Monitoring report form for CDM project activity
(Version 06.0)

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

MONITORING REPORT		
Title of the project activity	Patrind Hydropower Project	
UNFCCC reference number of the project activity	6560	
Version number of the PDD applicable to this monitoring report	Version 06	
Version number of this monitoring report	Version 01	
Completion date of this monitoring report	01/02/2019	
Monitoring period number	1st monitoring period	
Duration of this monitoring period	08/11/2017 ~ 31/10/2018	
Monitoring report number for this monitoring report	1	
Project participants	Star Hydro Power Limited	
Host Party	Islamic Republic of Pakistan	
Sectoral scopes	Sectoral scope: 1 - Energy industries (renewable / non-renewable sources)	
Applied methodologies and standardized baselines	ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 12)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	-	197,448 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	263,376 tCO_2e * This amount was recalculated by multiplying the day of this monitoring period over a year to the yearly estimated emission reductions in PDD, 269,278 tCO_2e. (269,278 tCO_2e / 365 days × 357 days = 263,376 tCO_2e)	

SECTION A. Description of project activity

A.1. General description of project activity

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The Patrind Hydropower Project is a grid-connected hydro power plant developed by Star Hydro Power Limited in Pakistan. The project is located in Patrind village, Muzaffarabad, provinces of Khyber-Pakhtunkhwa (KP) and Azad Jammu & Kashmir (AJ&K), Pakistan.

The proposed project generates electricity using water of the river Kunhar that rises in KP and flows into the river Jhelum. The annual generation of electricity is estimated at 632,628 MWh with the installed capacity of 150MW (50MW × 3), by displacing electricity generation by fossil fuel-fired plants.

This project is the first private run of river hydropower project with headrace tunnel in Pakistan. The headrace tunnel passes through the Lohar Gali ridge towards the Jhelum River. It opens into an underground surge tank, at the start of a vertical pressure shaft connecting with a horizontal pressure tunnel (penstock), dividing into three manifolds conveying design discharges to a surface type Powerhouse located on the right bank of the Jhelum River.

The electricity generated from the project is supplied to the national electricity grid system of Pakistan. The lifetime of the power generating equipment is considered to be 30 years based on the manufacturers' specification of the Francis turbines.

The project has the following positive impacts with respect to contribution to sustainable development in Pakistan:

- Environmentally offsetting fossil fuel use and lowering greenhouse gas emissions;
- Socially providing jobs, development of a cultural house, ensuring reliable electricity supply, roads;
- Technologically transfer of hydropower-related technology; and,
- Economically satisfying growing energy demands to allow the country and region to develop and alleviate poverty.

