FST SMALL-SCALE SOLAR POWER PLANT IN KAMPHAENG PHET, THAILAND

Document Prepared by FutureTech Solar (Thailand) co. ltd

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Project Title	FST SMALL-SCALE SOLAR POWER PLANT IN KAMPHAENG PHET, THAILAND
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Prepared By	FutureTech Solar (Thailand) co. ltd
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The FST solar project consists of the installation of solar photovoltaic power plants with a capacity of 9.98 MW_p, located in Kamphaeng Phet Province, Thailand.

Petroleum exploration and production required significant amounts of electricity use, baseline technology to produce electricity generate large amount of greenhouse gas (GHGs) emissions such as fossil-fuel power plant which use natural gas, diesel, and other fossil fuels used to generate electricity. The displacement of fossil fuel with solar power generation will generate GHGs emission reductions by replacing fossil fuels with renewable energy sources such as solar power. The project involves the installation of solar photovoltaic (PV) panels, which generate clean electricity without emitting GHGs emissions. In contrast, the use of fossil fuels for power generation produces significant GHGs emissions that contribute to climate change.

Moreover, the excess solar energy generated will be stored in batteries, reducing the reliance on fossil fuel-based power generation. This will further reduce GHGs emissions associated with power generation.

Overall, the replacement of fossil fuels with solar power generation projects will generate significant GHGs emissions reductions, contributing to fight against climate change.

The annual emissions reduction is 13,091.65tCO_2e/annum.

Audit Type	Period	Program	VVB Name	Number of years
Validation/ Verification	(DD-Month-YYYY-- DD-Month-YYYY)	VCS	LGAI Technological Center, S.A. (Applus+)	7 years

1.2 Sectoral Scope and Project Type

Sectoral Scope: 01 – Energy Industries (renewable/non-renewable)

Project Type: Renewable Energy Projects

Project Category: Displacement of fossil fuel electricity by small-scale solar technology.

Methodology: AMS-I.F. Renewable electricity generation for captive use and mini-grid

1.3 Project Eligibility

The solar project involves the installation of a 9.98 MW (lower than 15 MW) capacity solar power generation system replacing the electricity supply from a captive power plant electricity power generation, thus leading to reductions of anthropogenic GHGs e emissions from the atmosphere. Hence the project activity is eligible for Sectoral scope 1 i.e., energy industries (renewable/ non-renewable sources) under the scope of the VCS Program and does not fall in the excluded category as per section 2.1.3 of VCS standard 4.4.

The project activities supported by the CDM (Clean Development Mechanism) methodology AMS-I.F. version 5.0 (Renewable electricity generation for captive use and mini-grid).

1.4 Project Design

The proposed project activity includes single location and installation.

☒ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☐ The project is a grouped project

1.5 Project Proponent

Organization name	FutureTech Solar (Thailand) co. ltd
Contact person	Pilin Yongsinlapachai
Title	Project Manager
Address	555/1 Vibhavadi Road, Chatuchak, Bangkok 10900
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Organization name	FutureTech Solar (Thailand) co. ltd
Contact person	Direk Wangudomsuk
Title	Board of Director
Address	555/1 Vibhavadi Road, Chatuchak, Bangkok 10900
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Email	DirekW@pttep.com

1.6 Other Entities Involved in the Project

Organization name	ERM-Siam Co., Ltd.
Role in the project	Project Description Document Development and Project Consultant
Contact person	Chacharee Therapong, Ph.D.
Title	Principal Consultant
Address	179 Bangkok City Tower, Floor 24th, Room 2402 S Sathon Rd, Thung Maha Mek, Sathon, Bangkok 10120, Thailand
Telephone	+6620743057
Email	Chacharee.therapong@erm.com

1.7 Ownership

FutureTech Solar (thailand) co. ltd, a subsidiary of FutureTech energy Ventures Co., ltd (FTEV), operates this solar project in accordance with the statue, regulation and rights in the plant, equipment, process that generates GHGs emission reductions (Solar Photovoltaic electricity power plant) by Thai competent authority listed below:

- Department of industrial works (Factory operation permit)
- Office of the energy regulatory commission (Solar Photovoltaic electricity generation permit).

Therefore, demonstrates the right of use according to clause 3.7.1 (3) of VCS Standard (v4.4) – “Project ownership arising by virtue of a statutory, property or contractual right in the plant, equipment or process that generates GHGs emission reductions and/or removals (where the project proponent has not been divested of such project ownership)”.

1.8 Project Start Date

The project start date is 21/July/2023, which is the date of commissioning of the solar PV units involved in the project activity.

1.9 Project Crediting Period

Project crediting period start date: 21/July/2023

Project crediting period end date: 20/July/2030

Since this is a non AFOLU project, the crediting period of the project activity shall be seven years, twice renewable for a total of 21 years.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHGs emission reductions/removals of the project are:

☒ <20,000 tCO_2e/year

☐ 20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	Yes
Large project	-

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 2023 (21/07/2023- 31/12/2023)	5,535.12
Year 2024 (01/01/2024- 31/12/2024)	13,223.25
Year 2025 (01/01/2025- 31/12/2025)	13,160.73
Year 2026 (01/01/2026- 31/12/2026)	13,099.15
Year 2027 (01/01/2027- 31/12/2027)	13,035.69
Year 2028 (01/01/2028- 31/12/2028)	12,973.17
Year 2029 (01/01/2029- 31/12/2029)	12,910.64
Year 2030	7,495.35

(01/01/2030- 20/07/2030)	
Total number of crediting years	7
Average annual ERs	13,061.87

1.11 Description of the Project Activity

The solar project is a small-scale off-grid electricity generation project activity that has a power generation capacity of 9.98 MW_p, which is approximately 14.48 GWh/year of annual power generation. Including ground-mounted solar panels size 550-Watt Peak (25 years average lifetime), a 200-kW inverter, a 2,500 kVA transformer, and a control cabinet.
This solar project aims to displace natural gas off-grid electricity generation with solar power to support the electricity usage of PTTEP (PTT Exploration and Production) Siam Co., Ltd. (S1 Project) and shift from non-renewable fossil fuels to renewable energy sources in remote area. Thus, this project will reduce GHGs emissions and generate GHGs reductions throughout the project.

The project utilizes solar photovoltaic to convert energy from the sun into electricity for generation power, and inverter is installed to change the direct current generated from solar photovoltaic to alternating current. Then connecting the transformer and sending electricity to PTTEP Siam Co., Ltd. (S1 Project).
The project also involves implementing a monitoring system, which enables the project proponent to monitor the solar photovoltaic system's performance and the amount of GHGs reduction from the project.

