Project design document form

(Version 11.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	70MW Solar Power Plant Project in Ba Ria - Vung Tau, Vietnam
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	V1.7
Completion date of the PDD	17/01/2020
Project participants	SH Solar Farm Vina Co., Ltd SH Power Co., Ltd
Host Party	Socialist Republic of Viet Nam
Applied methodologies and standardized baselines	ACM0002 (Grid-Connected Electricity Generation from Renewable Sources – Version 19.0)
Sectoral scopes	Sectoral Scope : 01 Energy industries(renewable/non-renewable sources)
Estimated amount of annual average GHG emission reductions	98,545 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

SH Solar Farm Vina Co., Ltd is founded by SH Power Co., Ltd with a 100% stake and has installed the Solar Power Plant in Chau Duc Industrial Park, Nghia Thanh, Ba Ria - Vung Tau. SH Solar Farm Vina Co., Ltd also performs as an operation entity of the power plant. SH Power Co., Ltd will participate in the project activity as an investor and a Project Participant. SH Power Co., Ltd was established by investment from South Korean companies, Soosan Industries Co., Ltd and Halla E&C Co., Ltd.

The project adopted poly-crystalline photovoltaic cells without any backup generators and generates 100% clean energy to be fed into the Vietnamese national grid. And thus, the project activity does not result in waste, GHG emissions nor pollution to the environment during its operation. Polycrystalline modules are the most commonly used technology in commercial and industrial solar projects.

The project is installation of a grid-connected new power plant at the site, a Greenfield project, and is not a capacity addition or retrofit or replacement of any other existing plant.

The Location information of project activity is as follows.
- Host Party : Socialist Republic of Viet Nam;
- Exploit the local solar resources effectively;
- Produce clean electricity energy, contributing to environmental protection and reducing the GHG emissions due to fossil fueled electricity production activities;
- Create a motivation to develop similar renewable energy projects in the region;

The baseline scenario of the project is the electricity energy that is being fed into the Vietnamese national grid through other fossil fuelled power plants according to the applied methodology ACM0002 version 19.0.

Total installed capacity of the project is 69.552MW. The amount of electricty generated from the project activity is approximately 116,045 MWh/year and thus replaces anthropogenic GHG emission into the atmosphere 98,545 tCO_2e annually, 689,815 tCO_2e during the entire first credit period of 7 years.

General contributions to the sustainable development of the country:

- In recent years, Vietnam is facing a serious shortage of electricity due to the inadequate supply of electricity, which has caused negative impacts on the development process for the economy of the whole country as well as the activities of many households on a large scale. This project contributes to balancing the gap between supply and demand.
- The project mitigates dependence on fossil fuel which is running out and reduces the import of fuel for electricity generation.
- The project adopted up-todated technology from Korea, which is highly efficient and thus will encourage and promote the development of renewable energy technology in Vietnam.
- The project provides clean electricity, reducing GHG emissions and also reducing environmental pollution.

Contributions to the sustainable development of the locality:

- The project employed local workers during its construction and also promotes employment of locals for its operation.
- The project contributes to the provincial budget by a significant tax payment.
- The project provides large and stable electricity will contribute to ensure energy security thereby promote industrialization process of the province.

A.2. Location of project activity

The Location information of project activity is as follows.

- Host Party : Socialist Republic of Viet Nam Location : Road No. D15, Chau Duc Industrial Park, Nghia Thanh Commune, Chau Duc District, Ba Ria - Vung Tau Province

The coordinates of project boundary points are presented in the following table:

Table 1.Coordinates of the boundary points of the plant

No	Lattitude	Longtitude
1	10.578124^{o} North	107.191825^{o} East
2	10.580135^{o} North	107.180151^{o} East
3	10.573212^{o} North	107.185474^{o} East
4	10.584318^{o} North	107.181822^{o} East

The plant location map is shown in the following figure:

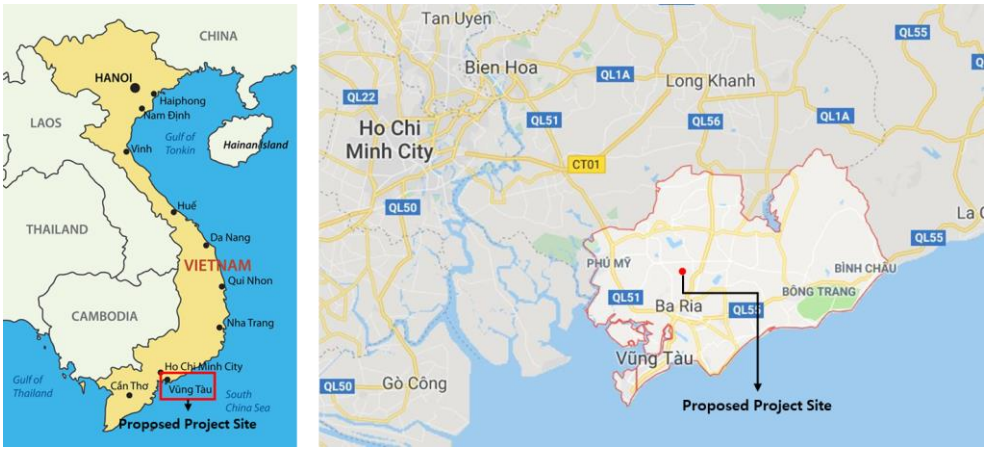

Figure 1. Map of Ba Ria-Vung Tau, Vietnam

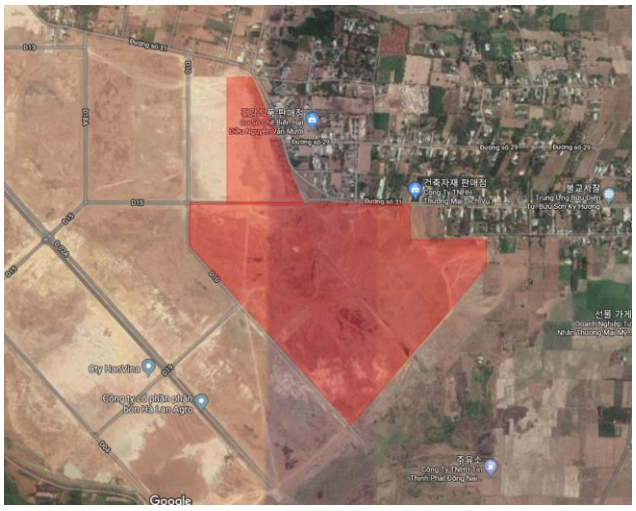

Figure 2. Satellite picture of the project site

A.3. Technologies/measures

The project uses photovoltaic solar power technology (PV). PV panels generate electricity by converting solar energy, the most abundant renewable energy source, into electricity without consuming fossil fuels and therefore without GHG emissions. Solar PV panels can only generate electricity during the day and electricity output will also vary according to different weather conditions. However, PV panels will produce the maximum amount of electricity in hot days, when demand for electricity increases.

PV panels transform solar radiation into direct current. The panels are connected in series to form a chain to ensure that the voltage is within the inverter's input voltage range. Many parallel strings form a group to match the inverter's capacity. The inverter connected to each group will convert direct current (DC) into alternating current (AC). The post-converted power is supercharged to 110kV using transformers and exported to the Vietnamese national grid via load lines and electricity metering systems.

The average generation time 4.57114 hr/day is applied for the calculation of ex-ante electricity generation for the project activity by PVSYST[1] program.

The lifetime of main device, PV panels, is 25 years according to manufacturer's information. The PV panels are fixed on the support frame, the angle of tilt for installation of PV panels is about 10 degrees southward, distances between the ranges is 0.9 meters.