A.2. Location of project activity

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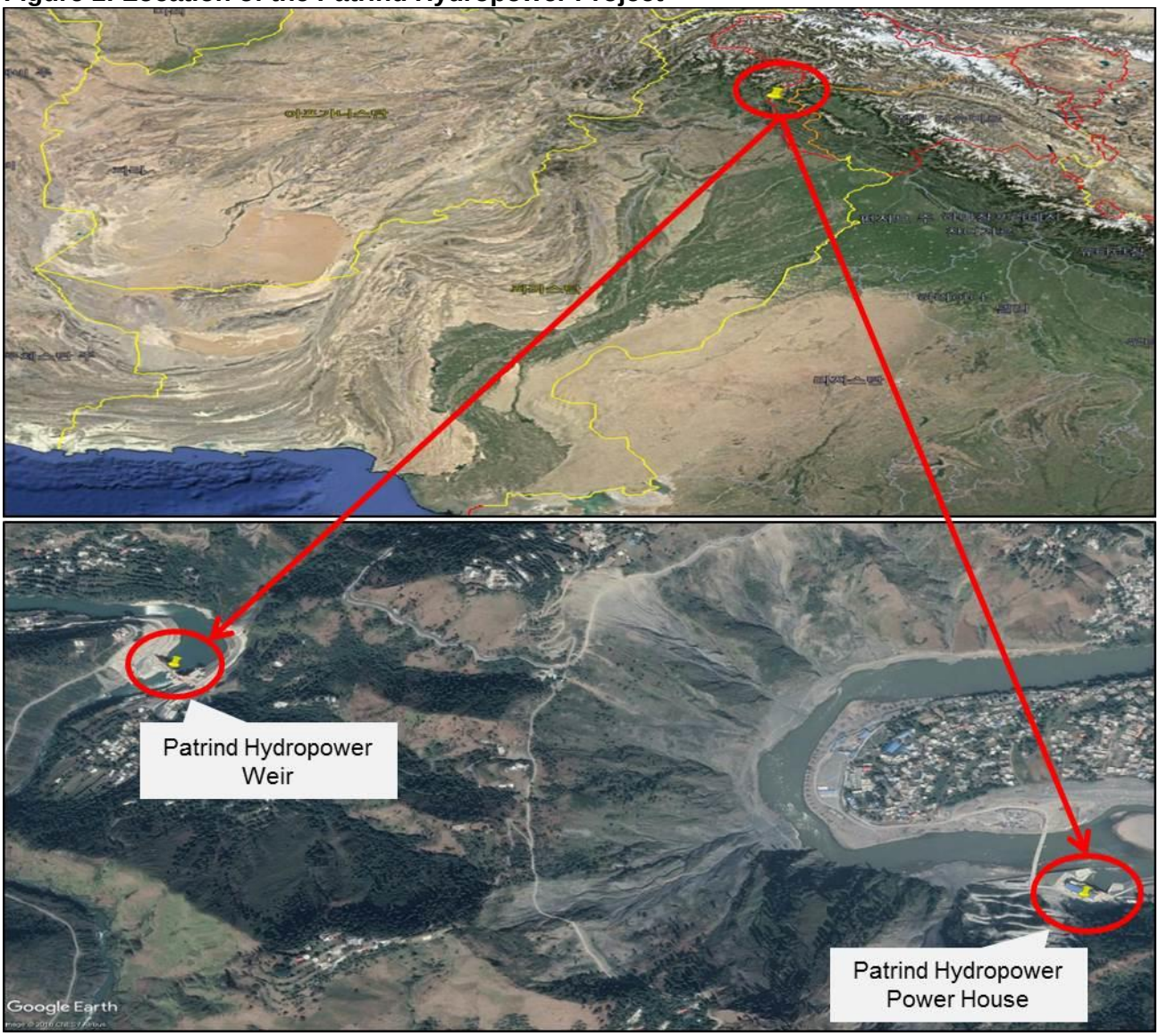
The Weir site of the project is located on the boundary of Khyber-Pakhtunkhwa (KP) and Azad Jammu & Kashmir (AJ&K) in Pakistan. The exact location of the project is Patrind village near Lohar Gali, Khyber Pakhtunkhwa (KP), Islamic Republic of Pakistan. Coordinates of the Weir site are;

- Latitude: 34°20'38" N
- Longitude: 73°25'46" E

The Power House is located at the right bank of River Jehlum, Near Thuri Park, Lower Chatter, Muzaffarabad, Azad Jannu & Kashmir (AJ&K), Islamic Republic of Pakistan. Coordinate for the Power House site is;

- Latitude: 34º20’06.67’’ N
- Longitude: 73º27’08.03’’ E

Figure 1: Location of the Patrind Hydropower Project



A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Islamic Republic of Pakistan (host)	Star Hydro Power Limited	No

A.4. Reference to applied methodologies and standardized baselines

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Title of approved baseline and monitoring methodology

Renewable electricity generation for a grid in accordance with approved large-scale methodology ACM0002 version 12.3, titled “Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable sources”.
Type: 1 – Renewable Energy Projects
Sectoral Scope: 01, Energy Industries (renewable and non-renewable sources)
https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP

