Sri Lanka® Carbon Crediting Scheme

Monitoring Report

Maduru Oya Left Bank Canal Sluice Small Scale Hydropower Project

Eagle Power (Pvt) Ltd.
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1. Description of Project Activity

1.1. Objective of the Monitoring

The purpose of a monitoring is to have a quantification the amount of actual GHG emission reduction for specific period. This project developer has authority to specify the period to be monitored. Monitoring report is the supporting document to independent verification of net GHG emission reduction during specific period to obtain Sri Lankan Certified Emission Reduction (SCER) units.

1.2. Summary Description of the Implementation of this Project

Maduru-oya left bank sluice hydro power project has been constructed in association with the Dam of the Maduru Oya reservoirs and the penstock lines off taking from the existing sluice conduit. It's the first regulated water way small-scale hydro power project undertaken along a waterway of Mahaweli Authority, with private sector participation. Capacity of the project is 5 MW and the annual average output is 15.99 GWh and the expected annual GHG emission reduction is 12,014 tCO_2e. This Power plant started operations in 2011.

As the civil works have been completed to a greater extent project is financially feasible even after paying a royalty of 34.2 % from the income of the generated power to MASL. Project is feasible as water is assured to meet the irrigation water demand for farmers.

Project	Proposed Installed Capacity	Expected Energy Output	Project Cost & IRR
Maduru Oya Left Bank Canal Sluice Small Scale Hydro Power Project	5000 kW	15.99 GWh	MSLRs 585 16.0 %

Parameters related to the Proposed Power Project

Hydrology

Maximum discharge observed	36.11 cumecs
Minimum discharge observed	1.01 cumecs
Average mean discharge	19.55 cumecs
Reservoir active capacity	476.3 mcm
Volume obtain from own catchment	248 mcm/annually
Volume obtain from diversion	550 mcm/annually
Rainfall	1000 – 4000 mm

Reservoir water level (head) variations

Maximum water level at the reservoir	96.0 m msl
Minimum operating level	84.5 m msl
Outlet canal water level	78.0 m msl
Head variations considered	18 ~ 6 m

Designed head	16.5	m

Proposed power plant

Installed Capacity	5.0	MW (as proposed in LOI)
Expected Energy Output	15.99	GWh annually
Type of the turbine	Dual operation Kaplan – Vertical	
Efficiency of the flow variation	60%	
Generation	Synchronous/semi umbrella type	
Generating Voltage	6.6	kV
Frequency	50	Hz
Line of connectivity and Voltage	300 m/ 33 kV	

Cost and financial status

Total Project Cost	585	m SLRs
Equity of the Project Proponent	30 %	
Lending Banks	70 %	
Internal Rate of Return	> 16%	
Royalty to MASL	34.2 % from generated power	

Operational Conditions

as per MASL seasonal operating plans/RPM sys 'B' directives

Parameter of Project and E & M equipment

Hydrology

Reservoir full supply level	96.0 m msl
Minimum operating level	84.5 m msl
Maximum observed discharge	36.11 m^3/sec
Designed discharge	22.0 m^3/sec
Head variation	18 ~ 6 m

Turbine Inlet valve

Type	Butterfly
Diameter	2.6 m

Turbine

Type	vertical shaft – Kaplan
Maximum net head	18.0 m
Minimum net head	06.0 m
Rated net head	16.0 m
Rated speed	350 rpm
Runaway speed	750 rpm
Power at rated head	2500 kW
Power at the maximum loading	3000 kW
Sense of rotation	anti clockwise

Generator

Phase	Three
Frequency	50 Hz

Rated Voltage	6600 V
Maximum output	3000 kVA
Power factor	0.9 lead or lag
Synchronous speed	350 rpm
Runaway speed	750 rpm

Main transformer

Frequency	50 Hz
Phase	three
Rated voltage	6.6 kV/33kV
Rated output	3000 kVA
Power factor	0.9 lead or lag
Off lo dap changer	- 10% to + 10% in steps of 5%

The estimated annual power generation output of this small hydropower plant is 15.99 GWh which is exported to the national electricity grid of Ceylon Electricity Board. This replaces an equal amount of fossil fuel dominated power in the National Grid. The expected annual GHG emission reduction is 12,014 tCO_2e

Prior to this project activity, there was no hydropower plant belonging to project participant in that region. Hence the project can be considered as a Greenfield project activity. Baseline scenario for this project activity will be the electricity from the grid.