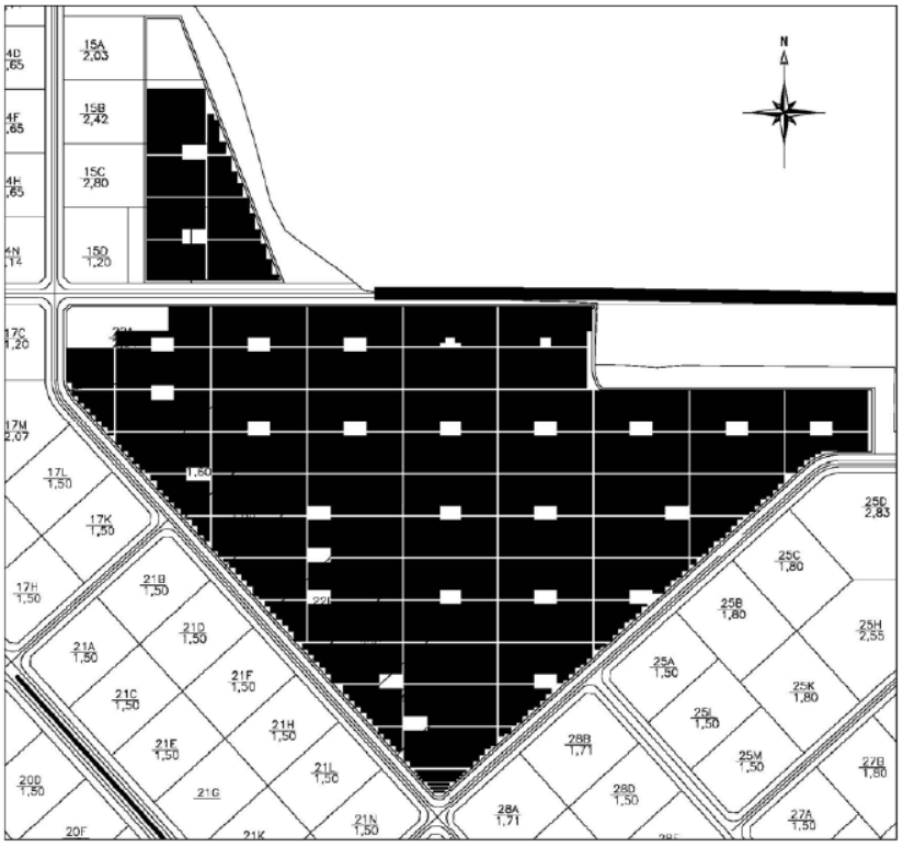

Figure 3. Layout of PV panels

[1] PVSYST : PVsyst is program that is a full package for the study of photovoltaic systems.(https://www.pvsyst.com/)

Main Equipment in Power Plant

- PV panels: Used to convert energy from solar radiation to electrical energy; rated power of photovoltaic panels at standard conditions is 345W; conversion efficiency of PV panel is over 17.8 %;
- Inverter equipment: Used to convert DC power to AC power; 3 phases, central type, capacity of 625 kW/machine; Maximum input voltage is 1000 VDC, output voltage is about 340V AC.

The details of the equipment to be used for the project is as follows:

Table 2. Technical information of the main equipment used in the project

Devices	Indicators	Specifications
PV Panel	Manufacturer	Hanwha Q CELLS
	Model	Q.PLUS L-G4.2 345
	Type	Poly crystal
	Rated Max. Power at STC	345W
	Module Efficiency	17.8%
	Class of Module	A
	Dimensions	1,994X1,000X35 mm
	Degradation Gradient	0.6%/year
	Warranty	83% of nominal power up to 25years.
Inverter	Manufacturer	HYOSUNG
	Model	HS-P625GLO
	Input	
	Rated DC Input Power	685kW
	Max. DC Input Voltage	1,000V
	DC Voltage Range	550-1,000V
	MPP Voltage Range	550-850V
	Max. DC Current	1,245A
	Output	
	Rated AC Output Power	625kW
	Max. AC Output Power	625kW
	Rated AC Voltage Range	340V (-12 ~ +10)%
	Rated Grid Voltage	340V
	Rated Output Current	1,061A
	Max Efficiency	>98%
	Dimensions	2,222x2,188x1,013mm
	Ambient Temperature Range	(-20 ~ 50)°C
Transformer	Manufacturer	HYOSUNG
	Model	N/A
	Rating Power	1,300/(650+650) kVA
	Rated Voltage	HV 22,000V, LV 340V
	Cooling Method	ONAN
PV Cables	Manufacturer	TAIHAN
	Model	0.6/1kV Cu/XLPE/FR-PVC 1Cx6 mm2
	Diameter	3.12mm
	Total Length	105 km
63MVA Transformer	Manufacturer	ABB
	Model	N/A

	Rated Power	48/63 MVA
	Rated Voltage	HV 115kV, MV 23kV, LV 11kV

The power plant consists of 14 groups, each group has 8 inverters with capacity of 625 kW/machine and 2 medium voltage transformers with capacity of 1.250 kVA. Each PV panel capacity is 345 W and total installed PV panels are 201,600 EA. Therefore, total installed capacity is 69.552 MW.

The details of the equipment to be used for the project is as follows:

Table 3. Configuration modules and inverters

LINE No.	Group	Inverter	PV Module	Power
		[EA]	[EA]	[kW]
A	1 Group	8	14,400	4,968
	2 Group	8	14,400	4,968
B	3 Group	8	14,400	4,968
	4 Group	8	14,400	4,968
C	5 Group	8	14,400	4,968
	6 Group	8	14,400	4,968
D	7 Group	8	14,400	4,968
	8 Group	8	14,400	4,968
E	9 Group	8	14,400	4,968
	10 Group	8	14,400	4,968
F	11 Group	8	14,400	4,968
	12 Group	8	14,400	4,968
G	13 Group	8	14,400	4,968
	14 Group	8	14,400	4,968
Total		112	201,600	69,552

Monitoring System:

Through computer-based monitoring tools to monitor plant operations, storage, alarms and control. Management services, diagnostics, discovery, troubleshooting, online system quality performance analysis, and reporting are the essential services of a SCADA[2] PV system. Remote management support and hourly output forecast protocol. The system is integrated in accordance with industry standards that are widely applied to open systems. This will facilitate upgrading or replacing part or all of the integrated system without having to rely on a vendor. Compliance with open system standards(IEC 61850, IEC 60870-5104) will enable integrated systems and in-plant equipment at the station to be easily interconnected based on international communications protocols.

[2] SCADA : Supervisory Control And Data Acquisition

A.4. Parties and project participants

Table 4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Socialist Republic of Viet Nam	Private entity - SH Solar Farm Vina Co., Ltd	No
Socialist Republic of Viet Nam	Private entity - SH Power Co., Ltd	No

A.5. Public funding of project activity

The project is not receiving any public funding from Annex-I countries and no diversion of Official Development Assistance (ODA) involved in the project activity.

A.6. History of project activity

Table 5. History of project activity

Date	Milestone	Document
17/04/2018	Feasibility Study Report submission to Vietnam Government	Feasibility Study Report
04/05/2018	Local stakeholder consultation	Environmental Impact Assessment Report
23/05/2018	Consideration of CDM benefit	PP Minutes of Board Meeting
01/06/2018	Environmental Impact Assessment Report submission to Vietnam Government	Environmental Impact Assessment Report
25/07/2018	Approval of Feasibility Study verification result	Announcement of basic design verification results of this project(Vietnam Government)
27/07/2018	Approval of Environmental Impact Assessment Report	Approval document of Environmental Impact Assessment Report(Vietnam Government)
27/09/2018	Signed contract for construction	Contract for Construction
19/10/2018 (start date)	Purchase of the Photovoltaic Modules	Photovoltaic Module Master Supply Agreement
28/02/2019	Prior Consideration Form submitted to the host country and UNFCCC	Submission of Prior Consideration Form
28/02/2019	Confirmation from Vietnamese DNA	Email regarding publication of project information for prior consideration of the CDM.

01/03/2019	Confirmation from UNFCCC	Email regarding publication of project information for prior consideration of the CDM.
26/06/2019	Commercial generation date of project activity	

A.7. Debundling

Large-scale project activities, not applicable

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

Methodology:

ACM0002 - "Grid-connected electricity production from renewable sources" (version 19.0).

Detailed methodological information are available at:

https://cdm.unfccc.int/methodologies/DB/VJI9AX539D9MLOPXN2AY9UR1N4IYGD

Reference tools:

(a) “TOOL01: Tool for the demonstration and assessment of additionality”;

(b) “TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality”;

(c) “TOOL03: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion”;

(d) “TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”;

(e) “TOOL07: Tool to calculate the emission factor for an electricity system”;

(f) “TOOL10: Tool to determine the remaining lifetime of equipment”;

(g) “TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”.

The tools that accompany the methodology and are referred-to in the methodology, for the purpose of computations and calculations, are as follows.
“Methodological Tool: Tool to calculate the emission factor for an electricity system” (Version 07.0).
Details are available at :
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

B.2. Applicability of methodologies and standardized baselines

Details of the applicability of the methodology ACM0002 (version 19.0) for the proposed project activity are presented in the following table:

Table 6. The applicability of the methodology applied to project activities

No.	Applying conditions	Project activities	In accordance with applicable conditions
1	This methodology is applicable to grid-connected renewable energy power generation project activities that: - Install a Greenfield power plant; - Involve a capacity addition to (an) existing plant(s); - Involve a retrofit of (an) existing operating plants/units; - Involve a rehabiliation of (an) existing plant(s)/unit(s); or - Involve a replacement of (an) existing plant(s)/unit(s)	Project activities include the installation and operation of a grid-connected solar power plant. The factory is completely newly built.	Yes

2	This methodoly is applied to the project of installing renewable power plants including: - Hydro power plant/unit with or without reservoirs; - Wind power plant/unit; - Geothermal power plant/unit; - Solar power plant/unit; - Wave power plant/unit or tidal power plant/unit.	Project activities include the installation and operation of a renewable solar power plant.	Yes
3	This methodology is not applicable to: - Switching from fossil fuels to renewable energy sources at the site of the project activity - Biomass fired power plants/units	The project is completely new. Project activities do not include fuel conversion nor use biomass to generate electricity	Yes

The project is a newly installed Greenfield power project, which is neither a retrofit nor a capacity addition and does not involve switching from fossil fuels to renewable energy sources.