Standardized baseline

Not applicable

A.5. Crediting period type and duration

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A seven years crediting period(renewable) is selected for the activity. And the duration of the crediting period corresponding to this monitoring period is 08/11/2017 - 07/11/2024.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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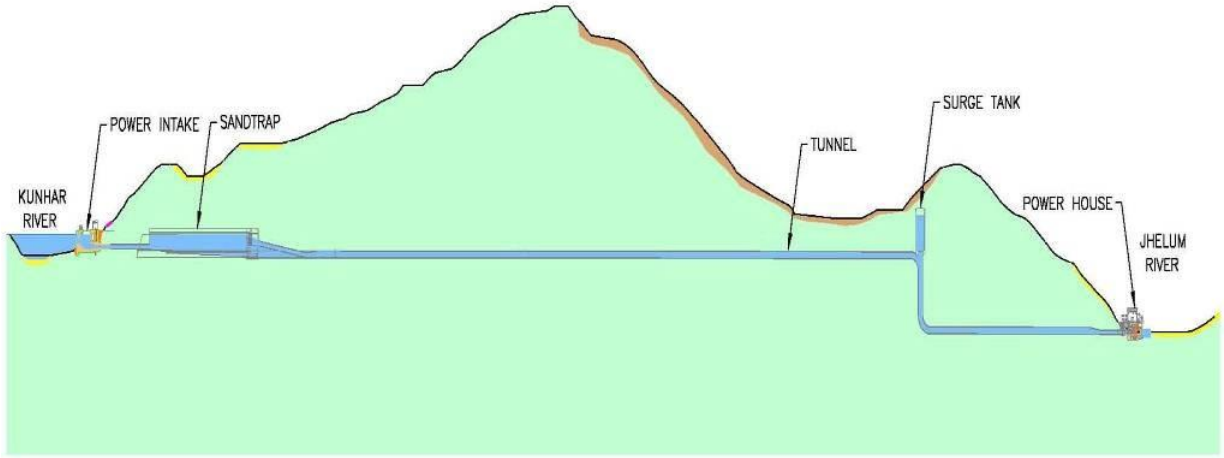
Technology employed by the project activity

The gross capacity of the Project is 150 MW while net capacity after auxiliary consumption is 147 MW and based on average hydrology, it is expected to generate 632,628 MWh of energy annually. The technology employed is hydropower run of river system with. Surface type powerhouse accommodating three vertical Francis turbine units, each of 50 MW capacity. Intake structure, is constructed at slightly upstream of the weir left abutment, comprising of an Intake gate and five trashrack chambers/slots, leading to the headrace tunnel. The headrace tunnel passes through the Lohar Gali ridge towards the Jhelum River. It opens into a vertical pressure shaft connected to an underground surge shaft and cavern through link tunnel. Horizontal pressure tunnel (Penstock) extends from the lower bend of the vertical pressure tunnel and opens in a manifold which divides into three branch pipes for conveyance and equal distribution of water to the generating units installed in the powerhouse.

A GIS type switchyard is constructed and commissioned on roof top of the powerhouse. The power from the Project is evacuated through a new double circuit 132 KV transmission (interim arrangement is in place for now) to the city of Mansehra and a single circuit tie-in with existing Muzaffarabad-Hattian Bala 132 KV transmission line. Figure 2 shows the main structures of the project. There is one monitoring point for the purposes of electricity generation quantity at the power plant itself.

Figure 2: Main structures



The Weir

The crest elevation of the Weir is 769.0 masl which is approximately 43.5m high from the river bed. There are two radial type overflow gates (12.0m wide x 10.4m high) with flap type gates installed on them to accommodate flood water & floating debris etc. and two radial type underflow gates (7.0m wide X 11.6m high) for carrying out sediments flushing settled in the rearranged sandtrap (OHDS). The weir also accommodates a bridge having deck at elevation 769.0 masl.

Headrace Tunnels
From Power intake section at Weir site a circular type headrace tunnel having 7.0 m internal diameter and a length of 2,193.86m, leads to a vertical shaft along with connection to the surge shaft via link tunnel.

Powerhouse
A surface type powerhouse accommodating three vertical Francis turbine units, each of 50 MW capacities, is successfully constructed and commissioned on the right bank of river Jhelum River.

Switchyard
A Gas Insulated Switchgear (GIS) system is constructed on Power house roof top. The power from the Complex is evacuated through 132 kV double circuit transmission line connecting Power house to the Rampura, Muzaffarabad Grid Station.

Relevant dates for the project activity

The relevant dates for the project activity are summarized in the table below;

Description	Patrind
Completion of construction	27/12/2016
Commissioning date	25/10/2017 ~ 07/11/2017
Starting date of operation	08/11/2017

Operational events of the project

Power plant during the monitoring period was temporarily stopped. The operational events of the power plant are described as below.

