

TEMPLATE

Monitoring Report

PUBLICATION DATE 14.10.2020

VERSION v. 1.1

RELATED SUPPORT - TEMPLATE GUIDE Monitoring Report v. 1.1

This document contains the following Sections

Key Project Information

0 - Description of project

0 - Implementation of project

0 - Description of monitoring system applied by the project

0 - Data and parameters

0 - Calculation of SDG Impacts

0 - Safeguards Reporting

0 - Stakeholder inputs and legal disputes

KEY PROJECT INFORMATION

This template has been revised to aid a consistent interpretation and to better support project developers submitting documentation for certification. Please read the accompanying guide to understand how to complete this template accurately.

[TEMPLATE GUIDE Monitoring Report v. 1.1](#)

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Programme of Activity Information – (delete below table if N/A)

Key Project Information

GS ID (s) of Project (s)	GS12112
Title of the project (s) covered by monitoring report	Liki Pinangawan Muaralaboh Geothermal Power Plant
Version number of the PDD/VPA-DD (s) applicable to this monitoring report	1.0
Version number of the monitoring report	1.7
Completion date of the monitoring report	16/04/2024
Date of project design certification	27/03/2023
Date of Last Annual Report	N/A
Monitoring period number	1 st .
Duration of this monitoring period	01/11/2020 – 31/01/2023 (both date inclusive)
Project Representative	Prijandaru Effendi
Host Country	Indonesia
Activity Requirements applied	<input type="checkbox"/> Community Services Activities <input checked="" type="checkbox"/> Renewable Energy Activities <input type="checkbox"/> Land Use and Forestry Activities/Risks & Capacities <input type="checkbox"/> N/A
Methodology (ies) applied and version number	ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 12.2.0

Product Requirements applied

- ☒ GHG Emissions Reduction & Sequestration
☐ Renewable Energy Label
☐ N/A

Table 1 - Sustainable Development Contributions Achieved

Sustainable Development Goals Targeted	SDG Impact	Amount Achieved	Units/ Products
13 Climate Action	Reduction in GHGs emissions	1,144,912	VERs
7 Affordable and Clean Energy	Total net electricity generation supplied to the main grid from the geothermal powerplant	1,598,751	MWh
8 Decent Work and Economic Growth	Total number of jobs created	386	Number

Table 2 – Product Vintages

		Amount Achieved		
Start Dates	End Dates	VERs	MWh	Number
01/11/2020	31/12/2020	78,092	109,466	386
01/01/2021	31/12/2021	502,721	702,971	386
01/01/2022	31/12/2022	519,334	723,884	386
01/01/2023	31/01/2023	44,765	62,429	386

SECTION A. DESCRIPTION OF PROJECT

A.1. General description of project

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Liki Pinangawan Muaralaboh Geothermal Power Plant (hereinafter referred to as the project activity) is an 88.81MW greenfield geothermal power project in West Sumatera Province, along the Sumatera Fault System (SFS) in Indonesia. The project being implemented by PT Supreme Energy Muara Laboh (PT SEML) (hereinafter referred to as the project owner) is a grid connected geothermal power plant and supplies low emission power to the Sumatera grid (hereinafter referred to as the grid).

The project activity consists of one turbine of 88.81MW that is installed in the southern Muara Laboh resource area (WKP). The power plant generates electricity to export to the state-owned electricity company, PT Perusahaan Listrik Negara (herein referred to as PT PLN) via Sumatera Grid. The project activity has a net capacity of 80MW and PT PLN will buy this at 90% Take or Pay Energy (ToP).

Geothermal power is a renewable source of energy which displaces the fossil fuel fired power generation in the connected grid. Hence the project activity will reduce greenhouse gas emissions by producing electricity from a renewable resource with low carbon emissions. At the current point, the project activity started operation on 16/12/2019. The project activity is estimated to generate emission reductions equivalent to 382,076 tCO₂/year during the first crediting period. The actual amount of emission reductions may differ from this figure as they depend on the concentration of non-condensable gases in the steam (Project Emissions) and on the thermodynamic parameters of the extracted geothermal fluid.

The project contributes towards sustainable development goals. Specifically, the project contributes to specifically the following aspects of sustainable development:

- Increase employment opportunities as 386 people are employed for the power plant operation. Furthermore, 1,800 people were employed during the construction phase of the project.
- Diversifies the sources of electricity generation in the host country which is important for meeting growing energy demands and facilitates the transition away from diesel and coal-supplied electricity generation.

Increases community development and corporate social responsibility at Muara Laboh Geothermal Field which contributes to showing great improvement to existing geothermal field operations.

The project is transitioning from CDM. The 1st MR is issued under CDM for crediting period 18/09/2015 – 17/09/2022, however the monitoring period is from 16/12/2019 – 31/10/2020

(<https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1338387972.21/view>)

A.2. Location of project

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Project location is in Pauh Duo Subdistrict, Solok Selatan Regency, West Sumatera Province, Republic of Indonesia. The project activity is located at Liki Pinangawan Muaralaboh Geothermal Working Area, about 100 km southeast of Padang, the capital city of West Sumatera. The GPS coordinates of the exploration area of the project activity are:

- Longitude: 1010 02' – 1010 08' East
- Latitude: 010 28' – 010 36' South



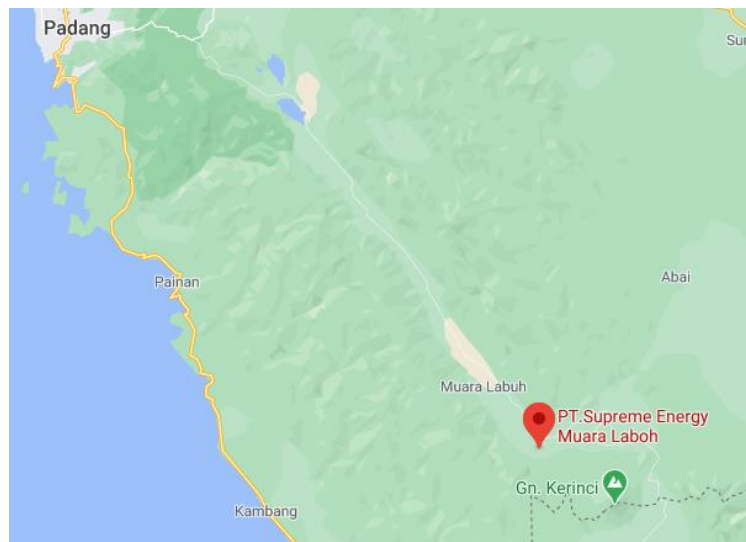


Figure A. Project Location

A.3. Reference of applied methodology

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Approved consolidated baseline and monitoring methodology ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 12.2.0, EB 65 Annex 16

<https://cdm.unfccc.int/UserManagement/FileStorage/Z5CN1XU07YRQ9JDBH4SGO2WA8M3TKP>

The project activity also refers to the latest approved versions of the following tools:

- Version 02.2.1 - Tool to calculate the emission factor for an electricity system, EB 63 Annex 19
<https://cdm.unfccc.int/UserManagement/FileStorage/ZULY095DAFBVKQ2IEXSM6HRT7NOG1C>
- Version 06.0.0- Tool for the demonstration and assessment of additionality, EB 65 Annex 21
<https://cdm.unfccc.int/UserManagement/FileStorage/9AGSVUJ4HP731N0DRL8CYF5EXTBZKQ>
- Version 02 - Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, EB 41 Annex 11.
https://cdm.unfccc.int/EB/041/eb41_repan11.pdf

A.4. Crediting period of project

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1st crediting period: 16/12/2019 -15/12/2024 (first and last days included).