The table above shows that this project activity is completely in accordance with the applicable conditions of the methodology ACM0002 (version 19.0) - "Grid-connected electricity generation from renewable sources".

B.3. Project boundary, sources and greenhouse gases (GHGs)

Methodology ACM0002 (version 19.0) describes the project boundary as: “The spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to.”

The project boundary is represented in Figure below:

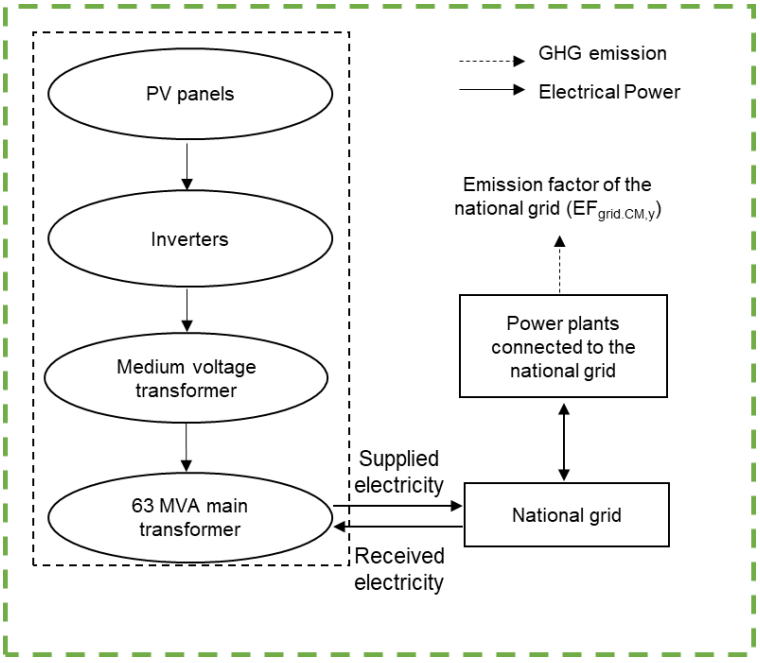

Figure 4. Project boundary

The project activity will produce electricity for distribution to the Vietnamese national grid. Therefore, the project boundary includes solar power plant, connection sub-stations, national power grid and all power plants connected to the Vietnamese national grid.

Table 7. Types of GHGs include and not included in project activities

Source		GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main Emission Source
		CH_4	No	Minor Emission Source
		N_2O	No	Minor Emission Source
Project activity	Electricity generation from grid connected solar power plant	CO_2	No	Zero-emissions from the project
		CH_4	No	Zero-emissions from the project
		N_2O	No	Zero-emissions from the project

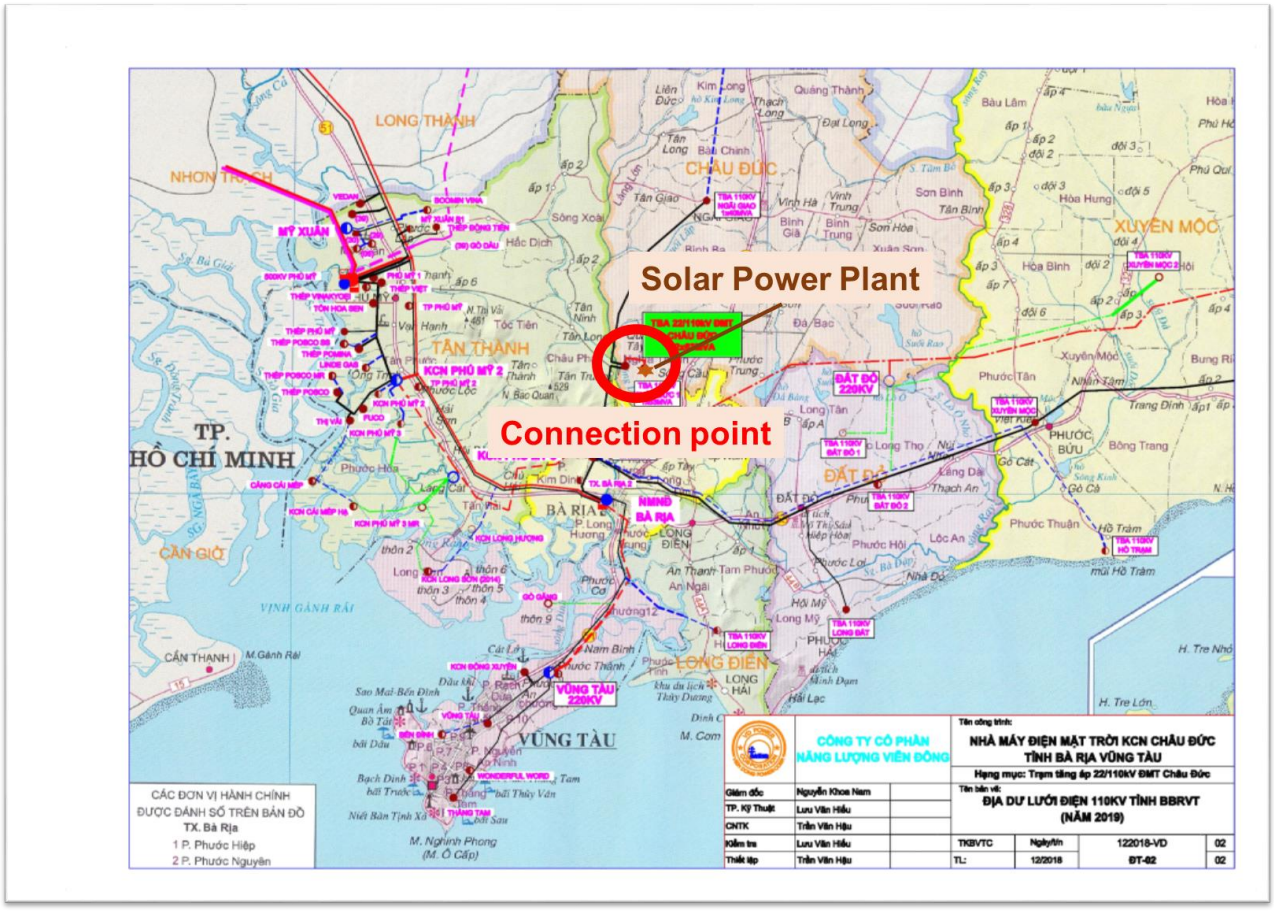

Figure 5. Connection map of the solar power plant to grid

B.4. Establishment and description of baseline scenario

According to the methodology ACM0002 (version 19.0), if the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and

by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in “TOOL07: Tool to calculate the emission factor for an electricity system”

The project is the installation and operation of new solar power plant, i.e. Greenfield project, and connected to the Vietnamese national grid. The electricity produced by solar power plants replaces the electricity produced by the use of fossil fuels in Vietnamese national grid. Therefore, the baseline scenario of the project is to provide an equal amount of electricity provided by the Vietnamese national grid where the proposed project is also connected.

The combined margin emission factor of the Vietnamese national grid ($EF_{grid,CM,y}$) is calculated according to Tool 07 - "Tool to calculate the emission factor for an electricity system", version 07.0, and will be used to calculate baseline emissions from project activities. The data to calculate $EF_{grid,CM,y}$ for specific solar power projects is calculated and published by Department of Climate Change - Ministry of Natural Resources and Environment, Official Letter No. 330/BDKH-GNPT dated 29 March 2019 on the "Vietnam grid emission factor 2017[3]".

B.5. Demonstration of additionality

According to 5.3.1 of methodology ACM0002 (version 19.0), solar photovoltaic technologies are in the positive list for grid connected electricity generation technologies. Moreover, it states that:

A specific technology in the positive list is defined as automatically additional if at the time of PDD submission, any of the following conditions is met:

A) The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent; or
b) The total installed capacity of the technology in the host country is less than or equal to 50MW.

According to the EVN annual report 2017, total installed power plant capacity in Vietnam is 42,135MW. And According to IRENA [4] Renewable Capacity Statistics 2019, installed solar photovoltaic capacity in Vietnam is 106MW.

Therefore, the total installed capacity of a grid-connected solar photovoltaic plant in Vietnam is less than 2%, and thus, it meets condition a) from the conditions above. The project is demonstrated additionality by simplified procedure to demonstrate addditionality.