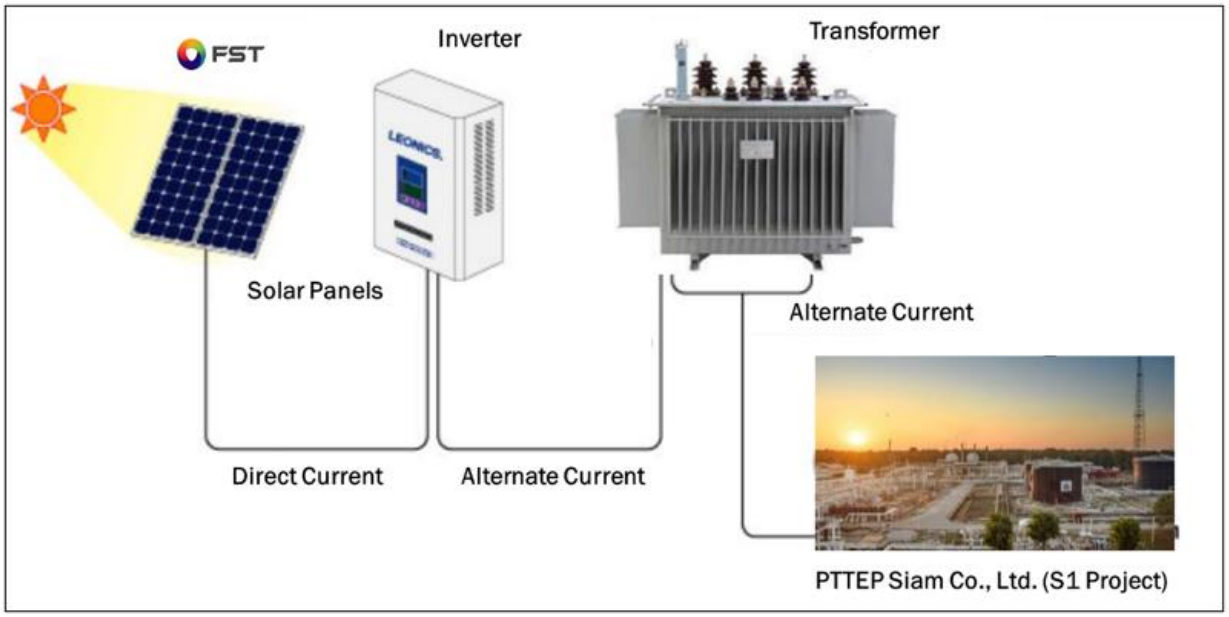


Figure 1 Project's power generation system diagram

The solar power plant consists of main equipment as follows:

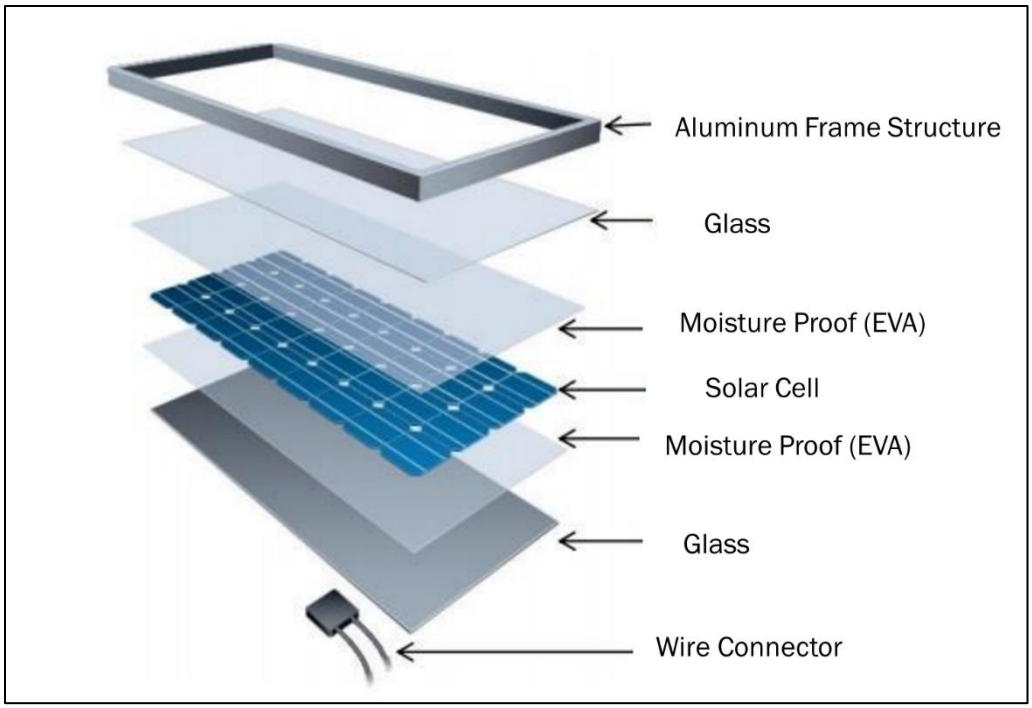
- PV panels
- Inverters
- Transformers
- Battery

Details of solar power generation equipment can be summarized as follows:

1. Solar Module

   The solar panels utilized in the project are the Mono-crystalline Photovoltaic type, with a size of 550 watts. A total of 18,144 such panels have been installed, providing the project with a total installed capacity of 9.98 megawatts. Each solar panel measures 1.092 meters in width, 2.384 meters in length, and 40 millimeters in thickness. Additionally, each panel weighs 31.5 kilograms and is composed of 20.2 cells connected in series. These solar cells exhibit an impressive efficiency of 20.2 percent and can operate within a temperature range of -40 to 85 degrees Celsius.

   The front cell panel's structure comprises 4 millimeters-thick safety glass that allows light to pass through effectively while also protecting the cell panel from harm. Currently, double-sided solar panels utilize PERC (Passivated Emitter Rear Contact) technology. Both sides of the solar panel feature glass, providing protection against direct contact with the glass while preventing water and moisture from entering the cell. The Tedlar Film serves to cool the side and accounts for the weight of the entire cell. Finally, an Aluminum Frame offers protection against side impact and provides a mounting point for the cell panel to the structure where the cell is installed.



2. Power Station and Transformer

The project comprises four electrical control buildings that oversee the conversion of direct current into alternating current. Specifically, the 42 inverters are of the Grid-Connected Photovoltaic Inverters, each inverter boasting a nominal AC output power capacity of 200 kW.

3. Transformer station

Transformer station consists of 4 electrical transformers, which is 22 kV/800 V, 3-Phase 50 Hz, YNd11 2,500 kVA, efficiency 98.8% transformers.

4. Control Building

The control building has a performance display for the solar panels and is responsible for recording their operation. Additionally, a CCTV system is in place to ensure safety in and around the project.

Table 1 Plant design and key equipment

Description	Design
Designed Capacity	9.98 MW
PV panel Degradation	0.45% per year
String Inverter	175 kW 48 sets
Number of String	660 strings
PV Module / String	28 modules

PV Module	540 W x 18,480 modules Mono, Half cut cell, bifacial.
DC Capacity	9.9792 MWp
AC Capacity	8.4 MW
Transformer 22 kV	2.5 MVA x 4 set
Auxiliary Transformer	1 set (sizing shall cover BESS charging loads)
Battery Storage	1250 kWh with PCS, BMS, containers, foundations.

1.12 Project Location

The boundary of the project activity is in Chong Lom, Lan Krabue District, Kamphaeng Phet Province, Thailand with the area of 165,001.55 m^2.