Total crediting period of 15 years.

SECTION B. IMPLEMENTATION OF PROJECT

B.1. Description of implemented project

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The project is converting steam from the geothermal production well into electricity by installing a condensing steam turbine with maximum capacity of 88.81MW. With the net capacity of 80MW and 90% TOP (take or pay), the estimated electricity generation is 630,720 MWh annually.

Resource from HP wells will be delivered to High Pressure (HP) separators to be separated into HP steam and HP brine through flashing. The HP brine will be mixed with resource from Low Pressure (LP) wells and will be flashed further into lower pressure to extract more steam. LP brine will be re-injected back to the reservoir. Both HP and LP steam will pass through HP and LP scrubbers and will be directed to the steam turbine coupled to the generator. The steam exhausted from the turbine will be condensed in the condenser. Part of condensate will be used for the cooling water circulation system; the excess condensate will be re-injected into the reservoir.

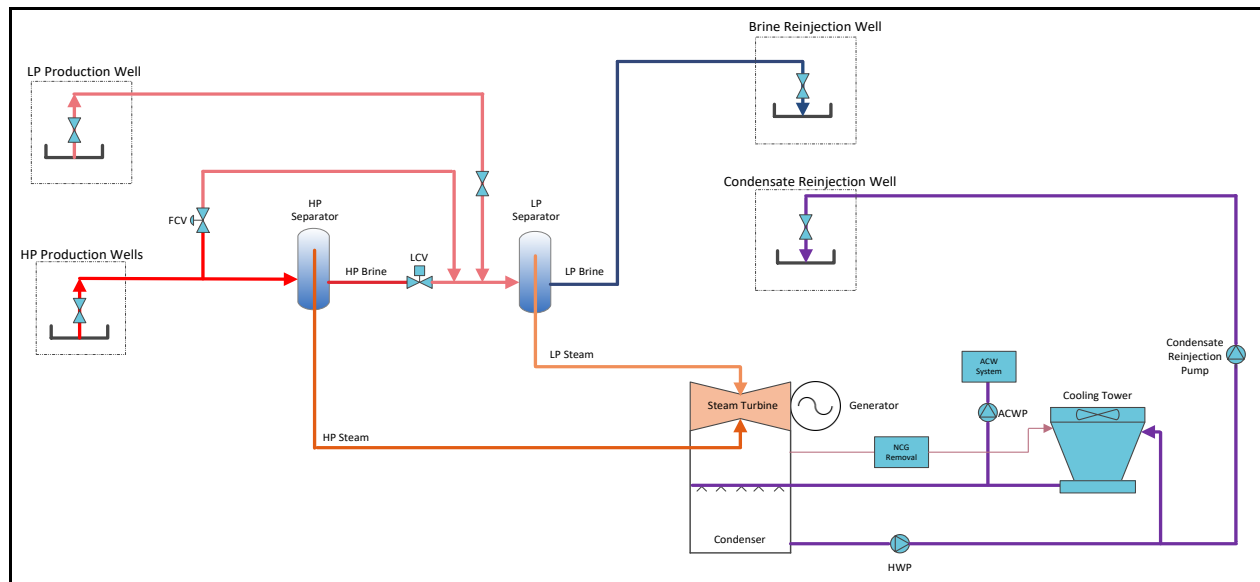


Figure B. Process Flow Diagram – Condensing Steam Turbine Power Plant

The technical specification of the condensing steam turbine is provided in the table below:

Table B.1 Turbine Technical Specification

Description	Value	Unit
Type	Single casing condensing reaction type	
Manufacturer	Fuji Electric	
Maximum Output	88,810	kW
Rated Speed	3,000	rpm
HP inlet steam pressure	8.4	bara
HP inlet steam temperature	172.1	°C
LP inlet steam pressure	3.90	bara
LP inlet steam temperature	142.6	°C
Exhaust pressure	0.07	bara

The project started on 15/08/2012 when well drilled for the exploration activity begun. Further Information on the implementation and actual operation of the project activity is explained below:

Table B.2 Relevant Implementation dates

Date	Event
02/03/2012	Power Purchase Agreement
15/08/2012	Project starting date
31/12/2012	CDM registration date
2012-2014	Exploration stage
09/09/2014	FS submission (End of Exploration)
2015 -2016	Tariff renegotiation and due diligence
01/03/2016	1 st Amendment of PPA
10/08/2016	2 nd Amendment of PPA.
20/02/2017	FS approval
2017-2019	Exploitation stage (Construction phase including Commissioning).
16/12/2019	Commercial Operation Date
14/04/2021	1 st CDM issuance for MR 18/09/2015-31/10/2020. https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1338387972.21/view
01/11/2020-present	Continued operation.

The exploration result was below expectation which made both project and PT. PLN have to renegotiate. This situation resulted delay on the project exploitation stage and further delay project commercial operation date.

During this Monitoring Report, there were Major operation maintenance and shutdown, that can be seen below:

No	Date	Note
1	14-Nov-2020 @18:16 PM - 16:56 PM	Unplanned outage due to disturbance at transmission line sei Rumbai. Total duration 22.66 hours.
2	08-Jan-2021 @15:24PM – 02:40AM	Unplanned outage due to Lo Lo pressure in HP Separator outlet steam pressure of HHP Let Down Valve. Total duration 11.27 hours.
3	10-Oct-2021 @00:24 AM until 25-Oct-2021 @4:28 PM	Power Plant Major Outage to perform Second Year Inspection. Total duration is 352.07 hours.
4	04 July 2022 @18:32PM – 02:26AM	Unplanned outage due to Black Out due to disturbance at transmission line 275 kV sei. Rumbai. Total duration 7.9 hours.
5	16-Jul-2022 @08:20 AM until 18-Jul-2022 @5:57 AM	Grid Maintenance Outage as requested by PLN (Grid Owner) to allow PLN to perform maintenance task at Inter Bus Transformer of Sungai Rumbai Substation. Total duration is 45.62 hours.

