str., Ward 7 District 3, <https://www.pecc3.com.vn/en/>
- ANT Consulting; <http://www.antconsult.vn>
- University of Science and Technology of Hanoi, Clean Energy and Sustainable Development (CleanED) lab: <http://about.cleand-ed-usth.com/>
- Institute of Energy Vietnam; No. 6 Ton That Tung Street, Dong Da District, Hanoi, Vietnam; <http://iev.vn.com.vn/>
- Research Center for Thermal Equipment and Renewable Energy (RECTERE), Ho Chi Minh City Technical University; <http://www.hcmut.edu.vn/en>

Construction companies

Operational wind farms

- Petro Vietnam Power Corporation
- PCC5, Power Consultant Investment and Construction Joint-Stock Company No.5, HCMC; www.pcc5.com.vn

Active foreign construction companies

Hydropower China

- CTV (France)
- HCE (Germany)
- GE

Suppliers

- GE Vietnam, Haiphong, <https://www.ge.com/vn/>
In 2009, GE established a manufacturing plant in the seaport city of Haiphong in response to the growing global demand for power generation equipment and in support of cleaner energy production. The factory produces mainly for export but also for local demand, supplying for example the 62 wind turbines for Vietnam's first wind farm in Bac Lieu province and 14 turbines in Phase I of Tay Nguyen Wind Farm project (to be completed in 2020).
- CS Wind, wind turbine towers, Phu My Industrial Zone No.1 Tan Thanh District, Baria-Vungtau Province, Vietnam; <http://www.cswind.com>

REGULATORY AUTHORITIES AND GOVERNMENTAL ORGANISATIONS

Governmental organisations are of great importance for the development of wind energy, figure 2.3 on page 11 in this report gives an overview of the different government agencies that are involved in policy making and the electricity system in Vietnam. To mention in particular:

Ministry of Industry and Trade (MOIT)

Address 54 Hai Ba Trung Street,
Hoan Kiem District,
Hanoi, Vietnam
T (84) 4 22 202 222
F (84) 4 38 264 696; (84) 4. 22 202 525
E moit@gov.vn
W www.moit.gov.vn

Main responsibilities of MOIT:

- Prepares the national electricity development plans and submits them to the Prime Minister for approval.
- Publicises, guides, and monitors the implementation of the approved plans.
- Co-ordinates with the Ministry of Finance to prepare the relevant price brackets and adjustments, and submits the same to the Prime Minister for decision.
- Issues relevant licences.

Electricity Regulatory Authority of Vietnam (ERAV)

Address D10 Khuat Duy Tien Street,
Thanh Xuan District,
Hanoi, Vietnam
T (84) 4 22 147 474
F (84) 4 35 543 008
W <http://www.erav.vn>
E DTDL@moit.gov.vn

Main responsibilities of ERAV (a sub-unit within the MOIT):

- Formulates and regulates the electricity market.
- Regulates electricity prices.
- Supervises the balance between supply and demand in electricity.
- Issues relevant licences.
- Inspects the electricity business.

Vietnam Electricity (EVN)

Address headquarters:
No. 11 Cua Bac Street, Truc Bach Ward
Ba Dinh district, Hanoi City
T (84) 4 66 946 789
F (84) 4 66 946 666
W www.evn.com.vn

Main subsidiaries:

- Power production: 3 Power Generation Corporations (GENCO 1, 2, 3);
- Power Business: 5 Power Corporations, namely, Northern Power Corporation (EVNNPC), Central Power Corporation (EVNCPC), Southern Power Corporation (EVNSPC), Hanoi Power Corporation (EVNHANOI), the Ho Chi Minh City Power Corporation (EVNHCMC).
- Power transmission: National Power Transmission Corporation (EVNNPT).

Main responsibilities of EVN:

Production, transmission, distribution and trading of electricity; directing and operating the system of production, transmission, distribution and allocation of power in the national power system; import and export of electric power; investment and capital management in the power projects; management, operation, repair, maintenance, overhaul, rehabilitation and upgrading of the electrical, mechanical equipment, control and automation system of the line of production, transmission and distribution of electricity, power works and electrical testing.

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NL Enterprise Agency is the contact point for businesses, educational institutions and government bodies for information and advice, financing, networking and regulatory matters.

Netherlands Enterprise Agency is part of the ministry of Economic Affairs and Climate Policy.