Geodetic Coordinates: Latitude (N) 1836740, Longitude (E) 595040

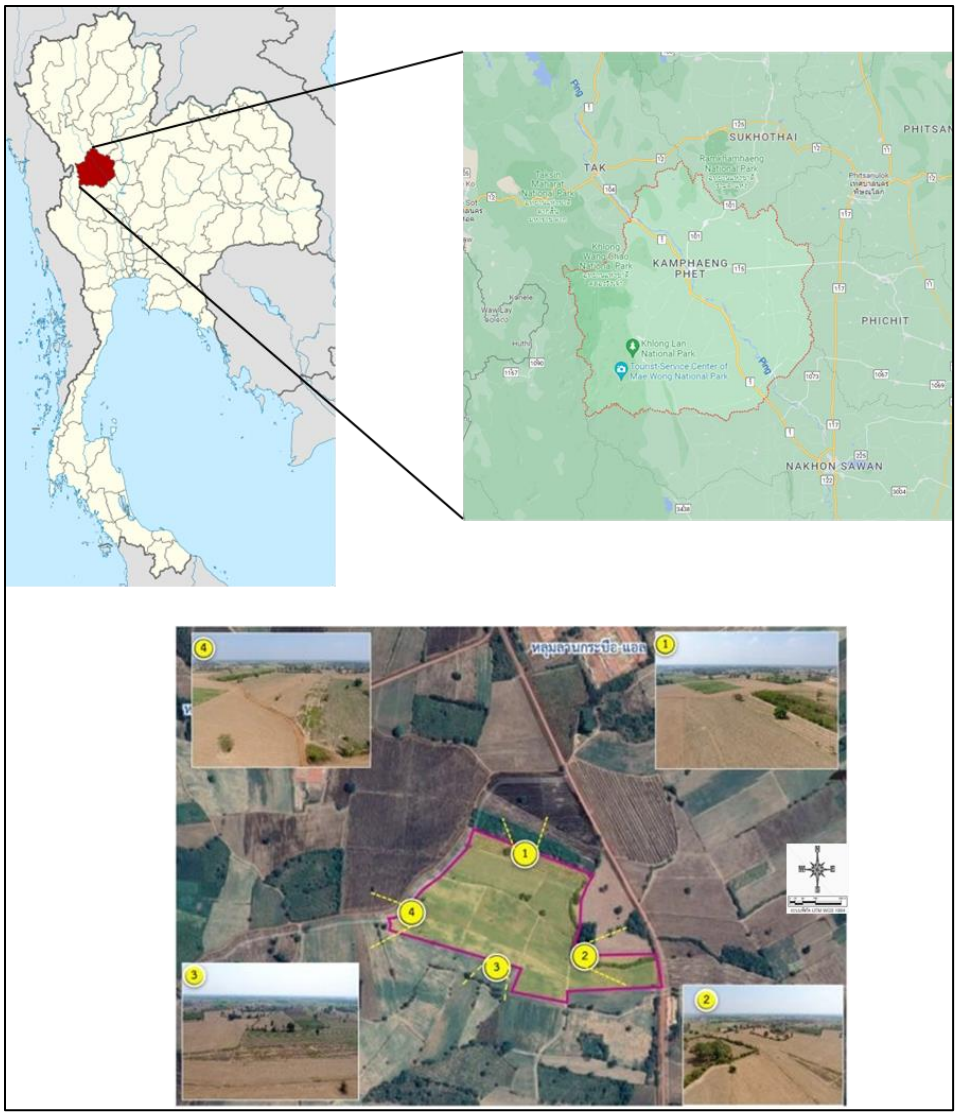


Figure 2 The project boundary (Kamphaeng Phet, Thailand)

1.13 Conditions Prior to Project Initiation

Prior to the implementation of the project activity, the baseline scenario refers to the usage of electricity of the PTTEP is from the existing conventional off-grid gas turbine generator, which emit the GHGs from burning natural gas to generate electricity. The baseline identified in section 3.4.

In summary, the GHGs emission will be reduced due to displacement of natural gas electricity by small-scale solar technology which does not generate project emissions.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The implementations of the solar project are under the Thailand laws, statutes, and regulatory frameworks that encompass the rights and regulations of electricity generation and the relevant environmental impact of the project activity.

Relevant laws, statutes, and regulatory frameworks summarized as below:

- Energy Regulatory Commission Announcement
- Ministry of Industry Announcement
- Factory Act, B.E. 2535 (1992)

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project activity has not been registered or seeking in any GHG programs at the moment.

1.15.2 Projects Rejected by Other GHG Programs

The project activity is not participating in any other GHG programs at the moment.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

The project activity is not including in an emissions trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

The project activity has not received any form of GHG-related credit.

Supply Chain (Scope 3) Emissions

Have the owner(s) or retailer(s) of the impacted goods and services[1] posted a public statement saying, "VCUs may be issued for the greenhouse gas emission reductions and removals associated with reduction of fossil fuel sources for electricity generation by PTTEP (PTT Exploration and Production) Siam Co., Ltd." since the project's start date?

☒ Yes ☐ No

FutureTech Solar will issue a public statement after the project start, stating that the impact of the solar project on reducing fossil fuel sources for electricity generation by PTTEP will be accounted for to avoid double credit counting.

Has the project proponent posted a public statement saying, "VCUs may be issued for the greenhouse gas emission reductions and removals associated with [name of good or service][describe the region or location, including organization name(s), where practicable]."

☒ Yes ☐ No

FutureTech Solar plans to publicly announce that their project contributes to greenhouse gas (GHG) emission reductions in Scope 3, Category 3, through the Verra Verified Carbon Standard (VCS) program. This announcement will be made available on the company's website.

Have the producer(s) or retailer(s) of the impacted good or service been notified of the project and the potential risk of Scope 3 emissions double claiming via email?

☒ Yes ☐ No

FutureTech Solar has notified PTTEP and solar panel's supplier that their solar project will have an impact on greenhouse gas (GHG) emission reductions in Scope 3, Category 3. This notification was made to avoid any potential for double credit counting.

1.17 Sustainable Development Contributions

In addition to generating electricity from solar power, the solar project activity also supports the region's sustainable development in social, environmental, and economic aspects.

The solar project contributes to sustainable development goals (SDGs) in the following ways:

- SDG 7 (Affordable and Clean Energy) Ensure access to affordable, reliable, sustainable and modern energy for all.

  The solar project promotes the use of sustainable and clean energy to generate electricity, reducing greenhouse gas emissions and supporting climate change

[1] Impacted goods and services are all goods and services directly impacted by the technologies and measures specified as project activities in the project description. Please see the VCS Program document *VCS Program Definitions* for additional information.

mitigation. By encouraging the adoption of sustainable energy, this project supports the transition towards a low-carbon economy and promotes access to affordable and sustainable energy, contributing towards the achievement of Sustainable Development Goal 7 - ensuring access to modern, reliable, and sustainable energy for all.

- SDG 8 (Decent work and economic growth): Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

  The project activity creates direct and indirect job opportunities for local communities related to the construction, and operation of the project activity. The construction of the project takes approximately 6 months in total, with the need for construction labour in each period, which is expected to employ up to 100 construction workers. The indirect economic impacts on the community stem from the rise in income for local traders due to the infusion of money.

- SDG 13 (Climate Action): Take urgent action to combat climate change and its impact. The objective of the project is to harness solar energy as an alternative to the conventional electric power generation methods that rely on fossil fuels, which are major contributors to GHGs emissions. This project represents a significant step towards a more environmentally friendly future and aligns with the organization's commitment to mitigating climate change. Hence, the solar project will contribute to reduce 13,091.65 tCO_2e/year of GHG reduction.

Table 2 Summary of sustainable development contributions

SDG Target	Net impact on SDG Indicator	Current Project Contributions
SDG Target number	*Indicate the project's contribution to the SDG Indicator (implemented activities to increase or decrease)*	*Brief description of the quantifiable impact of the project's activities related to the SDG indicator, during the monitoring period.*
SDG 7	Implemented activities to increase	Activity: Renewable electricity generation The solar project is estimated to generate 14,142 MWh of renewable energy annually during the crediting period with estimated annual degradation factor: 0.45% per operational year. The solar project is contributing towards SDG 7.1.2 by increasing the share of renewable energy in the global energy mix.

SDG 8	Implemented activities to increase	Activity: Employment The solar project expected to employ up to 100 local construction workers. The solar project is contributing towards SDG 8.5.2 by increasing the employment opportunities to the local people.
SDG 13	Implemented activities to increase	Activity: CO_2 emission reduction The solar project is estimated to reduce 13,091.65 tCO_2e annually during the crediting period.

1.18 Additional Information Relevant to the Project

Leakage Management

According to the CDM Methodology AMS-I.F. version 5.0, the solar project doesn't utilize any biomass and/or biomass residue. Thus, leakage calculation for this project is not required.

Commercially Sensitive Information

The project proponent will not disclose any commercially sensitive information in the project description document.

However, project proponent will ensure that all the required documents are accessible to the stakeholders involved.

2 SAFEGUARDS

2.1 No Net Harm

The solar project has no significant negative impact on environment and social aspects throughout the project lifetime.