B.1.1 Forward Action Requests

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During GS4GG Design Review, there are FAR for VVB to be checked during verification.

No	Summary	FAR Summary address
FAR #1 :	At the time of verification, the VVB shall ensure that no double counting takes place as PD has already issued credits under the CDM between 16/12/2019 - 31/10/2020.	This Monitoring Report (MR) is a continuation of the previous MR that was issued with CDM. This MR is from 01/11/2020 until 31/01/2023, thus there is no double counting with the previous MR.
FAR#2 :	At the time of verification, the VVB shall interview local stakeholders and provide their comments in the FVR,	VVB has interviewed local stakeholders during this verification.
FAR#3 :	In-line with GS4GG Principles and Requirements, VVB and PP shall consider the rule below for future monitoring activities: 5.1.39: An annual update report shall be provided to GS, when successfully	PP has sent the requested annual report to VVB and will be uploaded to GS.

	Transitioned to GS4GG, for each monitoring year by the end of next calendar year for which verification is not completed.	
FAR#4 :	In-line with GS4GG Principles and Requirements, VVB and PP shall consider the following rule after Certification is achieved: 5.1.29: 1st verification shall be completed within two years after the certification is achieved.	GS Project Design Certification is 27/03/2023 and currently, the project is under verification by VVB. Thus, it is within two years.
FAR#5 :	PD and VVB to consider the Rule Update – Applicability of Minimum Site Requirements by VVB to claim credits as the start date of the crediting period is before the project registration.	The project is transitioning from CDM to GS. The project start date was 16/12/2019, it was successfully verified in January 2021 and CER was issued in 14 April 2021. Thus, no gap in the site visit requirement.

The project is transitioning from CDM to Gold Standard. PD confirms that the project is not registered under any other carbon market mechanism and mitigation measures to avoid double counting. PD states that it cannot claim CER/VERs for the same vintage in another standard other Gold Standard.

B.2. Post-Design Certification changes

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B.2.1. Temporary deviations from the approved Monitoring & Reporting Plan, methodology or standardized baseline

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N/A

B.2.2. Corrections

>>

N/A

B.2.3. Changes to start date of crediting period

>>

N/A

B.2.4. Permanent changes from the Design Certified monitoring plan, applied methodology or applied standardized baseline

>>

N/A

B.2.5. Changes to project design of approved project

>>

N/A

SECTION C. DESCRIPTION OF MONITORING SYSTEM APPLIED BY THE PROJECT

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The monitoring plan complies with the methodology ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 12.2).

1. Management Structure & Data Management

The organisational set up for the CDM operational and monitoring management structure is described in the following figure:

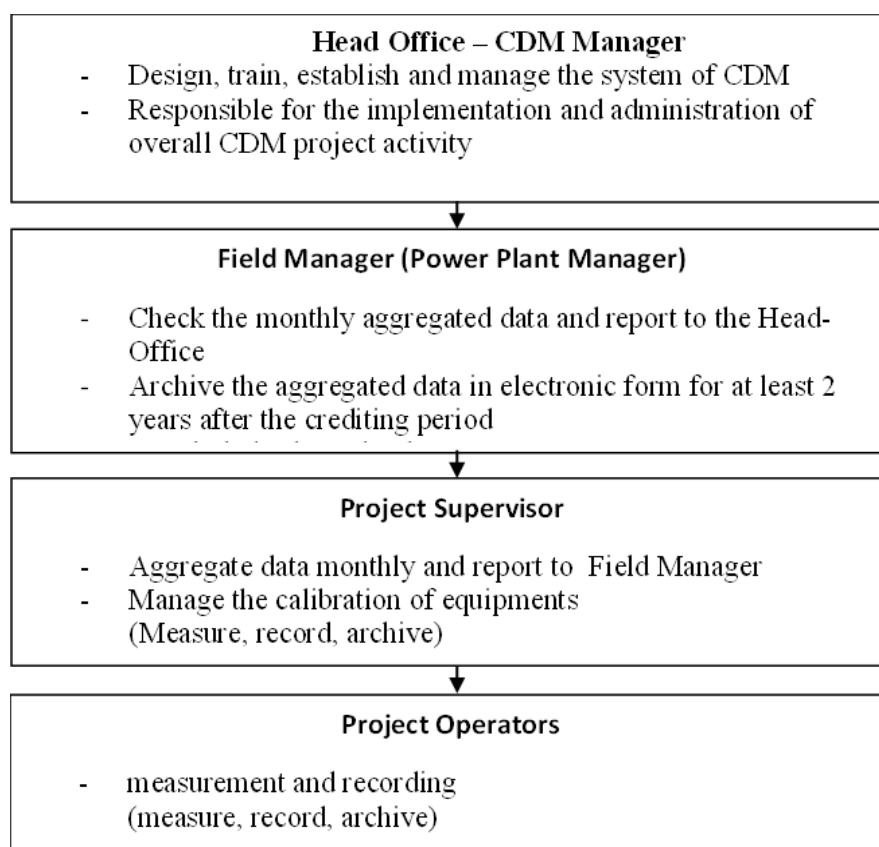


Figure C. Monitoring organization chart

All the data collected during the crediting period will be archived electronically and kept for at least two years after the end of crediting period.

2. Monitoring Equipment

Electricity exported to the grid and imported from the grid is measured by the main meter (M1) and back-up meter (M2). Both activities will be cross checked with

electricity invoice which based on monthly Minutes of Meter reading between project and PT. PLN.