1.3. Sectoral Scope and Project Type

Sectoral scope 1, Type I, AMS-I.D "Grid connected renewable electricity generation"

1.4. Project Proponent

Organization Name	*Eagle Power (Pvt) Ltd*
Contact Person	*Kapila Wijesekara*
Title	*No 09, Modarawila Industrial Zone, Panadura*
Address	*Director / General Manager*
Telephone	*0773822454*
Fax	*038 4282780*
E-mail	*kapila@ethimale.lk*

1.5. Other Entities Involved in the Project

Organization Name	*Anunine Holding (Pvt) Ltd*
Role in the project	*Mother company of Eagle power (Pvt) Ltd*
Contact Person	*G.A. Sithara Sewwandi*
Title	*77 Sri Saranankara Rd, Dehiwala-Mount Lavinia 00600*
Address	*Sustainability Analyst*
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E-mail	*sithara@anunine.com*

1.6 Project Start Date

Starting date of the Maduru Oya Left Bank Main Canal small-scale Hydropower project activity is **12th August 2008 (**This was the date when first real action was taken by PP and Letter of Award for construction of access road to the power house was made along with the advance payment to the contractor**)**

1.7 Project Crediting Period

The project crediting period is 01st March 2021 to 29th February 2028 and totally 7 years renewable.

1.8 Registration date of the project activity

The project registration date will be specified after obtaining approval for the project validation opinion.

1.9 Project track and credit use

The Maduru Oya Left Bank Canal Sluice Small Scale Hydropower Project intends to be registered under track II and issued carbon credits from project will only be used for internal offsetting of emissions.

1.10 Project Location

Management of the Project area is vested with MASL, which includes land, other natural resources and social infrastructures. On behalf of MASL the Resident Project Manager

(System B) and Maduru Oya Dam Site Engineer Headworks Division have been vested the authority to manage the project and in general;

- Province - North Central Province
- District - Pollonnaruwa
- DS Office - Dimbulagala
- Pradeshiya Saba - Dimbulagala
- GN Office - 239, Alawakumbura
- Village - Alawakumbura

The project site is located at 339 km from Colombo.

Location of Project Activity	Maduru Oya Left Bank Main Canal Sliuce
Province	North Central Province
District	Plonnaruwa
DS Division	Maduru Oya
City/Town	Aralaganwilla
Community	Alawakumbura
Coordinates	Latitudes - 7^0 66' 69.43'' N Longitudes - 81^0 19' 77'' E

