USAID VIETNAM LOW EMISSION ENERGY PROGRAM (V-LEEP)

Component 2

RE Developer Characterization Report

September 29, 2016

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Component 2

RE Developer Characterization Report

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Acronyms and Abbreviations

CAPEX	Capital Expenditure
CHP	Combined Heat and Power
EAB	New Energy GmbH
EPC	Engineering, Procurement and Construction
EPTC	Electric Power Trading Company (EVN)
ERAV	Electricity Regulatory Authority of Vietnem
EVN	Electricity Vietnam
EVN-NLDC	National Load Dispatch Centre
EVN-PECC3	Power Engineering Consulting Joint Stock Company 3
EVN-PECC4	Power Engineering Consulting Joint Stock Company 4
EVN-TBW	Thuan Binh Wind Power Joint Stock Company
FIT	Feed-in-tariff
FS	Feasibility Study
GDE-MOIT	General Directorate of Energy – Ministry of Industry and Trade
GE	General Electric
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
KfW	Kreditanstalt für Wiederaufbau
MOC	Ministry of Construction
MOET	Ministry of Education and Training
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Science and Technology
MPI	Ministry of Planning and Investment
NPTC	National Power Transmission Corporation
O&M	Operation and Maintenance
OPEX	Operational Expenditure
PDP	Power Development Plan
PM	Prime Minister
PPA	Power Purchase Agreement
PPC	Provincial Peoples Committee
Pre-FS	Pre-Feasibility Study
RE	Renewable Energy
SBV	State Bank of Viet Nam
SPPA	Standardized Power Purchase Agreement
TOR	Terms of Reference
VEPF	Vietnamese Environmental Protection Fund

Executive Summary

The goal of V-LEEP Component 2 is to improve the enabling environment for clean energy and fast-track the implementation of projects that generate renewable energy (RE), thus reducing fossil fuel consumption in the Vietnamese economy. There are many hurdles to address to make this happen including: low energy prices, inconsistency in permitting and licensing, among other challenges, weak capacities of relevant stakeholders, lack of investment guidance and regulatory frame for clean energy development.

To address the enabling environment challenges and promote new RE projects, the V-LEEP team profiles the capacity of project developers to have better understanding on their characteristics, capabilities, their project preferences and how are they being supported by regulatory frameworks and state management.

Based on the above framework, V-LEEP conducted an assessment of wind, biomass power and solar PV developers in Vietnam. The main activities were undertaken by this study, including:

- Identify the wind, biomass and solar PV technologies and sectors that V-LEEP desires to target and evaluate the likelihood of penetration and adoption by project developers;
- Profile the project developers according to a characterization criteria contained herein, and
- Develop this characterization report which profiles current and future developers and identifies any gaps in the capacity to actually consummate renewable energy projects in Vietnam.

The key findings that characterize RE developers in Vietnam are summarized as follows:

- Site Surveys and Construction Requirements - Most developers are able to conduct and analyze site surveys and construction requirements; and are knowledgeable about permitting requirements. However, knowledge about estimating resource potential assessment is limited.
- Experience – Many developers with previous experience in conventional power projects are familiar with the process of power project development. However, there is a significant need for developers who are inexperienced in power development to be supported with capacity building such as: i) FS preparation; ii) acquiring energy operator license; building permit; iii) Obtaining electricity Production License Business registration and iv) arrangement for inclusion of the project into the National/provincial power development plan.
- Project Management – Many developers are weak at conducting activities related to management of engineering, procurement and construction in the RE sector.
- Equipment installation, commissioning, compliance check (safety, fire protection) and, environment issues - These capacities are relatively weak and should be strengthened.
- O&M procedures and processes – Experience and capacity is limited with respect to RE project development.
- Import tax, CIT exempted, land use, other incentives – These are not well understood by most developers.
- Power Purchase Agreements – Companies which have previously worked on major power projects have adequate skills here, but new RE entrants do not.
- Company Size - Many developers are newly established companies and are at small size and will need considerable technical and managerial strengthening to serve the RE market.

There is a significant need for capacity building in all the aforementioned areas and will be a fundamental component of the V-LEEP program. The body of this report characterizes RE project developers and what are the challenges in terms of their capacity, technical, financial expertise. The report also provides recommendations on policy that can support the development and implementation of the RE projects and selected actions for supporting the developers.

1. Approach

The analysis to characterize renewable energy developers in Vietnam was carried out by desk research and primary data/information collection activities. This is to profile the capacity of project developers to have better understanding on their characteristics, capabilities, their project preferences and how are they being supported by regulatory frameworks and state management. The outputs of the report then serve to address the enabling environment challenges and promote new RE projects.

The VLEEP team established a criteria for profiling and characterization of RE developers in Vietnam. The criteria are based on capacity of project developer through the whole cycle of project development. It covers development, construction and operation of renewable projects.

Table 1 Criteria for RE Developer Characterization

Criteria
1. Technical capabilities
1.1. Resource assessment and site selection
▪ Ability to analyze Resource utilization potential; siting and/or Transportation and logistics of the resource *(applicable for biomass only)* ▪ Ability to feed stock resource assessment and secure frame contract with the biomass suppliers *(applicable for biomass only)* ▪ Ability/knowledge on wind/solar potential assessment (*applicable for wind/solar power)* ▪ Ability to conduct desk research and potential site visits ▪ Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation) ▪ Ability to Carry out site survey/energy potential measurement ▪ Register the site with provincial committee
1.2 *Administration authorization*
▪ Business registration, ISO certificates ▪ Ability to arrangement for inclusion of the project into the National/provincial power development plan ▪ Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report ▪ Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License
1.3 *Engineering, Procurement and Construction*
▪ Knowledge of major machinery, engines ▪ Ability in detailed engineering management ▪ Ability in civil construction management ▪ Ability in equipment procurement management and quality control
1.4 Commissioning and Grid Connection
▪ Ability in management of equipment installation and commissioning ▪ Ability in management of Compliance check of all safety, fire protection, environment issues ▪ Knowledge in Grid connection testing and commissioning
1.5 O&M
▪ Knowledge in Standard operation and maintenance of power plant ▪ Knowledge in operation and transaction in electricity market ▪ Skills of operators and engineers ▪ Monitoring and Performance control ▪ Training and capacity building plan/programs
2. Financial capacities
▪ Ability of Economic and financial analysis of large scale grid-connected project ▪ Preparation of the due diligent package for project ▪ Financial closure ▪ Risk assessment capacity ▪ Ability in mobilizing financing resources from third parties/financial institutions ▪ Biomass transportation costs and operation options of biomass power plants (biomass power only)
3. Corporate legal/Fiscal

Criteria
▪ Establishment of branch/joint stock company to develop the project ▪ Application of import tax, CIT exempted, land use, other incentives for biomass power development ▪ Off-take arrangements
4. Offtake Arrangements
▪ Negotiation and signing of PPA with local/provincial/national power purchase company
5. Experience
▪ Have invested/operated/developed energy projects ▪ Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)
6. Other
▪ Size of firm ▪ Level of interest in Vietnam

The characterization of RE developers has been conducted in the context of the following project development process as it is important to identify capacity, strengths, and weakness in each step of the process.

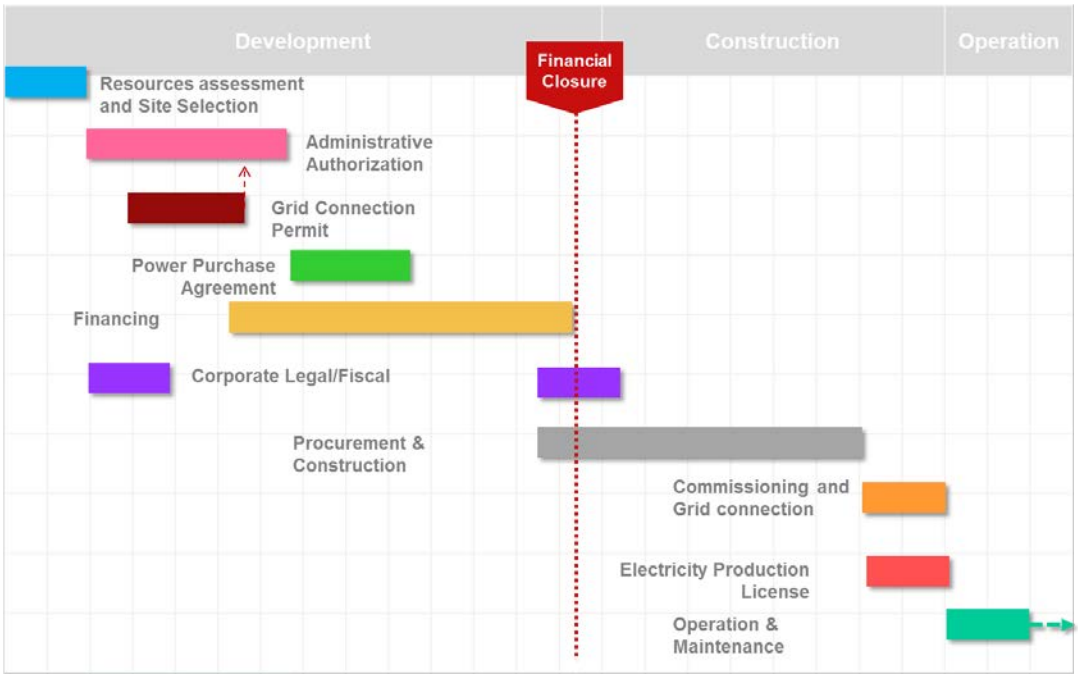

Figure 1 Overall Grid Connected Renewable Energy Power Project Development Procedure

1. Resource assessment and site selection: In this initial step, the project developer will need knowledge to acquire and study available data including National Power Development Plan, fuels sources and options for siting of the RE project. At the end of this step, the developer/investor will register the selected site with relevant provincial authority and obtain principal acceptance of the site from the local authority. The Authority will make a quick check of the provincial development plan to ensure that the site is in general available for further project development and no overlapping selection from other developer.
2. Administrative Authorization: The project developer needs to have the ability to conduct all administration procedures required by authorities to make project legally acceptable. The project developer will check if the project has been included in National power development plan, if it has been pre-selected then this step can be skipped, otherwise the project developer has to proceed to make it inclusive to the national power development plan as described.

3. Grid connection permit: A grid interconnection assessment needs to be conducted and alternatives for connection and evacuation of power to the grid should be discussed with local EVN organization (PC and NPTC). The local EVN organization will verify and approve the proposed grid connection alternative.
4. Power Purchase Agreement: In this step, the project developer/investor will negotiate with the electric power trading company (EPTC) on a specified standard form of agreement. The power selling price is based on feed in tariff or avoided cost tariff depend on whether the which RE resources are used and project will be co-generation or not. The developers need to have capacity to negotiate this issues with their contractual partner.
5. Electricity Production License: Before putting the plant in commercial operation, the project developer will have to acquire the license for generating electricity from Electricity Regulatory Authority of Vietnam (ERAV).
6. Financing: The project developer will conduct due diligence for financing from financial institution/banks. This step requires solid capacity in financial analysis and preparation of project prospectus. Depending on the financial institution, the required application may be different. At final stage, negotiation and signing agreement will complete bank closure.
7. Corporate Fiscal/Legal: The “corporate fiscal/legal” step means completing all necessary steps to establish the RE company.
8. Engineering, Procurement and Construction: The project developer conducts detailed engineering design, prepares procurement specifications and purchase orders, and conducts or oversees construction activities.
9. Commissioning and Grid Connection: Equipment and systems will be installed then commissioning activities proceed. The project developer must coordinate with EVN for test and start the synchronization process.
10. Operation and Maintenance: This last step includes establishing operation and maintenance procedures and training the operators and technicians to be able to keep plant in continuous operation. A process of monitoring and performance control needs to be put in place.

In consideration of this aforementioned project development process, this characterization will be completed by applying a criteria and evaluating each RE developer accordingly. At this stage, the assessment is based on general analysis of the VLEEP team and should be further developed by engagement with individual RE developers.

Table 2: Scoring system for the characterization criteria

Score	Attribute
5	Fully capable of undertaking all the steps to develop RE generation facilities, including: technical, financial, and administrative with a sound track record of successful projects. Company has a sound financial position with no record of disputes or failed projects.
4	Capable of undertaking most steps to develop RE generation facilities, including: technical, financial, and administrative with some track record of successful projects. Company has a sound financial position with no record of disputes or failed projects.
3	Capable of undertaking all the steps to develop RE generation facilities, including: technical, financial, and administrative. Company has an average financial position in good standing. Some track record of successful projects.
2	Limited capability to undertake all the steps to develop RE generation facilities, including: technical, financial, and administrative. Little or no track record of successful projects.
1	Not qualified

The key tools for data/information collection for analysis and assessment include reviewing the documents/reports that is available on the websites, Pre-FS/FS reports and the published statistics data from different sectors sub-sectors (no field visits to be done at current stage of this study). The historical data and information of wind power, biomass power and solar PV development in Vietnam are collected and reviewed. It consists of the installed capacity (MWe) of wind, biomass and solar power. In parallel, the wind, biomass power and solar PV power project developers are also identified and reviewed. This is mainly based on data obtained from websites and publish, and sectoral statistics (e.g. EVN, and Associations), and information obtained from pre-feasibility study (F/S) and F/S documents and the related reports.

Currently, the database and information of the developers of biomass power and solar PV power projects in Vietnam is not available because there is no study or any evaluation in Vietnam on this subject. Using only desk research methodology for this report is also challenging due to the lack of records, documents, information in the websites as well as the limited access to data directly from the developers.

To address this problem, the documents and records such as the pre-feasibility, feasibility study reports, the investment registration documents of the developers of biomass power and solar PV power projects have been collected from different sources and used for this analysis and evaluation. The generalized characteristics of the developers of biomass power and solar PV power projects in Vietnam and detailed assessment results for the typical developers by each specific criterion are presented by tables in Appendices.

2. Key Findings

Summary of findings of specific RE power developer characterizations, as a result of applying the characterization criteria, are presented below:

RE investors and developers are both domestic companies based in Vietnam and off-shore international companies. Some joint-venture entities are also set up under cooperative arrangements between foreign and local partners. In general, international companies are more experienced and capable than local companies: from resource assessment and site selection to project management, arranging financial resources and operation and maintenance of RE based power plants. However, local companies are perhaps more familiar with administrative and technical procedures than are international entities. Most local companies are weak at developing a RE power project in the context of life cycle. For new technologies such as wind and solar power, local developers lack experience on state-of-the-art technology. The weakest capacities identified by this characterizing exercise are: i) technical and engineering knowledge of developers; ii) Economical and financial analysis; and iii) Project management ability, particularly in procurement and selection of qualified EPC contractors.

Table 3: Summary of RE developer characterization

Criteria
1. Technical capabilities
1.1 Resource assessment and site selection
Most developers are able to conduct and analyze site surveys and construction requirements; and are knowledgeable about permitting requirements. However, knowledge about resource potential assessment is limited, thus training and capacity building in this area would be beneficial. This is also applicable for biomass developers in developing capacity of feedstock resource assessment and secure frame contract with the biomass suppliers.
1.2 Administration authorization
Although several developers with previous experience in conventional power projects are familiar with administration authorizations, there are huge needs for developers who are inexperienced in power development to be supported with capacities such as i) FS preparation; ii) acquiring energy operator license; building permit; iii) Obtaining electricity Production License Business registration and iv) arrangement for inclusion of the project into the National/provincial power development plan.
1.3 Engineering, Procurement and Construction
It is more likely that most of developers are weak at conducting works related to management of engineering, procurement and construction in RE sector. Thus, capacity building in this area should be prioritized.
1.4 Commissioning and Grid Connection
Developer's ability in management of equipment installation and commissioning and of Compliance check of all safety, fire protection, environment issues are relatively weak. Capacity building in this area would be worthwhile.
1.5 O&M
Knowledge of developers in most of O&M procedures and processes are limited and needed to be enhanced.
2. Financial capacities
It is identified that Re developer's staff are hardly able to undertake or appraise economic and financial analysis of large scale grid-connected project or preparation of the due diligent package for project. This adversely affects the possibility of the project to be financed by the bankers or third party financial institutions. Training to build capacity in this area is necessary for developers.
3. Corporate legal/Fiscal
Establishment of branch/joint stock company to develop the project
4. Off-take arrangements
Application of import tax, CIT exempted, land use, other incentives for biomass power development
5. Experience

Criteria
Some inexperienced developers in power sector would need to build with capacity of negotiation and signing of PPA with local/provincial/national power purchase company. Other companies with past experiences in power sector are more likely to be capacitated in this characteristic.
6. Other
Only a small amount of developers have invested/operated/developed energy projects or large scale power plants. Many developers are newly established companies and are at small size. Some others are branch or joint-ventured company with better structure and organization as well as resources. Most of these companies have considerable interest in Vietnam's market.

In relation to **wind developers/investors:** as they do not yet have sufficient knowledge in wind energy project management, they often rely on international project developers, national consultants and (international) EPC contractors. Hence, capacity building in wind power development should not only provided for project developers, investors but also for consultants and EPC contractors. The areas of capacity building should include (but not limited to):

- The entire process of project development, from planning to commission;
- Financial analysis including risk, cash-flow model analysis and due-diligence preparation;
- Technology assessment and improve engineering knowledge;
- Wind power project management, including procurement and selection of qualified EPC contractors;
- Wind power operation and maintenance;

Although supporting policies for wind power development in Vietnam has been gradually introduced, there are certain gaps between legal and regulatory framework and their enforcement in practice. Furthermore, it seems that there are inconsistent understandings by different actors of governmental agencies on policy implementation from central level to local levels. This is hindering the sector development and discouraging investors/developers. Similar efforts such as GIZ's "Information on the wind energy sector of Viet Nam" and "Guidelines on Wind Power Planning in Vietnam" are considered as very useful and praised by key wind power stakeholders.

Regarding market of biomass power and solar power: Many investors expect to have access wished and requested state agencies to carry out study and soon promulgate guidebook on biomass power and solar power investment, indicating steps, procedures in clear details in order to reduce duration of application for permissions relating to investment of biomass power and solar power projects. At present there are many administrative procedures, regulations on investment, development of biomass power and solar power such as regulation on granting investment permission and certificates. Because there were no implementation instructions, project investors have to spend much time in completion of documents in accordance with regulation. In many cases, these complicated procedures themselves made investors disheartened and leading to undeveloped market.

Other recommendation for supporting biomass power and solar power project developers in selection of sites and preliminary evaluation of project sites proposed that the Government and Ministry of Industry and Trade do preparation and soon promulgation of biomass power and solar power development plans at national level and provincial level. These plans will enable development of biomass and solar power market and may reduce and avoid risks relating to planning of land use, connection of the projects to the national power grid, ensuring enough supply of biomass quantity at desirable reliability and little fluctuation of biomass prices in increasing direction for project investors.

In order to create equal platform for all investors, it is also recommended that standards and norms of equipment should be facilitated to develop. These might include efficiency of solar PV modules, efficiency and parameters of biomass steam boilers, standards on connection of projects to the national power grid, etc.

For developers on biomass power, it needs also to share and train issues relating to contracts supplying raw biomass to power plants so that biomass supply is sufficient, stable with little price fluctuation.

At present, many developers of bagasse fired power generations in sugar plants have plans to make investment in new equipment such as steam boilers, turbines with high efficiency and super-critical or ultra-supercritical steam parameters (temperature and pressure) to replace the old boilers which have low efficiency and low steam parameters, in order to reduce specific biomass consumption (kg biomass/kWh) and selling more electricity to the national power grid. However, the problems of the above power plants are that they have to change manner of management and operation of new equipment with high steam pressure and temperature. This is considered as one of needs which shall be supported such as by training courses at various levels for groups of managers and group of operators in order to achieve the highest efficiency in optimal operation and ensuring safety of high pressure equipment, etc.