Year	Month	Date	Operational events	Remarks
2017	November	08 ~ 14	Waiting for the power purchaser official instruction to start generation	Project participants found that power plant during the monitoring period was temporarily stopped. Because the plant operation was suspended, the amount of net electricity supplied to the grid is zero. GHG emission reductions during the operational events of the project therefore also are zero.
	December	28 ~ 31	Dispute regarding liquidated damages owing to frequency tripping	
2018	January	01 ~ 18		

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

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Not application

B.2.2. Corrections

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Not application

B.2.3. Changes to the start date of the crediting period

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Change that has been approved by the Board or notified to the secretariat and that affects the start of this monitoring period

- Change to start date of crediting period from 01/04/2017 was postponed by 221days to 08/11/2017. This date was not prior to the date of registration on 24/12/2012. This type of change does not require requesting for prior approval by the board, but shall notify the secretariat by e-mail through a dedicated e-mail address.
  - Date of notifying the secretariat by e-mail: 20/09/2018
  - Date of responded the secretariat by email: 24/09/2018

B.2.4. Inclusion of monitoring plan

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Inclusion is being submitted together with this monitoring report

- Project participants included line diagrams showing monitoring point for Patrind hydropower plant at the new revised PDD.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

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Changes that are being submitted with this monitoring report as part of the request for issuance

- In the registered PDD, it is found that measurement procedures for the reservoir area (A_{PJ}, m^2) did not correspond with some measurement method at actual on-site. Considering geographical characteristic of Weir site and measurement method of on-site, project participants revised that measurement procedures of the reservoir area (A_{PJ}, m^2) must be topographical surveys, map, satellite pictures etc.

B.2.6. Changes to project design

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Changes that are being submitted with this monitoring report as part of the request for issuance

- Project participants updated the installed capacity of the emergency generator at the new revised PDD from 640kW (480kW, 160kW) to 660kW (500kW, 160kW).

SECTION C. Description of monitoring system

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Operational and Management Structure

The project operator assigns the person in charge of CDM project with assistance of the CDM monitoring officer and Site supervision and Quality Assurance officer. The team consists of three key positions and supported by the company's Quality Assurance Officer. An outline of responsibilities and roles of these three key positions are described in the table below:

Position and Reporting body	Responsibilities
CDM Monitoring Officer (Reports to the General Manager of the Project)	• Manages the collection, recording and storage of data; • Reviews the monitoring reports prepared and investigates any irregularities; • Ensures ongoing compliance with the CDM monitoring plan; • Supervises meter calibration requirements; • Calculates Emission Reductions; • Prepares annual (or biannual) Emission Reduction Report; • Prepares Baseline Emission Factor report at the end of each crediting period.
Site supervisor (Reports to the CDM Monitoring Officer)	• Responsible for the completeness and reliability of the data; • Responsible for carrying out meter calibration; • Responsible to ensure that there is no irregularities in meter function and data recording in between shifts; • Responsible for preparation of quarterly metered net electricity generation data reports.
Quality Assurance Officer (Reports to the CDM Monitoring Officer)	• Undertakes regular internal audits of the project; • Ensures compliance with Company Quality Assurance Procedures.