Figure 1: *Location map (source: Google map)*

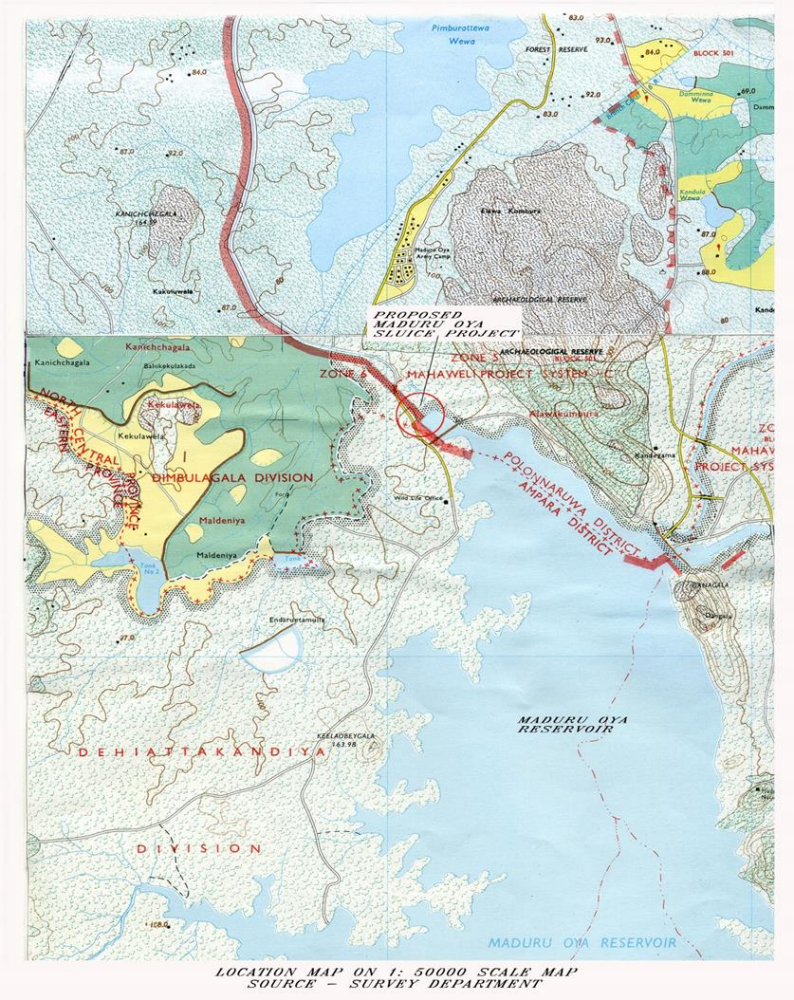


Figure 2: *Location map on 1:50000 scale map (Source – Survey Department)*

1.11 Title and Reference of Methodology

AMS-1.D "Grid connected renewable electricity generation" Version 18.0

1.12 Participation under other GHG Programs

This project is not registered under any other GHG programs.

1.13 Other Forms of Credits

This project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

1.14 Sustainable Development

This renewable electricity generation facility is able to reduce the contribution from thermal electricity generation to meet the electricity demand. Unlike in thermal power plants, this project will positively contribute to the electricity demand without compromising the ability of future generations to meet their own needs. Therefore, this renewable energy project is a positive step toward sustainable development. The national sustainable development criteria are,

1) Environmental well-being

2) Economic well-being

3) Social well-being

4) Technological well-being

Environmental well-being

The project contributes to an improvement of the local environment through reducing emissions such as SOx and NOx from thermal power plants which have to be operated to generate an equal amount of power using thermal sources if this project is not implemented.

Economic well-being

Discontinuing the use of fossil fuel saves foreign exchange since the entire quantity of fossil fuel requirement is imported to the country.

Social well-being

Good amount of employment opportunities had been created for the local workforce during the project construction phase. The project after implementation provides employment opportunities for the local populace in a sustained manner over the project life time. The enhanced employment opportunities created by this project activity will lead to alleviation of poverty, and eradicate unemployment.

Technological well-being

This power plant has been erected as a fully automated power plant. The project activity has used of the reliable and proven technology available locally to ensure that an environmentally safe technology is only being implemented in this project activity.

2. Implementation Status

2.1 Implementation Status of the Project Activity

Eagle Power (Pvt) Ltd, developed a 5.0 MW grid connected hydro power project in Maduru Oya, Alawakumbura, Aralaganwilla, Pollonnaruwa District in Sri Lanka and this project was

registered as a renewable energy generation project under Sri Lanka Carbon Crediting Scheme (SLCCS). The entire power generated from this project sells to Ceylon Electricity Board through a power purchase agreement with CEB. The estimated annual power generation output of this hydro power plant is 15,996 MWh which is exported to the national electricity grid of Ceylon Electricity Board. This replaces an equal amount of fossil fuel dominated power in the National Grid. The expected annual GHG emission reduction is 12,014 tCO_2e. Prior to this project activity, there was no hydro power plant belonging to project participant in that region. Hence the project can be considered as a Greenfield project activity. Baseline scenario for this project activity was the electricity from the grid.

Eagle Power Project	**Technical specification**		
General	Catchment Area		490 km^2
	Average Annual Catchment Rainfall		1000 mm – 2000mm
	Average Flow		19.55 m^3/s
	Gross Head		16.5 m
	Installed Capacity		5 MW
	Mean Annual energy generation		15.99 GWh
Weir1 (Main Weir) & Intake	Type		Existing Mahaweli Dam
	Max. Height		N/A
	Length		N/A
Outlet Channel	Type		Reinforced concrete,
	Length		20 m
	Height		4 m
	Inner Width		20 m
	Flow depth at design flow		3 m
	Hydraulic slope		0.001
Penstock	Type		Single welded steel pipe
	Length		50 m
	Inner diameter		2.6 m X 2
	Gross Head		16.5 m
Powerhouse	Size of Building		30 m x 13 m x 15 m
	Hydraulic Turbine	Type	Dual Operation Kaplan – Vertical (2500kW x 2)

		Rated Flow	16.5 m^3/s X 2
	Generator	Type	Synchronous, 6.6kV
		Operating Speed	300 RPM

Starting date of the Maduru Oya Left Bank Main Canal Sluice project activity is 12th August 2008 (This was the date when first real action was taken by PP and Letter of Award for construction of access road to the power house was made along with the advance payment to the contractor) and the project was successfully commissioned on 17th June 2011 and no any other changes after registration.

2.2 Deviations

2.2.1 Methodology Deviations

Not applicable

2.2.2 Project Description Deviations

Not Applicable

3. Safeguards

3.1 No Net Harm

This project has not any potential negative environmental and socio-economic impacts.