It needs also to share and train issues relating to contracts supplying raw biomass to power plants so that biomass supply is sufficient, stable with little price fluctuation.

There is also need for support from local authorities in improvement of procedures on investment, land lease, land procurement for biomass power projects as well as targets of biomass power development have been promulgated with indicated development roadmap.

Regarding developing capacity for developers on solar power, there are some further recommendations for next step as follows:

- Investment in solar power plants is considered as new area of business and industry. The market is only at initial point for developers, especially domestic private investors. Therefore, increasing capacity in how to make decision on selection of investment sites in correlation with unit investment costs, electricity selling prices and other preferences (taxation, fees, etc.) needs to be enhanced and strengthen.
- The main issues which need exchanging, training and supplementing are information of technologies (technology costs, O&M costs); economic-financial analysis, project's cash flows; optimal and efficient design and management of projects.

2.1 Wind Power Developer Characterization

Most of the wind power development locations are areas with high potential of wind energy such as Binh Thuan, Ninh Thuan, some coastal areas in Central region and Mekong Delta region and selected regions in Central Highland. General information on wind power development is given below:

- Number of projects registered: 48 projects for a total capacity of 4,876MW[1]
- Number of projects in operation: 3 projects with 52MW of installed capacity (the typology of technology used is Furlander 1.5; GE1.6, and Vestas 2.0 turbines)
- Financing sources:
    - ODA: 2 projects (located in Phu Lac financed by KfW, Loi Hai financed by DANIDA)
    - State budget: 1 project (located in Phu Quy Island)
    - Government guarantee: 1 project (Bac Lieu Project, financed by US Eximbank)
    - IPP: the other remaining projects.

Main characters of wind power developers are found including:

- Country of origin: the wind power sector in Vietnam have the participation of both international and local investors. There are also entities joint-ventured by foreign and domestic partners aiming to maximize their competitive advantages in specific projects;
- Size of firm: Many wind power developers in Vietnam are large corporations with extensive experiences of wind power development in many countries around the world. Apart from these, however, there are also private enterprises which were established only to develop wind power projects. This group of firms is likely less experienced in developing and operating wind farms

[1] MOIT/GDE: Presentation on Wind Power Development (2015)

- Experience in the field of wind power: Almost every Vietnamese wind power developer is lacking experiences in all phases of the project, from project planning, selection of contractors, construction management and commissioning. In contrast, international companies and large corporations have experiences in developing successful projects using wind energy power generation or renewable energy in the world or in Vietnam.
- Project location: Most of projects are located in windy regions of Vietnam including the South Central region, coastal areas of Mekong River Delta and Central Highlands region;
- Type of project: wind power developments in Vietnam mostly are onshore and on-grid projects. Some projects are in the nearshore and/or alluvial areas of Mekong Delta region and a hybrid project on offshore islands;
- Technology used: In general, projects are using horizontal axis turbines with a capacities of 1.5 MW to 3 MW. This turbine lines have been commercialized, most originating from renowned manufacturers such as GE, Vestas, Enercon
- Size of project: most projects' size range from a tens of MW to hundreds of MW. Normally, project development is diverging into several stages, with the first phase from a few to several tens of MW. Investment rate for the project is from 2,0-2,5 million US $ per MW installed;
- Financial resources: as prescribed by the Government of Vietnam, investors in wind power projects are required to have equity capital of at least 20% of the total investment. The rest of investment capitals (up to 80%) are loans. It seems that for wind power projects with large investments, the financial resources mobilization for equity capital is challenging for some project developers. Also, arranging loans and dealing with the banks are major obstacles for them as well. In fact, this is still happening despite the existence of some preferential loan program for renewable energy projects run by the banks. It is reported that the loans for wind power project are not being approved by the bank because the FIT rates are relatively low. Hence, investors are unable to prove the recoverability or rate of return of the wind power development to the banks;
- Offtake arrangements: the current regulations of the government of Vietnam provide considerable incentives for wind power. EVN had to purchase the entire electricity output of wind power generated with FIT rates prescribed during 20 years through a standard PPA. Therefore, once the project goes into operation, the investor does not have to worry about the output of the project;
- Technical capacity of project developers: In general, technical competence of developers and investors in the field of wind power developers are weak, except for a small number of international/foreign companies. Only few national developers/investors have the knowledge and experience to develop a wind farm project. Consultants are hired throughout the entire project development and EPCs are hired for the construction stage. To overcome this obstacle, several investors already participated in training programs and capacity building for project team through seminars and short / long term training courses. Some professional and specialized trainings are also integrated into the construction contracts, supply of equipment, etc. of contractors.
- Financial capacity of project developers: current available information is not sufficient for a reliable assessment. However, data collected within this study suggest that foreign investors indicate better financial capacity compared to local ones. Among local developers, while some investors are having secured financing arrangement for their projects, many others still struggle with mobilizing capital for the investments. Some projects were even delayed or halted because of difficulties in financing or portfolio management requirement.

Detail wind power characterization is given in Appendix 2.

2.2 Solar Power Developer Characterization

The solar power developers in Vietnam are likely at stage of planning and/or under pipeline in the sector. Their project proposals seem to be waiting for supporting policies and mechanisms. Therefore, there is very limited background information or database available for analysis and assessment of solar power project developer's experience and capacities in Vietnam. Several general assessments on developers are listed as follows:

- Lack of experience on technology as well as knowledge of solar power;
- There is not much experience on operating and maintenance of solar power plants though some Vietnamese private investors have experience on investment in small hydropower projects;
- Lack of understanding of investment procedures because Vietnam has not yet promulgated support policy mechanism for solar power project development and there is no planning of solar power development, therefore, solar power projects have to undergo through many procedural steps in obtaining permissions such as investment certificate, construction permission, electricity operation license, etc.; and
- Ability to mobilize finance (equity or owned finance) as well as arrangement of loans with banks is also hurdles for investors; especially ability to explain and present project cash flows for mobilizing capital is limited.

Detail characterization of solar power is provided in the Appendix 3.

For the developers of solar PV projects in Vietnam, there is not much to analyze and assess since so far Vietnam has not issues the electricity tariff (FITs) for solar PV power projects. Therefore, there is only one developer with the 19.2 MW project with the very first construction activity in August 2015. However, to take advantages of the going to be issued policy supporting electricity tariff, there are more developers have been implementing activities such as site selection, prepare reports to add their project into the provincial or national power development plan. Information gathered from the central provinces showed that both foreign and domestic developers are entering this market. The foreign developers have plenty of experience since they have invested in solar power projects (e.g. TATA, India) or coal & gas project (AES Holdings, USA) in Vietnam. Meanwhile, the domestic developers are mostly private or construction companies. This is a new field in Vietnam and of course for these developers. Lack of experiences and skills in site selection, potential evaluation as well as installation, operation and maintenance, etc. is main issue that needs address soon.

Currently, solar power projects have not been included in the power development plans, in particular not included in the List of power generation projects in the Provincial Power Development Plan for Period 2011-2015 with outlook to 2020. Therefore, the Developers/Investor of the project has to take the supplementary document that is preparing the report to supplement the project into the power development plan. Depending on the scale of the project, different processes will be followed: If the installed capacity is up to 50 MW, the Investor has to report to the Provincial People's Committee for review and submit to the MOIT for deciding the addition of the project into the provincial power development plan; In case of the installed capacity is over 50 MW, the project needs to be added into the National Power Development Plan and the addition decision will be made by the Prime Minister.

In above context, the solar PV developers and investors have to prepare documents and reports to conduct investment activities (getting different licenses).

- Preparing and submitting official letters to the PPC(s) to apply for investment intent of the solar power plant at the sites (proposed site or opened site).
- Conducting site surveys after the project site has been approved by the Provincial People's Committee.
- Preparing the report for PDP adjustment/or pre-feasibility study report.
- Submitting to the Ministry of Industry and Trade for review, approval and receiving Decision to supplement the project into the PDP.

- Negotiating with EVN on PPA and power purchase commitment in accordance with the principles/guidelines of EVN.
- Submitting those documents to the PPC(s) to apply for investment certificate and receiving license the investment certificate for the project.

Detail solar power developer characterization is given in Appendix 3.

2.3 Biomass Power Developer Characterization

The developers of biomass power projects could be categorized into 2 groups, namely: i) Using bagasse in sugar mills for combined heat and power (CHP); and ii). Using other biomass (e.g. rice husk, wood/wood wastes, etc.) only for electricity production. Currently, the tariff support mechanism for biomass power is also divided into 2 groups as mentioned above.

- Using bagasse in sugar mills for CHP: These developers have installed and are operating CHP projects in 41 sugar mills. They have invested since the 1995-2000 period within the framework of the production and supply 1 million ton of sugar program by the Government of Vietnam. During this period, nearly 20% of the developers are classified as foreign direct investment (FDI) and the rest are SOEs (state-owned enterprises). However, in recent years, there has been a change of ownership for the sugar mills/companies as well as CHP plants through equitization or privatization. The process of privatization has facilitated the expansion of plant capacity. Currently, there are about 3 to 5 developers have been investing in power capacity up scaling from 2 to 3 times more, or even up to nearly 6 times. The goal of expanding the power capacity is to sell the surplus electricity to the national grid following the FIT and Avoided Cost incentive mechanisms has just issued by the Government and the Ministry of Industry and Trade of Vietnam.
- Using other biomass (rice husk, wood/wood wastes, etc.) only for electricity production: there is a small number of the biomass power developer due to the fact that the Government have just issued the new policy supporting biomass power (early 2016). Currently, there is no project installed and operated in Vietnam even though there are some developers have completed FS documents. We are expecting more biomass power developers in the upcoming period for this technology.

Detail biomass power developer characterization is given in Appendix 4.

3. Recommendations and Next Steps

As detailed in Chapter 2, there is a considerable need for capacity building and training across most areas of the project development cycle, in particular:

3.1 Wind Power

As most of wind developers/investors have not yet acquired sufficient knowledge in wind energy project management, they often rely on international project developers, national consultants and (international) EPC contractors. Hence, capacity building in wind power development should not only provided for project developers, investors but also for consultant and EPC contractors. The areas of capacity building should include (but not limited to):

- The entire process of project development, from planning to commission
- Financial analysis including risk, cash-flow model analysis and due-diligence preparation
- Project management including procurement and selection of qualified EPC contractors
- Technology assessment and improve engineering knowledge
- Wind power project management
- Wind power operation and maintenance

3.2 Solar and Biomass Power

Solar and biomass power developers also need capacity development, as well as associated investors, consulting firms, and other service providers. Recommendations are as follows:

- Investment in solar power plants is considered as very new industry and are at the initial enrry point for investors, especially local private investors. Therefore, it is needed to enhance developer's capacity on how to select project sites in correlation with investment unit costs, electricity selling prices and other preferences (taxation, fees, etc.).
- Training and capacity building for state-of-the-art technologies (technology specifications, investment costs and O&M costs); economic-financial analysis, project's cash flows; optimal and efficient design and management of projects, would benefit most developers.
- For biomass power projects, there is also a need for training on subjects and topics relating to biomass supply-chain management so that biomass supply is sufficient, stable, and with manageable managed price fluctuations.

At present, many investors of bagasse fired power generations in sugar plants have plans to make investment in new equipment such as steam boilers, turbines with high efficiency and supercritical or ultra-supercritical steam parameters (temperature and pressure) to replace the old boilers which have low efficiency and low steam parameters. They aim to reduce specific biomass consumption (kg biomass/kWh) and selling more electricity to the national power grid. However, they face challenges to change the manner of management and operation of new equipment with high steam pressure and temperature. This is considered as one of needs which could be supported such as by training courses at various levels for groups of managers and group of operators in order to achieve the highest efficiency in optimal operation and ensuring safety of high pressure equipment, etc.

The above recommendations are synthesized from relevant reports, expert's opinions shared in workshops and course of consultancy for investors, policy makers for biomass power and solar power development. However, these recommendations are in need of further verification as approach applied in this study is only a desk study. It needs deeper investigation, cases studies, and especially direct consultations with investors to have clearer picture of priority issues need to be addressed.

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5. Appendix

A.1 RE Policies and Incentives in Vietnam

Over the last 10 years (2006-2015), the total installed capacity of RE sources in Vietnam has increased nearly 10 (ten) times, from 265 MWe to 2,646 MWe with an annual growth rate of around 32%. However, small hydropower accounts for majority of 81.5% of that growth2. The total installed power capacity of different RE sources accounts for 7.1% of the total installed generation capacity of the national power system. Around 375 MWe came from biomass (mainly, captive cogeneration in sugar mills), 2 MWe from biogas (off-grid), 5.8 MWe from solar PV, 135 MWe from wind, 2,152 MWe from small hydro, and 2.4 MWe from waste-to-energy power plants.

The RE policy framework of Vietnam is in place for promoting RE-based power generation projects. So far, only small hydropower and, to a lesser extent, wind and biomass power have been developed. Low electricity selling tariffs currently applied for RE-based power projects in Vietnam make development and investment in RE projects not sufficiently attractive for potential project developers and investors. Policies on other RE sources such as biomass to-energy were only introduced in late 2014 and 2015. While the solar PV policy framework has not been introduced yet. Hence, their impact on the development of these types of biomass power and solar PV cannot be assessed yet as it takes around 2 to 3 years for these projects to be developed and implemented.

Vietnam have published several strategies and master plans on the development of the RE sector in general and wind, biomass and solar energy in particular. These strategies and master plans set up the development targets on each RE technology as well as the orientations, required policy framework to achieve these targets.

The selling tariffs for electricity generated from different RE sources (except solar power[3]) were also introduced. An incentive framework including preferential corporate tax rates, exemption from import tax on equipment and materials, accelerated depreciation rates, exemption and reduction in land rental fees, was also established.

On 25 November 2015, the Prime Minister approved the National Renewable Energy Development Strategy up to 2030 with an outlook to 2050. This Strategy was promulgated with Decision No. 2068/QD-TTg dated 25 November 2015 of the Prime Minister. It sets the strategic targets as well as the mechanism and policies for RE development outlook in Vietnam.

Table 2 RE Utilization Targets for Power Generation

Electricity generated from different sources of RE	2020		2030		2050	
	Amount (TWh)	Share (%)	Amount (TWh)	Share (%)	Amount (TWh)	Share (%)
Hydropower (including large hydropower plants)	90	33.5%	96	17%	104	9.9%
Biomass	7.8	3.0%	37	6.3%	85	8.1%
Wind	2.5	1.0%	16	2.7%	53	5.0%
Solar	1.4	0.5%	35.4	6.0%	210	20%

Source: Decision No. 2068/QD-TTg dated 25 November 2015 of the Prime Minister

The latest RE targets of Vietnam were set and stated in the "Vietnam Power Development Master Plan for the period of 2011-2020 with an outlook to 2030" (called as PDP VII revised). This Master Plan was promulgated with Decision No. 428/QD-TTg dated 18 March 2016 of the Prime Minister (Table 3).

[2] It appears that the introduction of the regulations on electricity selling tariffs and Standard Power Purchase Agreement (SPPA) for small RE-based power projects in 2008 ("RE Tariff 2008") has had a significant impact on the development of the small hydro power projects.

[3] The final draft of solar PV development incentive and support mechanism has been just submitted by MOIT

Table 3 RE Utilization Targets for Power Generation

Targets of RE for power generation	2020		2025		2030	
	Install capacity (MW)	Share in power generation (%)	Install capacity (MW)	Share in power generation (%)	Install capacity (MW)	Share in power generation (%)
Biomass	-	1.0%	-	1.2%	-	2.1%
Wind	800	0.8%	2000	1.0%	6000	2.1%
Solar	850	0.5%	4000	1.6%	12000	3.3%

Source: Decision No. 428/QD-TTg issued by Prime Minister in 2016

RE Tariffs

Currently, tariff schemes have been introduced for only selected RE power generation namely wind and biomass.

Wind power tariff

Feed-in-tariff for wind power was given in Decision No.37/2011/QD-TTg, dated 29/06/2011 by Prime Minister on wind power price subsidy mechanism (currently under reviewing and updating): i) standard PPA; ii) grid connected electricity selling price is **7.8 USD cents/kWh** with 1 USD cents/kWh financed from Environmental Protection Fund. However, all of three existing wind power projects under operation now are financed by state guaranteed loans or special financing schemes but not under supporting mechanism for wind power development in Decision 37/2011/QD-TTg.

Recent study undertaken by GIZ[4] suggests that a new feed-in-tariff scheme should be 10.4 USD cents/kWh to facilitate more developments of wind power in Vietnam.

Biomass power tariff

The selling prices of electricity for different types of biomass technologies - based power projects are given by selected Prime Minister's and MOIT's decisions (Table 3):

- Decision no. 24/2014/QD-TTg: selling price of excess electricity generated from cogeneration (combined heat and power) plants;
- Avoided Cost Tariffs (ACTs) to follow Circular no. 44/2015/TT-BCT of MOIT for biomass power generation project selling all of their generated power to grid. The tariff is subjected to reviewed, revised and publicized annually by MOIT. ACT for 2016 is published in MOIT Decision no. 942/QD-BCT dated 11 March 2016.

A Standard Power Purchase Agreement (SPPA) was issued and is applicable for biomass based power projects. Electricity of Vietnam (EVN), the sole electricity buyer has also published the regulations on the procedures for SPPA negotiation, signing and implementation.

Table 4 Selling prices of electricity for types of biomass and technology based power projects

Technology	Capacity limits	Selling price of electricity (VAT-excluded)
Cogeneration	No limit	▪ 0.058 USD/kWh for excess electricity ▪ The electricity selling price shall be adjusted to the fluctuations of VND/USD exchange rate
Power generation	No limit	▪ 0.075551 USD/kWh for North region ▪ 0.073458 USD/kWh for Central region ▪ 0.074846 USD/kWh for South region ▪ The electricity selling price shall be adjusted to the fluctuations of VND/USD exchange rate

[4] GIZ, Up-scaling of Wind Power – Capacity Needs Assessment, 2015

Incentives

The Vietnamese Government have introduced several incentive measures for RE developers including tax incentives, financing supports and licensing. Detail description on incentives for wind, biomass power and solar PV are provided below.

Incentives for wind power

For wind development, import tax exemption for equipment which is not domestically manufactured could be initiated. There could also be a corporate income tax with either a 10% tax rate for the first 15 years and a possible extension up to 30 years or an exemption for the first 4 years and 50% reduction for next 9 years. A fast depreciation mechanism, 1.5 times faster than normal projects, could be set up followed by the exemption of land-use tax, charges and environmental protection fees.