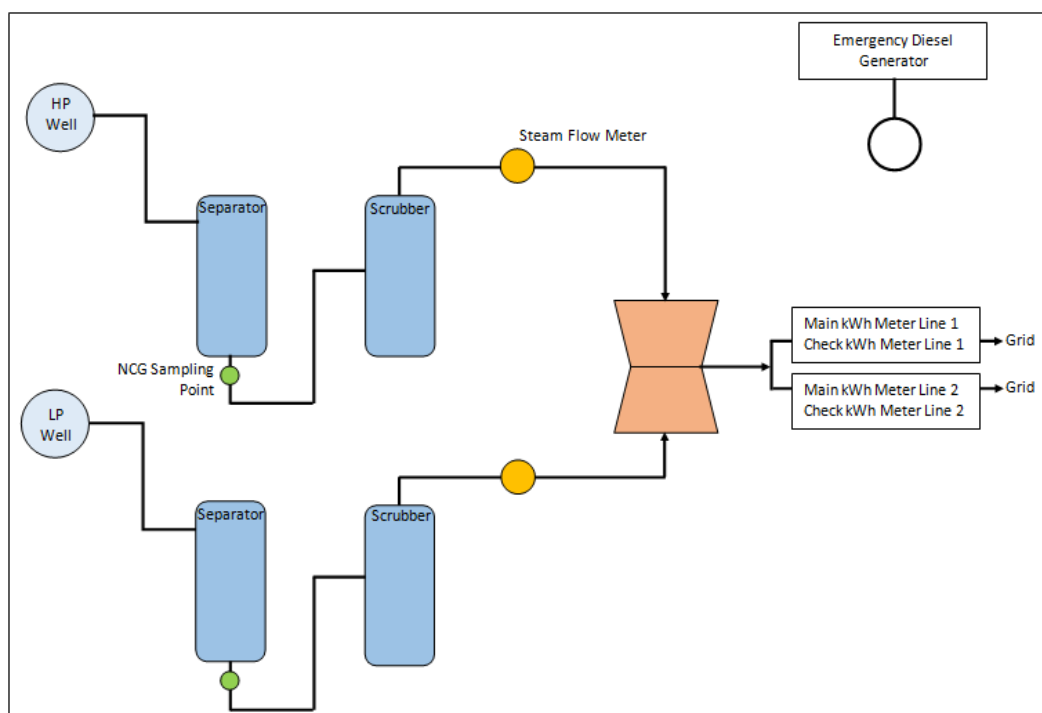


Figure D. Simplified Monitoring point

3. Calibration the Equipment

The energy meters will be calibrated annually as compliance with the provisions of the Power Purchase Agreement. The calibration of other monitoring equipment will follow the technical specification/requirement of the manufacturer.

SECTION D. DATA AND PARAMETERS

D.1. Data and parameters fixed ex ante or at renewal of crediting period

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SDG 13

Data/parameter	GWP, CH ₄
Unit	tCO ₂ e/tCH ₄
Description	Global warming potential of methane valid for the relevant commitment period as per RULE UPDATE-2020-P&R v1.2-GWP values.
Source of data	IPCC AR5

Value(s) applied	28 tCO ₂ /tCH ₄
Choice of data or Measurement methods and procedures	This is in accordance with the applied methodology ACM0002.
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	-

Data/parameter	EF _{grid,CM,y}
Unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for grid connected power generation in year y
Source of data	Published data by BPPT
Value(s) applied	0.743
Choice of data or Measurement methods and procedures	Calculated according to "Tool to calculate the emission factor for an electricity system", Version 02.2.1.
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	This parameter has been fixed <i>ex-ante</i>

Data/parameter	EF _{grid,OM,y}
Unit	tCO ₂ /MWh
Description	Operating margin CO ₂ emission factor for grid connected power generation in year y
Source of data	Published data by BPPT
Value(s) applied	0.905 for ex-ante estimate of emission reductions.

Choice of data or Measurement methods and procedures	Calculated according to "Tool to calculate the emission factor for an electricity system", Version 02.2.1.
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	This parameter has been fixed <i>ex-ante</i>

Data/parameter	$EF_{grid,BM,y}$
Unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor for grid connected power generation in year y
Source of data	Published data by BPPT
Value(s) applied	0.581 for ex-ante estimate of emission reductions.
Choice of data or Measurement methods and procedures	Calculated according to "Tool to calculate the emission factor for an electricity system", Version 02.2.1.
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	This parameter has been fixed <i>ex-ante</i>

Data/parameter	Density of diesel oil
Unit	kg/m ³
Description	Density of diesel oil
Source of data	Energy Statistics Manual, IEA, 2004 Table A3.8 page 181
Value(s) applied	843.9
Choice of data or Measurement methods and procedures	Density of diesel oil = 843.9 kg/m ³

Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	-

D.2 Data and parameters monitored

>>

SDG 13 & SDG 7

Data / Parameter	EG _{facility,y}																						
Unit	MWh																						
Description	Quantity of net electricity generation supplied by the project plant to the grid																						
Source of data	Electric meter																						
Value(s) applied	<table><tr><th rowspan="2">Period</th><th colspan="2">Net Export Electricity</th></tr><tr><th colspan="2">MWh</th></tr><tr><td>01/11/2020 - 31/12/2020</td><td colspan="2">109,466.00</td></tr><tr><td>01/01/2021 - 31/12/2021</td><td colspan="2">702,971.40</td></tr><tr><td>01/01/2022 - 31/12/2022</td><td colspan="2">723,884.65</td></tr><tr><td>01/01/2023 - 31/01/2023</td><td colspan="2">62,429.12</td></tr></table>						Period	Net Export Electricity		MWh		01/11/2020 - 31/12/2020	109,466.00		01/01/2021 - 31/12/2021	702,971.40		01/01/2022 - 31/12/2022	723,884.65		01/01/2023 - 31/01/2023	62,429.12	
Period	Net Export Electricity																						
	MWh																						
01/11/2020 - 31/12/2020	109,466.00																						
01/01/2021 - 31/12/2021	702,971.40																						
01/01/2022 - 31/12/2022	723,884.65																						
01/01/2023 - 31/01/2023	62,429.12																						
Measurement methods and procedures	<p>The electricity generation supplied to the Sumatera Grid is continuously monitored by bidirectional meters, the main meter and check meter, located at the Substation of Muara Laboh Power Plant 150kV, with an accuracy class of 0.2.</p> <p>The measurement procedures are in compliance with the provisions of the Power Purchase Agreement. The quantity of net electricity supplied to the grid by the power plant is calculated based on the electricity export deducted by the electricity import.</p>																						
Monitoring frequency	Continuous measurement and monthly recording																						
QA/QC procedures	<p>Data measured by electricity meters is cross-checked against the invoice.</p> <table><tr><th>Line</th><th>Status</th><th>Serial Number</th><th>Calibration Date</th><th>Validity</th><th>Frequency</th></tr><tr><td>1</td><td>Main Meter</td><td>MW 1810A247</td><td>21/09/2020 14/10/2021 06/10/2022</td><td>10 years</td><td>Annually</td></tr></table>						Line	Status	Serial Number	Calibration Date	Validity	Frequency	1	Main Meter	MW 1810A247	21/09/2020 14/10/2021 06/10/2022	10 years	Annually					
Line	Status	Serial Number	Calibration Date	Validity	Frequency																		
1	Main Meter	MW 1810A247	21/09/2020 14/10/2021 06/10/2022	10 years	Annually																		