Monitoring Procedure

Training

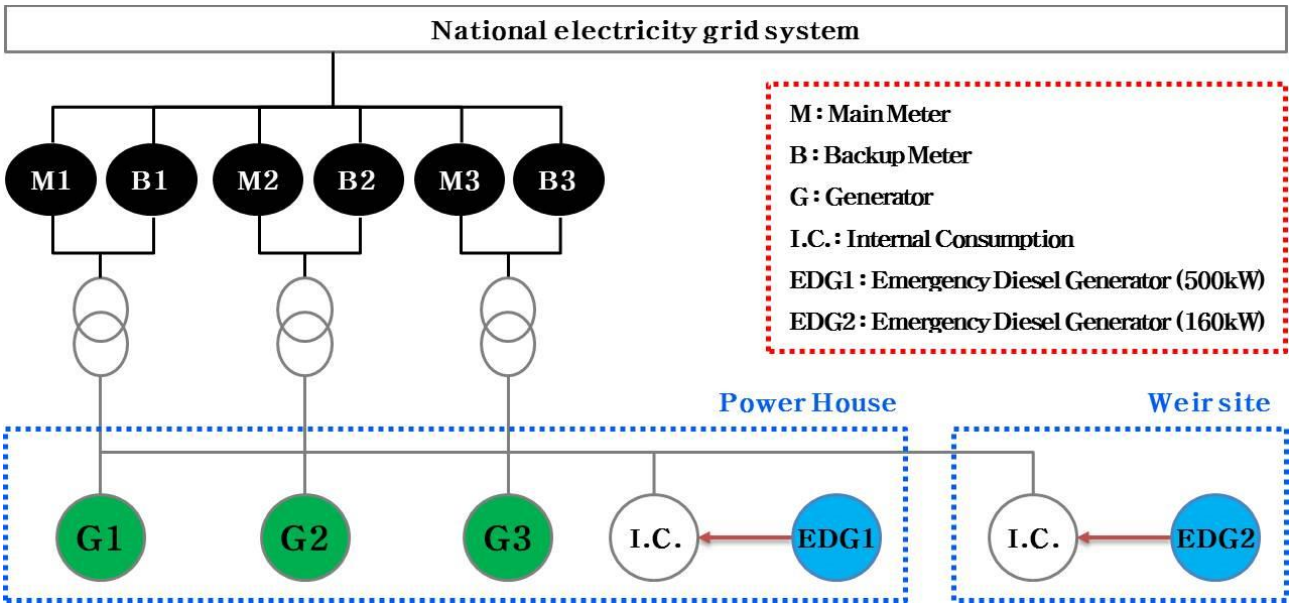
Everyone included in the CDM Management Team is received appropriate training providing an overview of the CDM, clear explanation of responsibilities and importance of each role in detail. The general manager of the Project performs ultimately responsible to ensure that the required capacity and internal training is made available to assigned staff, to enable them to undertake the tasks allocated for each role. All staff involved in any of the procedures is trained before the start of the crediting period in order to perform the tasks specified in the table above.

Metered Net Electricity Export Data

A transparent system for the collection, computation, and storage of data is established including adequate record keeping and data monitoring system. An electronic data recording system capable of recording the Net Electrical Output measured by the metering System on a continuous basis and capable of storing such recordings for a period of not less than ninety days is installed.

In the case of Patrind hydropower plants, the watt-hour meters (Main & Backup meter) for measuring both amounts of electricity exported to the grid and imported from the grid are installed in each single-line. And the auxiliary power consumed for powerhouse and weir site is supplied internally from the generated electricity during the generator's operation. Otherwise, the auxiliary power is directly supplied from the national electricity grid system. Also, two emergency diesel generators (500kW and 160kW) are installed on each on-site to supply standby emergency power about the internal consumption of the project site.

Figure 3 : A single-line diagram



A monthly report of metered net electricity export data is generated by the Site Supervisor and saved in electronic and paper form. The CDM Monitoring Officer reviews the Monthly report and crosschecks the data against the invoices for the quantity of electricity exported and sold to the national grid. Any discrepancies shall investigate as described in the "Review of Reports and Treatment of Uncertainty". The auxiliary loads and losses (gross metered electricity generation minus net generated electricity) shall be recorded in the quarterly report, to be used in the event of meter failure, as described in the "Emergency Preparedness".

Calibration of Meters

The calibration and maintenance of meters will be carried out as per the agreed Section 7.6 "Repair, Replacement or Recalibration of Metering System and Back-Up Metering System" of PPA. The Power Purchaser shall test the accuracy of the Metering System at any time when the readings of electrical energy from the Metering System and the Back-Up Metering System differ by an amount greater than one-fifth of one percent (0.2%). In such an event, the Power Purchaser shall test the accuracy of the Metering System and recalibrate the Metering System, if necessary. A report summarizing meter calibration requirements is prepared by the CDM Monitoring Office on project commissioning and updated with each recalibration.

Emission Reductions

Emission reductions will be calculated using the project and baseline emission data. Emission reductions occurring as a result of the project activity will be summarized in a biannual report that will be prepared by the Site Supervisor. The report will be generated using a template, approved by the CDM Monitoring Officer, to ensure that the data is reported consistently and can be compared to previous quarters. The biannual report will be reviewed by the CDM Monitoring Officer and submitted to the General Manager of the project.

Review of Reports and Treatment of Uncertainty

When reviewing the Metered Net Electricity Export Data and Emission Reductions report, the CDM Monitoring Officer will examine the report for data anomalies and compare the report with previous months for consistency.