Table 8. Percentage share of solar power plant in Vietnam

Division	Value	Note
Total installed power plant capacity in Vietnam (MW)	42,135 MW	a
Total installed capacity of the solar power plant in Vietnam (MW)	106 MW	b
Percentage share of solar power plant in Vietnam	0.25%	(b / a) X100

[3] http://www.dcc.gov.vn/van-ban-phap-luat/1053/He-so-phat-thai-luoi-dien-Viet-Nam-2017.html
http://www.dcc.gov.vn/van-ban-phap-luat/1054/Nghien-cuu,-xay-dung-he-so-phat-thai-(EF)-cua-luoi-dien-Viet-Nam-(K%C3%A8m-CV-330/BDKH-GNPT).html

[4] IRENA : The International Renewable Energy Agency
https://www.irena.org/publications/2019/Jul/Renewable-energy-statistics-2019

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

I. Project emission (PE_y)

According to the methodology ACM0002 (version 19.0), the proposed project is a solar power plant with photovoltaic technology that does not use fossil fuels. Therefore, project emissions are considered zero.

For most renewable energy power generation project activities, $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year y (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year y (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

II. Baseline emission (BE_y)

According to the methodology ACM0002 (version 19.0), for project activities including the installation of a renewable energy plant, baseline emissions only include CO_2 emissions from the amount of electricity provided by the fossil fuel power plants that will be replaced by project activities. This methodology assumes that the production power of all projects in the baseline will be generated by existing grid-connected power plants and the addition of new grid-connected power plants.

Baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$$

In which:

BE_y	=	Baseline emissions in year y (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity genenration that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year y (tCO_2/MWh)

Calculation of net electricity by project activity $EG_{PJ,y}$

The process for the calculation of $EG_{PJ,y}$ varies across different types of project activities. If the project activity is the installation of a Greenfield power plant, then:

$$EG_{PJ,y} = EG_{facility,y}$$

In which:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Calculation emission factors of the Vietnamese national grid $EF_{grid,CM,y}$

For solar power plants, emission factors are calculated using:

- Most updated national data: Data on Vietnamese national grid emission factors published by Vietnam DNA, Department of Climate Change, Ministry of Natural Resources and Environment with official letter No. 330/BDKH-GNPT on 29 March 2019 on "Vietnam grid emission factor 2017"
- The most updated emission factor calculation tool: Version 07.0 of the "Tool to calculate emission factor for an electricity system"

Emission factor of Vietnamese national grid is calculated and published by Vietnam DNA, Department of Climate Change, Ministry of Natural Resources and Environment (Official Dispatch No. 330/CC-GNPT dated 29 March 2019), including:

Operating margin emission factor : $EF_{grid,OM,y} = 0.8336\ tCO_2/MWh$; and

Build margin emission factor : $EF_{grid,BM,y} = 0.8961\ tCO_2/MWh$

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

In which:

$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor of Vietnamese national grid in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor of Vietnamese national grid in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor of Vietnamese national grid in year y (tCO_2/MWh)
w_{BM}	=	Weighting of build margin emissions factor (%)

However, the report of the DNA of Vietnam applying the weighting of margin emission factor and build margin emission factor is 0.5, this weighting is not applicable to solar power plants. According

to version 07.0 of the "Tool to calculate the emission factor for an electricity system", the following default weights are applied to solar power plants:

$$w_{OM} = 0.75 \text{ and } w_{BM} = 0.25$$

Therefore, the combined margin emissions factor for solar power plants are calculated as follows:

$$\boldsymbol{EF_{grid,CM,y} = 0.75 \times 0.8336 + 0.25 \times 0.8961 = 0.8492} \ (tCO_2/MWh)$$

III. Leakage

No leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

IV. Emission reduction (ER_y)

According to methodology ACM0002 (version 19.0), GHG emission reduction is calculated as follow:

$$ER_y = BE_y - PE_y$$

In which:

ER_y	=	GHG emission reduction in the year y (tCO_2e/yr)
BE_y	=	Baseline emissions in the year y (tCO_2e/yr)
PE_y	=	Project emissions in the year y (tCO_2e/yr)

B.6.2. Data and parameters fixed ex ante

Data/Parameter	**$EF_{grid,BM,y}$**
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor of Vietnamese national grid in year y
Source of data	Department of Climate Change, Ministry of Natural Resources and Environment, Official Letter No. 330/CC CC-GNPT on 29 March 2019 subject "Vietnam grid emission factor 2017"
Value(s) applied	0.8961 tCO_2/MWh
Choice of data or measurement methods and procedures	Calculated and published by the Department of Climate Change, applying the "Tool to calculate the emission factor for and electricity system" - version 07.0
Purpose of data	To calculate combined margin CO_2 emission factor ($EF_{grid,CM,y}$) of Vietnamese national grid
Additional comment	

Data/Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor of Vietnamese national grid in year y
Source of data	Department of Climate Change, Ministry of Natural Resources and Environment, Official Letter No. 330/BDKH-GNPT on 29 March 2019 subject "Vietnam grid emission factor 2017"
Value(s) applied	0.8336 tCO_2/MWh
Choice of data or measurement methods and procedures	Calculated and published by the Department of Climate Change, applying the "Tool to calculate the emission factor for an electricity system" - version 07.0
Purpose of data	To calculate combined margin CO_2 emission factor ($EF_{grid,CM,y}$) of Vietnamese national grid
Additional comment	

Data/Parameter	$EF_{CO2,grid,y} = EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor of Vietnamese national grid applying for solar power plant in year y
Source of data	Department of Climate Change, applying for solar power plant according to the "Tool to calculate emission factor for an electricity system" - version 07.0
Value(s) applied	0.8492 tCO_2/MWh
Choice of data or measurement methods and procedures	Calculate using $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ published by Department of Climate Change and w_{OM}, w_{BM} with value of 0.75 and 0.25 for solar power plant project
Purpose of data	To calculate baseline emission
Additional comment	

Data/Parameter	**Total installed power plant capacity in Vietnam**
Data unit	MW
Description	Total installed power plant capacity in the host country
Source of data	Vietnam electricity annual report 2017(published by EVN[5])
Value(s) applied	42,135
Choice of data or measurement methods and procedures	EVN publishes annual statistics on electricity of Vietnam. In 2018, total installed electricity capacity statistics of Vietnam are used.
Purpose of data	To demonstrate additionality
Additional comment	

[5] EVN : Vietnam Electricity(Government)

Data/Parameter	Total installed capacity of the solar power plant in Vietnam
Data unit	MW
Description	Total installed capacity of the solar power plant in the host country
Source of data	Renewable energy statistics 2019(published by IRENA[6])
Value(s) applied	106
Choice of data or measurement methods and procedures	IRENA publishes annual statistics on renewable energy in different countries around the world. In 2018, Solar photovoltaic capacity statistics of Vietnam are used.
Purpose of data	To demonstrate additionality
Additional comment	

B.6.3. Ex ante calculation of emission reductions

I. Project Emissions (PE_y)

The project emissions have been taken to be 0 as mentioned in section B.6.1.

$$PE_y = 0$$

II. Baseline Emissions (BE_y)

As mentioned in section B.6.1, the baseline emissions for a system can be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year y (tCO_2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The combined margin emission factor of the Vietnamese national grid in 2017 applies to solar power project activities as calculated above:

$$EF_{grid,CM,y} = 0.8492\ tCO_2/MWh$$

Quantity of net electricity provided by the project activity to the Vietnamese national grid in the year according to the "Completion Report for the Construction of Solar Power Plant in Chau Duc" is:

[6] IRENA : International Renewable Energy Agency

Table 9. Power generation calculation data

Item	Value/Data	Unit	Reference
Capacity of a PV panel	345	W/EA	Manufacturer's specification
Number of panels	201,600	EA	Construction completion report
Average generation time per day	4.57114	Hour/Day	Construction completion report (PVSYST S/W)
Operating days	365	Day/Year	Construction completion report

$$EG_{PJ,y} = 116{,}045 \text{ MWh/yr}$$

From the above values, the baseline emissions for the proposed project activity are:

$$BE_{2019} = 0.8492 \text{ tCO}_2\text{/MWh} * 116{,}045 \text{ MWh/yr}$$

$$= 98{,}545 \text{ tCO}_2$$

III. Emission reductions (ER_y)

The amount of emission reductions from project activities is calculated as follows:

$$ER_y = BE_y - PE_y = 98{,}545 \text{ tCO}_2\text{e/year}$$

B.6.4. Summary of ex ante estimates of emission reductions

The crediting period selected for the calculations is renewable crediting period of 7 years. The starting period of crediting would be from the start of Commercial Operations Date or the date of registration of proposed project activity as CDM project, whichever is later.