		Back-up Meter	MW 1807A670	21/09/2020 14/10/2021 06/10/2022	10 years	Annually
	2	Main Meter	MW 1810A249	21/09/2020 14/10/2021 13/10/2022	10 years	Annually
		Back-up Meter	MW 1807A671	21/09/2020 14/10/2021 13/10/2022	10 years	Annually
Meters have been calibrated by PLN.						
Even though the validity of calibration is for 10 years, according to annual calibration there was calibration gap between 20/09/2021 – 13/10/2021 (23 days). However, for the conservativeness, this MR apply 2 months (01/09/2021-31/10/2021) of corrective factor of 0.1% accuracy according to electric meter manual.						
Purpose of data	The Data is required to calculate the baseline emission					
Additional comment	N/A					

SDG 13

Data / Parameter	W _{steam,CO2,y}																						
Unit	tCO ₂ /t steam																						
Description	Average mass fraction of carbon dioxide in the produced steam																						
Source of data	Project & External Laboratory																						
Value(s) applied	<table><tr><th rowspan="2">Period</th><th>CO₂</th></tr><tr><th>(tCO₂/tsteam)</th></tr><tr><td>Nov-20</td><td>0.0044</td></tr><tr><td>Feb-21</td><td>0.0041</td></tr><tr><td>May-21</td><td>0.0045</td></tr><tr><td>Aug-21</td><td>0.0037</td></tr><tr><td>Dec-21</td><td>0.0040</td></tr><tr><td>Mar-22</td><td>0.0036</td></tr><tr><td>May-22</td><td>0.0038</td></tr><tr><td>Aug-22</td><td>0.0037</td></tr><tr><td>Nov-22</td><td>0.0039</td></tr></table>		Period	CO ₂	(tCO ₂ /tsteam)	Nov-20	0.0044	Feb-21	0.0041	May-21	0.0045	Aug-21	0.0037	Dec-21	0.0040	Mar-22	0.0036	May-22	0.0038	Aug-22	0.0037	Nov-22	0.0039
Period	CO ₂																						
	(tCO ₂ /tsteam)																						
Nov-20	0.0044																						
Feb-21	0.0041																						
May-21	0.0045																						
Aug-21	0.0037																						
Dec-21	0.0040																						
Mar-22	0.0036																						
May-22	0.0038																						
Aug-22	0.0037																						
Nov-22	0.0039																						
Measurement methods and procedures	The CO ₂ and CH ₄ sampling and analysis procedure consists of collecting non-condensable gases samples																						

	from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H ₂ S) and carbon dioxide (CO ₂) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analysed using gas chromatography to determine the content of the residuals including CH ₄ . All alkanes' concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months
QA/QC procedures	Methodology ASTM E1675-95a - Standard Specification for Sampling Two Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis
Purpose of data	The data is used to calculate project emissions.
Additional comment	N/A

Data / Parameter	$W_{\text{steam,CH}_4,y}$																				
Unit	tCH ₄ /t steam																				
Description	Average mass fraction of methane in the produced steam																				
Source of data	Project & External Laboratory																				
Value(s) applied	<table border="1"> <thead> <tr> <th>Period</th><th>CH₄ (tCH₄/t_{steam})</th></tr> </thead> <tbody> <tr><td>Nov-20</td><td>0.000134</td></tr> <tr><td>Feb-21</td><td>0.000136</td></tr> <tr><td>May-21</td><td>0.000150</td></tr> <tr><td>Aug-21</td><td>0.000147</td></tr> <tr><td>Dec-21</td><td>0.000115</td></tr> <tr><td>Mar-22</td><td>0.000110</td></tr> <tr><td>May-22</td><td>0.000118</td></tr> <tr><td>Aug-22</td><td>0.000121</td></tr> <tr><td>Nov-22</td><td>0.000117</td></tr> </tbody> </table>	Period	CH ₄ (tCH ₄ /t _{steam})	Nov-20	0.000134	Feb-21	0.000136	May-21	0.000150	Aug-21	0.000147	Dec-21	0.000115	Mar-22	0.000110	May-22	0.000118	Aug-22	0.000121	Nov-22	0.000117
Period	CH ₄ (tCH ₄ /t _{steam})																				
Nov-20	0.000134																				
Feb-21	0.000136																				
May-21	0.000150																				
Aug-21	0.000147																				
Dec-21	0.000115																				
Mar-22	0.000110																				
May-22	0.000118																				
Aug-22	0.000121																				
Nov-22	0.000117																				
Measurement methods and procedures	The CO ₂ and CH ₄ sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to																				

	prevent oxidation. Hydrogen sulphide (H ₂ S) and carbon dioxide (CO ₂) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analysed using gas chromatography to determine the content of the residuals including CH ₄ . All alkanes' concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months and more frequently, if necessary
QA/QC procedures	Methodology ASTM E1675-95a - Standard Specification for Sampling Two Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis
Purpose of data	The data is used to calculate project emission.
Additional comment	N/A

Data / Parameter	M _{steam,y}															
Unit	t steam/yr															
Description	Quantity of steam produced in year y															
Source of data	Site records															
Value(s) applied	<table><tr><th>Period</th><th>M_{steam} t_{steam}</th></tr><tr><td>01/11/2020 - 31/12/2020</td><td>715,242</td></tr><tr><td>01/01/2021 - 31/12/2021</td><td>4,578,744</td></tr><tr><td>01/01/2022 - 31/12/2022</td><td>4,766,022</td></tr><tr><td>01/01/2023 - 31/01/2023</td><td>407,993</td></tr></table>						Period	M _{steam} t _{steam}	01/11/2020 - 31/12/2020	715,242	01/01/2021 - 31/12/2021	4,578,744	01/01/2022 - 31/12/2022	4,766,022	01/01/2023 - 31/01/2023	407,993
Period	M _{steam} t _{steam}															
01/11/2020 - 31/12/2020	715,242															
01/01/2021 - 31/12/2021	4,578,744															
01/01/2022 - 31/12/2022	4,766,022															
01/01/2023 - 31/01/2023	407,993															
Measurement methods and procedures	The steam flow in the main steam line from the separators wells is measured with a Venturi flow meter. Measurement of temperature and pressure upstream of the Venturi meter is required to define the steam properties. The calculation of steam quantities is conducted on a continuous basis and based on international standards. The measurement results are summarized transparently in regular production reports.															
Monitoring frequency	Daily															
QA/QC procedures	<table><tr><td>Flow Meter</td><td>Number</td><td>Calibration</td><td>Accuracy</td><td>Validity</td><td>Frequency</td></tr></table>	Flow Meter	Number	Calibration	Accuracy	Validity	Frequency									
Flow Meter	Number	Calibration	Accuracy	Validity	Frequency											

	HP Main Steam Flow	ML01LBA64CF001	17/05/2018	1%	5 years	3 years
	LP Main Steam Flow	ML01LBA82CF001	17/05/2018	1%	5 years	3 years
Calibration: following the technical specification/requirement of the manufacturer but at least every three years						
There was a calibration gap since 17/05/2021, therefore in this MR applied 1% correction factor according to the manufacturer's technical specification						
Purpose of data	The data is used to calculate project emissions.					
Additional comment	N/A					