For the solar photovoltaic project, the project has set the standards for asses and analyse the potential impact issues in 4 phases around the project area.

Impact Issues	Project's Phases
– Physical impact – Biological impact – Well-being impact	– Preparation – Construction – Operation – Demolition phase

Physical impact

- The project will be developed in a limited area of approximately 103.12 Rai of project area, which is only to adjust the level of the area to be suitable for the installation of solar panels. There are no large structures that require deep foundation excavation to the rock level. And when considering the activities of the project, it was found that the project did not use soil as a medium for pollution treatment. The operation of the project therefore causes minimal impact on geology and soil resources.

- Air pollution of the project activity mostly from the preparation and construction phase such as soil surface adjustment for solar installation, machinery for construction, etc. From the assessment, total suspended particulate (TSP) value is 0.126 mg/m^3, which is within the criteria specified by the standard for not exceeding 0.33 mg/m^3 and considered as low-level impact on air quality.

- It is expected that the construction phase of the project will result in noise impacts. These impacts are anticipated to arise from activities such as levelling the area, installing various equipment, and from demolition activities. Conversely, during the operational phase, there will be no significant noise source, as the only activity will be the cleaning of the solar panels.

- It has been determined that the project will not utilize groundwater or any other natural water sources in the area for either the construction or operational phase. As a result, the hydrological conditions will not be impacted. Furthermore, the project will not involve the disposal of hazardous or non-hazardous waste by landfilling in the project area. This helps to reduce the risk of contamination of water sources, both under

normal circumstances and in the event of flooding, ensuring that the potential impact remains low.

- The project activities, both in the construction and operational phases, are limited to land levelling and do not include the filling of natural drainage channels. The project has incorporated a drainage system, which will collect and store rainwater within the project's pond, minimizing any potential impact on the hydrological conditions of the area. It is expected that the overall impact will be low.

Biological impact

The solar project is hypothesized that the implementation of the solar project will not have any adverse effects on biological resources. As a result, there has been no comprehensive analysis or assessment of the impact on biological resources at any stage of the project.

Well-being impact

Regarding the impact on well-being, the solar project takes into consideration the human impact in two aspects, human use values and the quality-of-life value. The project's implementation may affect these factors.

Solar projects have divided impacts on human use values into 5 parts including land use, transportation, water use, electricity consumption, and solid waste and waste management:

- Impact on land use

  The area surrounding the project is primarily utilized for agricultural purposes by the local community. As such, the selection of the project area is following all applicable laws currently in effect. As a result, the impact on the surrounding community is expected to be low.

- Impact on transportation

  During the operational phase of the project, there was no transportation activity. As the demolition activities are expected to have a limited duration, the impact on the use of roads by the public is expected to be low.

- Impact on water use

  The project has a water demand of 150 cubic meters for the purpose of cleaning solar panels, which is performed approximately 4 times a year or as dictated by the environment. The project will coordinate with local authorities, the Provincial Waterworks Authority operating in the area, or private agencies to secure an adequate supply of water. As a result, the impact of water usage on the surrounding communities is expected to be low.

- Impact on electricity consumption

During the construction activities of the project, generators will be utilized. However, during the operational phase of the project, there will be no requirement for additional electricity. To enhance the stability of the power source for the S1 project, generator use may be necessary during the construction phase for activities such as welding, drilling, lighting, and metalwork. These activities are anticipated to require only a small amount of electricity and will not have any impact on the electricity consumption of the surrounding community. As such, the expected impact is considered low.

- Impact of solid waste and waste management

  Upon evaluating the methods for managing waste, sewage, and unused materials during the project's construction, operational, and demolition phases, it was determined that an appropriate management approach had been implemented that would not negatively impact the surrounding community. As a result, the expected impact during the construction phase is considered low.

The project considers the impact on the quality-of-life values of the community in the surrounding area by considering the social and economic impact.

The project is expected to have a low social and economic impact as it will provide employment opportunities, with a maximum of 100 construction workers being hired. The preference will be given to local contractors, contributing to job creation and career opportunities in the community. Additionally, the project will increase income for local traders and wholesalers of construction materials, as workers will spend money in everyday life, thus contributing to the circulation of local exchange during the construction period.

2.2 Local Stakeholder Consultation

The process of hearing opinions from stakeholder groups has been conducted from provides details, environmental impact prevention and mitigation measures, and environmental impact monitoring measures of the solar project to stakeholders. There will be a forum to listen to the opinions of stakeholders and summarizing the results of the hearing and announcing the report to the public within 30 days after the hearing date.

Target groups to listen to opinions and understand with the people and stakeholders of the project according to the regulations of the Energy Regulatory Commission, regarding listening to opinions and understanding with the public and stakeholders in considering the issuance of a license to operate electricity generating operations B.E. 2565, consisting of

- Community leaders and citizens in the project area (radius of 1-kilometer from the boundary of the project location).
- Relevant government agency at all levels
- Educational institutions (Ex. School etc.)

The local stakeholder consultation for the solar farm project activities details has been conducted and held on Tuesday, May 17, 2022, from 9:00 a.m. – 11:00 a.m. at the meeting room of Ban Plak Mai Dam School and ZOOM online meeting application. The meetings consist of academic experts in providing project information and details.

The project has published a report summarizing its consultation with the public and project stakeholders. The report, along with a letter, has been submitted to relevant agencies and community leaders within a 1-kilometer radius of the project area. Additionally, the project has shared the results of its public hearings and engagement with stakeholders on the bulletin boards of government agencies and the community. This benefits the project by increasing public awareness and understanding.

Table 3 Opinion hearing process

Opinion hearing process	Period	Activity
Prepare for public hearing meeting	30 April – 16 May 2022	- Define the stakeholders around the solar project area - Gather relevant documents and provide information channels to stakeholders.
Set a meeting for public hearing	17 May 2022	- Listen to opinions from community representatives and stakeholders around the project boundary area.
Summarize of public hearing comments	2 – 6 June 2022	- Summarize the public opinions and concerns, - Identify the preventive measures on environmental and social impact of the project.
Report the summary of public hearing	16 June – 16 July 2022	- Report the summary around the project boundary area.

2.3 Environmental Impact

The operation of the 9.98 MW solar power plant project is not in compliance with the announcement of the Ministry of Natural Resources and Environment, which mandates that

thermal power plants with a power generation capacity of 10 megawatts or more must prepare an Environmental Impact Assessment (EIA) report.

However, the solar project has conducted the environmental impact assessment through the study of preventive and corrective measures on environmental quality and safety (ESA) report.

The project has set environmental management operations and measures in 4 phases include preparation, construction, operation, and demolition phase and analyze the impact that may occur from the project activities consisting of physical resources, biological resources, socio-well-being issues. Leading to the evaluation of prevention measures, solving, and environmental impact monitoring for report on the study of preventive and corrective measures on environmental quality and safety (ESA), and code of conduct reports.

In the result, the solar project has no environmental impact throughout the project lifetime.

2.4 Public Comments

The project has been made available for public comment through stakeholder consultation meetings at Ban Plak Mai Dam School in Chong Lom, Lan Krabue District, Kamphaeng Phet Province, Thailand.

In this public meeting, stakeholders were given the opportunities to express their opinions and suggestions through four channels as follows:

1. Opinions during the meeting.
2. Opinions in additional comment form.
3. Opinions in the assessment form after the meeting.
4. Additional opinions after the meeting within 15 days.

The channels for meeting participants who want to provide further comments after the meeting are post office, phone, fax, and email.

Stakeholder opinions and concerns fall into four areas: air pollution, transportation, social and public participation, and energy sharing to stakeholders around the project boundary area. The project proponent has clarified, explained, and reported the summary of the concerns through the hearing process of the project.

The details of stakeholder's opinions and concerns are in Table 4 below.