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 1	98,545	0	0	98,545
Year 2	98,545	0	0	98,545
Year 3	98,545	0	0	98,545
Year 4	98,545	0	0	98,545
Year 5	98,545	0	0	98,545
Year 6	98,545	0	0	98,545
Year 7	98,545	0	0	98,545
Total	**689,815**	**0**	**0**	**689,815**
Total number of crediting years	7			
Annual average over the crediting period	98,545	0	0	98,545

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{PJ, y}$
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year (y) in MWh
Source of data	Standard metering of the net electricity supplied to the Vietnamese national grid as indicated in the Energy Purchase Agreement (EPA)
Value(s) applied	116,045
Measurement methods and procedures	Electricity generated would be measured and monitored by the electricity meters on a continuous basis and readings will be taken every month for billing to the power purchaser. The data would also be monitored using SCADA system. Electricity imported by the project activity from the Vietnamese national grid is measured seperately by EVN installed a electricity meter. The difference of export and import of the project activity is used for calculation of net electricity supplied to the grid by the project activity and same value will be considered for $EG_{PJ, y}$ calculations. (Using for calculating $EG_{PJ, y} = EG_{export,y} – EG_{import,y}$)
Monitoring frequency	Continuously measurement by electricity meters and monthly recording
QA/QC procedures	Electricity meters will be calibrated periodically per 2 years according to national standards and regulations. The data on electricity output will be cross-checked using the invoices billed to the Electricity Power Trading Company (EVN-EPTC) for payment.
Purpose of data	Calculation of Certified Emission Reduction (CER) units
Additional comment	

B.7.2. Sampling plan

The data would not be collected through sampling. It would be available on ground and recorded as per the actual generation of electricity.

B.7.3. Other elements of monitoring plan

The proposed project activity monitoring plan complies with the methodology ACM0002 (version 19.0), whereby it is stated that:
As per methodology ACM0002 (version 19.0) provisions for record handling, all data collected as part of monitoring is archived electronically and kept at least for 2 years after the end of the last crediting period.
All measurements are conducted with calibrated measurement equipment according to relevant industry standards. Indeed, the quantity of net electricity generation supplied by the project plant to the grid is reliably monitored through calibrated electricity meters and cross-checked with sales records as part of quality assurance/quality control measures on top.

The monitoring plan, which will be implemented by the project participants describe about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.
The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project participants. The following structure is proposed for data monitoring, collection, data archiving and calibration of equipment for this project activity. The team comprises of the following members:

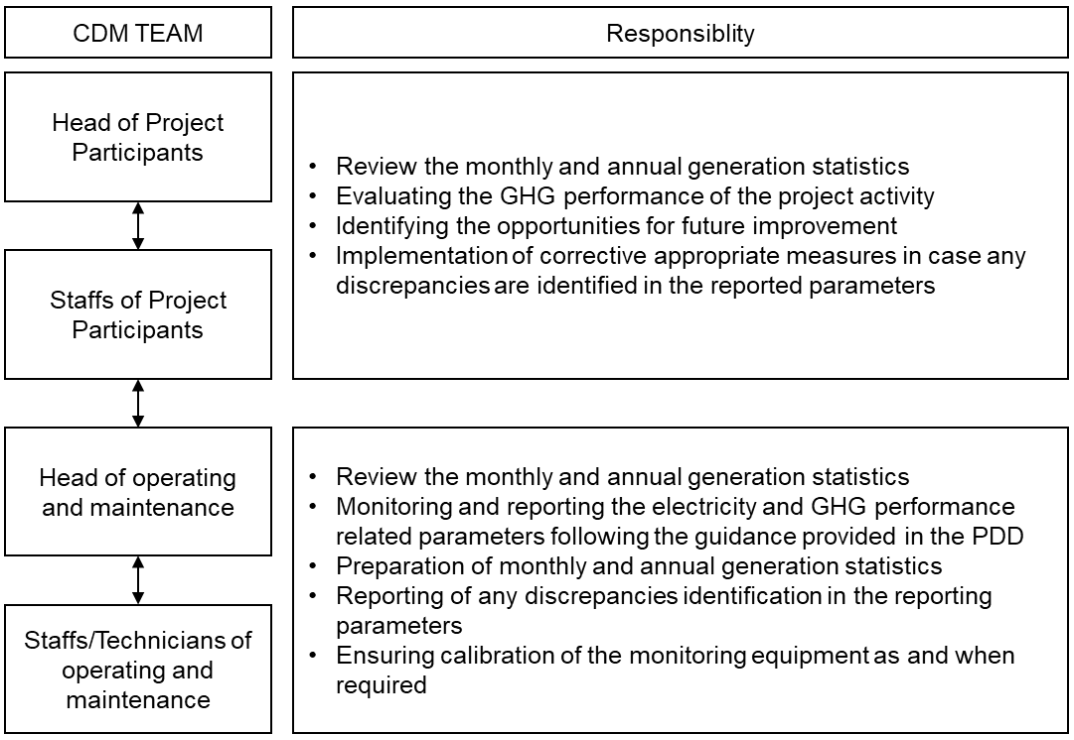

Figure 6. Organizational chart

Data Measurement
The export and import energy will be measured continuously using meters. Based on the article 3. Connection, metering and operation of the power plant of "Power Purchase Agreement" with EVN, readings of meters shall be taken on monthly basis by officer of PP. The metered data can be cross checked with other suitable data source (like daily generation report).

Data collection and archiving
Export and Import data would be recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Emergency preparedness
The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Personnel training
In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff will be trained. The plant helpers will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.
In case of mismatch between billing period cycle and monitoring period cycle, the daily generation electricity data will be used to calculate the electricity for specific period.

The metering and data collection system will be installed and used to monitor the parameters including (1) Power output of the project exported to the Vietnamese national grid during the year y ($EG_{export,y}$) and (2) The amount of electricity the plant imported from the Vietnamese national grid in the year y ($EG_{import,y}$). Net electricity of the plant is exported to the Vietnamese national grid during the year y ($EG_{PJ,y}$) using for calculating baseline emissions, calculated according to the following formula:

$$EG_{PJ,y} = EG_{export,y} – EG_{import,y}$$

Electricity metering systems including main metering system and backup metering system were installed according to "Technical design agreement of electricity metering system and data collection and measurement system of solar power plant Chau Duc industrial zone", No.3086/EPTC-KT&CNTT-KDBD dated August 21, 2018 between the Electricity Trading Company - Vietnam Electricity Corporation and SH Solar Farm Vina Co., Ltd. and in accordance with the electricity metering regulation.

Ⅰ. Measurement location

- Main measurement location: at the extended 110kV outgoing compartment of 110kV Chau Duc substation connected to solar power plan in Chau Duc industrial zone;
- Backup measurement location: at the extended 110kV outgoing compartment of 110kV Chau Duc substation connected to solar power plant in Chau Duc industrial zone, adjacent to the main measurement location;
- Measurement location serving output separation: at the 22kV outgoing compartments of 110kV substation of SPP in Chau Duc IP connected to solar cell clusters.

Ⅱ. Electricity meter and inspection/ calibration requirements

The main metering system uses 3-phase 4-wire electricity meter, Elster-A1700, rated voltage 3x63.5/110V, rated current 3x1 (1,2) A, exactly 0.2s for Active capacity and 2.0 for reactive power.

Measurement system for backup and measuring system for separating output using electricity meter 3 phase 4 wire, Elster-A1700, rated voltage 3x58/100-240/415V, line Rated power 3x1(1,2) A, exactly 0.5s for active power and 2.0 for reactive power.

Auxiliary equipment and features that meet the conditions of remote data acquisition and data transfer system are located at the measurement data management unit.

Electricity meters before installation at the measurement location will be verified and sealed. Periodic inspection of meters is implemented every 2 years according to the law. The inspection and verification of measuring and counting equipment must be approved by the accredited device testing organization and agreed by EVN and the Project participants; must comply with state inspection procedures. The measuring and counting equipment must be sealed and leaded after inspection.

Ⅲ. Method of measuring the export and import of electricity

On the first day of the month, the legal representative of EVN and the Project participants will jointly close the meter readings and make a report certifying the meter readings at 0:00 on the first day of the month and quantity of electricity power export and import of the previous month..

Power output delivered between EVN and project participants is determined based on the main metering system. In case the main metering system is in trouble or inspection results show that the main metering system has a higher error level than the specified level, the power output delivered between the two parties during the measurement system The main count is in trouble or has errors exceeding the regulations determined by the following principles:

- Using the backup measurement system's results to determine the delivery power output.

- In case the backup metering system suffers a problem or the inspection results show that the backup measurement system has errors exceeding the permitted level, the delivered power output will be determined according to a reasonable agreement between EVN and project participants based on historical power delivery data, current status of measuring equipment and collected data. Details are specified in the power sale and purchase contract.

Ⅳ. Etc

All data collected as part of monitoring are archived electronically and are kept at least for 2 years after the end of the last crediting period.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

Start date of the project activity is 19/10/2018, and it is determined when the Photovoltaic Module Master Supply Agreement was signed.

C.2. Expected operational lifetime of project activity

25 years 00month

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable crediting period, First period of crediting

C.3.2. Start date of crediting period

The start date of crediting period is 01/01/2020 or the CDM registration date whichever is later

C.3.3. Duration of crediting period

7 years 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Environmental impact assessment for the project activity was carried out according to the Vietnamese regulation "Regulation on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan", Decree 18/2015/ND-CP[7] and "Regulation on strategic environmental assessment, environmental impact assessment and environmental protection plan" Circulars 27/2015/TT-BTNMT[8].
The result of the environmental impact analysis was approved by Vietnamese local government.

The summary of environmental impact assessment performed is as follows.