Data / Parameter	FC _y												
Unit	m ³ /year												
Description	Quantity of diesel combusted in the process, in year y (diesel generator)												
Source of data	Onsite measurement												
Value(s) applied	<table><tr><th rowspan="2">Period</th><th>FC_y</th></tr><tr><th>m³</th></tr><tr><td>01/11/2020 - 31/12/2020</td><td>0.0411</td></tr><tr><td>01/01/2021 - 31/12/2021</td><td>16.3487</td></tr><tr><td>01/01/2022 - 31/12/2022</td><td>1.0958</td></tr><tr><td>01/01/2023 - 31/01/2023</td><td>0.0348</td></tr></table>		Period	FC _y	m ³	01/11/2020 - 31/12/2020	0.0411	01/01/2021 - 31/12/2021	16.3487	01/01/2022 - 31/12/2022	1.0958	01/01/2023 - 31/01/2023	0.0348
Period	FC _y												
	m ³												
01/11/2020 - 31/12/2020	0.0411												
01/01/2021 - 31/12/2021	16.3487												
01/01/2022 - 31/12/2022	1.0958												
01/01/2023 - 31/01/2023	0.0348												
Measurement methods and procedures	A Flow meter is installed at the output of the diesel storage tank. Fuel tank level reading is monitored from Distributed Control System (DCS) at Power Plant Central Control Room, converting fuel level to volume is carried out by manual calculation. The reading is taken every day and recorded in logbooks by the operator.												
Monitoring frequency	Monitoring continuously and recording daily. The data will be aggregated monthly.												
QA/QC procedures													

	<p>Calibration: following the technical specification/requirement of the manufacturer but at least every three years</p> <p>There was a calibration gap since 01/11/2020, therefore this MR applied 0.1% correction factor according to the technical specification of the instrument.</p>
Purpose of data	The Data/Parameter is required to calculate the baseline emission
Additional comment	N/A

Data / Parameter	NCV _y
Unit	GJ/m ³
Description	Net calorific value of diesel in year y
Source of data	Table 1.2, Chapter 1, Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	36.54
Measurement methods and procedures	The IPCC data gives an NCV of 43.3TJ/Gg at the upper limit of the uncertainty at a 95% confidence interval. The unit is then converted to 36.54 GJ/m ³ by multiplying it with diesel density of 843.9 kg/m ³ .
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	The Data/Parameter is required to calculate the project emission
Additional comment	-

Data / Parameter	EF _{CO₂,y}
Unit	t CO ₂ /GJ
Description	CO ₂ emission factor of diesel
Source of data	Table 1.4, Chapter 1, Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	0.0748
Measurement methods and procedures	The IPCC data gives a value of 74,800 kg/TJ at the upper limit of the uncertainty at a 95% confidence

	interval (CO2 emission factor). The units are converted to tCO2/GJ.
Monitoring frequency	-
QA/QC procedures	--
Purpose of data	The Data/Parameter is required to calculate the project emission
Additional comment	

SDG 8

Data/parameter	Number of jobs created locally
Unit	Number
Description	Refers to the total number of jobs generated as a result of the project operation.
Source of data	Record keeping spreadsheet
Value(s) applied	Total: 386 <u>Breakdown by gender</u> Men: 351 Women: 35
Measurement methods and procedures	The number of jobs created are recorded. The source of data is recorded in an Excel spreadsheet. The spreadsheet enables employees to be categorised as part-time, full-time, permanent, and/or temporary.
Purpose of data	To demonstrate contribution to SDG 8.
Additional comment	N/A

D.3. Comparison of monitored parameters with last monitoring period

Data/Parameter	Value obtained in this monitoring period	Value obtained last monitoring period
$EG_{\text{facility},y}$	1,598,751 (822 days)	595,286 (321 days)
$W_{\text{steam},\text{CO}_2,y}$	41,551	13,380
$W_{\text{steam},\text{CH}_4,y}$	1,346	296
$M_{\text{steam},y}$	10,468,002	3,854,987
FC_y	47	22
Number of jobs created locally	386	386

For this 2nd Monitoring Period, there are slightly increased values of Electricity Generation, the quantity of steam and fossil fuel consumption for emergency purposes. The number of people employed by this project (direct and indirect) is 386 employees. It consists of 351 men and 35 women with 71% of the employees from the population.

In this Monitoring Report (01/11/2020 – 31/01/2023), the project contributes a regulated fees of USD 6,816,132 to the government of which 82% is set aside for the local government.

D.4. Implementation of sampling plan

>>

N/A

SECTION E. CALCULATION OF SDG IMPACTS

E.1. Calculation of baseline value or estimation of baseline situation of each SDG Impact

>>

SDG 7 Impact of baseline situation

Without the project activity, 0 MWH of clean energy was generated and supplied to the grid from the Liki Pinangawan Muaralaboh Geothermal Power Plant.

SDG 8 Impact of baseline situation

Without the project activity, 0 jobs were created, and no new monthly earnings were obtained.

SDG 13 Impact of baseline situation

As per section B.6.1 of the Transition Form, baseline emissions in year y (BE_y) can be calculated as follows,

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y} \quad (1)$$

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 . This is calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO ₂ /MWh)

Calculation of $EG_{PJ,y}$

The project activity is a Greenfield renewable energy project. Hence the net electricity generation is calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where:

$EG_{PJ,y}$	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)

During this 2nd Monitoring Period (01/11/2020 – 31/01/2023) the meter reading are consistent with the electricity invoice. The EG_{Export} and EG_{Import} could be seen on the MR sheet version 02 attached to this Monitoring Report. The project applied a conservativeness approach by rundown the quantity of net electricity generated supplied to the grid.

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

$$BE_y = 1,598,751 \text{ MWh} * 0.743 \text{ tCO}_2/\text{MWh}$$

$$= 1,187,872 \text{ tCO}_2$$

E.2. Calculation of project value or estimation of project situation of each SDG Impact

>>

SDG 7 Impact of project situation

During this 2nd Monitoring Period (01/11/2020 – 31/01/2023), the project activity delivered 1,598,751 MWh of clean energy to the grid.

SDG 8 Impact of project situation

During this 2nd Monitoring Period (01/11/2020 – 31/01/2023), 386 jobs were created which consisted of 351 men and 35 women.