Incentives for biomass power and solar PV

- Tax incentives: On 26 December 2013, the Government promulgated Decree No. 218/2013/ND-CP, providing detailed regulations and guidelines for the implementation of the Law on Corporate Income Tax. According to this Decree, the exemption and reduction of corporate income tax are applied to the newly-established enterprises working on RE projects. These enterprises enjoy a preferential tax rate of 10% (instead of normal tax rate of 20% applicable since the 1st January 2006). On top of that, these enterprises enjoy additional tax incentives including tax exemption for the first 4 years and 50% tax reduction for the next 9 years. The corporate income tax rate for RE-based power generation enterprises can be summarized as follows: 0% for years 1 to 4; 5% for years 5 to 13; 10% for years 14 to 15; and 20% for year 16 onwards.
- The biomass-based power projects are exempted from import tax on imported goods that would become fixed assets of the project and goods used as raw materials, input or semi-finished products that are not available on the domestic market for the project operation. This is according to the Law on Import and Export Taxes and other regulations on import and export duties.
- Financial supports: The developers of biomass-based power projects have access to investment credits of the State which provides loans at favorable interest rate (e.g. Vietnam Development Bank).
- Based on the "Vietnam Renewable Energy Development Strategy up to 2030 with an outlook to 2050", the Sustainable Energy Promotion Fund (SEPF) will be established to support all RE developments. The fund will be financed by the State Budget, revenue from environmental fees levied on fossil fuels, various sources of funds and contributions from domestic and foreign organizations/individuals as well as other funding sources.
- The Government also offers the biomass-based power projects other incentives on land rent and use, subsidy for products from CDM projects, etc.
- Other supports: Land for RE development will be allocated to the investor by provincial People's Committees to implement RE-based power projects in accordance with the national/provincial Power Development Plans approved by the competent authorities. The compensation for and support to site clearance are carried out in line with the current Law on Land. Biomass plants, power lines and transformer stations connected to the grid are entitled to exemption and reduction in land rental fees in line with the current law and regulations applicable to investment projects with preferential treatment.

Incentives for solar PV

The tariff of electricity from the solar PV power projects to the grid are being prepared by the Drafting Committee that was established by MOIT. Summary of legal backgrounds and draft support mechanism for investment in on-grid solar power projects in Vietnam.

National Renewable Energy Development strategy of Vietnam for period to 2030, with outlook to 2050" has defined one of its main contents as prioritizing rapid solar power development, orientation of power development from solar energy resource in Vietnam as follows:

- Development of solar power to supply electricity to the national power system;
- Electricity production from solar power will increase from 10 million kWh in 2015 to about 1.4 billion kWh in 2020; about 35.4 billion kWh in 2030.
- Share of solar electricity production in total electricity production will increase from negligible level at present to about 0.5% in 2020, about 6% in 2030.

In order to achieve these targets, the Government of Vietnam provided several preferences for investors. The renewable power projects will benefit from preferential investment, preferential electricity tariffs and preferential taxes. Investors can also enjoy other incentives such as exemption from equipment import duties, reduction of corporation income tax and exemption of land use tax in certain time duration, and other preferences in investment in accordance with provisions of the existing law on investment credit and export credit of the State.

Renewable Portfolio Standard is compulsory for investors of fossil fired power projects and electricity buyers in coming time:

- Electric power generating units with capacity more than 1,000 MW (not including BOT power projects) must acquire share of electricity produced from renewable energy resources (excluding hydropower plants with capacity more than 30 MW): from 3% by 2020; and from 10% by 2030).
- Electricity distributing units which produce electricity, purchase electricity and electricity end users who are self-producing electricity must have share of electricity produced from renewable energy resources (not including hydropower plants with capacity more than 30 MW): from 5% by 2020; and from 10% by 2030.

Support mechanism for solar power projects: has been prepared and submitted by the Ministry of Industry and Trade to the Government for consideration "Decision on support mechanism for solar power projects development in Vietnam". At present, this decision is pending for approval. The points which need paying attention in this draft decision are electricity tariffs and other support mechanisms. The main points of the draft decision for large scale on-grid solar power projects are summarized as follows:

(i) Buyer is responsible for buying all electricity amount generated from on-grid solar power projects at purchase price of 11.2USCents/kWh (VAST excluded);

(ii) This electricity price is applied only for on-grid solar projects with efficiency of solar cells higher than 16% (efficiency of module is from 15%). Electricity purchase price is adjustable in accordance with change of exchange rate of VND/USD;

(iii) Buying and selling electricity shall be performed according to non-negotiable standard power purchase agreement. Terms and conditions of power purchase agreement for solar power projects is twenty (20) years from commercial operation date. After 20 years, two sides may extend agreement or sign new agreement in compliance with existing laws;

(iv) Other privileges including: privileges on investment capital and tax (as applied for projects in the priority investment areas in accordance with provisions of existing law on taxes); incentive on land use (Solar power projects and associated power lines and substations for their connection to the national power grid are benefitting from exemption or reduction of land use - land lease fees in accordance with existing laws applied for projects in the priority investment areas); import duty exemption (for raw materials, semi-products which are impossibly manufactured within country).

A.2 Wind Power Projects and Developers in Vietnam

Cong Ly Construction Trade and Tourism Co., Ltd

Cong Ly is a private company established in Vietnam in 2000. The company is operating in the fields of trade, construction and tourism in the province of Ca Mau. The main business activity of the company includes building resorts, the waste treatment plants, composting, building bridges and roads and freight.

September 2010, Cong Ly started Cong Ly Wind Power Project (Bac Lieu). Project is located on the alluvial land of Vinh Trach Dong, Bac Lieu, which are near-shore project. In phase 1 (16MW), there will be 16 General Electric (GE) turbines, each turbine has capacity of 1,6MW and officially operated in May 2013. In the second phase, the project raised to capacity of total 99.2 MW and commissioned in January 2016. The wind farm connected to the national grid by 18km 110kV transmission line. Cong Ly has received soft loan from US EXIM Bank through underwriting of the Government of Vietnam. The project was starting operation after the Government of Vietnam issued FIT for wind power price of 7.8 US cents / kWh. However, the selling price of the project to EVN was agreed at 9.8 USD cent/kWh due to some exceptions such as its location was considered as not on-shore project.

Currently, Cong Ly is implementing other wind power projects, including Cong Ly Wind Farm Phase 3 (142 MW), Khai Long Wind Farm, Ca Mau province (150 MW).

Characterization	Criteria	Cong Ly	
		Score	Justification
1. Technical Capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	has been installed 02 wind measurement masts, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	2	most of site has been chosen based on local relationship
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	4	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	4	based on capability of external resources
	Register the site with provincial committee	5	most of site has been chosen based on private relationship
1.2. Administration authorization	Business registration, ISO certificates	3	NA
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	all of projects have been added into the National/provincial power development plans
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	2	the FS has been done by unqualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	has been experienced in 01 project, based on private relationship
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in 01 project (2 phases)

Characterization	Criteria	Cong Ly	
		Score	Justification
	- Turbine size, hub height, type		
	Ability in detailed engineering management	3	has been experienced in 01 project (2 phases)
	Ability in civil construction management	3	has been experienced in 01 project (2 phases)
	Ability in equipment procurement management and quality control	3	has been experienced in 01 project (2 phases)
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	3	has been experienced in 01 project (2 phases)
	Ability in management of Compliance check of all safety, fire protection, environment issues	3	has been experienced in 01 project (2 phases)
	Knowledge in Grid connection testing and commissioning	3	has been experienced in 01 project (2 phases)
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	4	has been experienced in 01 project (2 phases)
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	4	some engineers has been trained in GE office 5 yrs. ago
	Monitoring and Performance control	4	some engineers has been trained in GE office 5 yrs. ago
	Training and capacity building plan/programs	3	some engineers has been trained in GE office 5 yrs. ago
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	2	the FS has been done by unqualified consultants
	Preparation of the due diligent package for project	2	only done technical due diligent for phase 2 as requirement from the MOIT
	Financial closure	4	
	Risk assessment capacity	2	
	Ability in mobilizing financing resources from third parties/financial institutions	2	
3. Corporate legal/Fiscal	Establishment of SPV and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	5	got the Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	has signed the PPA with EVN already
5. Experiences	Have invested/operated/developed energy projects	5	has been experienced in 01 project

Characterization	Criteria	Cong Ly	
		Score	Justification
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	no have
6. Others			
	Size of firm	3	
	Level of interest in Vietnam	3	

Vietnam Renewable Energy One Member Company Limited (REVN)

REVN was founded in 2006 with business focusing on investing, constructing, operating RE power plants. The company has 74 staff, including 36 engineers.

In 2009, REVN started operating Binh Thanh Wind Power Plant as the first grid connected wind farm in Vietnam. Project site is in Binh Thanh commune, Tuy Phong district, Binh Thuan province. The planned capacity of Binh Thanh project was 120MW. However, only 30MW has been built and operated up to now. Currently, there are 20 Fuhrlaender turbines were installed with capacity each of 1.5MW. The project was commission before feed-in-tariff for wind power approved by the Government. Hence, the selling price of the project was given in the Decision no. 130/2007 of Prime Minister on several mechanisms and financial policies for clean development.

REVN has also installed wind towers in different locations in Binh Thuan, Ninh Thuan, Quang Binh, Quang Tri. This was to identify potential project sites. However, REVN has not completed any other investments in wind farms after the license of project Wind Power No.1 Project in Ninh Thuan was withdrawn by the Ninh Thuan PPC.

Currently, REVN has only one project under operation as mentioned above.

Characterization	Criteria	REVN	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	3	has been installed many wind measurement masts, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	1	stopped doing that task for many years
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	4	based on capability of external resources
	Register the site with provincial committee	4	has been done for 02 sites, but 01 site has been withdrawn due to insufficient ability to deploy
1.2. Administration authorization	Business registration, ISO certificates	3	NA

Characterization	Criteria	REVN	
		Score	Justification
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	4	all of projects have been added into the provincial power development plans
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	2	the FS has been done by unqualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	has been experienced in 01 project, based on private relationship
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in 01 project
	- Turbine size, hub height, type		
	Ability in detailed engineering management	3	has been experienced in 01 project
	Ability in civil construction management	3	has been experienced in 01 project
	Ability in equipment procurement management and quality control	3	has been experienced in 01 project
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	3	has been experienced in 01 project
	Ability in management of Compliance check of all safety, fire protection, environment issues	3	has been experienced in 01 project
	Knowledge in Grid connection testing and commissioning	3	has been experienced in 01 project
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	2	poor in operation and maintenance of power plant
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	3	some engineers has been trained in Germany 10 yrs. ago
	Monitoring and Performance control	3	some engineers has been trained in Germany 10 yrs. ago
	Training and capacity building plan/programs	3	some engineers has been trained in Germany 10 yrs. ago
2. Financial	Ability of Economic and financial analysis of large scale grid-connected project	2	the FS has been done by unqualified consultants
	Preparation of the due diligent package for project	2	only done technical due diligent as requirement from the MOIT
	Financial closure	3	
	Risk assessment capacity	2	
	Ability in mobilizing financing resources from third parties/financial institutions	2	

Characterization	Criteria	REVN	
		Score	Justification
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	5	got the Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	has signed the PPA with EVN already
5. Experience	Have invested/operated/developed energy projects	5	has been experienced in 01 project
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	no have
6. Other	Size of firm	3	
	Level of interest in Vietnam	3	

EAB Group

EAB Group was founded in 1991 and headquartered in Freiberg city, Saxony state (Germany). EAB is a conglomerate with 12 companies in Germany, Europe and South America, having a lot of experience in the development of renewable energy projects including wind farms, solar PV farms, heat production from wood chips. The Group operates in the fields of consulting, appraisal, construction and deployment of renewable energy power plants, with the technical team has experience in the design and operation of wind farms.

Since the successful construction of the first 270 kW wind farm in Saxony, EAB has built more onshore wind power plants in Germany, East and South America.

Branch Company of EAB Group in Vietnam is Wind Power Vietnam LLC. Since 2010, the company has conducted studies on wind potential in many localities in Vietnam such as Ninh Thuan, Binh Thuan, Soc Trang, Binh Chau, Con Dao Island and Cu Lao Cham.

Mui Dinh Wind Power Project (Phuoc Dinh commune, Thuan Nam district, Ninh Thuan province) is invested by EAB locating in one of the areas with the best wind potential in Vietnam. The project has been approved and was included in the wind power development plan of Ninh Thuan province.

The company has finished selecting turbines for planned capacity of 37 MW, consisting of 16 turbines of the Enercon, each with a capacity of 2.3 MW. Investment capital for the project is also completed. Currently, the project is in the stage of site clearance. EAB Group expected to start the construction in June 2016 and put into operation in 2017.

Mui Dinh project completed procedures for signing PPA with EVN. The PPA follow sample form issued by the MOIT. Selling prices of electricity (FIT) also comply with the provisions of 7.8 USD cents/kWh.

Another project of the EAB, Vinh Chau wind power project (Vinh Chau district, Soc Trang province), capacity of 120MW of which Phase 1 is 28,8MW. The project surveyed wind measurements from 2011, was added to the Power Development Plan of Soc Trang Province and received a certificate of investment from 2013. It is expected that this should be the next deployment project after project Mui Dinh come into operation.

Characterization	Criteria	EAB Group	
		Score	Justification
1. Technical capabilities			

Characterization	Criteria	EAB Group	
		Score	Justification
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	5	Installed 06 wind measurement masts, owns a team of international experts
	Ability to conduct desk research and potential site visits	5	Cooperated with qualified local consultant for that task
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	5	Cooperated with qualified local consultant for that task
	Ability to Carry out site survey /energy potential measurement	5	Cooperated with qualified local consultant for that task
	Register the site with provincial committee	5	Cooperated with qualified local consultant for that task
1.2. Administration authorization	Business registration, ISO certificates	5	
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	2 projects have been added into the provincial power development plans
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	5	FS conducted by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	5	Experience with 1 project
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	5	Experience with many projects around the world
	- Turbine size, hub height, type		
	Ability in detailed engineering management	5	Experience with many projects around the world
	Ability in civil construction management	5	Experience with many projects around the world
	Ability in equipment procurement management and quality control	5	Experience with many projects around the world
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	5	Experience with many projects around the world
	Ability in management of Compliance check of all safety, fire protection, environment issues	5	Experience with many projects around the world
	Knowledge in Grid connection testing and commissioning	5	Experience with many projects around the world
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	5	Experience with many projects around the world

Characterization	Criteria	EAB Group	
		Score	Justification
	Knowledge in operation and transaction in electricity market	5	Experience with many projects around the world
	Skills of operators and engineers	5	Owned foreign qualified engineers
	Monitoring and Performance control	5	Owned foreign qualified engineers
	Training and capacity building plan/programs	3	Owned foreign qualified engineers
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	5	Owned foreign qualified engineers
	Preparation of the due diligent package for project	5	Experience with many projects around the world
	Financial closure	4	
	Risk assessment capacity	4	Experience with many projects around the world
	Ability in mobilizing financing resources from third parties/financial institutions	4	Experience with many projects around the world
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV in Vietnam has been established
4. Off-take arrangements	Grid connection agreement	5	got the Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	Signed the PPA with EVN already
5. Experiences	Have invested/operated/developed energy projects	5	Experienced with many RE projects
	Have invested/operated/ developed large scale power plants (e.g. hydro, thermal power plants)	1	Does not have
6. Others			
	Size of firm	5	
	Level of interest in Vietnam	5	

Thuan Binh Wind JSC

TBW is a joint stock company established in Vietnam in 2009 with the primary objective is the development of wind power projects. TBW's shareholders are entities in the power sector and in other industries such as Refrigeration Electrical Engineering Company (REE). Since its establishment, TBW has conducted surveys, studies several locations in Ninh Thuan, Binh Thuan, Dak Lak, Gia Lai to develop wind power projects at industrial scale.

Phu Lac 1 wind power project is the first project invested by TBW with capacity of 24 MW with 12 Vestas wind turbines. The project locates on Phu Lac commune, Tuy Phong district, Binh Thuan province, is one of the areas with the most wind potential Vietnam.

The project was approved into wind power development plan of Binh Thuan Province; was established and approved the investment project and basic design; completed most of the procedures related to the connection, metering, power purchase agreement, etc. Electricity prices prescribed by MOIT FIT 7.8 USD cents/kWh.

The arrangement of capital is also completed with the agreement for preferential loan from the German Reconstruction Bank (KfW).

Phu Lac 1 project is being constructed under EPC contract (including the proposed wind turbine type, nominal capacity of the turbines and the disposition optimal wind turbines in the project area). The consultant of the project includes Fichtner (Germany) is the main consultant, and PECC3 as local consultant. Winning EPC contractor is Hydrochina (China). The work was to begin in July 2015, is expected to completed and put into operation in September 2016.

Characterization	Criteria	Thuan Binh Wind JSC	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	Installed 04 wind measurement masts, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	3	Based on capability of external resources
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	4	Based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	5	Based on capability of external resources
	Register the site with provincial committee	5	Most of site registered with provincial authorities
1.2. Administration authorization	Business registration, ISO certificates	3	NA
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	02 of projects have been added into the provincial power development plans
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	5	the FS has been done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	5	Experience with 1 project
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as - Turbine size, hub height, type	4	Experience with 1 project
	Ability in detailed engineering management	4	Experience with 1 project
	Ability in civil construction management	4	Experience with 1 project
	Ability in equipment procurement management and quality control	4	Experience with 1 project
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Experience with 1 project
	Ability in management of Compliance check of all safety, fire protection, environment issues	4	Experience with 1 project

Characterization	Criteria	Thuan Binh Wind JSC	
		Score	Justification
	Knowledge in Grid connection testing and commissioning	4	Experience with 1 project
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	3	01 project in operation soon
	Knowledge in operation and transaction in electricity market	1	Electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	4	Some engineers has been trained in Vestas office recently
	Monitoring and Performance control	4	Some engineers has been trained in Vestas office recently
	Training and capacity building plan/programs	3	Plan to be completed in the future
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	4	Based on capability of external resources
	Preparation of the due diligent package for project	3	Due diligent package has been done as requirement from KfW
	Financial closure	5	Soft loan from KfW
	Risk assessment capacity	3	Based on capability of external resources
	Ability in mobilizing financing resources from third parties/financial institutions	3	TBW is a JVC from some large companies to have abundant capital
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	5	Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	Signed the PPA with EVN already
5. Experiences	Have invested/operated/developed energy projects	5	Director has been experienced in many hydro power projects before
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	5	Director has been experienced in many hydro power projects before
6. Others			
	Size of firm	2	
	Level of interest in Vietnam	4	

Asia Renewable Energy Corporation (RENERGY Co. ltd)

RENERGY is a joint stock company founded in 2008 by a Vietnamese living abroad5. The project Thuan Nhien Phong Wind Power project is developed by RENERGY in Hoa Thang commune, Bac Binh district, Binh Thuan province.

The project was included into Wind Power Development plan in Binh Thuan province and has received the investment certificate by the Binh Thuan province in 2009. Major components of the project such as Investment Project Report, basic Technical Design; selected processes of grid connection, metering, power purchase agreement, etc.

The scale of the project is 50 MW which is divided into two phases: 32 MW in the first phase and 18 MW in the second phase using its 16 turbine made by TECO (Taiwan). The project is expected to connect to the national grid via the 110kV transmission line with length of about 18.5 km.

Due to some financial difficulties, the project was suspended for a long time and is being restarted recently.

Currently, preliminary site clearance and several components such as the 110kV connecting line, turbine foundation have been finished. It is now be constructing and the step-up 110 kV substation and other remaining turbine foundations are now being built.

The financial capacity of the project developer is weak and financing sources for the project has not been secured. According to the updated progress, erection of wind farm turbines will be carried out by the end of 2016 and the first phase of power plant will be put into operation in 2017.