Ⅰ. Evaluation and forecast of impacts during construction preparation phase

The project was built on an area of 600,000m^2 in the completed Chau Duc industrial park. There are no land acquisition and compensation activities. Therefore, the impacts during the preparation of the project are not available

Ⅱ. Evaluation and forecast of impacts in the construction phase

ⅰ) Impact impacts related to waste

1. Impact on air environment

During the construction process, in the area around the air quality project is affected by the means of transportation, construction, ground leveling, earthworks, transporting materials causing. The main pollutants are dust, smoke containing CO, SOx, NOx, Hydrocarbon.

The concentration of dust, CO, SO2and NO2 in the exhaust smoke of construction vehicles (the levelling process and the construction process of construction items) is lower than the limit of the allowed standard. (QCVN 19: 2009 / BTNMT - Column B). In addition, construction equipment must not be used at the same time and not in the same location, so emissions from construction vehicles are easily dispersed.

However, the project participant will also apply construction vehicle control solutions to minimize the impact of emissions on ambient air quality.

2. Impact on water environment

Source of waste water during construction of the project is mainly domestic wastewater of construction workers. The number of workers participating in construction is 55 people.

Comparison of concentrations of pollutants in domestic wastewater with the National Technical Regulation on domestic wastewater (QCVN 14: 2008 / BTNMT, column B) shows that most parameters have a content exceeding the Standard Allow, if not treated, can cause surface water quality degradation. Therefore, the project plans to arrange mobile toilets to ensure that domestic

[7] https://m.thuvienphapluat.vn/van-ban/tai-nguyen-moi-truong/Nghi-dinh-18-2015-ND-CP-bao-ve-danh-gia-moi-truong-chien-luoc-danh-gia-tac-dong-moi-truong-266409.aspx

[8] https://m.thuvienphapluat.vn/van-ban/tai-nguyen-moi-truong/Thong-tu-27-2015-TT-BTNMT-danh-gia-moi-truong-chien-luoc-tac-dong-moi-truong-bao-ve-moi-truong-277442.aspx

wastewater is collected and not discharged into the environment. Therefore, this impact is assessed as small and controllable and minimized.

In general, the impact of pollution due to stormwater runoff during the construction phase is not large, rainwater is mainly high turbidity due to the rolling of rock and part of construction materials scattered during construction.

3. Impact due to solid waste generation

Solid waste generated during construction phase includes construction waste and domestic waste of construction workers.

Construction solid waste: including construction and waste materials such as iron, scrap steel, brick, stone, cement, etc. This amount of waste is estimated at 30-50kg / day. This waste is not discharged into the environment but will be reused for levelling (brick, stone, debris, etc) or reusing, selling scrap (iron, steel, etc). Therefore, the impact of construction waste is negligible.

Domestic solid waste: With a maximum of 55 workers / day, an average of 0.45 kg / person / day is discharged per person. The total amount of waste generated is about 25 kg / day. The main components of domestic waste include:

- Organic compounds such as fruits and vegetables, excess food
- Packages, packages for food and drinks
- Inorganic compounds such as plastic, plastic, glass
- Metal like cans

At the construction site, domestic solid waste is collected and gathered in the waste collection area. The project will contract with the collection team at the Industrial Park to transport and handle it.

4. Impact due to hazardous waste generation

Hazardous solid wastes include: Greasy rags, oil, paint and solvent containers, etc., are not much (about 5-6 kg / month depending on the situation at the construction site) during the process.

All hazardous waste generated will be collected, sorted and stored in covered containers, labelled and placed in a safe location at the site.

Because the volume is not much, hazardous waste will be stored. Once every 6 months and at the end of construction, the project participants and the construction contractor will contract with a specialized unit (having a license to transport and handle hazardous waste) for transportation and handling. Managing all hazardous waste at construction sites. The process of collecting, storing, transporting and processing are subject to hazardous waste management regulations so this impact is small and controllable.

ii) Impact impacts not related to waste

1. Impact due to noise and vibration

The typical vibration emission level of machinery used in construction is shown in the table below.

This is also the source of vibration generated from the activities of equipment and machinery in the construction of project items of the Project

According to QCVN 27: 2010 / BTNMT on vibration acceleration, the allowed level of vibration in construction activities in residential areas mixed with commercial, service and production areas must not exceed 75dB.

Compared to the Standard, the vibration of construction mechanics is about 30m from the source within the permissible limits of QCVN 27: 2010 / BTNMT

2. Impact to public transport

The process of transporting and gathering materials and equipment for construction mainly by road traffic, in the course of transportation may affect road traffic as follows:

Increase the density of means of transport on the roads leading to the project area. Construction materials are purchased locally and transported and assembled by motor vehicles;

The risk of causing damage, subsidence when transporting equipment and machinery. The most noticeable is the transformer for the station because this is a super-weight device. The transport process complies with Circular 46/2015 / TT-BGTVT on September 7, 2015, regulating the load, the limited size of roads; circulation of overloaded vehicles, limited vehicles, tracked vehicles on roads; transporting super-length and super-weight goods; limit the loading of goods on road vehicles when participating in traffic on roads.

With the project construction scale not too large, the level of operation of transport means is not high, transporting heavy equipment will use specialized vehicles and comply with current regulations to ensure safety. for people and existing infrastructure systems. Therefore, this impact is moderate, controllable and minimized.

3. Impact on cultural and historical relics

Location of the project is located in the Industrial Park. Therefore, the project will not cause any impact on the landscape or protected areas.

The results of the field survey showed that the project did not go near or cross any military area or cultural and historical site.

However, during construction, if historical relics or archaeological relics are found, investors and contractors report immediately to the Department of Culture, Sports and Tourism for consideration.

4. Impact due to concentration of workers

Spread the disease from construction workers to local people and vice versa in unsanitary conditions and regularly come in daily contact. This impact is assessed as small because there is a medical station in the locality; moreover, construction workers will be equipped with knowledge about prevention of infectious diseases.

For construction teams, direct contractors have strict regulations and management methods. All employees must abide by these rules and do not affect social order.

5. Impacts on other socio-economic activities

Due to the peculiar nature of the work, in addition to the main work of the construction project, it is required to have professional staff trained by technical construction from electric construction companies, the rest Other jobs such as excavation, transportation of soil, stone, materials, construction, etc. can mobilize local labor sources. This work can provide temporary jobs for local leisure workers.

The number of construction workers locally increases the demand for social services and amenities. The demand of construction workers on food, daily necessities and services leads to the development of a number of local services.

6. Impact due to power cut at Chau Duc 110kV substation to connect

The 110kV connection line will be built from 110kV station of the project to the existing 110kV Chau Duc station to join the Vietnamese national grid. In order to carry out the connection, it is expected to conduct power cuts at Chau Duc 110kV substation for 1 day to connect. In the process of power cut to ensure the supply of electricity for local and production activities, the Southern power system dispatching center will coordinate electricity from Ngai Giao 110kV station to ensure power supply.

With a short cut-off time and active supply of additional power, the impact from power cuts does not affect the region's production and living conditions.

Ⅲ. Evaluation and forecast of impacts in the operation phase

ⅰ) Impact impacts related to waste

1. Impact on air environment

The project is an electrical engineering infrastructure project. The process of transporting solar power plants, transformer stations and connection lines is mainly the management, maintenance, maintenance and repair activities when incidents occur. Therefore, air, water, soil and waste pollution is almost negligible, without changing the nature or value of soil, water and air environments. The waste generated is mainly due to the domestic waste of the operators of the station and the transformer oil arising when there is a problem.

2. Impact on water environment

The total number of employees in the operation period is 17 people, arranged to work in shifts, up to 3 people / shift and 3 working days. The rest of the staff will be rested alternately to ensure health because they must work in a high voltage environment. Water is used for living, sanitation, hand washing.

Daily domestic wastewater contains many suspended substances, high levels of organic matter, residues, nutrients (nitrogen, phosphorus) and microorganisms.

Comparing the concentration of pollutants in domestic wastewater with QCVN on domestic wastewater (QCVN 14: 2008 / BTNMT, column B) shows that the pollution parameters have exceeding the permitted standards.

However, the wastewater flow is low and treated by septic system before flowing into the sewage drainage system of the IZ and is directed to the centralized wastewater treatment system of the industrial zone before being discharged. environment. Therefore, the impact of domestic wastewater is considered not large, does not cause significant pollution to the environment.

At the substation and the operator, all yard grounds are concreted, as well as no contaminated areas. Therefore, rainwater flows over the base of the station, which is insoluble and does not follow the waste, so it is considered as clean water.

This stormwater runoff is directed directly into manholes (with garbage protection installed) located along the internal road and flowing under the rain drainage system of the industrial park.

During operation, there will be no routine cleaning. The battery will be cleaned with natural rain. However, in the case of risks when natural disasters (storms, etc) will make the battery will be affected by soil, sand reducing the performance of the battery. To ensure PV panels operate at the right capacity, the operator performs cleaning of PV panels with water to wash away all dirt.