SDG 13 Impact of project situation

Calculation of project emissions or actual net removals

>>

$$PE_y = PE_{FF,y} + PE_{GP,y} \quad (3)$$

Where:

PE_y Project emissions in year y (tCO₂e/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 geothermal power plants due to the release of non-condensable gases in year y (tCO ₂ e/yr)

Project emissions from fossil fuel consumption $PE_{FF,y}$

$$PE_{FF,y} = PE_{FC,y} \quad (4)$$

$$PE_{FC,y} = \sum FC_y \times COEF_y \quad (5)$$

Where:

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

FC_y Quantity of diesel combusted in the process, in year y (mass or volume unit/yr)

$COEF_y$ CO₂ emission coefficient of diesel, in year y (tCO₂/mass)

Option B of the tool is chosen to calculate the CO₂ emission coefficient $COEF_y$ based on net calorific value and CO₂ emission factor of the fuel type, as follows:

$$COEF_y = NCV_y * EF_{CO2,y} \quad (6)$$

Where:

NCV_y Weighted Average net calorific value of diesel in year y (GJ/m³)

$EF_{CO2,y}$ CO₂ emission factor of diesel (tCO₂/GJ)

The calculation is available in MR sheet version 02 attached to this Monitoring Report. From the MR sheet, $PE_{FF,y}$ is 47.831 tCO₂.

Project emissions from the Non Condensable Gas $PE_{GP,y}$

$$PE_{GP,y} = (w_{steam,CO2,y} + w_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y} \quad (7)$$

Where:

$PE_{GP,y}$ Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO₂e/yr)

$W_{\text{steam},\text{CO}_2,y}$	Average mass fraction of carbon dioxide in the produced steam in year y (tCO ₂ /t steam)
$W_{\text{steam},\text{CH}_4,y}$	Average mass fraction of methane in the produced steam in year y (tCH ₄ /t steam)
GWPC _{CH₄}	Global warming potential of methane valid for the relevant commitment period (tCO _{2e} /tCH ₄)
$M_{\text{steam},y}$	Quantity of steam produced in year y (t steam/yr)

The calculation for project emission from NCG is available in MR sheet version 01 attached to this Monitoring Report, and the value is:

Period	W _{steam} CO ₂	W _{steam} CH ₄
	tCO ₂	tCO ₂
01/11/2020 – 31/12/2020	3,143.97	95.66
01/01/2021 – 31/12/2021	18,888.16	646.84
01/01/2022 – 31/12/2022	17,947.61	556.45
01/01/2023 – 31/01/2023	1,571.67	47.93
Total	41,551	1,346

Total Project Emission

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

$$PE_y = 47.831 + 42,898$$

$$= 42,946 \text{ tCO}_2$$

E.3. Calculation of leakage

>>

No leakage emissions are considered. As per the methodology these emissions sources are omitted.

E.4. Calculation of net benefits or direct calculation for each SDG Impact

SDG	SDG Impact	Baseline estimate	Project estimate	Net benefit
13	Amount of Emission Reduction	(01/11-2020 – 31/01/2023): 0 tCO ₂	(01/11-2020 – 31/01/2023): 1,144,912 tCO ₂	(01/11-2020 – 31/01/2023): 1,144,912 tCO ₂

7	Amount of renewable energy	(01/11-2020 – 31/01/2023): 0 MWh	(01/11-2020 – 31/01/2023): 1,598,751 MWh	(01/11-2020 – 31/01/2023): 1,598,751 MWh
8	Total of job created	(01/11-2020 – 31/01/2023): 0	(01/11-2020 – 31/01/2023): 386 (351 men and 35 women)	(01/11-2020 – 31/01/2023): 386 (351 men and 35 women)

E.5. Comparison of actual SDG Impacts with estimates in approved PDD

SDG	Values estimated in ex ante calculation of approved PDD for this monitoring period	Actual values ¹ achieved during this monitoring period
13	01/11-2020 – 31/01/2023 (822 days): 860,456 tCO ₂	01/11-2020 – 31/01/2023 (822 days): 1,144,912tCO ₂
7	01/11-2020 – 31/01/2023 (822 days): 1,420,416 MWh	01/11-2020 – 31/01/2023 (822 days): 1,598,751 MWh
8	01/11-2020 – 31/01/2023 (822 days): 386 jobs created	01/11-2020 – 31/01/2023 (822 days): 386 jobs created

E.5.1. Explanation of calculation of value estimated ex ante calculation of approved PDD for this monitoring period

>>

SDG13

According to the PDD, the estimated emission reduction for this 2nd Monitoring Report 01/11/2020-31/01/2023 (822 days) is 860,456 tCO₂, while the actual amount is 1,144,912tCO₂. Both estimation in Transition Form and actual figure are calculated based on Methodology ACM0002: Grid-connected electricity generation from renewable sources version 12.2.0.

¹ Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.

SDG 7

Based on the Transition Form, the estimated energy generated from the project activity for this 2nd Monitoring Report 01/11/2020-31/01/2023 (822 days) is 1,420,416 MWh, which was sourced from Feasibility Study. The figure is the result of calculating the net installed capacity with the annual availability of the project. The actual amount of renewable energy generated for this 2nd Monitoring Report (01/11/2020-31/01/2023) is 1,598,751 MWh, based on electricity meter monitoring.

SDG 8

The total jobs created for this 2nd Monitoring Report (01/11/2020-31/01/2023) is 386 jobs which consist of 351 men and 35 women. This figure is based on project records and corresponds to the figure estimated in the Transition Form.

E.6. Remarks on increase in achieved SDG Impacts from estimated value in approved PDD

>>

SDG 13

The actual emission reduction is higher than the estimated figure mainly due to lower Non Combustion Gases (NCG) of CO₂ with actual NCG having an average of 0.4% compared to the figure estimated in PDD of 1.9%. The lower NCG leads to lower Project Emission.

SDG 7

The actual electricity generation from the project activity is higher than the estimated value in the PDD due to the higher availability factor of the power plant.

SDG 8

The actual number of jobs created is consistent with the ex-ante estimation.

SECTION F. SAFEGUARDS REPORTING

>>

As per section D.1 Safeguarding Principles that will be monitored and appendix 1 of the PDD, most safeguarding principles are not relevant to the project and the safeguards reporting is not needed.