Characterization	Criteria	RENERGY	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	1	
	Ability to conduct desk research and potential site visits	1	based on capability of external resources
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	1	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	1	based on capability of external resources
	Register the site with provincial committee	5	the site has been registered from 2008
1.2. Administration authorization	Business registration, ISO certificates	3	NA
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the provincial power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	4	the FS has been done by qualified consultant

[5] www.renergy.vn

Characterization	Criteria	RENERGY	
		Score	Justification
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	has been experienced in 01 project, be constructing now
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in 01 project, but the crew changes so much
	- Turbine size, hub height, type		
	Ability in detailed engineering management	3	has been experienced in 01 project, but the crew changes so much
	Ability in civil construction management	3	has been experienced in 01 project, but the crew changes so much
	Ability in equipment procurement management and quality control	3	has been experienced in 01 project, but the crew changes so much
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	1	no have experience
	Ability in management of Compliance check of all safety, fire protection, environment issues	1	no have experience
	Knowledge in Grid connection testing and commissioning	1	no have experience
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	1	no have experience
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	1	no have experience
	Monitoring and Performance control	1	no have experience
	Training and capacity building plan/programs	1	no have
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	1	no have ability
	Preparation of the due diligent package for project	1	no have
	Financial closure	3	still to find out the final source
	Risk assessment capacity	1	
	Ability in mobilizing financing resources from third parties/financial institutions	3	
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	5	got the Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	has signed the PPA with EVN already

Characterization	Criteria	RENERGY	
		Score	Justification
5. Experiences	Have invested/operated/developed energy projects	3	has been experienced in 01 project
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	no have
6. Others			
	Size of firm	2	
	Level of interest in Vietnam	2	

Trung Nam Wind Power JSC

Trung Nam Wind Power JSC (TNWP) established in 2010 as a subsidiary of Trung Nam Group[6]. Trung Nam Wind Power project is invested by TNWP, locating in Bac Phong and Loi Hai commune, Thuan Bac district, Ninh Thuan province, is one of the areas with the most wind potential Vietnam.

The project was approved into Wind Power Development plan of Ninh Thuan province; has installed and operated a wind met-mast 4 years ago. The Feasibility Study and basic Technical Designs have been approved. Total capacity of the entire wind farm is expected to be 90 MW, of which the first phase is 34 MW.

TNWP currently in the process of selection of turbine, contractor(s) and vendors for supplying electrical equipment and construction service.

Regarding financial resources, TNWP is in the process of mobilizing capital. It is considered as highly qualified to arrange equity sources as its parent company is a large corporation with track proven financial record. Trung Nam Group has been successfully implemented wide range of projects including hydropower, infrastructure and real estate.

Characterization	Criteria	Trung Nam Wind Power	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	has been installed 01 wind measurement mast, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	2	based on capability of external resources
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	4	based on capability of external resources
	Register the site with provincial committee	5	the site has been registered from 2009
1.2. Administration authorization	Business registration, ISO certificates	3	NA

[6] Trung Nam Group established in 2007 is a large corporation in Vietnam to invest in areas such as hydropower, real estate, investment, construction and machine installation, ... some energy projects typical of Trung Nam Group may include: hydropower plant Dong Nai 2 (70MW) hydropower plant Krong No 2 & 3 (48MW)

Characterization	Criteria	Trung Nam Wind Power	
		Score	Justification
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the National power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	4	the FS has been done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	4	has been experienced in many power projects
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in 01 project
	- Turbine size, hub height, type		
	Ability in detailed engineering management	5	has been experienced in many power projects
	Ability in civil construction management	5	has been experienced in many power projects
	Ability in equipment procurement management and quality control	5	has been experienced in many power projects
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	5	has been experienced in many power projects
	Ability in management of Compliance check of all safety, fire protection, environment issues	5	has been experienced in many power projects
	Knowledge in Grid connection testing and commissioning	5	has been experienced in many power projects
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	5	has been experienced in many power projects
	Knowledge in operation and transaction in electricity market	5	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	3	owns some power engineers
	Monitoring and Performance control	3	owns some power engineers
	Training and capacity building plan/programs	3	proposed capacity building programs
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	4	based on capability of external resources
	Preparation of the due diligent package for project	3	based on capability of external resources
	Financial closure	3	may happen sooner
	Risk assessment capacity	3	
	Ability in mobilizing financing resources from third parties/financial institutions	3	the parent company has some credibility in the capital settlement

Characterization	Criteria	Trung Nam Wind Power	
		Score	Justification
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	5	got the Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	has signed the PPA with EVN already
5. Experiences	Have invested/operated/developed energy projects	5	has been experienced in 03 hydropower projects
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	5	has been experienced in 01 large hydropower project
6. Others			
	Size of firm	4	
	Level of interest in Vietnam	5	

Ocean Renewable JSC

ORE is a Vietnam company established since 2012 in Lam Dong with the immediate objective is to invest in wind power projects in Lam Dong province. The company has implemented the installation of wind met-masts in several locations such as the Cau Dat, Da Loan, Loan Ninh in Lam Dong Province.

Cau Dat Wind Power project is invested by ORE and located in Tram Hanh commune, Da Lat City, Lam Dong Province, expressed in the report "Survey and assessment of potential wind power in Lam Dong province".

Initially, the project has received the investment certificate from the Lam Dong Province People's Committee since 2009 (transferred from CAVICO7). Since then, the investment certificate has been adjusted and reissued on August 1st 2012. The project has also been approved to be included in Lam Dong wind power development plan in 2014.

The total installed capacity of Cau Dat wind farm is expected to be 100-300 MW, while installed capacity is 28.8 MW first phase. According to plan, the project is expected to put into operation in 2016. However, project investors are still in the process of arranging capital.

Characterization	Criteria	Ocean Renewable JSC	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	has been installed 01 wind measurement mast, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	2	based on capability of external resources

[7] A Vietnamese company has business covering in energy, construction and being listed in NASDAQ.

Characterization	Criteria	Ocean Renewable JSC	
		Score	Justification
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	4	based on capability of external resources
	Register the site with provincial committee	5	the site has been registered from 2009
1.2. Administration authorization	Business registration, ISO certificates	3	NA
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the provincial power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	the FS would be done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	has been experienced in some power projects
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	2	no have much knowledge
	- Turbine size, hub height, type		
	Ability in detailed engineering management	2	no have much ability
	Ability in civil construction management	2	no have much ability
	Ability in equipment procurement management and quality control	2	no have much ability
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	1	no have
	Ability in management of Compliance check of all safety, fire protection, environment issues	1	no have
	Knowledge in Grid connection testing and commissioning	1	no have
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	1	no have
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	1	no have
	Monitoring and Performance control	1	no have

Characterization	Criteria	Ocean Renewable JSC	
		Score	Justification
	Training and capacity building plan/programs	1	no have
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	3	based on capability of external resources
	Preparation of the due diligent package for project	2	based on capability of external resources
	Financial closure	2	still to find out the final source
	Risk assessment capacity	1	
	Ability in mobilizing financing resources from third parties/financial institutions	3	may be
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	2	not yet
	Negotiation and signing of PPA with local/provincial/national power purchase company	2	not yet
5. Experiences	Have invested/operated/developed energy projects	3	has been experienced in some small hydropower projects
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	no have
6. Others			
	Size of firm	3	
	Level of interest in Vietnam	2	

PetroVietnam Power Corporation (PV Power)

PVP was founded and owned by Petro Vietnam in 2007. Since then, PVP is an active investor in numerous power generation projects including hydropower and thermal power in Vietnam and abroad. Typical PVP's projects are: Nhon Trach thermal power plant, Xekaman hydropower plant (Laos) and Phu Quy Wind Power Plant.

Wind power project on Phu Quy Island has a capacity of 6 MW, including 03 Vestas turbines of 2 MW. The power plant's construction was completed in late 2011 and officially put into operation in May 2013. This is off-grid and hybrid project supplying power for the island. Wind turbines are combined with a 3 MW diesel power station. The power plant was unable to have electricity selling agreement with EVN as project owner requested higher tariff than specified FIT of the government. From 2014, PVP has handed over the project to the EVN Southern Power Corporation (EVN SPC) to be the power plant operator. ENV SPC is the network company managing and operating power grid in South Vietnam (including Phu Quy Island) from 2015.

Another project of PVP is Hoa Thang 1 Wind Power project which is located in Hoa Thang commune, Bac Binh district, Binh Thuan province. This is an onshore projects connected to the national grid.

The project was approved into wind power development plan of Binh Thuan province. It has installed and operated on site wind met-masts since 2009. Project's Investment Report and basic Technical Design was established and approved. Total capacity of the wind farm is expected to be 85.5 MW in which 49.5MW will be built in the first phase installation.

Financial capacity of the investors is relatively high because it is a reputational corporation in the field of energy, with credible financial resources and has carried out many projects hydropower and thermal power. However, PVP had to stop investing in this project as the central government issued policy for state owned companies to withdraw investments from non-core business of large corporations.

Characterization	Criteria	PV Power	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	has been installed 03 wind measurement masts, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	2	based on capability of external resources
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	4	based on capability of external resources
	Register the site with provincial committee	5	the site has been registered from 2009
1.2. Administration authorization	Business registration, ISO certificates	3	NA
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the provincial power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	the FS would be done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	5	has been experienced in some power projects
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in 01 island wind project
	- Turbine size, hub height, type		
	Ability in detailed engineering management	4	has been experienced in 01 island project
	Ability in civil construction management	4	has been experienced in 01 island project
	Ability in equipment procurement management and quality control	4	has been experienced in 01 island project
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	5	has been experienced in 01 island project
	Ability in management of Compliance check of all safety, fire protection, environment issues	5	has been experienced in 01 island project

Characterization	Criteria	PV Power	
		Score	Justification
	Knowledge in Grid connection testing and commissioning	5	has been experienced in 01 island project
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	4	has been experienced in 01 island project
	Knowledge in operation and transaction in electricity market	5	has been experienced in 01 island project
	Skills of operators and engineers	4	owns some power engineers
	Monitoring and Performance control	4	owns some power engineers
	Training and capacity building plan/programs	3	proposed capacity building programs
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	5	based on capability of external resources
	Preparation of the due diligent package for project	4	based on capability of external resources
	Financial closure	3	project stopped due to Company policy changes
	Risk assessment capacity	3	project stopped due to Company policy changes
	Ability in mobilizing financing resources from third parties/financial institutions	3	project stopped due to Company policy changes
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established
4. Off-take arrangements	Grid connection agreement	2	not yet
	Negotiation and signing of PPA with local/provincial/national power purchase company	2	not yet
5. Experiences	Have invested/operated/developed energy projects	5	has been experienced in many power projects
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	5	has been experienced in many power projects
6. Others			
	Size of firm	5	
	Level of interest in Vietnam	5	

EVN Power Generation Corporation 2 (EVN GENCO2)

EVN GENCO2 was founded in 2012 in the process of power sector reform and unbundling of EVN. The main task of EVN GENCO2 is the production of electricity and investment management of power generation projects. EVN GENCO2 owns selected power plants such as O Mon Thermal Power Plant, Song Bung 4 Hydropower Plant. Thac Mo hydropower plant expansion project is also another investment portfolio of EVN GENCO2. The company was handed over wind power project in Cong Hai Wind Power project in Binh Thuan province.

This project has been invested by EVN Investment and Construction Company (EVNIC), a subsidiary of the Electricity of Vietnam. The project was transferred to GENCO2 as an investor in 2014. It locates in Cong Hai commune, Thuan Bac district, Ninh Thuan province.

The project was approved into Wind Power Development plan of Ninh Thuan Province and has installed and operated on site wind met-mast over 3 years ago.

As proposed by the investors, project's area is about 180 hectares and is divided into 02 stages:

- Stage 1 (the planned construction and completion in 2013): the investor will implement 01 projects claiming 20 hectares of land to erect 3 units of wind turbines with capacity of 1MW per unit by Russian technology (wind turbine with two coaxial rotor). Construction of Phase started in Ninh Thuan on 05 May 2014. It is expected that it would progress into commercial operation stage 1 in February 2015 (extended).
- Stage 2 (scheduled for implementation in the period 2014-2015): investors continue to implement the project component with claimed area of 160 ha to support for 15 units with a capacity of 2.5 MW per units using American technology.

Currently, Phase 1 seems to halt as Russian partners were not handed over turbines as expected. Phase 2 is also suspended.

Characterization	Criteria	EVN GENCO2	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	has been installed 01 wind measurement mast, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	2	based on capability of external resources
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	2	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	2	based on capability of external resources
	Register the site with provincial committee	5	the site has been registered
1.2. Administration authorization	Business registration, ISO certificates	3	NA
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the provincial power development plan

Characterization	Criteria	EVN GENCO2	
		Score	Justification
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	4	the FS has been done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	5	has been experienced in many power projects
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	2	has been experienced in 01 project
	- Turbine size, hub height, type		
	Ability in detailed engineering management	4	has been experienced in many power projects
	Ability in civil construction management	4	has been experienced in many power projects
	Ability in equipment procurement management and quality control	4	has been experienced in many power projects
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	5	has been experienced in many power projects
	Ability in management of Compliance check of all safety, fire protection, environment issues	5	has been experienced in many power projects
	Knowledge in Grid connection testing and commissioning	5	has been experienced in many power projects
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	4	has been experienced in many power projects
	Knowledge in operation and transaction in electricity market	5	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	4	owns some power engineers
	Monitoring and Performance control	4	owns some power engineers
	Training and capacity building plan/programs	3	proposed capacity building programs
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	5	based on capability of external resources
	Preparation of the due diligent package for project	4	based on capability of external resources
	Financial closure	3	may happen sooner
	Risk assessment capacity	3	
	Ability in mobilizing financing resources from third parties/financial institutions	3	the parent company has some credibility in the capital settlement
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	1	SPV has not been established
4. Off-take arrangements	Grid connection agreement	2	not yet

Characterization	Criteria	EVN GENCO2	
		Score	Justification
	Negotiation and signing of PPA with local/provincial/national power purchase company	2	not yet
5. Experiences	Have invested/operated/developed energy projects	5	has been experienced in many power projects
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	5	has been experienced in many power projects
6. Others			
	Size of firm	5	
	Level of interest in Vietnam	5	

HBRE Wind Power Solution (HBRE)

HBRE is a Vietnamese company founded in 2012, operating in various areas including real estate, construction, waste management and energy.

Highland Wind project has been invested by HBRE locating in Dlie Yang commune, Ea H'leo district, Dak Lak Province. The project is expected to have a capacity of 120 MW and implemented in 3 phases. The first phase will capacitate at 28 MW consisting of 14 units of GE 2 MW.

Highland Wind project's construction has been started from April 2015 and is expected to operate in 2016. The shareholders and also EPC contractor of the project is Huy Hoang Transport Corporation (HTL). HTL committed to contribute 25 % of total investment capital for the project. Power purchase agreement has been signed between HBRE and EVN. However, the project seems to be no progress so far. This is likely due to lack of funding arrangements and importantly, incomplete investment procedures with local government (the project just received building permit recently).

There are some other energy projects being developed by HBRE in recent years. However, there are no substantial progresses to those projects. These include offshore wind power project in Binh Thuan province, solar power projects using CSP technology in Ninh Thuan province.

Characterization	Criteria	HBRE	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	1	has been installed 01 wind measurement mast, but no have wind analysis expert
	Ability to conduct desk research and potential site visits	1	based on capability of external resources
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	1	based on capability of external resources
	Ability to Carry out site survey /energy potential measurement	1	based on capability of external resources
	Register the site with provincial committee	5	the site has been registered
1.2. Administration authorization	Business registration, ISO certificates	3	NA

Characterization	Criteria	HBRE	
		Score	Justification
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the provincial power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	the FS has been done by unqualified consultant
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	has been experienced in 01 project, be constructing now
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	2	has been experienced in 01 project
	- Turbine size, hub height, type		
	Ability in detailed engineering management	3	has been experienced in 01 project
	Ability in civil construction management	3	has been experienced in 01 project
	Ability in equipment procurement management and quality control	1	no have ability
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	1	no have ability
	Ability in management of Compliance check of all safety, fire protection, environment issues	1	no have experience
	Knowledge in Grid connection testing and commissioning	1	no have experience
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	1	no have experience
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	1	no have experience
	Monitoring and Performance control	1	no have experience
	Training and capacity building plan/programs	1	no have
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	1	no have ability
	Preparation of the due diligent package for project	1	no have
	Financial closure	2	still to find out the final source
	Risk assessment capacity	1	
	Ability in mobilizing financing resources from third parties/financial institutions	1	may not
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV has been established

Characterization	Criteria	HBRE	
		Score	Justification
4. Off-take arrangements	Grid connection agreement	5	got the Grid connection agreement from EVN
	Negotiation and signing of PPA with local/provincial/national power purchase company	5	has signed the PPA with EVN already
5. Experiences	Have invested/operated/developed energy projects	1	has been experienced in 01 project
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	no have
6. Others			
	Size of firm	2	
	Level of interest in Vietnam	2	

Tra Vinh Wind Power Co. Ltd., (TWP)

TWP (Woojin Construction Co., Ltd.) was set up in 2015 by a Korean investor to develop wind power projects in Vietnam. TWP has begun the installation of a wind measurement masts in some areas in the Mekong River delta.

Tra Vinh Wind power project phase 1 is invested by TWP, has the capacity of 48 MW and consisting of 24 wind turbines with power of 2 MW per each. This is a nearshore project and is expected to connect to the power grid. The project is located in the coastal mudflats Truong Long Hoa commune, Duyen Hai district, Tra Vinh province. The ground breaking ceremony of the project was held in February 2016. However, other the specific activities in preparation for the construction such as designing, site clearance were not undertaken.

The project is expected to come into operation on 02 January 2017. Phase 2 of the project has a capacity of 96 MW (48 turbines of 2 MW) and also got provincial investment certificate in May 2015.

Engineering services such as design, equipment, construction is expected be Korea partners. Financial arrangements provided for the project are also from Korea applied for the scale of investment is greater than 100 MW.

Characterization	Criteria	Tra Vinh Wind Power Co.Ltd,	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	
	Ability to conduct desk research and potential site visits	3	has been cooperated with local consultant for that task
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	
	Ability to Carry out site survey /energy potential measurement	3	has been cooperated with local consultant for that task
	Register the site with provincial committee	5	the site has been registered from 2015

Characterization	Criteria	Tra Vinh Wind Power Co.Ltd,	
		Score	Justification
1.2. Administration authorization	Business registration, ISO certificates	5	
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the provincial power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	5	the FS has been done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	2	foreign developer, not familiar with Vietnam context
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in some projects in Korea
	- Turbine size, hub height, type		
	Ability in detailed engineering management	3	has been experienced in some projects in Korea
	Ability in civil construction management	3	has been experienced in some projects in Korea
	Ability in equipment procurement management and quality control	3	has been experienced in some projects in Korea
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	3	has been experienced in some projects in Korea
	Ability in management of Compliance check of all safety, fire protection, environment issues	3	has been experienced in some projects in Korea
	Knowledge in Grid connection testing and commissioning	1	no have experience
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	1	no have experience
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	1	no have experience
	Monitoring and Performance control	1	no have experience
	Training and capacity building plan/programs	1	no have
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	3	based on capability of external resources
	Preparation of the due diligent package for project	3	based on capability of external resources
	Financial closure	2	still to find out the final source
	Risk assessment capacity	2	

Characterization	Criteria	Tra Vinh Wind Power Co.Ltd,	
		Score	Justification
	Ability in mobilizing financing resources from third parties/financial institutions	4	Korean sources
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV in Vietnam has been established
4. Off-take arrangements	Grid connection agreement	1	not yet
	Negotiation and signing of PPA with local/provincial/national power purchase company	1	not yet
5. Experiences	Have invested/operated/developed energy projects	1	not yet
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	not yet
6. Others			
	Size of firm	2	
	Level of interest in Vietnam	2	

Hanbaram Co. Ltd

Hanbaram is a joint venture of companies including GEC Daemyong Korea, Hanwha Asset Management and Landvill Energy. Hanbaram has been established to implement Hanbaram Wind Power project. This project (including 3 separate locations) located in the Loi Hai, Bac Phong commune (Thuan Bac District) and Tan Hai, Xuan Hai commune (Ninh Hai District) of Ninh Thuan province.