PV panels are washed with a specialized cleaning machine with automatic washing hands or manual cleaning.

The solar power plant project selects the PV panels cleaning plan with a dedicated cleaning machine with an automatic arm to save time and labor costs.

Water used to clean the panels is clean water, stored by water tanks built by the project participants (water after washing the battery mainly contains dust, soil, sand without hazardous or polluting components. Organic). The amount of water after washing the battery will automatically seep into the soil surface below the panels. In addition, this work only needs to be done when there is a disaster risk, not periodically. According to meteorological data, the project area is less affected by storms and floods. Therefore, this impact is considered negligible.

3. Impact of solid waste

During the operation phase, the solid waste produced is most notably solar panels. Refer to solar power plant in Korea, the rate of failure is only about 0.005% / year, the total number of damaged panels in 1 year is estimated 11sheet.

For all batteries damaged during the warranty period, the project participants will transfer to the repair supplier.

Domestic solid waste generated from the activities of employees at the station is about 4 kg / day (0.45 kg / person / day x 3 persons / shift x 3 shifts / day). Main components include:

- Organic compounds such as fruits and vegetables, excess food
- Packages, packages for food and drinks
- Inorganic compounds such as plastic, plastic, glass

- Metal like cans

Domestic solid waste will be collected and treated as follows:
- In the departments of the operator, the security house arranges the garbage baskets;
- Everyday, the trash staff collects waste in all rooms, stores it in a 240-liter garbage bin and concentrates in the area near the station gate;
- The project participant carry out the hire collection team of the Industrial Park to collect and transport to treat.

4. Impact due to hazardous waste generation

During operation, insulating oil is used in transformers. The equipment is provided to ensure electrical safety standards as well as environmental safety, so the insulation oil is determined not to contain PCBs. Used oil for transformers is mineral oil, distillate products from petroleum (hydrocarbon) are mainly composed of series of cords (CnH2n) and methane (CnH2n+2) Shell Diala AX type according to ANSI / ASTM D3487 standards.

Normally, insulating oil is fixed in the MBA used for circulation to cool or keep the function as an insulator, so normal insulation oil does not generate the environment.

The management and operation of substations can generate hazardous wastes such as waste toner cartridges, waste bulbs, waste batteries, oil-cleaning rags, etc.

When in operation, the project participants will register the hazardous waste source master book with the Department of Natural Resources and Environment under the guidance in Circular No. 36/2015 / TT-BTNMT on hazardous waste management.

All hazardous wastes generated at the station are collected, classified and stored with labeled containers and containers, with lids and arranged in hazardous waste storage areas.

The project participants will contract with a specialized unit to transport and treat all hazardous waste powder generated at the station in accordance with the regulations on hazardous waste management. Transportation and handling is done every 6 months and when needed.

ii) Impact impacts not related to waste

1. Impact due to noise and vibration

During the operation phase, noise may be generated by the transformer (the only device with noise when operating). However:

Domestic solid waste will be collected and treated as follows:
- During the investment project and technical design phase, transformers are proposed to be built with noise level meeting international operating standard IEC-51 which is <70dBA in distance of less than 3m;
- When making bidding documents, the requirements of the noise level of the transformer when operating (<70dBA in less than 3m distance) are clearly stated in the bidding documents. And during the bidding process, this noise level requirement will also be considered as other mandatory technical conditions;

Therefore, the selected contractor's (manufacturer) MBA will meet international operating

standards <70dBA within a distance of 3m.

The maximum noise level caused by the transformer operation at the location adjacent to the station barrier above 50m from the transformer position may be estimated lower than the standard prescribed for normal areas (from 6 to 21 hours) according to QCVN 26: 2010 / BTNMT (70 dBA).

The measurement results show that noise at locations in the station is lower than QCVN 24: 2006 / BYT of the Ministry of Health.

Thus, the noise generated by the station can be negligible to the staff working at the station.

When in operation, the connection line can generate noise due to optical discharge when there is small rain, humid air and porcelain string dust but the noise level is very low, negligible.

2. Effect of electromagnetic fields

The electric field at the measurement positions in the station ranges from 284.5-1.317 V / m, lower than the value specified in Decree 14/2014 / ND-CP dated February 26, 2014 (5,000V / m) ;

In addition, the operating staff mainly concentrated in the operating room, which has a low electromagnetic field, is divided into shifts for no more than 8 hours, equipped with labor protection equipment and health examination. year by year. Therefore, the impact of electromagnetic fields at the station is assessed as average.

Under the 110kV connection line, the electric field strength 1m from the ground below the line is always <2.5kV / m, lower than the permitted level (5kV / m) so the ability to affect power Human health under the line is low.

Therefore, the project ensures electromagnetic safety according to current regulations and the ability to affect human health.

3. Impact due to luminescent maintenance of line safety corridors

For the 110kV overhead connection line, the protection corridor is limited by two vertical planes parallel to the line, with a distance to the outer wire when the wire is in a static state of 4 m.

Plants inside and outside the safety corridors are capable of falling into lines, breaking power lines, causing power lines to be damaged or exploded causing disruption of electricity transmission and danger to people People live in the surrounding area. Therefore, plants in the corridor are safely cleared periodically, and plants grown in the corridors safely without distance will be pruned.

The road corridor clearing is done manually, when clearing the corridor, it must comply with Decree No. 14/2014 / ND-CP dated February 26, 2014 of the Government detailing the implementation of the Law electric power safety.

Crops after clearing (if any) will be collected, concentrated along the connection line. The maintenance team will hire a local waste collection team to transport it for processing.

4. Environmental impact of storage of solar panels

Damaged battery panels will be stored in the warehouse before being transferred to units with hazardous waste treatment functions to handle the panels. The project participants will build a warehouse to store the panels. The warehouse is 40x20m in size, 5.3m roof top height, 8x8x16cm brick wall construction, reinforced concrete floor foundation 1x2 B20 stone, main door uses rolling door, aluminum window glass frame, ventilation door Aluminum foil book frame.

The warehouse uses steel and composite structures, single-reinforced concrete foundations, tole roofs combined with insulation.

These waste panels will be stored in a walled warehouse and covered. They do not generate an external environment, so there will be no environmental impact.

5. Benefits of implementing the project

These benefits include:

- Avoided generation costs: due to the project, the economy will reduce investment (avoid) for a certain amount of thermal power, and reduce the amount of fuel costs to generate electricity generated by the power project heaven provided.
- Health care costs avoided: by reducing the amount of air pollution and environmental pollution mitted when burning the amount of avoided fuel above; avoidable costs due to reducing the rate of global climate change (resulting from reduced emissions of harmful emissions to the ozone layer).

Because of the recognition of these benefits, governments of developed solar power countries have incentive and incentive policies to support investors to develop solar power.

D.2. Environmental impact assessment

Approval of Environmental Impact Assessment Report for the Solar power plant project in Chau Duc Industrial Park

The project was approved by the Government of Vietnam under the Environmental Impact Assessment Report. The approved contents are as follows.

- Pursuant to the Law on Organization of Local Administration dated June 19, 2015;
- Pursuant to the Law on Environmental Protection dated June 23, 2014;
- Pursuant to the Government's Decree No. 18/2015/ND-CP dated February 14, 2015, prescribing environmental protection master plan, strategic environmental assessment, environmental impact assessment and environmental protection plan;

Pursuant to the Minister of Natural Resources and Environment's Circular No.27120 15/TT - BTNMT dated May 29, 2015 on strategic environmental assessment, environmental impact assessment and environmental protection plans;

At the proposal of the Council for Evaluation of Environmental Impact Assessment Report for the Solar power plant project in Chau Duc Industrial Park, Chau Duc District, Ba Ria - Vung Tau Province on June 1, 2018;

Considering the content of Environmental Impact Assessment Report for the Solar power plant project in Chau Duc Industrial Park, Chau Duc District, Ba Ria - Vung Tau Province that has been amended and supplemented with document No. 117/CV-KT dated June 25, 2018 by SH Solar Farm Vina Co., Ltd;

At the proposal of the Director of the Department of Natural Resources and Environment in Report No. 3490/TTr-STNMT dated July 5, 2018,

DECIDE:
Article 1, To approve Environmental Impact Assessment Report for the Solar power plant project in Chau Duc Industrial Park, Nghia Thanh Commune, Chau Duc District, Ba Ria - Vung Tall Province (hereinafter referred to as the "Project") prepared by SH Solar Farm Vina Co., Ltd. (The project participants) with the following main contents:

1. Scope, scale and capacity of the project: To invest in a solar power plant on an area of about 600,000m^2 and a 110 KV connection line with a length of 856 m in Chau Duc Industrial Park, Nghia Thanh Commune, Chau Duc District, Ba Ria - Vung Tau Province.