Table 4 Summary of opinions and concerns of stakeholders/clarification of project proponent

Opinions and Concerns	Explanations and Clarifications
1. Air pollution	

- In the future, if the dust generated by community activities around the project area results in soiling of the solar panels, it may cause a dispute between the farmers and the project's owner. The community is keen to avoid such a situation, especially considering the potential for dust from the sugarcane farming activities to contribute to the issue.	- The company cannot control the farming activities around the project area. The project has found that agriculture does not affect electricity production. However, solar panels may need more frequent cleaning during high dust periods.
2. Transportation	
- The construction and adjustment of the project location require the importation of soil from external sources to prepare the project area. This activity may have an impact on the streets and roads of the surrounding community. Therefore, the community would appreciate it if the contractor company could assist in the maintenance of the shared roads to ensure they remain in the same condition as before. - Kindly request that the company prioritize safety measures at the intersection in front of Plak Mai Dam during morning and evening hours, as it is a crucial junction where numerous accidents have occurred. - Community would prefer to minimize the frequency of overtime construction activities.	- During the project implementation, various measures have been taken to address transportation and safety concerns. In addition, the project team will oversee contractors to ensure strict adherence to these measures. Specifically, transportation measures include addressing potential traffic accidents and road damage. If evidence shows that such incidents are caused by the project or its developer, appropriate care or responsibility must be taken.

3. Social and public participation	
- Kindly consider hiring locals for available job vacancies to support the community's income.	- Regarding social aspects, there are multiple factors of concern, particularly community involvement. In the operational phase, if there is a desire for continuous engagement with the community, it may be necessary to organize a discussion to determine the optimal operating model. Public relations officers will gradually reach out to community members or leaders to publish relevant information. Moreover, relevant information will be summarized for public use concerning employment opportunities in line with social measures.
4. Others	
- Distributing a portion of the energy generated to members of the local community? - Would like to have a meeting to summarize the progress of the impact of the project to community representative, and would like to establish a fund for energy activities Every half a year or 1 year - Establish a community fund to provide benefits such as the acquisition of community-benefiting goods.	- In the development of a power project, there will be a development fund established around the power plant. Any project that produces electricity from the date of the construction commencement must contribute 50,000 baht/megawatt/year to the fund. For electricity production from solar energy, a smaller fund will be established. The management of the local funds can be handled accordingly. Once electricity generation begins, payment to the fund will be required. The funds will be accumulated for community development purposes. - However, the power producer is only responsible for making payments to the fund. The Office of the Energy Regulatory Commission (ERC) will supervise and provide guidance on the Fund's management and utilization.

2.5 AFOLU-Specific Safeguards

Not applicable, this project is a non – AFOLU project activity.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Reference of the methodology : CDM AMS.I.F. version 5.0

Project Type : Renewable Energy Projects

Title : Renewable Electricity Generation for captive use and mini-grid

Tool used for calculation in the project are listed below:

- TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion version 3.0
- TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation version 3.0.
- TOOL21: Demonstration of additionality of small-scale project activities version 13.1
- TOOL27: Investment Analysis version 12.0

3.2 Applicability of Methodology

The solar project will meet the applicability conditions of the methodology AMS I.F. version 5.0 as describes below:

Table 5 Methodology scope applicability of the project

Methodology Scope	Project Activity
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit, i.e., in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:	**Applicable** This project aims to displace electricity that was previously supplied by a fossil fuel-fired captive power plant through the generation of renewable energy using photovoltaic technology in the distribution system.

(a) A national or a regional grid (grid hereafter); (b) A fossil fuel fired captive power plant; (c) A carbon intensive mini-grid.	
Illustration of respective situations under which each of the methodologies (AMS-I.D., AMS-I.F. and AMS-I.A.) applies are included in Table 7 below.	The project activity applies methodology AMS I.F and the detailed scenario has been explained in Table 7 below.

Table 6 Tool03 Methodology criteria applicability of the project

No.	Methodology Applicability criteria	Project Applicability
1	This methodology is applicable for project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition, (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	**Applicable** The solar project involves an investment in a new solar power plant that replaces the existing natural gas off-grid electricity generation.
2	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	**Applicable** The solar project's capacity is 9.98 MW, not exceeding the limit of 15 MW.
3	If the unit added has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	**Applicable** The project consists only of a renewable power plant component (solar power plant) with a capacity of 9.98 MW, which does not exceed the limit of 15 MW.
4	Combined heat and power (co-generation) systems are not eligible under this category.	**Not Relevant**

		This solar project does not include any combined heat and power (co-generation) systems.
5	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: (a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir; (b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; (c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	**Not Relevant** This solar project does not include any hydro power plants.
6	If electricity and/or steam/heat produced by the project activity is delivered to a third party, i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions.	**Applicable** The solar project proponent has notified PTTEP via email that the solar project will affect GHGs emission reductions
7	In the case the project activities utilize biomass, the "TOOL16: Project and leakage emissions from biomass" shall be applied to determine the relevant project emissions from the cultivation of biomass and the utilization of biomass or biomass residues.	**Not relevant** The solar project falls in the renewable power plant category, which does not generate any biomass or biomass residue.

Table 7 Difference between the applicable of AMS-I.A, AMS-I.D, and AMS-I.F.

The solar project displaces captive fossil fuel electricity generation by solar power generation falls in the project type no.2 of the table above.

	Project type	AMS-I.A.	AMS-I.D.	AMS-I.F.
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	
4	Project supplies electricity to a mini grid5 system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

Table 8 TOOL05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation version 03.0 applicability of the project

Applicability Criterion	Project Applicability
If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: *(a)* Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to	**Applicable** The baseline scenario of the solar project is that the electricity consumption is sourced from the captive power plant, which burns natural gas to generate conventional electricity, and is not connected to the electricity grid. Thus, this project is fall to Scenario B

provide electricity to the electricity consumer; *(b)* Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or *(c)* Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	
This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities;	**Applicable** The project supplies electricity generated from renewable solar energy to the electricity-consuming facilities of PTTEP Siam Co., Ltd. (S1 Project). As a result, the electricity from renewable sources is not connected to the main grid. Thus, this project is fall into Scenario II.

(c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	
This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO2 emissions.	**Applicable** According to the baseline scenario, there is no captive renewable power generation technologies.

Table 9 TOOL21: Demonstration of additionality of small-scale project activities Version 13.1 applicability of the project

Scope and Applicability Criterion	Project Applicability
The use of the methodological tool "Demonstration of additionality of small-scale project activities" is not mandatory for project participants when proposing new methodologies. Project participants and coordinating/managing entities may propose alternative methods to demonstrate additionality for consideration by the Executive Board.	**Applicable** This project will not propose any new methodology

Table 10 TOOL27: Investment analysis version 12.0 scope and applicability of the project

Scope and Applicability Criterion	Project Applicability
This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	**Applicable** The solar project is aligned with the methodological tool "Tool for the demonstration and assessment of additionality"
In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	**Not Relevant** The solar project is aligned with the methodological tool "Tool for the demonstration and assessment of additionality"

3.3 Project Boundary

From the project boundary described in AMS-I.F. version 5.0 methodology; The spatial extent of the project boundary includes industrial, commercial facilities consuming energy generated by the system. In the case of electricity generated and supplied to distributed users (e.g., residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of renewable generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity that the solar power plant project is connected to.

The project boundary is limited to the location of the solar power generation units connected to PTTEP (S1 Project). Hence, the solar project connected to PTTEP (S1 Project) has been considered within the project boundary for the Voluntary Carbon Standard (VCS) project activity.

Table 11 Summary of the emissions sources that are included or excluded in the project boundary for the calculation of both baseline and project emissions.