Hanbaram project has 117 MW total capacity consisting of 51 units of 2.3 MW from Enercon (proposed) and subjected to be implemented in several phases. The project was approved by the Prime Minister to be put on National Master Power Development plan (PDP VII revised) in December 2015.

The project is in the stage of preparing Feasibility Study report. Project timeline is expected to be deployed as follows: stage 1 (48.3 MW) commissioned in 2018, phase 2 (69 MW) operational in 2019.

The contractor provides engineering services such as design, equipment and construction is expected to be Korean company. Funds provided for the project is also from Korea, applied for the scale of investment is greater than 100 MW.

Characterization	Criteria	Hanbaram Co. Ltd	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on wind potential assessment	2	
	Ability to conduct desk research and potential site visits	4	has been cooperated with local consultant for that task
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	4	
	Ability to Carry out site survey /energy potential measurement	4	has been cooperated with local consultant for that task
	Register the site with provincial committee	5	the site has been registered from 2013
1.2. Administration authorization	Business registration, ISO certificates	3	
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	5	the project have been added into the National power development plan
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	the FS would be done by qualified consultants
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	2	
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as	3	has been experienced in some projects in Korea
	- Turbine size, hub height, type		
	Ability in detailed engineering management	3	has been experienced in some projects in Korea

Characterization	Criteria	Hanbaram Co. Ltd	
		Score	Justification
	Ability in civil construction management	3	has been experienced in some projects in Korea
	Ability in equipment procurement management and quality control	3	has been experienced in some projects in Korea
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	3	has been experienced in some projects in Korea
	Ability in management of Compliance check of all safety, fire protection, environment issues	3	has been experienced in some projects in Korea
	Knowledge in Grid connection testing and commissioning	1	have no experience
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	1	have no experience
	Knowledge in operation and transaction in electricity market	1	electricity market in Vietnam is not including RE power plants
	Skills of operators and engineers	1	have no experience
	Monitoring and Performance control	1	have no experience
	Training and capacity building plan/programs	2	have no capacity
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	3	based on capability of external resources
	Preparation of the due diligent package for project	3	based on capability of external resources
	Financial closure	2	still to find out the final source
	Risk assessment capacity	2	
	Ability in mobilizing financing resources from third parties/financial institutions	4	Korean sources
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	5	SPV in Vietnam has been established
4. Off-take arrangements	Grid connection agreement	1	not yet
	Negotiation and signing of PPA with local/provincial/national power purchase company	1	not yet
5. Experiences	Have invested/operated/developed energy projects	1	not yet
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	not yet
6. Others			
	Size of firm	2	
	Level of interest in Vietnam	2	

Other potential wind energy project developers

Above list details some of the investors have been actively implemented various activities related to the project until the present time. The consultant team consider that, those projects are likely to complete the deployment and into operation before 2020.

In addition, there are many other investors who are implementing projects in different stages. There are still many uncertainties, but they would be capable to complete projects before 2020. These may include: AGECO with 2 projects Phuoc The and Tien Thanh (Binh Thuan), Enfinity with 3 separate plots project in Ninh Phuoc district (Ninh Thuan), Van Thanh with project in Hong Phong commune (Bac Binh, Binh Thuan), Quoc Vinh with project in Vinh Hai commune (Soc Trang), IMPSA project in Hoa Thang (Binh Thuan), Thanh Phong with project in Thanh Hai commune (Ben Tre), BTP with project in Tien Thanh commune (Binh Thuan).

Table 5 Wind Power Developers Summary to 2020

No	Developer	Country of origin	Project	Capacity (MW)	Type	Location	Status	Note
1	Cong Ly Construction Trade and Tourism Co., Ltd	Vietnam (2000)	Cong Ly Wind Power Plant	142	Off-shore	Vinh Trach Dong, Bac Lieu	Commissioned (Phase 1 and 2) Phase 3 to be developed with more 42.8MW	Selling price at 9.8 USD cents/kWh
			Khai Long Wind Farm	150	On-shore	Ca Mau	FS	
2	Wind Power Vietnam LLC (under EAB Group)	Germany (2010)	Mui Dinh Wind Farm	37	On-shore	Phuoc Dinh, Thuan Nam district, Ninh Thuan	Land clearance, expected to have ground breaking in 2016, commission in 2017; PPA signed with EVN	Selling price; 7.8UScent/kWh
			Vinh Chau Wind Farm	120	On-shore	Vinh Chau, Soc Trang	Approved in provincial PDP, licensed for investment. Expected to start construction in 2017	
3	Thuan Binh Wind JSC (TBW)	Vietnam (2009)	Phu Lac Wind Farm	24	On-shore	Phu Lac, Tuy Phong, Binh Thuan	Approved in provincial PDP, PPA signed, connection agreed, FS completed. Under construction by EPC contract. Expected to commission by September 2016.	Selling price; 7.8UScent/kWh. Co-financed by KfW
4	RENERGY Co. Ltd	N/A (2008)	Thuan Nhien Phong Wind Farm	50	On-shore	Hoa Thang, Bac Binh, Binh Thuan	First phase to be commissioned by 2017 (32MW). Approved in provincial PDP, PPA signed, connection agreed, FS completed.	Progress used to be delayed, owner's financial capacity is weak.
5	Trung Nam Wind Power	Vietnam (2007)	Trung Nam Wind Farm	34	On-shore	Bac Phong and Loi Hai commune, Thuan Bac, Ninh Thuan	Approved in provincial PDP, FS completed. Under construction and selecting turbines.	
6	Ocean Renewable JSCo	Vietnam (2012)	Cau Dat Wind Farm	100 – 300MW	On-shore	Tram Hanh, Da Lat, Lam Dong	Approved in provincial PDP, investment licensed, phase 1's capacity is 28.8MW. Developer is still arranging capital for the project.	
7	PV Power	Vietnam (2007)	Phu Quy Wind Power Plant	6	On island / off grid		Commissioned in 2013, hand-over to EVN Southern Power Corporation	Failed to deal with EVN on power purchasing price
			Hoa Thang 1 Wind Power Project	85.5	On-shore	Bac Binh, Binh Thuan	Approved in provincial PDP, FS completed. Phase 1 is expected to install 49.5MW. PV Power stop investing in this project in 2015.	
8	EVN GENCO2	Vietnam (2012)	Cong Hai Wind Power Project	40.5	On-shore	Thuan Bac, Ninh Thuan	Approved in provincial PDP. Project delayed due to failure of Russian partner to provide turbines for Phase 1 (3MW) and Phase 2 is also postponed.	
9	HBRE Wind Power Solution	Vietnam (2012)	Tay Nguyen Wind Power Project	120	On-shore	Đliê Yang, Ea H'leo, Đăk Lăk	Co-invested by Huy Hoang JSC (also as EPC contractor). PPA signed with EVN.	

No	Developer	Country of origin	Project	Capacity (MW)	Type	Location	Status	Note
							However, procedures have not been finalized with local GoV (just licensed for investment recently). Financial arrangement is still undergoing.	
10	Tra Vinh Wind Power Co. Ltd	Korea (2015)	Tra Vinh Wind Power Project	48	Near-shore	Truong Long Hoa, Duyen Hai, Tra Vinh	Investment for Phase 1 (48MW) was licensed. However, most of procedures have not been finalized including technical designs, land clearance, etc). Financed by Korean investors.	
11	Hanbaram Ltd	Korea	Hanbaram Wind Power Project	117	On-shore	Loi Hai – Bac Phong (Thuan Bac) – Tan Hai – Xuan Hai (Ninh Hai), Ninh Thuan	Approved in national PDP 7. FS is in preparation. It is planned to complete the Phase 1 (48.3MW) by 2018, and Phase 2 (69MW) by 2019. Financed by Korean investors.	

A.3 Solar Power Projects and Developers in Vietnam

Thien Tan Investment Construction Joint Stock Company

Characterization	Criteria	Thien Tan Investment Construction	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on solar potential assessment	2	Thien Tan is a domestic private firm, having experience in the construction, operation of small hydro power and aquaculture. The project is to build a ground mounted solar PV power plant with 19.2 MW in Mo Duc, Quang Ngai province. It is the first solar PV project of the company so that experience is too limitation in term of analyzing wood and wood waste potential, and transportation and logistics of biomass sources
	Ability to conduct desk research and potential site visits	1	Has ability to conduct desk research and potential site visits for small hydro power (SHP) only. Knowledge and experience in the solar power is too limitation
	Ability to analyze the logistic/ transportation (of machinery during construction phase or during operation)	4	Has ability to analyze the logistic/ transportation (of machinery during construction phase because the company has experiences in construction and operation for SHP
	Ability to Carry out site survey /energy potential measurement	3	The company used own lands for solar PV plant and applied for other sites in the largest solar potential areas in Vietnam, e.g. Ninh Thuan province. However, the company has not ability to carry out assess energy potential. Lack of skills and manpower
	Register the site with provincial committee	4	Has been experienced in term of construction, installation and operation of SHP power plant
1.2. Administration authorization	Business registration, ISO certificates	4	Received ISO 9001: 2008
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	4	Has been implementing to adjust 19.2 MW solar PV plant in to Quang Ngai power development plan and a new 300MW solar PV plant in to national power development plan (PDP VII adjusted). Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	2	Through a contract with specialized consultant units in accordance with the relevant regulations). The contract will be output-based of the reports (investment report; site clearance plan and geological investigation report; environment impact assessment report).
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	4	Has been experienced in term of construction, installation and operation of SHP power plant
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as solar cells, inverters, charge controllers, etc (solar power)	1	Lack of skills and manpower
	Ability in detailed engineering management	3	Has been experienced in term of construction, installation and operation of SHP power plant
	Ability in civil construction management	3	Has been experienced in term of construction, installation and operation of SHP power plant

Characterization	Criteria	Thien Tan Investment Construction	
		Score	Justification
	Ability in equipment procurement management and quality control	3	Has been experienced in term of construction, installation and operation of SHP power plant
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	3	Has been experienced in term of construction, installation and operation of SHP power plant
	Ability in management of Compliance check of all safety, fire protection, environment issues	3	Has been experienced in term of construction, installation and operation of SHP power plant
	Knowledge in Grid connection testing and commissioning	3	Has been experienced in term of construction, installation and operation of SHP power plant
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	3	Has been experienced in term of construction, installation and operation of SHP power plant
	Knowledge in operation and transaction in electricity market	3	Has knowledge but not much
	Skills of operators and engineers	3	Has been experienced in term of construction, installation and operation of SHP power plant
	Monitoring and Performance control	3	Has been experienced in term of construction, installation and operation of SHP power plant
	Training and capacity building plan/programs	3	Has been experienced in term of construction, installation and operation of SHP power plant
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	3	Has knowledge but not much
	Preparation of the due diligent package for project	3	Has knowledge but not much
	Financial closure	-	NA
	Risk assessment capacity	2	Has knowledge but not much
	Ability in mobilizing financing resources from third parties/financial institutions	-	NA
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for RE power development	3	Has knowledge but not much
4. Off-take arrangements	Grid connection agreement	3	Has experience in the selection of consultants to make the report to adjust project into plan (through a contract with specialized consult unit)
	Negotiation and signing of PPA with local/provincial/national power purchase company	3	Has experience in the selection of consultants to make the report to adjust project into plan (through a contract with specialized consult unit)
5. Experiences	Have invested/operated/developed energy projects	4	Have one SHP plant
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	4	Have one SHP plant
6. Others			
	Size of firm	3	an average company

Characterization	Criteria	Thien Tan Investment Construction	
		Score	Justification
	Level of interest in Vietnam	4	Quite interest level in term of RE investment.

Doo Sung Vina Company Ltd

Characterization	Criteria	Doo Sung Vina Company Limited	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability/knowledge on solar potential assessment	2	Doo Sung Vina Co., Ltd based in Vietnam as a FDI firm of Korea belong Doo Sung corporation. The Company's main business activities in Vietnam is wholesale of others machines, equipment and spare parts. The solar PV 30 MW proposal project is first plant of the Company in Binh Thuan province of Vietnam. It has not been found the any experience and ability to carry out assesses solar potential.
	Ability to conduct desk research and potential site visits	2	Knowledge and experience in the solar power is too limitation
	Ability to analyze the logistic/ transportation (of machinery during construction phase or during operation)	4	Has ability to analyze the logistic/ transportation (of machinery during construction phase because the company has experiences in this field
	Ability to Carry out site survey /energy potential measurement	2	The company has not ability to carry out assess energy potential and lack of skills and manpower
	Register the site with provincial committee	2	Has been registered the site with Binh Thuan province
1.2. Administration authorization	Business registration, ISO certificates	3	Received ISOs for other activities, not yet received ISO for solar energy activities
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	3	Has been implementing to adjust 30 MW solar PV plant in to Binh Thuan power development plan and received the MOIT's Decision. Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	2	Knowledge and experience in the solar power is too limitation. The Pre-FS was made through a contract with specialized consultant units in accordance with the relevant regulations. The contract will be output-based of the reports (investment report; site clearance plan and geological investigation report; environment impact assessment report).
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	2	The company has not ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as solar cells, inverters, charge controllers, etc. (solar power)	2	Lack of skills and manpower on solar PV activities
	Ability in detailed engineering management	2	Lack of skills and manpower on solar PV activities
	Ability in civil construction management	4	Lack of skills and manpower on solar PV activities
	Ability in equipment procurement management and quality control	4	Has been experienced in term of construction, wholesale of others machines, equipment and spare parts

Characterization	Criteria	Doo Sung Vina Company Limited	
		Score	Justification
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Has been experienced in term of construction, wholesale of others machines, equipment and spare parts
	Ability in management of Compliance check of all safety, fire protection, environment issues	4	Has been experienced in term of construction, wholesale of others machines, equipment and spare parts
	Knowledge in Grid connection testing and commissioning	1	Lack of knowledge, skills and manpower in grid connection testing and commissioning
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	1	Has been experienced in term of wholesale of others machines, equipment and spare parts but not much for power plant
	Knowledge in operation and transaction in electricity market	1	Lack of knowledge, skills and manpower in wholesale of others machines, equipment and spare parts
	Skills of operators and engineers	4	Has been experienced in term of construction, wholesale of others machines, equipment and spare parts
	Monitoring and Performance control	4	Has been experienced in term of construction, wholesale of others machines, equipment and spare parts
	Training and capacity building plan/programs	2	Needs training to strengthen capacity
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	2	Needs training to strengthen capacity
	Preparation of the due diligent package for project	3	Has knowledge but not much
	Financial closure	-	NA
	Risk assessment capacity	3	Has knowledge but not much
	Ability in mobilizing financing resources from third parties/financial institutions	-	NA
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for RE power development	3	Has knowledge but not much
4. Off-take arrangements	Grid connection agreement	3	Has experience in the selection of consultants to make the report to adjust project into plan (through a contract with specialized consult unit)
	Negotiation and signing of PPA with local/provincial/national power purchase company	2	Has knowledge but not much
5. Experiences	Have invested/operated/developed energy projects	1	Not yet
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	4	Not yet
6. Others			
	Size of firm	4	Big company
	Level of interest in Vietnam	4	Lager interest level in term of RE investment

Solar Power Developer Summary

The total installed power capacity of solar PV systems increased from 0.5 MWe in 2006 to 5.6 MWe in 2015[8]. However, only 1 MWe are national grid-connected only in term of rooftop solar PV systems. The remaining 4.6 MWe are used for off-grid electricity supply of the households on islands or in mountainous areas in term of solar PV home systems and mini grids (hybrid system).

As of June 2016, only one first solar power project at ground mounted to be connected to the 110 kV power network has just organized ground breaking ceremony (August 2015). This project with capacity of 19.2MW is owned by Thien Tan Construction Investment Joint Stock Company – Private Company, located in Duc Minh commune, Mo Duc district, Quang Nam province. Project land area is 27.5 ha consisting of no-longer-used shrimp rearing marsh of the project owner (rate of land occupation of the project is 1.43 ha/MW).

There are also 10 other planned solar power projects distributed in provinces of Central region of Vietnam (from Ha Tinh province to Binh Thuan province) in the various development stages such as: pending for license for investigation of investment site or waiting for investment permission, etc.

At present, there are about 10 solar power projects to be connected to the national power grid, with total anticipated installed capacity of about 1000 MW. Owners of these projects are divided into two groups:

- Foreign Direct investors (FDIs); and
- Domestic investors.

Most domestic investors are private and divided into two sub-groups:

- Companies limited; and
- Joint stocks companies.

As solar power market in Vietnam has not matured yet, electricity tariffs are not promulgated, therefore, the above projects are at stage of waiting policies, incentive mechanisms and they are considered as projects in the pipeline or in plan.