Analysis of environmental impacts

In terms of regulations in Sri Lanka, small hydropower projects require approval from the Central Environmental Authority (CEA) which looks at both environmental and social aspects. Developers should prepare an Environmental Assessment Report and submit to the CEA for approval. CEA grants approval for the project if they are satisfied, after obtaining all necessary clarifications.

Then this project has received the Environmental Clearance from the CEA.

Table 1: *Date of Environment Clearance by CEA*

Hydropower plant	Capacity rating (MW)	Date of environment approval received from CEA
Maduru Oya Left Bank Canal Sluice Small Scale Hydro Power Project	5	31st December 2007

These clearances by CEA reflect the finding that the environment impacts of this project is negligible.

The general and specific conditions of approvals of the EAs are in most instances generic, i.e., guidance on minimizing impacts of site preparation. Also, all projects require an environmental monitoring plan that covers surface water (not relevant in practice for run-of-river projects), flora and fauna within the river and below the diversion point, river bank erosion, and sediments upstream of the weir.

The noteworthy specific condition to the project site is summarized below.

- No damage to the rock boulder deposits in the upstream area from the weir
- Maintain the downstream in proper condition, a continuous uninterrupted flow of 30 litres/sec shall be maintained
- Adhere to the approved trace of the transmission line route identified by the CEB
- Solid waste associated with the work force shall be disposed of in consultation with the local authority
- Shall adapt appropriate conservation methods to stabilize any disturbed slopes
- Sediments collected at the weir site and accumulated in the setting basin should be disposed in controlled manner
- Soil conservation techniques should be adapted in controlled manner

Should be incorporated in the design at the mouth of intake to prevent entry of fish into conveyances system and build overpass of the open head race canal to facilitate movement of small terrestrial

Environmental impact assessment

The environmental impacts of this project are not considered significant.

3.2 Local Stakeholder Consultation

Stakeholder Consultation Process

There should be some public involvement to ensure that critical issues are identified and that local information about the project area is gathered and that alternative ways of

achieving the project objectives are considered. Public involvement could be used to avoid biases inaccuracies in analysis to identify local values and preferences to assist in the consideration of mitigation measures and to select the best practicable alternative.

Eagle Power (Pvt) Ltd had expressed their plan to develop the proposed 5 MW grid connected project and called for the suggestions/comments of the local stakeholders. In line with the public notice, a meeting was held on 7th September 2005. Stakeholder consultation for the project activity has been conducted to account for the views of the people impacted either directly or indirectly due to the project activity as well as impact to the environment. This has been carried out at all levels of stakeholders

The stakeholder consultation process of Maduru Oya Sluice Hydropower project started with the identification of most relevant stakeholders to the project. It was found that the several types of stakeholders with different social status were interested in the project.

Summary of Comments Received

Director and consultant of Eagle Power (Pvt) Ltd made a detailed description of the project activity. A series of questions were raised by the participants and majority of them were focused on the possible environmental impacts. In response to them, consultant of project activity described the actions planned to be taken to prevent possible negative environmental impacts. Further the participants were presented with the credentials of stipulated environmental clearance obtained from the relevant authorities. Then villagers were more curious in knowing the advantages and benefits of the project. The participants were convinced that job creation and infrastructure development would be a key outcome of this project. With that insight, participants did not raise any objection against the development and implementation of the project.

- The procedures or methods used for engaging local stakeholders (eg, dates of announcements or meetings, periods during which input was sought).
- The procedures or methods used for documenting the outcomes of the local stakeholder communication.
- The mechanism for on-going communication with local stakeholders.
- How due account of all and any input received during ongoing communication has been taken. Include details on any updates to the project design or justify why updates are not appropriate.

3.3 AFOLU-Specific Safeguards

Not applicable

4. Data and Parameters

4.1 Data and Parameters Available at Validation

The responsibilities of various personnel in the organization in keeping records as follow;

Small hydropower operators monitor plant operation including energy generated and exported to the CEB grid by taking at least daily readings of generation levels and recording them on site. The monthly invoice sent to CEB by the small hydropower developer is cross checked by the CEB with the meter reading taken by the CEB staff and payment made accordingly. These data are also archived at Eagle Power (Pvt) Ltd office in Panadura as well as the power station site. The verifier will also be welcome to visit the power station site and the office in Panadura to confirm the status of operations.

No leakage effects are applicable to the plant's operation as the equipment at the plant has not been moved from any other operational location.