If any discrepancies are found they will be investigated and corrected. The discrepancies and corrective actions will be recorded in an appendix to the relevant report. If the corrective actions result in any adjustments to monitoring data, then the relevant report will be revised after the adjustments have been made. The company's Quality Assurance Officer will undertake an internal audit of the project activity every three months to ensure the operational and maintenance regime of the project and data collection and recording practices are complaint with the content of this

Project Design Document. The results of the audit will be summarised in a report, which will be sent to the General Manager of the Project for review. The report will also list any corrective actions required to ensure project compliance.

Meters will be recalibrated in accordance with the manufacturer's requirements. As long as the meters are calibrated in accordance with the accuracy range specified by the manufacturer, no treatment of uncertainty will be undertaken.

Emergency Preparedness

The project has the necessary provisions for emergency preparedness to deal with any unforeseen events such as fire or an electrical blackout. The emergency situation are adequately covered in the Section 5.8 of PPA under 'Emergency Set-up and Curtailment Plans' which specifies that Star Hydro Power Limited shall cooperate with the power purchaser in developing 'emergency procedures for the complex' including without limitation 'recovery from local or widespread electrical blackout and voltage reduction in order to effect load curtailment'.

Data Archiving

Data monitored and required for verification and issuance will be archived and maintained for two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	$FC_{i,y}$
Unit	Metric tonnes for oil; mmcft for gas, litres for diesel
Description	Amount of fossil fuel type *i* consumed by the project electricity system in year *y*
Source of data	Pakistan Energy Yearbook, Ministry of Minerals & Natural Resources
Value(s) applied	Values used for 2007, 2008 and 2009(See PDD Annex 3)
Choice of data or measurement methods and procedures	Based on requirements from ACM0002, the required data has been collected from government official sources. Data is only available for public sector power plants. For IPPs, fuel consumption was estimating using efficiency values.
Purpose of data/parameter	Calculation of baseline emission
Additional comments	None

Data/Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) per mass or volume unit of fuel *i* in year *y*
Source of data	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1
Value(s) applied	41.4 GJ/tonne for diesel 39.8 GJ/tonne for oil 0.89 TJ/MMCFT for gas 21.6 GJ/tonne for coal Note that the density of diesel is taken as 0.89 kg/liter as per the IPCC Guidelines. Also, note that the density of natural gas is taken as 0.6728 kg/m^3 as per API, 2009
Choice of data or measurement methods and procedures	Data is not available from local sources and the IPCC figures are more appropriate.
Purpose of data/parameter	Calculation of baseline emission
Additional comments	None

Data/Parameter	$EF_{CO_2,i,y}$
Unit	tCO_2/TJ
Description	CO_2 emission factor of fossil fuel type *i* used in year *y*
Source of data	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1
Value(s) applied	Natural gas: 54.3 tCO_2/TJ Fuel oil: 75.5 tCO_2/TJ Diesel oil: 72.6 tCO_2/TJ Coal: 94.6 tCO_2/TJ
Choice of data or measurement methods and procedures	Data is not available from local sources
Purpose of data/parameter	Calculation of baseline emission
Additional comments	None

Data/Parameter	EG_y
Unit	MWh
Description	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh)
Source of data	Pakistan Energy Yearbook (2007-2009)
Value(s) applied	Values used for 2007, 2008 and 2009(See PDD Annex 3)
Choice of data or measurement methods and procedures	Based on requirements from Methodology ACM0002, the required data has been collected from government official sources.
Purpose of data/parameter	Calculation of baseline emission
Additional comments	None

Data/Parameter	$\eta_{m,y}$
Unit	%
Description	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data	The default values provided in the Tool to Calculate the Emission Factor of an Electricity System (Annex 1) were used in the absence of publically available data
Value(s) applied	See PDD Annex 3
Choice of data or measurement methods and procedures	This data from the Tool was used for the IPPs only in the WAPDA grid, as details on their fuel consumption are not available. The average efficiency data was used to calculate their fuel consumption based on known energy generation and year of commissioning.
Purpose of data/parameter	Calculation of baseline emission
Additional comments	None