[8] ***Source***: i). Institute of Energy, "The investigated reports on solar PV power development projects in 9 provinces of Central coastal areas, 2016; ii) Institute of Energy, Analyze costs of non-hydro renewable power, especially solar power generation in Vietnam, UNDP, 2015. ; and iii). Institute of Energy, Research project "Design and test of automatic tracking system for solar PV in Vietnam", 2012

Table 6 Overview of Solar PV Power Developers/Investors

No	Developer/ Investors	Province	District	Land claimed (ha)	Capacity (MW)	Status	Note
1	Hoanh Son Group JSC	Ha Tinh	Cam Hoa, Cam Xuyen,	97	50	Preparing the report for power development plan adjustment at province level	To get Investment License
2	Doo Sung Vina, Korea	Quang Binh			300	Under making site survey and preparing the report for PDP adjustment at province level	To get Investment License
3	NA	Da Nang	Da Nang Airport	NA	2,8	Preparing the demonstration project	Information coming from DOIT Da Nang city
4	WB		NA	NA	30-40	Preparing the demonstration project	Proposal
5	Venture between Arman Holding and Royal Star	Quang Nam	Binh Nam, Thang Binh	190	100	Having the Decision of the provincial People's Committee approved site survey and preparing the report for power development plan adjustment at province level	
6	Venture between Marshell and Street and GT associates		KCN Tam Thanh	250	150	Surveying and making procedures for investment register	
8	Thien Tan Investment and Construction JSC	Quang Ngai	Duc Minh, Mo Duc	27,5	19,2	Broke ground, and raising capital and loan	
9	Tuan Anh Investment and Construction JSC	Khanh Hoa	Cam Thanh Tay, Cam Ranh	NA	10+10	Surveyed the location, doing the investment registration procedures	
10	Venture between Doosung vina and Hoang Phuc Real estate company		Vinh Dong, An Nam, Cam Lam	60	50	Approved to make site survey/study	
11	Asia Oil & Gas Energy Investment and Construction JSC		Ninh Ha, Ninh Hoa	150	100	Letter submitted to the PPC to further study the project sire	
12	Doosung Vina Company Ltd.	Binh Thuan	Vinh Hao, Tuy Phong	50	30	Received Investment License	
13	Korea Company		KCN Son My	400	200	Letter submitted to the PPC to further study the project site	

No	Developer/ Investors	Province	District	Land claimed (ha)	Capacity (MW)	Status	Note
14	Tata Power Company, India		KCN Tan Duc	80	50	Letter submitted to the PPC to further study the project site	
19	AES, USA		Song Luy, Bac Binh	470	50	Letter submitted to the PPC to further study the project site	
20	Terra Wood and Belectric Solar	Ninh Thuan	Tri Hai, Ninh Hai	4,5		Accepted the survey and establishment of investment projects (FS), Letter No 1083/UBND-KTN dated 18/3/2014	
21	Up Treasure Holdings Limited		Site number 7, 7A, 7B (Solar PV development planning)	Open	Open	Letter submitted to the PPC to further study the project site	
22	Thien Tan Investment and Construction JSC		Phuoc Trung, Bac Ai and Nhon Son, Ninh Son	600	300	Accepted the survey and establishment of investment projects, Letter No. 1169/UBND-KTN dated 23/3/2015	Added the Project into the revised PDP VII
22	Tata Power Company, India		Open	80	50	Letter submitted to the PPC to further study the project sire	

A.4 Biomass Power Projects and Developers in Vietnam

KCP Vietnam Industries Limited (KCP VIL)

Characterization	Criteria	KCP Vietnam Industries Limited (KCP VIL)	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability to analyze resource utilization potential; siting and/or Transportation and logistics of the resource	4	KCP is FDI firm, having experience in the agricultural industries. Collecting and supplying bagasse as fuel for 9 MW CHP plant in Vietnam
	Ability to feed stock resource assessment and secure frame contract with the biomass suppliers	4	Has ability to assess and analysis biomass feed stock and build contract with suppliers (sugarcane and other biomass)
	Ability to conduct desk research and potential site visits	4	Has ability to conduct desk research and potential site visits
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	4	The existing biomass CHP plant located in a province with good availability of sugarcanes, and positioned not too far from the grid. Transport distances for bagasse are not far the CHP plant.
	Ability to Carry out site survey /energy potential measurement	4	Has ability to carry out site survey and analysis, assess resource potential.
	Register the site with provincial committee	4	Has been experienced in term of construction, installation and operation of combined heat and power (CHP) plant based fired bagasse in sugar mill in Vietnam since 2000
1.2. Administration authorization	Business registration, ISO certificates	5	Received ISO 9001: 2008
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	4	Has been implementing to adjust new 60MW CHP in to national/province power development plan. Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	Has been implementing to adjust new 60 MW CHP in to national power development plan (Through a contract with specialized consultant units in accordance with the relevant regulations). The contract will be output-based.
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	4	Has been experienced in term of construction, installation and operation of combined heat and power (CHP) plant based fired bagasse in sugar mill in Vietnam since 2000
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as kiln, furnaces, generator, etc (biomass power);	5	The parent company, the KCP Group in India http://www.kcp.co.in is reputed manufacturer of heavy and high quality machinery for Cement, Steel and Sugar industries for more than 60 years. The group has been involved in developing sugar industry in Vietnam since 1990's by supplying machinery for turkey projects as well as for expansion projects
	Ability in detailed engineering management	5	The parent company, the KCP Group in India is one of the suppliers of boiler, turbine, etc.
	Ability in civil construction management	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam

Characterization	Criteria	KCP Vietnam Industries Limited (KCP VIL)	
		Score	Justification
	Ability in equipment procurement management and quality control	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Ability in management of Compliance check of all safety, fire protection, environment issues	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Knowledge in Grid connection testing and commissioning	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	5	The parent company, the KCP Group in India is one of the suppliers of boiler, turbine, etc.
	Knowledge in operation and transaction in electricity market	4	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Skills of operators and engineers	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Monitoring and Performance control	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Training and capacity building plan/programs	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	4	Has been implementing to adjust new 60MW (30MW-phase 1+30MW phase 2) CHP in to province power development plan. Has experience in the selection of high quality consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Preparation of the due diligent package for project	5	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Financial closure	4	NA
	Risk assessment capacity	4	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
	Ability in mobilizing financing resources from third parties/financial institutions	-	NA
	Biomass transportation costs and operation options of biomass power plants (biomass power only)	4	Operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for biomass power development	5	Has experience in admin. process and applies with the relevant regulations
4. Off-take arrangements	Grid connection agreement	4	Has experience in the selection of consultants to make the report to adjust project into plan (through a contract with specialized consult unit)
	Negotiation and signing of PPA with local/provincial/national power purchase company	4	Has experience in the selection of consultants to make the report to adjust project into plan (through a contract with specialized consult unit)

Characterization	Criteria	KCP Vietnam Industries Limited (KCP VIL)	
		Score	Justification
5. Experiences	Have invested/operated/developed energy projects	5	Have one CHP plant and operating the 9 MW based fired bagasse CHP in Phu Yen province of Vietnam
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	5	Have one CHP plant and operating the 9 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
6. Others			
	Size of firm	5	Being a big company
	Level of interest in Vietnam	4	Lager interest level in term of investment in Vietnam. Being a 100% foreign invested company with total investment a capital of 42 million USD, is established on 19th May 2000 in Vietnam

Son Duong Sugar and Sugarcane Joint Stock Company

Characterization	Criteria	Son Duong Sugar and Sugarcane	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability to analyze resource utilization potential; siting and/or Transportation and logistics of the resource	3	This is a domestic joint stock firm, having some experiences in collecting and supplying bagasse as fuel for 4.5 MW CHP plant in Tuyen Quang province of Vietnam
	Ability to feed stock resource assessment and secure frame contract with the biomass suppliers	3	Has some experiences in collecting and supplying bagasse as fuel for 4.5 MW CHP plant in Tuyen Quang province of Vietnam
	Ability to conduct desk research and potential site visits	2	Lack of skills to calculate the input and output
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	Has some experiences in collecting and supplying bagasse as fuel for 4.5 MW CHP in Tuyen Quang province of Vietnam
	Ability to Carry out site survey /energy potential measurement	2	Lack of skills to calculate the input and output
	Register the site with provincial committee	4	Just completed the registration of 25 MW expansion project in Tuyen Quang province
1.2. Administration authorization	Business registration, ISO certificates	4	Received Business registration and ISO 9001: 2008
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	3	Just completed adjustment of 25 MW expansion project into Tuyen Quang power development plan (through a contract with the domestic consultant to make a document/report for adjustment of the new CHP into power planning)
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	Lack of skills in term of conducting FS study, and geological investigation report; Environment impact assessment report
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	Has been experienced in term of construction, installation and operation of combined heat and power (CHP) plant based fired bagasse in sugar mill in Vietnam since 2008
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as kiln, furnaces, generator, etc (biomass power);	3	Has been experienced in term of construction, installation and operation of combined heat and power (CHP) plant based fired bagasse in sugar mill in Vietnam since 2008
	Ability in detailed engineering management	3	Operating the 4.5 MW based fired bagasse CHP plant in Tuyen Quang province of Vietnam
	Ability in civil construction management	4	Operating the 4.5 MW based fired bagasse CHP plant
	Ability in equipment procurement management and quality control	4	Operating the 4,5 MW based fired bagasse CHP plant
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Operating the 4.5 MW based fired bagasse CHP plant

Characterization	Criteria	Son Duong Sugar and Sugarcane	
		Score	Justification
	Ability in management of Compliance check of all safety, fire protection, environment issues	4	Operating the 4.5 MW based fired bagasse CHP plant
	Knowledge in Grid connection testing and commissioning	4	Operating the 4.5 MW based fired bagasse CHP plant
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	3	Operating the 4.5 MW based fired bagasse CHP plant
	Knowledge in operation and transaction in electricity market	4	Operating the 4.5 MW based fired bagasse CHP plant
	Skills of operators and engineers	4	Operating the 4.5 MW based fired bagasse CHP plant
	Monitoring and Performance control	4	Operating the 4.5 MW based fired bagasse CHP plant
	Training and capacity building plan/programs	3	Operating the 4.5 MW based fired bagasse CHP plant in Phu Yen province of Vietnam
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	4	Has been implementing to adjust new 25MW CHP in to national power development plan.
	Preparation of the due diligent package for project	3	Operating the 4.5 MW based fired bagasse CHP plant
	Financial closure	-	NA
	Risk assessment capacity	2	Lack of capacity and knowledge
	Ability in mobilizing financing resources from third parties/financial institutions	1	Lack of experiences and capacities
	Biomass transportation costs and operation options of biomass power plants	3	Operating the 4.5 MW based fired bagasse CHP plant
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for biomass power development	4	Knowing any process and applies
4. Off-take arrangements	Grid connection agreement	3	Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Negotiation and signing of PPA with local/provincial/national power purchase company	3	Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
5. Experiences	Have invested/operated/developed energy projects	4	Operating the 4.5 MW based fired bagasse CHP plant
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	4	Operating the 4.5 MW based fired bagasse CHP plant
6. Others			
	Size of firm	3	At the average level
	Level of interest in Vietnam	3	Likely but not much

Quang Ngai Sugar Joint Stock Company

Characterization	Criteria	Quang Ngai Sugar Joint Stock Company	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability to analyze Resource utilization potential; siting and/or Transportation and logistics of the resource	3	This is a domestic joint stock firm, having some experiences in collecting and supplying bagasse as fuel for 15.8 MW CHP plant in Gia Lai province of Vietnam
	Ability to feed stock resource assessment and secure frame contract with the biomass suppliers	3	Has some experiences in collecting and supplying bagasse as fuel for 15.8 MW CHP plant in Gia Lai province of Vietnam
	Ability to conduct desk research and potential site visits	2	Lack of skills to calculate the input and output
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	Has some experiences in collecting and supplying bagasse as fuel for 15.8 MW CHP plant in Gia Lai province of Vietnam
	Ability to Carry out site survey /energy potential measurement	2	Lack of skills to calculate the input and output
	Register the site with provincial committee	4	Just completed the registration of 110 MW expansion project in Gia Lai province (An Khe biomass CHP plant)
1.2. Administration authorization	Business registration, ISO certificates	5	Received Business registration and ISO 9001: 2008
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	4	Just completed adjustment of 110 MW expansion project into National power development plan (PDP VII adjusted).
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	Not enough ability to themselves conduct Pre-FS, FS and other study but, Developer has ability to evaluate and select good consultant for those studies
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	4	Has been experienced in term of construction, installation and operation of CHP plant based fired bagasse in sugar mills
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as kiln, furnaces, generator, etc (biomass power);	3	Has been experienced in term of construction, installation and operation of combined heat and power (CHP) plant based fired bagasse in sugar mill in Vietnam since 2008
	Ability in detailed engineering management	3	Operating the 15.8 MW based fired bagasse CHP plant in Gia Lai province of Vietnam
	Ability in civil construction management	4	Operating the 15.8 MW based fired bagasse CHP plant
	Ability in equipment procurement management and quality control	4	Operating the 15.8 MW based fired bagasse CHP
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Operating the 15.8 MW based fired bagasse CHP plant
	Ability in management of Compliance check of all safety, fire protection, environment issues	4	Operating the 15.8 MW based fired bagasse CHP plant

Characterization	Criteria	Quang Ngai Sugar Joint Stock Company	
		Score	Justification
	Knowledge in Grid connection testing and commissioning	4	Operating the 15.8 MW based fired bagasse CHP plant
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	3	Operating the 15.8 MW based fired bagasse CHP plant
	Knowledge in operation and transaction in electricity market	4	Operating the 15.8 MW based fired bagasse CHP plant
	Skills of operators and engineers	4	Operating the 15.8 MW based fired bagasse CHP plant
	Monitoring and Performance control	4	Operating the 15.8 MW based fired bagasse CHP plant
	Training and capacity building plan/programs	3	Operating the 15.8 MW based fired bagasse CHP plant
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	4	Has been implementing to adjust new 100 MW CHP in to national power development plan.
	Preparation of the due diligent package for project	3	Operating the 15.8 MW based fired bagasse CHP plant
	Financial closure	-	NA
	Risk assessment capacity	4	Operating the 15.8 MW based fired bagasse CHP plant
	Ability in mobilizing financing resources from third parties/financial institutions	3	Has experiences in this field
	Biomass transportation costs and operation options of biomass power plants (biomass power only)	4	Operating the 15.8 MW based fired bagasse CHP plant
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for biomass power development	4	Knew any process and applies
4. Off-take arrangements	Grid connection agreement	4	Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Negotiation and signing of PPA with local/provincial/national power purchase company	4	Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
5. Experiences	Have invested/operated/developed energy projects	4	Operating the 15.8 MW based fired bagasse CHP plant
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	4	Operating the 15.8 MW based fired bagasse CHP plant
6. Others			
	Size of firm	4	Being a big company in Vietnam
	Level of interest in Vietnam	4	Wanting to develop biomass power projects in Vietnam

Dinh Hai Equipment Company Limited

Characterization	Criteria	Dinh Hai Equipment Company Limited	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability to analyze Resource utilization potential; siting and/or Transportation and logistics of the resource	3	This is a domestic private equity firm. The project is to build a rice husk power plants in Mekong River Delta region of Vietnam. Has ability to analyze rice husk resource potential; select sites but lack of experience in forecasting raw biomass price after installing project.
	Ability to feed stock resource assessment and secure frame contract with the biomass suppliers	3	Has some experiences to collect and supply rice husk as fuel for based rice husk boiler with 70 tons of steam in Can Tho city of Vietnam. But, this is the first project of the company so that experience is not much.
	Ability to conduct desk research and potential site visits	2	Lack of skills to calculate the input and output and assess, select good sites
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	Has some experiences to collect and transport rice husk by boat on the rivers but lack of experiences in term of fuel transportation by trucks on the roads.
	Ability to Carry out site survey /energy potential measurement	2	Lack of skills to calculate the input and output
	Register the site with provincial committee	4	Has some experiences in term of register to get investment license, license of pressure equipment and boiler operating.
1.2. Administration authorization	Business registration, ISO certificates	4	Received Business registration and ISO 9001: 2008
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	2	Lack of ability to adjust the project into both national and provincial power development plan.
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	2	Not much experiences and abilities to conduct formulation and development of FS report and other reports related the biomass project.
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	4	Has experiences over 10 years in term of construction, installation and operation of thermal and electricity equipment and collect the investment license, license of pressure equipment and boiler operating.
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as kiln, furnaces, generator, etc (biomass power);	3	Has been experienced in term of installation and operation of machinery, engines such as kiln, furnaces, and boilers.
	Ability in detailed engineering management	4	Has been experienced in term of design, manufacturing machinery, and provided repair services, installation and maintenance of machinery.
	Ability in civil construction management	4	Installed and operating the boiler based rice husk in the plant

Characterization	Criteria	Dinh Hai Equipment Company Limited	
		Score	Justification
	Ability in equipment procurement management and quality control	4	Installed and operating the boiler based rice husk in the plant
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
	Ability in management of Compliance check of all safety, fire protection, environment issues	4	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
	Knowledge in Grid connection testing and commissioning	1	Lack of knowledge
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	2	Has ability but not enough. Need more trainings
	Knowledge in operation and transaction in electricity market	1	Lack of knowledge in operation and transaction in electricity market
	Skills of operators and engineers	3	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
	Monitoring and Performance control	4	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
	Training and capacity building plan/programs	3	Has ability but not enough. Need more trainings
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	2	Has ability but not enough. Need more trainings
	Preparation of the due diligent package for project	3	Has ability but not enough. Need more trainings
	Financial closure	-	NA
	Risk assessment capacity	2	Has capacity but not enough. Need more trainings
	Ability in mobilizing financing resources from third parties/financial institutions	1	Lack of ability in mobilizing financing resources
	Biomass transportation costs and operation options of biomass power plants	4	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for biomass power development	4	Know in the general level but not much and detailed. Need more consults.
4. Off-take arrangements	Grid connection agreement	4	Has experience in the selection of consultants to make the report to adjust project in to plan (through a contract with specialized consult unit)
	Negotiation and signing of PPA with local/provincial/national power purchase company	4	Lack of skills and experiences

Characterization	Criteria	Dinh Hai Equipment Company Limited	
		Score	Justification
5. Experiences	Have invested/operated/developed energy projects	4	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	4	Installed and operating the boiler based rice husk in the plant to produce heat and selling to customers in the industry park
6. Others			
	Size of firm	2	At the small size level
	Level of interest in Vietnam	4	Quite high interest in industry parks in Vietnam

Hau Giang Rice Husk Power Plant Joint Stock Company

Characterization	Criteria	Hau Giang Rice Husk Power Plant	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability to analyze Resource utilization potential; siting and/or Transportation and logistics of the resource	2	This is a domestic private joint stock firm. The project is to build a rice husk power plant with 10 MW in Hau Giang province. It is the first proposal biomass project of the company so that experience is limitation in term of analyzing rice husk potential, storing rice husk as well as transportation and logistics of the rice husk.
	Ability to feed stock resource assessment and secure frame contract with the biomass suppliers	2	Lack of experiences and capacities to feed stock resource assessment, and the ability to secure frame contract with the biomass suppliers is limitation. Although the contract with the rice husk suppliers signed.
	Ability to conduct desk research and potential site visits	2	The Company claims to have some experience in research, development and investment in clean energy projects but not clear and detailed. It may be experiences in electricity transmission field in general.
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	1	The key issues causing the score to be lower were that the company experience on infrastructure projects and the ability to raise finances were not presented with facts.
	Ability to Carry out site survey /energy potential measurement	2	Lack of skills to calculate the input and output. However, selection of the project size of 10 MW with about 100 rice mills operate in the Hau Giang province with a capacity between 5-10 ton/day is good idea. But, there is no established supply chain.
	Register the site with provincial committee	4	Received certificate for land use right of 10 ha at Vi Thanh town, Hau Giang province
1.2. Administration authorization	Business registration, ISO certificates	3	Applicant submitted business licenses
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	2	It has been conducted by consultants in accordance with the relevant regulations. The contract will be output-based. PECC2 provides most of the outputs. The company stated that the project is included in the province power development plan.
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	This project has been complete FS. However, the FS has not been approved. FS's quality should be improved to meet the funding requirements. Sources, supply contract and price of biomass were stated
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	The company has proposed directors and key staff members with power plant experience. They will draw staff from electric utility companies and consulting companies

1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as kiln, furnaces, generator, etc. (biomass power);	2	Lack of knowledge of major machinery, engines such as kiln, furnaces but may be experiences in the generator and electricity transmission and distribution
	Ability in detailed engineering management	2	Not much. Needs for trainings
	Ability in civil construction management	2	Not much. Needs for trainings
	Ability in equipment procurement management and quality control	3	Has ability but not much. Needs for trainings
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	3	Has ability but not much. Needs for trainings
	Ability in management of Compliance check of all safety, fire protection, environment issues	3	Has ability but not much. Needs for trainings
	Knowledge in Grid connection testing and commissioning	4	Has ability because some staffs have worked in this fields
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	4	Has ability because some staffs have worked in this fields
	Knowledge in operation and transaction in electricity market	4	Has ability because some staffs have worked in this fields
	Skills of operators and engineers	4	Has ability because some staffs have worked in this fields
	Monitoring and Performance control	4	Has ability because some staffs have worked in this fields
	Training and capacity building plan/programs	3	Has ability but not much. Needs for trainings
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	4	Has ability because some staffs have worked in this fields
	Preparation of the due diligent package for project	3	Has ability because some staffs have worked in this fields
	Financial closure	-	NA
	Risk assessment capacity	1	Lack of experiences
	Ability in mobilizing financing resources from third parties/financial institutions	-	NA
	Biomass transportation costs and operation options of biomass power plants	1	Lack of experiences. It is first project of the company
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for biomass power development	2	Know but not much
4. Off-take arrangements	Grid connection agreement	4	Has ability because some staffs have worked in this fields

	Negotiation and signing of PPA with local/provincial/national power purchase company	4	Has ability because some staffs have worked in this fields
5. Experiences	Have invested/operated/developed energy projects	1	It is first project of the company
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	It is first project of the company
6. Others			
	Size of firm	2	Small size (has just established)
	Level of interest in Vietnam	3	Average level