Source		Gas	Included?	Justification/Explanation
Baseline	Grid connected electricity generation	CO_2	Yes	Main emission source
		CH_4	N/A	N/A
		N_2O	N/A	N/A
		Other	N/A	N/A
Project	Solar Project activity	CO_2	Yes	Fossil fuel consumption in project activity
		CH_4	N/A	Project activity does not emit CH_4
		N_2O	N/A	Project activity does not emit N_2O
		Other	N/A	N/A

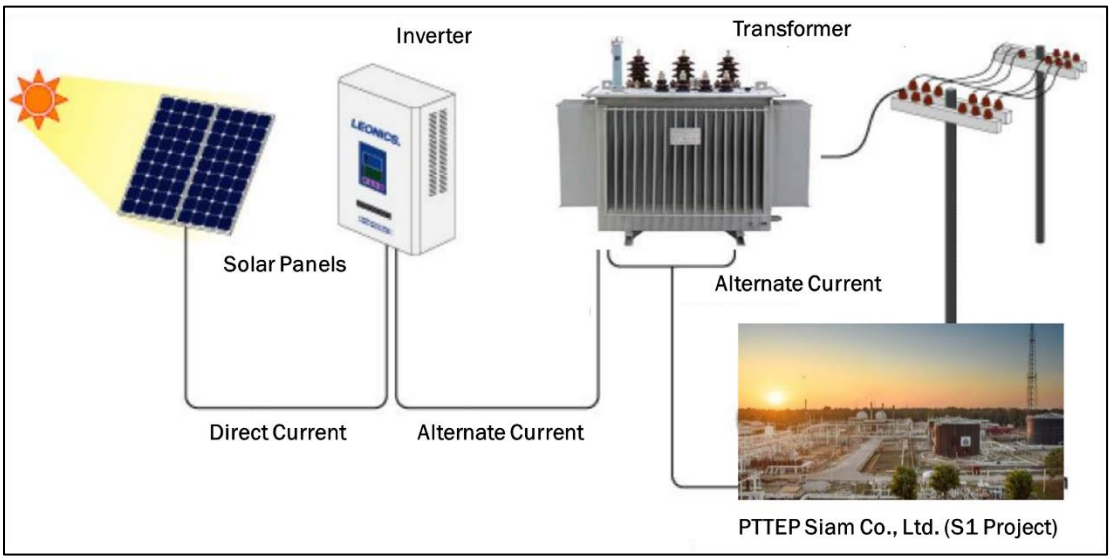


Figure 4 Project boundary diagram

3.4 Baseline Scenario

The solar project is defined as “a new renewable energy power plant that is displace electricity from an electricity distribution system that is or would have been supplied by fossil fuel generating unit” as described in the AMS-I.F. version 05.0 methodology.

The baseline for the project activity is the amount of electricity supplied with the electricity produced by the solar power generating unit, which calculated by the quantity of electricity that would be consumed by the baseline electricity consumer (EC) and emission factor – quantity of electricity consumed by the project electricity consumption source (EF).

Table 12 Parameter for baseline scenario calculation

Parameter	Description	Value	Source
$EC_{BL,k,y}$	Quantity of electricity that would be consumed by the baseline electricity consumer k in year y	13,903.47 MWh/yr	Estimation based on potential
$EF_{CO2,i,t}$	Average CO_2 emission factor of fossil fuel type i used in the period t	0.06 tCO_2/GJ	IPCC Default Values
$TDL_{k,y}$	Average technical transmission and distribution losses for providing electricity to source k in year y	0.00	Assumption in Data / Parameter table 3, TOOL05
$FC_{n,i,t}$	Quantity of fossil fuel type i fired in the captive power plant n in the time	NM^3/day	Record
$NCV_{i,t}$	Average net calorific value of fossil fuel type i used in the period y (GJ / mass or volume unit)	GJ/NM^3/day	Specification sheet
$EG_{n,t}$	Quantity of electricity generated in captive power plant n in the time period t.	MWh	Specification sheet

3.5 Additionality

According to the CDM methodological TOOL21 "Demonstration of additionality of small-scale project activities" version 13.1, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier:

a financially more viable alternative to the project activity would have led to higher emissions.

(b) Technological barrier:

a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.

(c) Barrier due to prevailing practice:

prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.

(d) Other barriers:

without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The project proponents have identified the "**Investment Barrier**" as the main challenge encountered by the project. This barrier arises from the substantial costs involved, which turn affect the returns generated.

Investment Barrier:

The aim of conducting an Investment Barrier Analysis is to find out if the project activity is economically or financially less viable than other options, and if additional funding can be obtained through the sale of carbon credits. The investment barrier analysis was conducted align with guidelines on TOOL27: Investment Analysis.

The project proponent has assessed IRR as the appropriate financial metric for the purposes of investment analysis.

Suitable for Benchmark:

According to TOOL27: Investment Analysis, version 12.00

The investment barrier analysis has been conducted in real terms. Thus, the project proponent has been used suitable Benchmark based on the paragraph 6, Table 1 of the Appendix of TOOL27: Investment Analysis, version 12.0. According to the location of solar project (Thailand) and project activity, the project is suitable for Group 1, Energy Distributions. In summary, the suitable Benchmark value is 8.93% and has been described below:

FST Solar Project (9.98 MW)

As per paragraph 5 of Appendix of TOOL27: Investment Analysis, the project activity generates power utilizing solar energy is considered as Group 1, Energy Distributions, and has been identified as a suitable category.

The investment analysis has been conducted using real terms. Accordingly, the project proponent utilized the benchmark value from the default value as specified in paragraph 6 of the Appendix of TOOL27: Investment Analysis.

Real Benchmark = Default Value, 8.93% as per paragraph 5, criteria (a) Group 1 and paragraph 6, Table 1, Thailand of the Appendix of TOOL27: Investment Analysis, version 12.0.

The project's IRR is evaluated for the entire 25-year lifetime of the solar project activity and considers all cash flows generated by the project, including both positive (inflows) and negative (outflows) amounts.

The analysis for the IRR and Benchmark is conducted through a spreadsheet. According to the outcome of the IRR spreadsheet, the project's IRR is lower than the Benchmark. Therefore, it can be concluded that the project is an additional activity and not a business-as-usual scenario. Thus, the data and input values used in the investment analysis complies with section 4, guidance 10 of TOOL27: Investment Analysis, version 12.0, which can be verified that the input values valid and applicable at the time of the investment decision taken by the project proponent.

Parameters	Values	Sources
Solar Project Details		
Project Location	Kamphaeng Phet, Thailand	PPA
Total Capacity (MW)	9.98	PPA
Date of Commissioning	21 July 2023	PPA
Life of the plants (Years)	25	PPA
Generation of Electricity		
Average Annual Generation (MWh)	13,061	PPA
Annual Degradation Factor per operational year (%)	0.45	PPA

IRR Financial Spreadsheets.

	Parameters	Values	Sources
Revenue	Total Revenue from electricity (MTHB)	944	Calculated
	Total Revenue from others (MTHB)	34	Calculated
CAPEX	Total EPC Cost (MTHB)	330	Calculated
	Total Land Acquisition (MTHB)	34	Calculated
	Total RFS (MTHB)	22	Calculated

	Total Consulting and other Fees (MTHB)	10	Calculated
OPEX	Total O&M expenses (MTHB)	233	Calculated
	Total G&A (MTHB)	101	Calculated
TAX	Total Tax (MTHB)	88	Calculated

Project IRR is summarized as below:

Project IRR	Benchmark
2.57%	8.93%

Hence, the solar project activity can be considered as financially unattractive as the project IRR is less than the Benchmark.