D.2. Data and parameters monitored

Data/Parameter	**EG_y**
Unit	GWh/yr
Description	Quantity of net electricity generation supplied by the project plant / unit to the grid in year y
Measured/calculated/ default	Measured
Source of data	Metered on site by the metering system as per the description in the PPA

Value(s) of monitored parameter	Total values in this monitoring period: 463,919.6 MWh (a) The total electricity supplied to the grid is 464,331.1 MWh (b) The total electricity imported from the grid and consumed by the plant is 411.5 MWh For the detail value in the monitoring period, refer to the ER spreadsheet.
Monitoring equipment	**Main meter** **- Unit 01** Measurement equipment: Watt-hour meter 1.Type: MT-860 2. Accuracy: 0.5% 3. Serial number: 66213744 4. Calibration frequency: within 2 year 5. Date of last calibration: 05/05/2017 6. Validity period: 05/05/2017 – 04/05/2019 **- Unit 02** Measurement equipment: Watt-hour meter 1.Type: MT-860 2. Accuracy: 0.5% 3. Serial number: 66213745 4. Calibration frequency: within 2 year 5. Date of last calibration: 05/05/2017 6. Validity period: 05/05/2017 – 04/05/2019 **- Unit 03** Measurement equipment: Watt-hour meter 1.Type: MT-860 2. Accuracy: 0.5% 3. Serial number: 66213746 4. Calibration frequency: within 2 year 5. Date of last calibration: 05/05/2017 6. Validity period: 05/05/2017 – 04/05/2019 **Backup meter** **- Unit 01** Measurement equipment: Watt-hour meter 1.Type: MT-860 2. Accuracy: 0.5% 3. Serial number: 67051232 4. Calibration frequency: within 2 year 5. Date of last calibration: 05/05/2017 6. Validity period: 05/05/2017 – 04/05/2019 **- Unit 02** Measurement equipment: Watt-hour meter 1.Type: MT-860 2. Accuracy: 0.5% 3. Serial number: 67051233 4. Calibration frequency: within 2 year 5. Date of last calibration: 05/05/2017 6. Validity period: 05/05/2017 – 04/05/2019 **- Unit 03** Measurement equipment: Watt-hour meter 1.Type: MT-860 2. Accuracy: 0.5% 3. Serial number: 67051234 4. Calibration frequency: within 2 year 5. Date of last calibration: 05/05/2017 6. Validity period: 05/05/2017 – 04/05/2019
Measuring/reading/recording frequency	Continually Measured and Recorded

Calculation method (if applicable)	N/A
QA/QC procedures	The metering system and Back-up Metering System will be under continuous surveillance and in the event of greater than specified inaccuracy of 0.5% recalibration is specified. Sealing of the metering system will be checked regularly. The readings of the Back-Up Metering System shall be used to calculate the correct amount of Net Electrical Output, unless a test of such Back-Up Metering System reveals that the Back-Up Metering System is inaccurate by more than 0.5%.
Purpose of data/parameter	Baseline emission calculations
Additional comments	Further details of the data collection, recording and storage procedures and the QA/QC procedures are contained in the Monitoring Plan in Section B.7.2

Data/Parameter	**CAP_{PJ}**
Unit	W
Description	Gross (Total) installed capacity of the hydro power plant after the implementation of the project activity
Measured/calculated/ default	default
Source of data	Project site
Value(s) of monitored parameter	150×10^6
Monitoring equipment	Installed capacity
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	N/A
QA/QC procedures	N/A
Purpose of data/parameter	Project emission calculations
Additional comments	As per the project technical characteristics, the gross installed capacity is 150 MW, and this is not expected to change. It will be monitoring nevertheless on an annual basis.

Data/Parameter	**A_{PJ}**
Unit	m^2
Description	Reservoir area (surface area at full reservoir level)
Measured/calculated/ default	Measured
Source of data	Monitoring reports from third qualified entity
Value(s) of monitored parameter	598,000
Monitoring equipment	Measures from topographical surveys, maps, satellite pictures etc.
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	N/A
QA/QC procedures	N/A
Purpose of data/parameter	Project emission calculations
Additional comments	N/A

Data/Parameter	FC_y
Unit	Mass or volume unit per year (e.g. ton/yr or m^3/yr)