Vietpeco Company Limited

Characterization	Criteria	Vietpeco Company Limited	
		Score	Justification
1. Technical capabilities			
1.1. Resource assessment and site selection	Ability to analyze Resource utilization potential; siting and/or Transportation and logistics of the resource	2	This is a domestic private equity firm. The project is to build a wood waste and other biomass power plant with 7MW in Que Sơn, Quang Nam province. It is as the first proposal biomass project of the company so that experience is limitation in term of analyzing wood and wood waste potential, and transportation and logistics of biomass sources
	Ability to feed stock resource assessment and secure frame contract with the biomass suppliers	2	Lack of experiences and capacities to feed stock resource assessment, and the ability to secure frame contract with the biomass suppliers is limitation.
	Ability to conduct desk research and potential site visits	2	The Company claims to have some experience in research, development and investment in clean energy projects but not many experiences in biomass power plants.
	Ability to analyze the logistic/ transportation (of machinery during construction phase or fuel during operation)	3	The company mentioned having experiences on infrastructure projects but not strong.
	Ability to Carry out site survey /energy potential measurement	2	Lack of skills to calculate the input and output. There is no established biomass supply chain. Has some issues on selection of site
	Register the site with provincial committee	4	Received certificate for land use right at the industry group and small scale area in Que Thuan, Que Son, Quang Nam province.
1.2. Administration authorization	Business registration, ISO certificates	3	Received business licenses but not mentioned ISO certificates
	Ability to arrangement for inclusion of the project into the National/provincial power development plan	4	It has been conducted by consultants in accordance with the relevant regulations. The company stated and received that the project is included in the province power development plan.
	Ability to conduct FS study including: Project investment report; Site Clearance plan and geological investigation report; Environment impact assessment report	3	This project has been complete FS and other related report. It has been conducted by consultants in accordance with the relevant regulations However, the FS has not been approved. FS's quality should be improved to meet the investment requirements.
	Ability to and familiarity with Acquiring energy operator license; Building permit and Obtaining electricity Production License	3	Lack of knowledge of major machinery, engines such as kiln, furnaces but may be experiences in the generator and electricity transmission and distribution
1.3. Engineering, Procurement and Construction	Knowledge of major machinery, engines such as kiln, furnaces, generator, etc (biomass power);	3	Lack of knowledge of major machinery, engines such as kiln, furnaces but may be experiences in the generator and electricity transmission and distribution

Characterization	Criteria	Vietpeco Company Limited	
		Score	Justification
	Ability in detailed engineering management	3	Not much. Needs for trainings
	Ability in civil construction management	4	Not much. Needs for trainings
	Ability in equipment procurement management and quality control	4	Has ability but not much. Needs for trainings
1.4. Commissioning and Grid Connection	Ability in management of equipment installation and commissioning	4	Has ability but not much. Needs for trainings
	Ability in management of Compliance check of all safety, fire protection, environment issues	4	Has ability but not much. Needs for trainings
	Knowledge in Grid connection testing and commissioning	4	Has ability because some staffs have worked in this fields. Access for 3 km from the 22 kV transmission line
1.5. O&M	Knowledge in Standard operation and maintenance of power plant	3	This is the first project of the company. Its key staff have some experience in energy projects
	Knowledge in operation and transaction in electricity market	2	Lack of experiences
	Skills of operators and engineers	2	Lack of experiences
	Monitoring and Performance control	2	Lack of experiences
	Training and capacity building plan/programs	2	Has ability but not much. Needs for trainings
2. Financial capacities	Ability of Economic and financial analysis of large scale grid-connected project	3	Has ability because some staffs have worked in this fields
	Preparation of the due diligent package for project	3	Has ability because some staffs have worked in this fields
	Financial closure	-	NA
	Risk assessment capacity	1	Lack of experiences
	Ability in mobilizing financing resources from third parties/financial institutions	-	NA
	Biomass transportation costs and operation options of biomass power plants (biomass power only)	2	Lack of experiences. It is first project of the company
3. Corporate legal/Fiscal	Establishment of SPV[1] and/or branch/joint stock company to develop the project	-	NA
	Application of import tax, CIT exempted, land use, other incentives for biomass power development	3	Know but not much
4. Off-take arrangements	Grid connection agreement	4	Has ability because some staffs have worked in this fields
	Negotiation and signing of PPA with local/provincial/national power purchase company	3	Has ability because some staffs have worked in this fields
5. Experiences	Have invested/operated/developed energy projects	1	It is first project of the company

Characterization	Criteria	Vietpeco Company Limited	
		Score	Justification
	Have invested/operated/developed large scale power plants (e.g. hydro, thermal power plants)	1	It is first project of the company
6. Others			
	Size of firm	2	Small size (has just established)
	Level of interest in Vietnam	3	Average level

Biomass Power Developer Summary

To date, only bagasse and wood wastes are used as fuel for combined heat and power generation (cogeneration) in the existing 41 sugar mills and one paper & pulp mill. There is still no operational power generation plant using other types of biomass such as rice husk, coffee husk, rice straw, and wood cheeps for power generation in Vietnam.

The total installed power capacity of the cogeneration plants in all sugar mills of Vietnam has increased from 125 MWe in 2009 to 154.4 MWe in 2010, and 350 MWe in 2015. The increase in the installed power capacity was due to the implementation of the capacity expansion of sugarcane presses in some sugar mills after 2011. According to a GIZ-GDE/MOIT report[9] and the Vietnam Sugar Association, up to 2015, only 7 out of 41 existing sugar mills are selling a total of 78.51 MWe of electricity to the national power grid.

One wood waste cogeneration plant in the paper & pulp mill with the installed capacity of 25 MWe is operating to provide heat and power for own consumption.

There are also many biomass power projects using other biomass sources (e.g. rice husk, wood cheeps/wasted under planning and pipelines.

Rice husk power developers and investors

Table 7 Summarized information on rice husk power plants under pipeline

No	Project	Capacity (MW)	Expected technology	Investor or developer	Status
1	Husk-burning heat and power cogeneration plant in Can Tho	9	Fluidized Bed Combustion (FBC)	Dinh Hai Thermal Power JSC Address: Lot 2.9A5, Road 10, Tra Noc 2 IP, Can Tho Tel: 0710 3744 295 # Fax: 0710.3744 296 – Website: www.dinhhai.com	**Installed FBC boiler**
2	Husk-burning heat and power cogeneration plant in Can Tho	10	FBC	J-Power (Electricity Power Development Co., Ltd and Chubu Electric Power Company Inc	Investment Report completed on Dec 21st, 2009
3	10-MW husk-burning power plant in Can Tho	10	FBC	TOPEC BV, the Netherlands	NA
4	Husk-burning power plant in Cai Lay, Tien Giang	10	FBC	HCMC-based Duy Phat Power JSC	Investment Report completed in Jan 2009
5	Husk-burning power plant in Cai Be, Tien Giang	10	FBC	HCMC-based Duy Phat Power JSC	Investment Report completed in Nov 2010
6	Husk-burning power plant at the Ba Sao, Cao Lanh, Dong Thap	6	FBC	Korea Power Corporation (KEPCO)	Investment Report completed in Jan 2009
7	Proposed husk-burning power plant in Cho Gao, An Giang	10	FBC	NA	In the process of making an investment report
8	Husk-burning power plant in Kien Giang	10	FBC	NA	In the process of applying for investment
9	Husk-burning power plant in Long An	10	FBC	NA	NA

[9] ***Source***: GIZ-GDE/MOIT, 2013, the "Study and Propose the Support Mechanism for the Development of Grid-Connected Electricity Generated from Biomass Projects in Vietnam". Authors: Nguyen Duc Cuong, Institute of Energy, et al.

No	Project	Capacity (MW)	Expected technology	Investor or developer	Status
10	Husk-burning power plant in An Giang	**10**	**FBC**	**NA**	In the process of applying for investment

Note: NA (not available)

Although, there is no operational biomass-burning power plant in Vietnam but data put together from local documents/reports[10] suggest that about 10 developers and investors have applied to build such plants each averaging 10 MW. These include Vietnamese developers, investors and partnerships with foreign investors. The documents/reports show that most are likely to use rice husk to generate power for sale to the national grid and employ the fluidized bed combustion (FBC) technology and direct combustion technology with the moving grade.

These candidate projects concentrate in Mekong River Delta provinces of Vietnam, specifically main rice areas, such as in Tien Giang, Dong Thap, Can Tho, An Giang, and Kien Giang province. The following is a brief introduction of these projects. The reasons for their concentration in this region are: i). This region accounts for 55% of the national total of rice husk; ii). This region is far distant from fossil fuel sources, especially coal; and iii) there is great demand for heat and power in this region, especially in the rice harvesting season.

The 9-MW rice husk-burning heat and power cogeneration plant in Can Tho city. The investor is the Dinh Hai Thermal Power Joint Stock Company (JSC). The plant produces 20 tons of steam per hour, which was sold to other consumers and companies inside the Tra Noc industrial park of Can Tho city. The construction has been started in 2007 and composed of three phases. Phase 1 installed the boiler of 20 tons of steam per hour serving companies in the industrial park; Phase 2 will be installed a 2-MW steam-turbine generator; and Phase 3 will be expanded its capacity to 9 MW. The expected schedule by each phase is mentioned as follows: Phase 1: from 2007-2009; Capacity of 20 tons of steam/hr.; not generating power; Phase 2: from 2011-2012; Capacity of 20 tons of steam/h; generating 2 MW; Phase 3: from 2013-2014; Capacity of 70 tons of steam/h; generating 7 MW. However, there were still many issues on the electricity tariff during discussion with EVN in the period of 2010-2015, so that the phase 2 and 3 has not yet completed today even the new Avoided Cost Tariff has been issued in December 2015.

The 10-MW rice husk-burning power plant in Tien Giang province. The developer is the Tan Hiep Phuc Power Installation and Construction JSC. The candidate site is Cai Be district of Tien Giang province. The generated power will be sold to the national grid. The estimated investment cost is about 1,860 USD per kW (inclusive of Deb. Interest rate payment for two years' construction) with the majority of equipment to be imported from Europe. A feasibility study was completed in 2007. However, the project has been delayed due to problems with land rental, power purchase agreement with EVN, rice husk purchase contracts and the other issue, e.g. loan access as well as loan interest rates. The project is expecting a similar treatment in power purchase price to wind power (7.8 USD cents/kWh). Hope that this project will be re-started soon due to the new tariff (7.4846 USD cents/kWh) for this biomass was published by MOIT in the Decision no. 942/QD-BCT dated 11 March 2016.

The 10-MW rice husk-burning power plant in Can Tho. A feasibility study was conducted by the J-Power (Electricity Power Development Co., Ltd and Chubu Electric Power Company Inc) in 2009. After that the project has been delayed with main reason is the electricity tariff negotiations with the buyer lower than Company's expectations.

[10] ***Source***: GIZ-GDE/MOIT, 2015, the Study and Preparation of an "Avoided Cost Tariff" Applicable to Grid–Connected Biomass Power Projects in Vietnam. Authors: M.E. Martina Schweneke, E.Quadrat; Nguyen Duc Cuong, Institute of Energy, et al.

The 10-MW rice husk-burning power plant in Can Tho. A feasibility study was conducted by the Dutch company TOPEC BV in 2007. The selection of investors will be later (after feasibility study report approved). The project is unlikely to start before 2011 for in the initial negotiations after the feasibility study, the bid price for power was offered at as low as 5 USD cents/kWh by the EVN. Like the rice husk-burning power project by the Tan Hiep Phuc Power Installation and Construction Company, this project is pinning hope on special treatment in buying its power at a price higher than 8 USD cents/kWh.

The 10-MW husk-burning power plant by Duy Phat Power JSC in Dong Thap. This project is still under study. Project status is similar on project in Can Tho City and others.

The 6-MW husk-burning power plant at the Ba Sao industrial park in Cao Lanh, Dong Thap. Formed in 2009 by the Korea Power Consulting Company, this plant is designed to burn rice husk to generate power using the FBC technology with one boiler, one turbine and one generator. The selection of the project investor is to be undertaken later (after the tariff agreed with EVN). This project is also unlikely to start before 2011 but the project status is the same reasons as mentioned above.

10-MW rice husk-burning power plants at the Vị Thanh, Hau Giang province and An Giang province. Formed in 2012 by the Hau Giang Power JSC. The power plant will be designed to burn rice husk to generate power using the FBC technology with one boiler, one turbine and one generator for each plant.

There are 3 – 5 rice husk-burning power plants each of 10 MW in An Giang, Kien Giang, Hau Giang and Long An now in the process of site selection and application for licensing from respective local authorities. However, no progress has been seen. A possible cause is the absence of a pricing system for biomass power. If the Time-of-Use price table for small hydropower plants applies to biomass-based power plants it is discouraging to investors. Worse still, the high loan interest rates of over 10% a year, make these projects hardly viable.

Wood chips power developers and investors

Up to now, there is only one biomass – based wood chips power plant has been licensed for investment after completing FS. The tender process has been prepared for equipment supply and construction works. This biomass – based wood cheeps power plant locates in the Que Son district, Quang Nam province. The investor is Vietpeco Company Ltd. The installed capacity is 7 MW to produce about 47,400 MWh. Boiler type will be direct combustion with traveling grate. The tentative schedule to implement the project has been proposed as below:

- Completing loan negotiation with the Vietnam Development Bank: June 2016
- Construction phase: July 2016 – May 2018.

Bagasse cogeneration developers and investors

Bagasse from sugar mills and wood wasters from paper and pulp mills are the key biomass feedstock for energy cogeneration plants. There are now 42 energy cogeneration plants (41 in the sugar mills and 1 in the paper and pulp mill) with the total installed capacity of about 375 MWe. Their capacity ranges from 1.5 to 30 MWe. The power and steam generated from these plants is used to feed these very plants. The majority of energy produced is used to crush sugarcane and refine sugar.

There are only 7 plants selling their redundant power to the national grid at the price of 4-5.8 USD cents/kWh. Other plants are keen to sell their power on their expansion. However, the bid price for their power is discouraging. Furthermore, the vast majority of these plants are using the outdated technology hence low efficiency. Renewing technology and improving capacity now top their concerns.

In May 2011, the Vietnam Sugarcane and Sugar Association sent an official letter to the Government, MOIT and Ministry of Agriculture and Rural Development asking that there be policy to buy power from the

expanding sugar mills to take advantage of bagasse and sugarcane leaves and buds, which are being wasted. The amount the association asks to be purchased is nearly 1950 MW.

An unsuccessful energy cogeneration project, which comprises an FBC boiler of 2.5 tons/h, a turbine-generator of 50 kW, a heat exchanger and 3 rice driers and was commissioned in Long An in 1999 but has ceased to operate for not being viable.

Some sugar mills in the provinces of Phu Yen, Gia Lai, Tuyen Quang, Hau Giang province are working against the clock to invest in expanding their bagasse-burning factories. Some key details are as follows:

- *A 60-MW bagasse-burning combined heat and power factory in* Phu Yen. The investor is KCP Vietnam Industries (India), which is owning KCP Phu Yen sugar mill. Its investment report was completed in 2015. Most all energy quipments will be imported from India.
- *A 75-MW bagasse-burning combined heat and power factory expansion in Gia Lai province*. In August 2015, the investor – the Quang Ngai Sugar cane and Sugar JSC applied to the MoIT to expand its combined heat and power factory by 75 MW. The expansion includes a boiler with the steam capacity and turbine-generator of 75 MW.The The project was added to the PDP VII Adjusted that approved by Government of Vietnam in March 2016.
- *A 25-MW bagasse-burning combined heat and power factory expansion in Tuyen Quang province*. In May 2015, the investor – the Sugar Corporation No. 1/ Tuyen Quang sugar mill applied to the MoIT to expand its combined heat and power factory by 25 MW to receive from MoIT the additional Decision of 25 MW cogenerarion power plant into the electricity planning of Tuyen Quang province. Ground-breaking ceremony was performed on October 4, 2015.

Summary of bagasse-burning combined heat and power factories at sugar mills are provided in Table 2 below.

Table 8 Bagasse-based heat and power cogeneration plants at sugar mills

No	Name of Sugar mills/Sugar companies (*)	Capacity (tone of sugarcane per day)	Technology											Remark
			Boiler				Turbine and generator							
				Main parameter					Main parameter					
			No. of boiler	Steam pressure (kg/cm²)	Superheated temperature (⁰C)	Made in	No. of turbine	Capacity (MW)	Steam pressure (kg/cm²)	Superheated temperature (⁰C)	Made in	Year	
1	Tuyen Quang	2.600	1	24	390	China	1	4,5	<24	<390	China	2013	Expanding the capacity of 25 MW
2	Son Duong	3.000	1	24	390	China	1	1,5	<24	<390	China	1997	Planning to expand capacity
			2	24	390	China	2	1,5	<24	<390	China	1997	
			3	24	390	China	3	1,5	<24	<390	China	2013	
3	Cao Bang	1.800	1	24,5	400	China	1	1,3	23	<400	China	1997	
							2	1,3	23	<400	China	2012	
4	Son La	2.500	1	24,5	400	China	1	1.2/1.5	24,5	<400	China	1998	
			2	24,5	400	China	2	1.2/1.5	24,5	<400	China	1998	
							3	1.2/1.5	24,5	<400	China	1997	
5	Hoa Binh	1.000	1	24,5	400	China	1	1/1.5	24,5	<400	China	NA	
			2	24,5	400	China	2	1/1.5	24,5	<400	China	NA	
6	Lam Son	9.700	1	32	380	India	1	3	31	370	India	NA	
			2	32	380	India	2	3	31	370	India	NA	
			3	67	505	India	3	12,5	65	500	India	2011	
7	Viet - Dai	6.000	1	25	340	Australia	1	12	25	<340	Japan	1997	

No	Name of Sugar mills/Sugar companies (*)	Capacity (tone of sugarcane per day)	Technology										Remark
			Boiler				Turbine and generator						
				Main parameter					Main parameter				
			No. of boiler	Steam pressure (kg/cm^2)	Superheated temperature (^{0}C)	Made in	No. of turbine	Capacity (MW)	Steam pressure (kg/cm^2)	Superheated temperature (^{0}C)	Made in	Year	
			2	25	340	Australia	2	4,3	25	<340	Japan	1997	
							3	1,5	25	<340	Japan	1997	
8	Nong Cong	3.000	1	25	380	India	1	3	23	340	India	NA	
			2	25	380	India	2	1,5	24,5	<380	China	NA	
			3	24,5	400	China							
9	Nghe An	8.400	1	22	300	ABB	1	10	20	285	Japan	1998	
10	Song Lam	1.000	1	24,5	400	China	1	1.3/1.5	24,5	<400	China	2012	
11	Song Con	3.300	1	20	350	India	1	2	20	340	Japan	2009	
			2	24,5	400	China	2	1,5	24,5	<400	Germany	2001	
12	Pho Phong - Quang Ngai	2.000	1	24,5	400	China	1	1,5	24,5	<400	China	1997	
			2	24,5	400	China	2	1,5	24,5	<400	China	1997	
13	An Khe - Quang Ngai	12.000	1	24,5	400	China	1	1,5	24,5	<400	China	1997	
			2	24,5	400	China	2	1,5	24,5	<400	China	1997	
			3	20	365	Japan	3	1,5	24,5	<365	Japan	1997	
			4	20	365	Japan	4	1,0	24,5	<365	Japan	1997	
			5	20	360	India	5	5	24,5	<360	China	1997	
			6	38	420	France	6	7	84	<420		2001	
			7	42	420	China	7	7	90	<420		2013	
14	Binh Dinh	3.500	1	24,5	400	China	1	1,5	23,5	390	China	1997	