Principles	Mitigation Measures added to the Monitoring Plan
Principle 1 Human Rights	Not required
Principle 2 Gender Equality and Women's Rights	Not required
Principle 3 Community Health, Safety, and Working Conditions	Not required
Principle 4 Cultural Heritage, Indigenous Peoples, Displacement and Resettlement	Not required
Principle 5 Corruption	Not required
Principle 6 Economic Impacts	Not required
Principle 7 Climate and Energy	Not required
Principle 8 Water	Not required
Principle 9 Environment, Ecology, and Land Use	<p>Project location is outside the conservation forest area, however to monitor the biodiversity aspects the project develops a biodiversity action plan and critical habitat assessment program.</p> <p>The monitoring through direct observation is at least done annually and reported in six monthly report (Refer to SEML 6 monthly report). During this Monitoring Period, the PD has been installing 4 camera traps in 2020. One camera was reported broken, therefore in 2021 there were 3 cameras remaining. In 2022, the PD added one camera trap to 4 cameras in 2022-2023.</p> <p>The project also cooperates with stakeholders including the Ministry of Environment and Forestry on ecosystem restoration of buffer zone of conservation area. This activity through replanting of 52.5 Ha of degraded land with location is 2 Km from project location.</p>

SECTION G. STAKEHOLDER INPUTS AND LEGAL DISPUTES

As per the project design, the project has a grievance mechanism in place whereby stakeholder can provide their feedback and report any concerns that they may have. These grievances can be reported via a call center and are also kept in a logbook. The grievances can be reported using the details below:

Method	Include all details of Chosen Method (s) so that they may be understood and, where relevant, used by readers.
Continuous Input / Grievance Expression Process Book (mandatory)	There is a call centre present whereby stakeholders are able to express their concerns and comments. There is also a grievance logbook present as another method for stakeholders to report their grievances. Stakeholders are able to check the status of their grievances after lodging them.
GS Contact (mandatory)	help@goldstandard.org
Other	N/A

G.1. List all Inputs and Grievances which have been received via the Continuous Input and Grievance Mechanism together with their respective responses/mitigations.

>>

Inputs/Grievances	Period of event
Comments: The chairman of KAN APD and Kelp Rezi CS who on behalf of KAN APD visited the SEML office about 15 people submitted complaints and asked SEML to acknowledge the function and authority of KAN, KAN asked for a temporary suspension of phase 2	05/04/2021-01/10/2021

<p>activities and would send names that would negotiate with SEML.</p> <p>Solution: SEML acknowledges the existence of KAN APD and has assisted in the construction of the KAN office is a form of maintaining good relations, submitting claims to management.</p> <p>Complainant received the information and confirmed that the grievance was closed-out on 01 Oct 2021.</p>	
<p>Comments: Mr.Raju complained to SEML because the material at the sluice gate under yard 1 was already high and if the water rose the discharge would overflow into the fields/gardens, the material piled up due to the presence of a sluice gate with the function of dividing the water evenly.</p> <p>Solution: Relation will coordinate with maintenance team related to the use of tools for dredging materials because if left unchecked it will damage the road if the water overflows</p> <p>Complainant received the information and confirmed that the grievance was close-out on 25 March 2022.</p>	<p>27/11/2021-30/11/2021</p>
<p>Comments: Mrs. Sus complained that the floodgate under yard 2 was closed and caused the landslide to cause damage to the plants that had been planted.</p>	<p>04/02/2022-25/03/2022</p>

<p>Solution: Relation will coordinate with project team related to landslide occurrence and joint survey location with owner.</p> <p>Complainant received the information and confirm that the grievance was close-out on 25 March 2022.</p>	
<p>Comments: All DKB drivers protested the reduction on the grounds that the car would be driven by SEMI employees who had received a DDC certificate.</p> <p>Solution: The number of drivers requested is the same as the number already approved with the initial acceptance of 11 people increasing to 16 people.</p> <p>Complainant received the information and confirmed that the grievance was close-out on 2 April 2022.</p>	<p>31/03/2022-02/04/2022</p>
<p>Comments: The head of Jorong Taratak Tinggi submitted a complaint via WA that there was fluid that had washed away from the drums in the Mayhendri UAP field, smelled and had troubled the residents, especially since the material rainwater was flowing into the rice fields and ponds of Taratak Tinggi residents</p> <p>Solution: Team Relations and chief security immediately coordinated with SHE PT. UAP to check the location</p>	<p>20/09/2022-22/09/2022</p>

<p>together with the Head of Jorong and the Community to move the drums as soon as possible. SHE PT.UAP is willing to move the drums the next day at the latest, the Jorong Chief and the community agree to this.</p> <p>Complainant received the information and confirmed that the grievance was close-out on 23 September 2022.</p>	
<p>Comments: Several community leaders and the head of Jorong, his family and 9 security members whose contracts were not renewed protested because they thought the test conducted by Securindo was unfair.</p> <p>Solution: Securindo and the police as independent institutions involved in the Samapta test process were ready to provide explanations and present values.</p> <p>Complainant received the information and confirmed that the grievance was close-out on 3 November 2022.</p>	<p>31/10/2022-02/11/2022</p>

G.2. Report on any stakeholder mitigations that were agreed to be monitored.

>>

No concerns were raised during the Local Stakeholder Consultation and most safeguarding principles were considered to have a low risk. The only stakeholder mitigation that was agreed to be monitored was the Environment, Ecology, and Land Use principle. A biodiversity action plan and critical habitat assessment program including installed camera traps and endangered species monitoring were successfully implemented by PT. SEML in collaboration with Kerinci Seblat National Park (KSNP).

The biodiversity action plan involves the ecosystem restoration of sub-montane forest. The agreement between PT. SEML and KSNP were created in 2018 and started at 52.5 ha. A total of 27,959 trees were planted in this area using native species. Monitoring and maintenance of the ecosystem restoration program has been conducted 6 times between 2021 and 2022. By the end of the 2nd year of maintenance, the plant survival rate reached almost 100%. Patrols that were carried out in the ecosystem recovery area did not find any threats or disturbances in the area.

Fauna was directly monitored by collected data that included but was not limited to footprints, animal feces, and camera traps. In the fauna monitoring that was conducted between 2021 and 2022, several species were recorded including 30 species of bird of which 13 species were new, 10 species of terrestrial mammals of which 4 were new, and 6 species of arboreal mammals including 2 new species.

The first step of ecosystem restoration was implemented successfully. No records of encroachment in the area were recorded, the growth rate of trees is continuing as predicted, and there has been discoveries of endemic and protected animals that were not previously reported. PT. SEML will continue the progress of the ecosystem restoration program through these monitoring processes.

G.3. Provide details of any legal contest that has arisen with the project during the monitoring period

>>

No legal contests or disputes have arisen resulting from the implementation of the project.

Revision History

Version	Date	Remarks
1.1	14 October 2020	<p>Hyperlinked section summary to enable quick access to key sections</p> <p>Improved clarity on Key Project Information</p> <p>Section for POA monitoring</p> <p>Forward action request section</p> <p>Improved Clarity on SDG contribution/SDG Impact term used throughout</p> <p>Clarity on safeguard reporting</p> <p>Clarity on design changes</p> <p>Leakage section added for VER/CER projects</p> <p>Addition of Comparison of monitored parameters with last monitoring period</p> <p>Provision of an accompanying Guide to help the user understand detailed rules and requirements</p>
1.0	10 July 2017	Initial adoption