2. Environmental protection requirements for the project The project participants must comply with the following requirements:

a) In the course of construction and operation, to strictly control and treat wastes arising, strictly abide by relevant national standards and technical regulations on environment related, ensuring that noise and vibration meet national technical standards on environment.
b) To collect and treat exhaust gases, especially dust generated up to national technical standards on environment according to regulations. Waste water collection and treatment shall be in accordance with the agreement to receive waste water input of Chau Duc Industrial Park. To comply with the Decision No. 43/2011/QD-UBND dated August 23, 2011 of the People's Committee of Ba Ria - Vung Tau province promulgating regulations on zoning of waste gas emission and discharge of wastewater according to national technical regulations on environment in the province.

c) To manage, collect, store, transport and dispose of hazardous wastes, hazardous wastes and ordinary solid waste arising in the course of construction and operation, ensuring the requirements on sanitary protection and environmental conditions as prescribed
d) To implement the environmental monitoring and management program strictly according to the contents of the approved Environmental Impact Assessment Report. To implement periodic environmental monitoring program for waste at the frequency of every 03months. To periodically report at least every 6 months to the Department of Natural Resources and Environment for inspection and supervision
e) To work out plans and necessary plans and fully implement measures to prevent and respond to environmental incidents, especially incidents in the course of construction and activities related to fire and explosion safety, safety of project items and surrounding ones.

Reliability of the methods used in the Environmental Impact Assessment

Method of EIA
- Method of making list and matrix method:

Lists and matrices are used to establish the relationship between project activities and environmental impacts.

- Method of comparison

Based on survey results, field measurements, results of laboratory analysis and calculation

results based on comparative theory with Vietnamese standards to determine environmental quality in the project construction area. , Refer to the documentation of similar projects on the scale made.

These methods have been studied and published on many specialized documents, it is highly accurate, provides quite sufficient information needed to perform environmental impact assessment and forecasting, create basis quite solid to build an environmental monitoring program in the construction and operation stages.

- Prediction method and expert

Some impacts need to be forecasted based on similar projects, practical tests and calculation tools in consultation with experts. From the forecast results, impacts will be classified and proposed appropriate mitigation measures.

This method is based on theory and experience to predict and predict possible impacts. Based on that, consider the impact of the project on environmental quality.

This method is subjective, the results depend on the awareness and qualifications of the researchers.

- Rapid assessment method

This method was issued by the World Health Organization (WHO) in 1993. The basis of the rapid assessment method is based on the nature of materials, technology, rules of processes in nature and experience to Identify and characterize pollution parameters.

This method results in limited results in the case of limited parameters and data on industries and activities. In this report, there are many data on waste load (waste gas, waste, ...) in the construction phase (earthworks, transportation, ...) that are estimated based on the scope of influence, Climate conditions, assumptions. In fact, the actual climate conditions are very volatile, so it can be seen that the quantitative data on pollutant load is difficult to achieve 100% accuracy.

Other methods

- Field survey method, field sampling and laboratory analysis

Field survey for environmental sampling and laboratory analysis to determine the parameters of air quality, water, noise levels in the project area and around.

Conduct field surveys in communes and districts where the project goes through, Collect data through working sessions, questions, face-to-face interviews, ...

After collecting, the data are statistic with many methods such as descriptive statistics, inference statistics, estimation and testing, analysis and processing in order to analyze survey data of environmental factors. (water, air, ,,,) serve for the analysis of environmental status and environmental impact assessment.

The method has been verified and standardized, the result is likely to carry random errors.

- Methods of modeling

Using the electric field transition program (EMTP) to calculate the electric field strength 1m from the ground below the 110kV line. From there, assess the electromagnetic impact of the project.

This method gives visual results, large systematic errors, depending on the tests and standardization performance.

Evaluate the reliability of the methods used:

The assessments in EIA reports are quite accurate based on the solid foundations, popular specialized documents of domestic and foreign professional units.

The selected evaluation methods and impact mitigation measures, based on the actual operation of the same lines, are therefore feasible and highly effective.

Evaluate the reliability of the methods used:

The assessments in EIA reports are quite accurate based on the solid foundations, popular specialized documents of domestic and foreign professional units.

The selected evaluation methods and impact mitigation measures, based on the actual operation of similar lines, are therefore feasible and highly effective.

Table 10. Reliability of EIA methods

	EIA method	Trust level
1	Method of making list and matrix method	High
2	Comparative method	High
3	Forecasting methods and experts	medium
4	Quick assessment method	medium
5	Field survey methods, field sampling and laboratory analysis	High
6	Statistical methods and data processing	High
7	Modeling method	medium

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

There are Vietnamese regulations on local stakeholder consultations applicable to the project activity. In Vietnam, the project participant is requested to carry out consultations with community councils that are directly affected by the project when conducting environmental impact assessments by the article 12 of Decree 18/2015/ND-CP[9] and article 7 of Circular 27/2015/TT-BTNMT[10]. The consultation process by the article 12 of Decree 18/2015/ND-CP is as follows.

① The project participants send the project's environmental impact assessment report to the People's Committee of the commune where the project is implemented.

② The People's Committee of the commune where the project is executed and the organization directly affected by the project sent a written response within a maximum of fifteen (15) working days from the date of receipt of the document.

③ The community meeting is held by project participants and the People's Committee of the commune.

④ The project participants guide solutions and plans for comments given at the meeting.

⑤ All contents is recorded in the minutes and in the environmental impact assessment report.

By following the procedure above, local stakeholder consultation was conducted.

The project participant sent a draft final environmental impact assessment (EIA) report along with letter, No. 17 / CV-Halla dated 27/04/2018, during the issuing stage of the report to the People's Committee of Nghia Thanh commune, Chau district. Duc, Ba Ria-Vung Tau province.

The project participant received a written reply No. 223 / UBND-VP dated 03/05/2018 from Nghia Thanh Commune People's Committee which state opinion on the draft final EIA report of the project.

The project participant has collaborated with Nghia Thanh Commune People's Committee to hold a meeting to consult affected communities as follows:

- Loaction: Nghia Thanh Commune People's Committee
- Date: 04/05/2018
- Attendance: Leader of CPC [11] , member of CPC, EIA consultant, Project participant representative

The project participant agreed on the adverse effects on the natural and socioeconomic environment mentioned in the EIA report and decided to minimize the environmental impact.

E.2. Summary of comments received

Summary of the comments received from the consultation are as follows:

1. The Commune People's Committee requested full implementation of environmental protection measures during construction and operation.

[9] https://m.thuvienphapluat.vn/van-ban/tai-nguyen-moi-truong/Nghi-dinh-18-2015-ND-CP-bao-ve-danh-gia-moi-truong-chien-luoc-danh-gia-tac-dong-moi-truong-266409.aspx

[10] https://m.thuvienphapluat.vn/van-ban/tai-nguyen-moi-truong/Thong-tu-27-2015-TT-BTNMT-danh-gia-moi-truong-chien-luoc-tac-dong-moi-truong-bao-ve-moi-truong-277442.aspx

[11] CPC : Commune People's Committee

2. Prioritizing the use of unskilled local labours in the construction process.
3. Ensuring security and order in the project area

E.3. Consideration of comments received

The project participant considered the comments from the LSC that the project participants will fully implement measures to minimize environmental impacts during the project implementation and will consider other requests.

And the Commune People's Committee agreed on the project participant’s pledges above.

The implementation and result of the consultation were inserted in the final EIA report and the final EIA report was approved by the Vietnamese local government.

SECTION F. Approval and authorization

The project has been awarded Host country(Vietnam) Approval letter from Ministry of Natural Resources and Environment dated 28/10/2019.
Vide ref. no 08/2019/DCC-BCD.

Appendix 1. Contact information of project participants

Organization name	SH Solar Farm Vina Co.,Ltd
Country	Vietnam
Address	D15 street Chau Duc Industrial Zone, Nghia Thanh Commune, Chau Duc Town, Ba Ria-Vung Tau Province, Vietnam
Telephone	+84-90-9977-957
Fax	
E-mail	peh86@soosan.co.kr
Website	
Contact person	Eun-hwan, Park

Organization name	SH Power Co.,Ltd
Country	Republic of Korea
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Fax	+82-2-2017-8181
E-mail	Kbk0311@soosan.co.kr
Website	
Contact person	Byeong-Kyu, Kim

Appendix 2. Affirmation regarding public funding

The project does not receive any public funding from Annex I countries.

Appendix 3. Applicability of methodologies and standardized baselines

The applicability of the methodology has been discussed in section B.1 and B.2.

Appendix 4. Further background information on ex ante calculation of emission reductions

All the information required for the calculation has been given in section B.6., and an excel sheet would be provided, showing all the figures used for the calculations of emission reductions. No further information is required in this regard.

Appendix 5. Further background information on monitoring plan

The monitoring plan has been discussed in section B.7.

Appendix 6. Summary report of comments received from local stakeholders

Summary report of comments received from local stakeholders has been discussed in section B.2.

Appendix 7. Summary of post-registration changes

The proposed project activity is not registered yet and hence no post registrations changes have been recorded.

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.

Version	*Date*	*Description*
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
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Keywords: project activities, project design document