Sensitivity Analysis

According to section 7 of TOOL27: Investment Analysis, following factors has been considered to sensitivity analysis

1. Electricity Production
2. CAPEX
3. OPEX

Project IRR (%)					
Sensitivity Variation %	**10%**	**5%**	**0%**	**-5%**	**-10%**
Electricity Production	*4.04%*	*3.32%*	*2.57%*	*1.78%*	*0.95%*
CAPEX	*1.72%*	*2.13%*	*2.57%*	*3.05%*	*3.56%*
OPEX	*2.03%*	*2.30%*	*2.57%*	*2.83%*	*3.09%*

This sensitivity analysis shown that the investment in this solar project is not financially attractive (Project IRR for the Project activity is less than the Benchmark IRR) for any potential investors.

3.6 Methodology Deviations

Not applicable: The methodology AMS-I.F. has no deviations.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As per CDM methodology AMS-I.F. version 5.0, the baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

For the solar project, baseline emissions are from the captive power plants that burns natural gas to generate the electricity. The emission factor for captive electricity generation shall be calculated as per the procedures described in the TOOL05.

The baseline emissions are calculated as follows:

$$BE_y = \Sigma \left[EC_{BL,y} \times EF_{ef,y}\right]$$

Where:

BE_y = Baseline emissions in year y (t CO_2)

$EC_{BL,y}$ = Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{ef,y}$ = Emission factor for electricity in generation in year y (t CO2/MWh)

Emission Factor ($EF_{ef,y}$) Calculation

As per TOOL05, the emission factor for electricity generation is calculated as follows:

$$EF_{ef,y} = (\Sigma\ \Sigma\ FC_{n,i,t} \times NCV_{i,t} \times EF_{CO2,i,t}) / \Sigma\ EG_{n,t}$$

Where:

$FC_{n,i,t}$ = Quantity of fossil fuel type i fired in the captive power plant n in the time (SCF/day)

$NCV_{i,t}$ = Average net calorific value of fossil fuel type i used in the period t (GJ/mass or volume unit)

$EF_{CO2,i,t}$ = Average CO2 emission factor of fossil fuel type i used in the period t (tCO2/GJ)

$EG_{n,t}$ = Quantity of electricity generated in captive power plant n in the time period t (MWh/day)

Parameter	Unit	Quantity	Reference
$FC_{n,i,t}$	SCF/day	5,795,605.36	Record
$NCV_{i,t}$	GJ/SCF	0.00105	Spec Sheet

$EF_{CO2,i,t}$	tCO2/GJ	0.05610	TOOL05, Table 1.4 of Chapter1 of Vol. 2
$EG_{n,t}$	MWh/day	360.72	Spec Sheet

Where:

$EF_{ef,y} = (\Sigma\ \Sigma\ FC_{n,i,t} \times NCV_{i,t} \times EF_{CO2,i,t}) / \Sigma\ EG_{n,t}$

$EF_{ef,y} = (5{,}795{,}605.36 \times 0.00105 \times 0.05610) / 360.72$

$EF_{ef,y} = 0.94$ t CO2/MWh

Baseline Emission (BE_y) Calculation

Year	$EC_{BL,y}$ (MWh)	$EF_{ef,y}$ (t CO2/MWh)	BE_y (t CO2)
2023	5,892.36	0.94	*5,551.44*
2024	14,075.15	0.94	*13,260.79*
2025	14,008.64	0.94	*13,198.12*
2026	13,943.13	0.94	*13,136.40*
2027	13,875.62	0.94	*13,072.79*
2028	13,809.10	0.94	*13,010.13*
2029	13,742.59	0.94	*12,947.46*
2030	7,977.71	0.94	*7,516.13*
		Total	*91,693.26*

The total baseline emission is described as below:

$\Sigma BE_y = \Sigma[EC_{BL,y} \times EF_{ef,y}]$

ΣBE_y = 5,551.44 + 13,260.79 + 13,198.12 + 13,136.40 + 13,072.79 + 13,010.13 + 12,947.46 + 7,516.13

ΣBE_y = 91,693.26 t CO2

4.2 Project Emissions

As per the CDM methodology AMS-I.F. Version 5.0, the solar project involves the installation of a renewable power generation system that is connected to the mini-grid and involves the on-site

consumption of fossil fuels by the project activities, the project proponent shall use the TOOL03 version 3.0 to calculate the CO2 emissions (Project Emission).

CO2 emissions from fossil fuel combustion are calculated based on the quantity of fuels combusted and the CO2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \Sigma\ FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$ = CO2 emissions from fossil fuels combustion in process j during the year y (tCO2/yr)

$FC_{i,j,y}$ = Quantity of fuel type I combusted in process j during the year y (mass or volume unit/yr)

$COEF_{i,y}$ = CO2 emission coefficient of fuel type I in year y (tCO_2/mass or volume unit)

The emissions generated by this solar project are a result of the use of fossil fuel energy consumption in the operation of FST.

The solar project included the fossil fuel based as listed below:

- Diesel Pump 1 unit
- Vehicles (Trucks) 2 units

Assumption

	Operations and Consumptions	CO2 emission coefficient
Diesel Pump	• 30 day per year • 1 hour per day • 18 liters per hour	• 2.7078 kg CO_2eq per liter
Vehicles (Trucks)	• 365 day per year • 1 hour per day • 40 kilometers per hour • 0.074074 liters per kilometer	• 2.7406 kg CO_2eq per liter

From:

$$PE_{FC,j,y} = \Sigma\ FC_{i,j,y} \times COEF_{i,y}$$

CO_2 emissions from Diesel pump

$PE_{diesel\ pump}$ = (30 day/year x 1 hr/day x 18 liter/hr) x 2.7078 kg CO2eq/ liter

$PE_{diesel\ pump}$ = 1,462.2 kg CO2eq/year

$PE_{diesel\ pump}$ = 1.462 t CO2eq/year

CO_2 emissions from vehicle (4 wheels-pickup)

PE_{truck} = (365 day/year x 1 hr/day x 0.074074 liter/km x 40 km/hr) x 2.7406 kg CO2eq/ liter

PE_{truck} = 2,963.9 kg CO2eq/year

PE_{truck} = 2.964 t CO2eq/year

The total project emissions are calculated as follows:

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

Where:

PE_y = Project emissions in year y (tCO_2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2e/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)

From:

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

The total project emission is described as below:

$$PE_y = PE_{FF,y}\,(\text{Diesel Pump}) + PE_{FF,y}\,(\text{Truck}) + PE_{FF,y}\,(\text{Truck}) + 0 + 0$$

$$PE_y = 1.462 + 2.964 + 2.964 + 0 + 0 \text{ ton CO2eq/year}$$

$$PE_y = 7.39 \text{ t } CO_2\text{eq/year}$$

As the solar project activity is involved with the 1 diesel pump and 2 vehicles which is generates CO_2 emissions by consuming fossil fuel, and does not involve any operation of dry, flash steam or binary geothermal power plants, and from water reservoirs of hydro power plants.

In summary the total project emissions (PE_y) of the solar project is 7.5 ton CO_2eq per year.

4.3 Leakage

Since the project involves the generation of electricity through renewable energy (solar energy power plants), with a total installed capacity of 9.9 MW, which is below the 15 MW threshold,

which does not result in any significant GHGs emissions and leakage beyond the project boundaries as per paragraph 29 of the small-scale methodology AMS.I.F. (version 5.0).