Description	Quantity of diesel combusted in emergency generator operation during the year *y*
Measured/calculated/ default	Measured
Source of data	Fuel purchase records and receipts
Value(s) of monitored parameter	7,000
Monitoring equipment	Calculated from fuel purchase receipts
Measuring/reading/recording frequency	Recorded when the diesel fuel is purchased
Calculation method (if applicable)	N/A
QA/QC procedures	Calculated fuel consumption quantities can be crosschecked with available purchase invoices from the financial records.
Purpose of data/parameter	Project emission calculations
Additional comments	For the emission factor of the diesel generator, refer to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)

D.3. Implementation of sampling plan

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Not application

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

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The baseline emissions are the product of electrical energy baseline EG_y expressed in MWh of electricity produced by the renewable generating unit by the grid emission factor.

$BE_y = EG_y \times EF_y$

Where:
BE_y = Baseline emissions in year y (tCO_2e/MWh)
EG_y = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
EF_y = CO_2 emission factor of the grid in year y (tCO_2e/MWh)

Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (EGy)

Thus, EGy = 463,919.6 MWh

Therefore,

BEy = EGy × EFy
= 463,919.6 × 0.42565
= 197,467.377 tCO2e

E.2. Calculation of project emissions or actual net removals

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The project emissions from the water reservoirs of hydro power plants are calculated based on power density.

The power density of the project activity (PD) is calculated as follows:

$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$

Where:

PD = Power density of the project activity (W/m2)
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

$Cap_{PJ} = 150 \times 10^6$ (W)
$Cap_{BL} = 0$
$A_{PJ} = 598{,}000$ (m^2)
$A_{BL} = 0$

$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$
$= (150 \times 10^6 / 598{,}000)$
$= 251$ W/m^2

The power density of the project activity (PD) is greater than 10 W/m^2, therefore, according to ACM0002:
$PE_{HP,y} = 0$

The emergency diesel generator sets are operated, and then the project emissions (PE) can be calculated as below;

$PE_{FC,DG,y} = \Sigma FC_y \times COEF_y$

Where:

$PE_{FC,DG,y}$ = CO_2 emissions from diesel fuel combustion (FC) in emergency DG use during the year y (tCO_2e/yr)
FC_y = Quantity of diesel fuel combusted during year y (y mass or volume unit/yr)
$COEF_y$ = CO_2 coefficient of diesel in year y (tCO_2e/mass or volume unit/yr)

FC_y = 7,000 L
$COEF_y = \rho_{Diesel,\ y} \times NCV_{Diesel,\ y} \times EF_{CO2,\ Diesel,\ y}$
$= 0.89$ kg/L × 41.4 GJ/ton × 72.6 tCO_2e/TJ

$PE_{FC,DG,y} = FC_y \times COEF_y$
$= 7{,}000$ L × 0.89 kg/L × 41.4 GJ/ton × 72.6 tCO_2e/TJ ÷ 10^6
$= 18.725$ tCO_2e

Therefore,

$PE_y = PE_{HP,y} + PE_{FC,DG,y}$
$= (0 + 18.725)$ tCO_2e
$= 18.725$ tCO_2e

E.3. Calculation of leakage emissions

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There is no leakage in the project activity.

$LE_y = 0\ tCO_2e$

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
2017	7,963.826	0	0	0	7,963.826	7,963.826
2018	189,503.551	18.725	0	0	189,484.826	189,484.826
Total	**197,467.377**	**18.725**	**0**	**0**	**197,448.652**	**197,448.652**

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
197,448	263,376

E.6. Remarks on increase in achieved emission reductions

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This project was estimated to reduce 263,376 tCO_2e according to the registered PDD for this monitoring period. However, actual reduction is 197,448 tCO_2e and the net electricity supplied to the grid was 463,919.6 MWh. This shows that the actual value is smaller by 65,928 tCO_2e than the estimated value in the PDD. Also, the actual amount of net electricity supplied to the grid (463,919.6 MWh) is smaller than the estimated values (632,628 MWh, the yearly estimated electricity generation in PDD).
The factor that caused considerable reduction in a generation in this monitoring period is owing to the reduction of the actual amount of water inflow. In the registered PDD, estimated energy generation was based on historical data of the river (average inflows). However, lesser inflows were received during this monitoring period which caused a considerable reduction in annual energy generation.

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Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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