No	Name of Sugar mills/Sugar companies (*)	Capacity (tone of sugarcane per day)	Technology											Remark
			Boiler				Turbine and generator							
				Main parameter					Main parameter					
			No. of boiler	Steam pressure (kg/cm^2)	Superheated temperature (^{0}C)	Made in	No. of turbine	Capacity (MW)	Steam pressure (kg/cm^2)	Superheated temperature (^{0}C)	Made in	Year	
			1	24,5	400	China	2	1,5	23,5	390	China	1997	
			1	24,5	400	China	3	1,75	24,5	390	India	1997	
15	KCP Phu Yen	6000	1	42	420	India	1	3	42	<420	India	1998	Expanding the capacity of 60 MW
			2	42	420	India	2	3	42	<420	India	1998	
							3	3	42	<420	India	2010	
16	Tuy Hoa	2.300	1	21,5	340	India	1	1,2/1,5	21,5	<340	India	1995	
			2	21,5	340	India	1	2,5/4	21,5	<340	India	2012	
			3	21,5	340	China							
17	Vạn Phat	1.500	1	25	400	China	1	1,5	24,5	390	China	1998	
			2	25	400	China	2	1,5	24,5	390	China	1998	
			3	25	360	India	3	1,5	24,5	<360	China	1998	
18	Ninh Hoa	6.000	1	64	500	China	1	25.5/30	60	<500	India	2013	
19	Phan Rang	1200	1	10	183	Vietnam	1	1.2/1.5	24,5	<400	China	1998	
			2	24,5	400	China	1	1.2/1.5	24,5	<400	India	NA	
20	Khanh Hoa	10.000	1	52	450	Australia	1	25	50	<450	Germany	2000	
								35	50	<450	China	2014	
21	Gia Lai	6.000	1	38,2	485	China	1	12	34,3	475	China	2010	Expanding the capacity of 75 MW
22	KonTum	2.000	1	24,5	400	China	1	1,5	23,5	390	China	1998	
			2	24,5	400	China		1,5	23,5	390	China	1998	

No	Name of Sugar mills/Sugar companies (*)	Capacity (tone of sugarcane per day)	Technology											Remark
			Boiler				Turbine and generator							
				Main parameter					Main parameter					
			No. of boiler	Steam pressure (kg/cm^2)	Superheated temperature (^0C)	Made in	No. of turbine	Capacity (MW)	Steam pressure (kg/cm^2)	Superheated temperature (^0C)	Made in	Year	
23	333 Dak Lak	2.500	1	23,5	390	China	1	3	23,5	<390	China	2010	
			2	23,5	390	China	2	1,5	23,5	<390	China	2003	
			3	23,5	390	China					China	NA	
24	Dak Nong	1.500	1	2,45	400	China	1	6	23,5/2,9	390	China	2011	
			2	2,45	400	China							
25	MK-Sugar VN	1.200	1	24,5	400	China	1	1,5	24,5	390	China	1997	
			2	24,5	400	China	2	1,5	24,5	390	China	1997	
26	La Nga	2.000	1	23	325	Denmark	1	2,6	21	<325	UK	1984	
			2	23	325	Denmark	2	1,2	21	<325	India	2006	
27	Bien Hoa Tri An	2.000	1	24,5	400	China	1	3	24,5	<400	UK	NA	
			2	24,5	400	China	2	1,5			China	1998	
28	Bien Hoa Luyen	350 TĐ/N	1	25	400	China	1	1,5	24,5	<400	China	1998	
29	Bien Hoa - Tay Ninh	4.500	1	24	350	Australia	1	4	17,5	<350	Japan	1996	
30	TTC Tay Ninh	9.800	1	33	410	Australia	1	12	33	<410	UK	1998	
								12	33	<410	UK	1998	
31	Nuoc Trong TN	1.000	1	19	350	Spain	1	1,5	18	<350	Germany	1992	
32	Hiep Hoa	2.000	1	18	350	Spain	1	3,2	21	<350	Germany	1994	
			2	21	350	India							

No	Name of Sugar mills/Sugar companies (*)	Capacity (tone of sugarcane per day)	Technology											Remark
			Boiler				Turbine and generator							
				Main parameter					Main parameter					
			No. of boiler	Steam pressure (kg/cm^2)	Superheated temperature (^0C)	Made in	No. of turbine	Capacity (MW)	Steam pressure (kg/cm^2)	Superheated temperature (^0C)	Made in	Year	
			3	21	350	France							
33	Soc Trang	2.700	1	0.8	450	China	1	12	30-40	440	China	2014	
34	Ben Tre	2.300	1	25	400	China	1	1,5	24	390	China	1998	
			2	25	400	China	2	1,5	24	390	China	1998	
							3	1,5	24	390	China	1998	
35	Phung Hiep/ Can Tho	3.000	1	21	345+-15	India	1	1.2/1.5	21	345	India	1999	
			2	21	345+-15	India	2	2.2/2.5	24,5	390	India	2011	
			3	8	174	Vietnam							
			4	24,5	400	China							
36	Vi Thanh - Can Tho	3.500	1	25	400	China	1	1,5	23,5	<400	China	1998	
			2	25	400	China	2	1,5	23,5	<400	China	1998	
			3	38,2	400	China	3	3	37	<400	China	2006	
37	Long My Phat	2.000	1	22	365	Japan	1	3,2	21	<365	Germany	1998	
				22	365	Japan	2	1,5	21	<365	Japan	1968	
				22	365	India							
38	Kien Giang/ Tay Nam	1.000	1	18	350	India	1	1,6/2	18	<350	Japan	1997	
39	Ca Mau/ Tay Nam	1.000	1	18	350	India	1	1,6/2	18	<350	Japan	1997	
40	Tra Vinh	2.650	1	24,5	400	China	1	1,5	24,5	<400	China	1998	
			2	24,5	400	China	2	1,5	24,5	<400	China	1998	
							3	1,5	24,5	<400	China	1998	
41	NIVL	5.000	1	32	380	India	1	3	32	<380	India	NA	

No	Name of Sugar mills/Sugar companies (*)	Capacity (tone of sugarcane per day)	Technology										Remark
			Boiler				Turbine and generator						
				Main parameter					Main parameter				
			No. of boiler	Steam pressure (kg/cm^2)	Superheated temperature (^0C)	Made in	No. of turbine	Capacity (MW)	Steam pressure (kg/cm^2)	Superheated temperature (^0C)	Made in	Year	
			2	32	380	India	2	3	32	<380	India	NA	
			3	10	183	India	3	3	32	<380	India	NA	

Source: The Vietnam Sugarcane and Sugar Association indicates that all the listed sugar mills are keen to sell their redundant power to the grid from their expanded production processes (Official Letter 529/HHMĐ addressed to the Prime Minister, MOIT and MARD to request purchase of 1950 MW of bagasse-based power).

(*): Most of sugar mills or sugar companies usually use the name of the province/district to name company or mill

Table 9 Biomass Power Developer/Investor Capacity

Name of the developer	Size of the firm	No. of successful RE Projects	Main information: Project location	Technology	Type of Project	Financial resources	Capacity
Biomass power developers/investors							
Hau Giang rice husk power plant	6 main persons (one-director; one-vice director; one- Chief of financial officer; one - business development and operations manager; one-production manager; one-RHA development manager)	NA (this is new business sector for the investor)	Long My town, Long My district, Hau Giang province	10 MW (one boiler, turbine and generator); rice husk direct combustion tech.	Grid connection	Total investment cost: USD 18 million. Equity (20%); Loan (80%). The Developer has discussed with the Banks (VIDB) for loans	Technical: Many experiences in power activities (e.g. electricity transmission, distribution) Financial: NA
Dinh Hai Thermal Power JSC	18 persons have working since 2009 in the plant. They are: Director; Chief of financial officer; Business development and operations manager; production manager; and operators	PHASE 1: Implementation years: 2007-2009 Installed rice husk boiler capacity: steam: 20 t/h; no electricity PHASE II: Preparing to start again.	Lot A 2.9 Venue 10, Tra Noc Industrial Zone, Can Tho city	Installed one FBC boiler using rice husk as fuel to produce heat (steam) to sell neighbor companies based in Tra Noc Industrial Zone. Steam parameters: 20 tons/hr.; 45 bar; 450^{o}C. Boiler efficiency: 82%	Grid connection	Equity: VND 20.1 billion	Business areas: Design, manufacture, trade of thermal equipment Repairing, installation, maintenance of thermal equipment Sale of heat, electricity.
Vietpeco Company Ltd	20 persons will involve in term of Director; Chief of financial officer; Business development and operations manager; production manager; and operators	NA (this is new business sector for the investor)	Que Son district, Quang Nam province	Biomass – based wood cheeps power plant. The Boiler -Direct combustion with traveling grate	Grid connection	Total investment cost: 13.36 USD million. Equity (30%): 4 USD million; Loan (70%).	Completed FS documents and gets Investment License. Preparing EPC biding documents
Tuyen Quang sugar mill	44 persons will involve in term of Director; Chief of financial officer; Business development and operations manager; production manager; and operators	Installed and operating the baggage CHP cogeneration plant to produce heat and power for own consumption in term of sugar processing	Tuyen Quang province	25-MW bagasse-burning combined heat and power. Steam parameters: 120 tons/hr.; 70 bar; 510^{o}C. Boiler efficiency: 90.6%	Grid connection	Total investment cost: 17.9 USD million. Equity (30%): 5.37 USD million; Loan (70%).	Technical: Many experiences in biomass power activities Financial: NA Under construction. Planned operation schedule: Nov. 2016 Under construction. Planned operation schedule: Nov. 2016

Name of the developer	Size of the firm	No. of successful RE Projects	Main information				
			Project location	Technology	Type of Project	Financial resources	Capacity
KCP Sugar Mill	52 persons will involve in term of Director; Chief of financial officer; Business development and operations manager; production manager; and operators	Installed and operating the baggage CHP cogeneration plant to produce heat and power for own consumption in term of sugar processing	Tuy Hoa province	60-MW bagasse-burning combined heat and power. Steam parameters: 120 tons/hr.; 70 bar; 510^{o}C. Boiler efficiency: 92%	Grid connection	Total investment cost: 60 USD million. Equity (30%): 18 USD million; Loan (70%).	Technical: Many experiences in biomass power activities Financial: NA Under construction.

Note: NA = Not Available

A.5 Biomass Power Projects Summary

As of March 2013, detailed information was received from six grid-connected biomass project under the different deployment stages as the following:

- 4 husk-burning power plant (FS study, in which there has been only one project installed a steam capacity of 20 tons of steam per hour), and;
- 2 bagasse-burning power plant (FS study, under installation of equipment).
- The following to brief information on six investment projects as mentioned above is given in the table and analysis below.

Project scale: Rice husk power: There are three of four husk-burning power projects with the installed capacity of 10 MW per turbine and only one project to be less than 6 MW. The reason for proposed installed capacity of less than or equal 10 MW has been analyzed and explained that due to be transporting husk far away and uneconomic (specific weight of husk of around 120 kg/ton). It is thus used the range of less than 10 MW installed capacity as representative in this study to be reasonable at this moment when those projects are not able to use other biomass sources.

Bagasse power: there two sugar mills have proposed to expand their installed capacity of 6-10 MW up to 16 and 12.5 MW, which are the plants with large capacity. This range of installed capacity is selected and used in this study based on the amount of redundant bagasse that have not used in the sugar mills so that it is able to save steam and power in current production. Thus, the representative installed capacity is selected of 10 MW in this calculation for bagasse power price due to the rest of plants of averaged capacity level.

Wood chip, rice straw, other biomass: unavailable investment report.

Technology: Technical parameters of six biomass power projects (including husk and bagasse) are proposed as follows: 01 boiler, 01 turbine and generator. The boilers are circulating semi-fluidized bed combustion for bagasse and circulating fluidized bed combustion for husk. The turbine is condensing (using for power production only) or for those plants having self-use or selling steam to users. The steam parameter is at average level such as: steam pressure of 35-60 bar and steam temperature of 400-500^{o}C.

Capacity factor: Capacity factor of a power plant is the ratio of the total amount of actual generated power over a year and divide by the amount of generated power with a full capacity over a year (8760 hours). The factor varies depending on the amount of fuel collection and storage capacity by the types of biomass varying in crops (planting and harvesting of sugarcane and rice). The greater factor is, the lower power production cost will be. According to survey, the capacity factor of those rice husk-burning power plants is around 65-70 per cent, corresponding to the number of operating hours is about 6500 hours per year. It is around 50-55 per cent for the capacity factor of bagasse-burning power plants and corresponding to be about 4500-5000 hours per year of operating hours.

Investment Cost: There is very difference in investment costs of four rice husk-burning power plants in Vietnam. The highest investment cost is of 2.95 USD million/MW and the lowest investment cost is of 1.8 USD million/MW. The reason for the big difference may be explained that investment projects have developed in the different time (equipment cost, construction cost varying very much within four year, original equipment manufacturer…). Some projects have used investment cost based on internet and other sources (estimate, average values…) that leading to be unreliable.

Bagasse power plant, the investment costs of two plants are around of 1-1.1 US$ million/MW due to they already have infrastructure availability (land, transport, water and electricity systems) and both plants using equipment made in India.

Financial structure: Three main components are as follows:

- Equipment cost: boiler, turbine, generator and other supplemental equipment, pipeline, electrical equipment, metering, connecting taking into account for 65-75% of the total investment cost, that varying by the types of biomass source, capacity scale, and original technology.
- Construction cost: foundation, building …, account for 20-30%.
- Other costs: insurance, consulting, land and transport account for 4-5%.

Capital investment cost: Normally there are two main source which are shareholder (equity) and debtholder. The structure of capital investment is as follows:

- Debt capital: 65-85%: average 70%
- Equity capital: 15-35%: average 30%

Proposed selling price: There are five projects that have been proposed the fixed selling price in whole the project life (from 20 -25 years) and only one project proposing increased selling price per year with a level of 5% per year. The highest proposed selling price is of 10.5 USD cents/kWh, the lowest selling price is of 5 USD cents/kWh (excluding selling CERs and VAT).

Table 10 Biomass Power Project Summary

ID	Region	Province	Project	Location	Status	Owner	Consultant	Year	Plant	Installed capacity (MW)
1	Mekong Delta	Dong Thap	Husk-burning power project	Lap Vo	Investment report	Duy Phat Power JSC	Sai Gon Bach Khoa JSC	10/2007	Grid-connection	10
2	Mekong Delta	Can Tho	Husk-burning power project	Thot Not	Investment report	Dinh Hai Thermal power JSC	J-Power/Chubu	12/2009	Grid connection	20
3	North Central Region	Thanh Hoa	Expanded 2rd Lam Sơn bagasse-burning power project	Lam Son, Tho Xuan	Investment report	Lam Son sugarmill	PECC 1	2010	Cogen-Grid connection	12.5
4	Mekong Delta	Hau Giang	Hau Giang husk-burning power project	Long My, Long My	Investment report	Hau Giang Power JSC	PECC 2	02/2012	Grid-connection	10
5	Mekong Delta	Dong Thap	Cao Lanh husk-burning power project	Cao Lanh	Investment report	Korean Power JSC	IE	01/2009	Grid-connection	6
6	South Central Region	Tuy Hoa	Co-generation power project	TT Cung Son, Son Hoa	Investment report	KCP Industry JSC	IE	2008	Cogen-Grid connection	16

Table 11 Technology and Equipment of Biomass Power Projects

		Boiler								Turbine				
ID	**Project**	**Boiler**	**Fuel**	**Qty**	**Fuel consumption rate**	**Steam capacity**	**Pressure**	**Temperature**	**Efficiency**	**Turbine**	**Steam capacity**	**Pressure**	**Temperature**	**Installed capacity**
					(kg/kWh)	(T/h)	(bar)	(ºC)	(%)	(Condenser/ Changed pressure)	(T/h)	(bar)	(ºC)	(MW)
1	Husk-burning power project		Husk	1	1.468	50-57	45	420	80%	Pure condenser	50-57	45	420	10
2	Husk-burning power project	Fluidized bed	Husk	2	1.32	55	41	405	80%	Pure condenser	55	41	405	2x20
3	Expansion of 2nd Lam Son bagasse-burning power project		Bagasse	1	3.71	80	65.7	500	78%	Pure condenser		65.7	500	12.5
4	Hau Giang husk-burning power project	Fluidized bed	Husk	1	1.122	41.58	44	404	89%	Pure condenser	41.58	40	400	10
5	Cao Lanh husk-burning power project	Fluidized bed	Husk	1	1.5	30	45	450	82%	Pure condenser	23.56	43	448	6
6	Co-generation power project		Bagasse	2	1.34	75	43	400		Pure condenser		42	398	18

Table 12 Economy and Operation of Biomass Power Projects

ID	Project	Operation				Economy							
		Operating hour	Generated power	Self-use	Grid-connected power	Investment cost	Total investment	Own capital	Debt	Interest rate	Selling price	Project lifetime	Fuel price
		(hour)	(MWh/Year)	(%)	(MWh/Year)	(USD million /MW)	(USD thousand)	(%)	(%)	(%)	(cents/kWh)	(Years	(VND/Ton)
1	Husk-burning power project	8,000	80,000	10%	72,000	1.82	18,215	30%	70%	8.4%	4.92	20	100,000
2	Husk-burning power project	6,570	131,400	10%	118,260	2.20	44,000	20%	80%	6.9%	5.30	15	180,000
3	Expansion of 2nd Lam Son bagasse-burning power project	6,552	81,900	9.15%	74,406	1.02	12,790	36.7%	63.3%	9.6%	4.49		500,000
4	Hau Giang husk-burning power project	6,500	65,000	7.22%	60,307	2.95	29,540	30%	70%	8.0%	10.27	25	309,000
5	Cao Lanh husk-burning power project	6,000	36,000	10%	32,400	1.89	11,353	50%	50%	7.0%	5.00	20	150,000
6	Co-generation power project	4,560	69,700	5.31%	65,840	0.98	15,664	30%	70%	12.5 %	4.916	20	99,998

A.6 List of Key RE Policies in Vietnam

Year	Policy issued
2004	Electricity Law
2006	Grid connection regulations
2007	Financial mechanism for CDM projects Development Scheme for Bio-fuels up to 2015 with an outlook to 2025 National Energy Development Strategy (NEDS) up to 2020 with an outlook to 2050
2008	Regulations on electricity selling tariff and SPPA for small RE-based power projects
2010	Regulations on interconnecting power plants to power T&D grid
2011	Supporting mechanism for wind power projects National Power Development Plan (NPDP) up to 2020 with an outlook to 2030
2012	Law no. 24/2012/QH13 on the amendment of and supplement to several articles of the Electricity Law.
2012	Regulations on implementation of an SPPA for wind power projects Electricity Law amended
2013	Regulations on preparation, appraisal and approval of Wind Power Development Plan Corporate Income Tax for RE-based power projects
2014	Supporting mechanism for biomass cogeneration projects Regulations on negotiation, signing and implementation of the PPA for power generation projects Supporting mechanism for solid waste-based power projects Regulations on electricity selling tariff and SPPA for small hydropower projects Price list of electricity selling tariff for 2015 for small hydropower projects
2015	Regulations on issuance, revocation and duration of Power Operation License Regulations on preparation, appraisal and approval of Biomass Energy Development and Utilization Plans SPPA for solid waste-based power projects Renewable Energy Development Strategy (REDS) up to 2030 with an outlook to 2050 SPPA for biomass power projects Regulations on interconnecting power plants to power distribution grid
2016	Price list of electricity selling tariff for 2016 for biomass-based power generation projects