4.4 Net GHG Emission Reductions and Removals

The emissions reductions are calculated as follows:

$ER_y = BE_y - PE_y - LE_y$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/y)
BE_y = Baseline Emissions in year *y* (t CO_2/y)
PE_y = Project emissions in year *y* (t CO_2/y)
LE_y = Leakage emissions in year *y* (t CO_2/y)

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 2023 (21/07/2023-31/12/2023)	*5,551.44*	3.70	0	*5,548.36*
Year 2024 (01/01/2024-31/12/2024)	*13,260.79*	7.39	0	*13,253.40*
Year 2025 (01/01/2025-31/12/2025)	*13,198.12*	7.39	0	*13,190.73*
Year 2026 (01/01/2026-31/12/2026)	*13,136.40*	7.39	0	*13,129.01*
Year 2027 (01/01/2027-31/12/2027)	*13,072.79*	7.39	0	*13,065.40*
Year 2028 (01/01/2028-31/12/2028)	*13,010.13*	7.39	0	*13,002.74*
Year 2029 (01/01/2029-31/12/2029)	*12,947.46*	7.39	0	*12,940.07*

Year 2030 (01/01/2030-20/7/2030)	*7,516.13*	3.70	0	*7,511.82*
Total	91,693.26	51.73	0	91,641.53

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{CO2,i,t}$
Data unit	tCO_2 / GJ
Description	Average CO_2 emission factor of fossil fuel type *i* used in the period *t*
Source of data	IPCC default values at the upper or lower limit – whatever is more conservative5 – of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	15.30
Justification of choice of data or description of measurement methods and procedures applied	No CO_2 emission factor is provided. Thus, project proponents use the IPCC default values to be the choice of data.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$TDL_{j,y}$
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data	Specification sheet
Description of measurement methods	-

and procedures to be applied	
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline and project emissions.
Calculation method	-
Comments	

5.2 Data and Parameters Monitored

Data / Parameter	$EC_{pj,j,y}$
Data unit	MWh/yr
Description	Quantity of electricity that would be consumed by the baseline electricity consumer *k* in year *y*
Source of data	Direct measurement
Description of measurement methods and procedures to be applied	Use electricity meter
Frequency of monitoring/recording	Continuous measurement at least monthly recording
Value applied	

Year	Electricity Consumption (MWh)
2023	5,892.36
2024	14,075.15

	2025: 14,008.64 2026: 13,943.13 2027: 13,875.62 2028: 13,809.10 2029: 13,742.59 2030: 7,977.71
Monitoring equipment	Type of meter: 3 Phase smart meter (Energy meter) Location of meter: Interconnection point (Export switchgear Accuracy of meter: 0.5s Serial number of meters: EDMI Mk6E, S/N 25150799 Calibration frequency: This information will be submitted during the validation process.
QA/QC procedures to be applied	The export and import electricity by the project activity will be crosschecked with the Power Quality Meter (PQM) monthly by O&M team before issuing the invoices. Data will also be recorded by SCADA system.
Purpose of data	Calculation of baseline and project emissions.
Calculation method	-
Comments	-

Data / Parameter	$TDL_{j,y}$
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to source j in year y

Source of data	Specification sheet
Description of measurement methods and procedures to be applied	As per data / parameter table 3 in TOOL05 version 3.0,
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline and project emissions.
Calculation method	-
Comments	-

Data / Parameter	$FC_{n,i,t}$
Data unit	SCF/day
Description	Quantity of fossil fuel type i fired in the captive power plant n in the time period t
Source of data	Annual data during the crediting period: Onsite measurement Historical data: Historical records / onsite measurements
Description of measurement methods and procedures to be applied	As per data / parameter table 4 in TOOL05, Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on daily basis or per shift)
Frequency of monitoring/recording	Continuous measurement

Value applied	5,808,942.81
Monitoring equipment	Mass or volume meter
QA/QC procedures to be applied	The consistency of metered fuel consumption quantities should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes.
Purpose of data	Calculation of emission factor for electricity generation.
Calculation method	-
Comments	-

Data / Parameter	$NCV_{i,t}$
Data unit	GJ/SCF
Description	Average net calorific value of fossil fuel type i used in the period t (GJ / mass or volume unit)
Source of data	Fuel supplier's invoices
Description of measurement methods and procedures to be applied	Measurements are undertaken in line with national standards
Frequency of monitoring/recording	Continuous measurement
Value applied	0.00105
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of emission factor for electricity generation.
Calculation method	-

Comments	-

Data / Parameter	$EG_{n,t}$
Data unit	MWh/day
Description	Quantity of electricity that would be consumed by the baseline electricity consumer k in year y
Source of data	Onsite measurements
Description of measurement methods and procedures to be applied	Use electricity meters
Frequency of monitoring/recording	Continuous measurement
Value applied	360.72
Monitoring equipment	
QA/QC procedures to be applied	Cross check measurement results with records for sold electricity where relevant
Purpose of data	Calculation of emission factor for electricity generation.
Calculation method	-
Comments	-

5.3 Monitoring Plan

FutureTech Solar has constructed the organization structure and provided responsibilities of each position for the monitoring activity as per Figure 5 a Table 13 below.

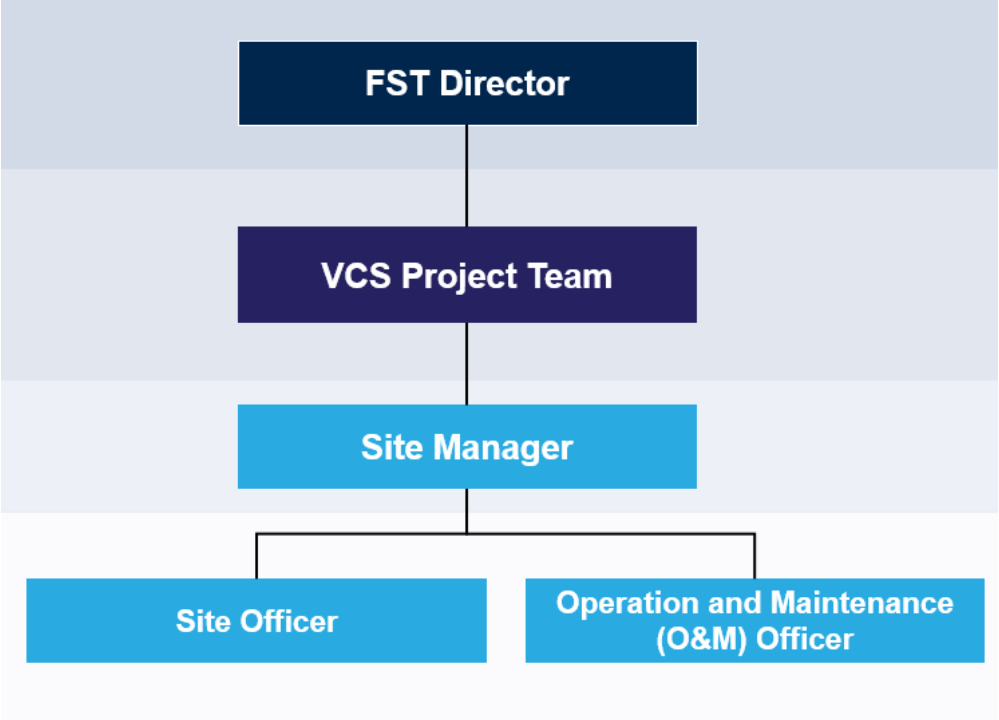


Figure 5 Organizational structure for monitoring activity

Table 13 Responsibilities of each position for monitoring activity (This table will be updated later)

Position	Responsibility	Reporting
FST Director	• Decision making to the project • Acknowledge and approve the project outcomes	-
VCS Project Team	• Oversee the project implementation status • QA/QC and approve the GHG calculation • Report the monthly summary report • Calculate GHG emission reduction from the solar project • Report the calculation data to the VCS project manager	FST Director
Site Manager	• QA/QC and approve data collected from the site officer and operation and maintenance team • Report the monthly summary report to the VCS working team	VCS Project Team
Site Officer, Operational and Maintenance (O&M) Officer	• Daily collect and monitor all the data from the solar farm project • Tracking feedback from local stakeholders • Monitor the performance of the solar farm to ensure that it is operating at maximum efficiency • Inspect and maintain the electrical equipment used in the solar farm	Site Manager

	• Daily records all maintenance activities and report any issues or problems to the site managers	

APPENDIX

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.