Following data and parameters were available at the validation and those were utilized in calculating the net emission reduction, in accordance with the methodology specified in the validated CMA.

Data / Parameter	$EF_{CM,Grid,y}$
Data unit	tCO_2e/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year y
Source of data	Energy balance 2020 - Sri Lanka Sustainable Energy Authority
Value applied	0.7512
Justification of choice of data or description of measurement methods and procedures applied	Methodological tool published by UNFCCC to calculate the emission factor for an electricity system
Purpose of Data	Calculate the emission reduction
Comments	This factor was applied to calculate baseline emission reduction of the project activity.

Data / Parameter	$\rho_{i,y}$
Data unit	kg/m^3
Description	Weighted average density of generator fuel (Diesel)
Source of data	Values provided by national fuel supplier, Ceylon Petroleum Corporation (CEYPETCO)
Value applied	840

Justification of choice of data or description of measurement methods and procedures applied	CEYPETCO conducts periodic testing of the specifications of Auto Diesel (A0013L99), which it supplies itself, and publishes the results on its official website for public access and reference. As declared by CEYPETCO, the fuel testing is conducted by selected professionals in its laboratories adhering to international best practice guidelines, standards, and protocols.
Purpose of Data	Calculate the mass of fuel consumed by the on-site diesel generator
Comments	This value is provided as a range (820-860 kg/m^3) of which average was applied in the calculation of project emissions.

Data / Parameter	$NCV_{i,y}$
Data unit	GJ/kg
Description	Weighted average net calorific value of diesel
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	0.043
Justification of choice of data or description of measurement methods and procedures applied	IPCC is an organization attached to UNFCCC publishing periodic reports on climate change and guidelines on national inventory development. As a technical body, IPPC reviews the latest global research findings of scientific communities and consolidate them into useable format through simplified reporting framework. The NCV values for fuel type are periodically published by IPPC for the use of reporting emissions from fossil fuels. Though these values are presented with an uncertainty range, they are recommended to be used in the emission offset calculation in the absence of local data. The locally published fuel calorific value is given by CEYPETCO on a gross basis. As this value needs to be converted into NCV using a conversion factor, the default value given in IPCC was used to minimize the uncertainty.
Purpose of Data	To estimate the energy content of fuel
Comments	This factor will be applied to calculate project emissions attributable to the project boundary

Data / Parameter	$EF_{CO2,i,y}$
Data unit	tCO_2e/GJ
Description	Weighted average CO_2 emission factor of fuel type (diesel)
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	0.0741
Justification of choice of data or description of measurement methods and procedures applied	As per the CDM methodological tool; Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, version 03.3, this value can be applied in the emission accounting of fossil fuel combustion.
Purpose of Data	To estimate the energy content of fuel
Comments	This factor will be applied to calculate project emissions attributable to the project boundary

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{p.j.y}$
Data unit	MWh
Description	Quantity of net electricity exported to the CEB grid
Source of data	Monthly electricity export and import vouchers (bills) issued by CEB
Description of measurement methods and procedures to be applied	This parameter was continuously monitored by project participants using an electronic energy meter supplied by CEB. The meter is a bidirectional meter and capable of measuring import and export data at the same time.
Frequency of monitoring/recording	Daily and Monthly
Value applied	33,334.04

Monitoring equipment	Energy meters Accuracy class of the meters- class 01 From the developer side there were two meters installed (of same accuracy class). One has been installed before the transformer and one after, so that the losses can be recorded. These meters were used to track the electricity generation. While CEB meters were utilized to track both import and export of electricity.
QA/QC procedures to be applied	The meter was properly calibrated and maintained in order to ensure accuracy. Testing/Calibration interval: Annually by CEB Cross checking of the data with the cheque received from CEB for import electricity to the grid
Purpose of data	Calculate baseline emission
Calculation method	The parameter was calculated by deducting the import energy from the export energy
Comments	Monitoring data is archived for two years after the crediting period.

Data / Parameter	$FC_{i,j,y}$
Data unit	L
Description	Diesel burnt in the back-up generator
Source of data	Onsite measurements
Description of measurement methods and procedures to be applied	Fuel consumed by generator was measured by a ruler gauge fixed to the fuel tank. Power plant operators/ technicians are responsible for taking monthly measurements of the fuel consumption. A log book is maintained for recording monthly fuel consumption
Frequency of monitoring/recording	Measurements were taken on monthly basis
Value applied	400
Monitoring equipment	Ruler gauge is used to measure fuel consumption

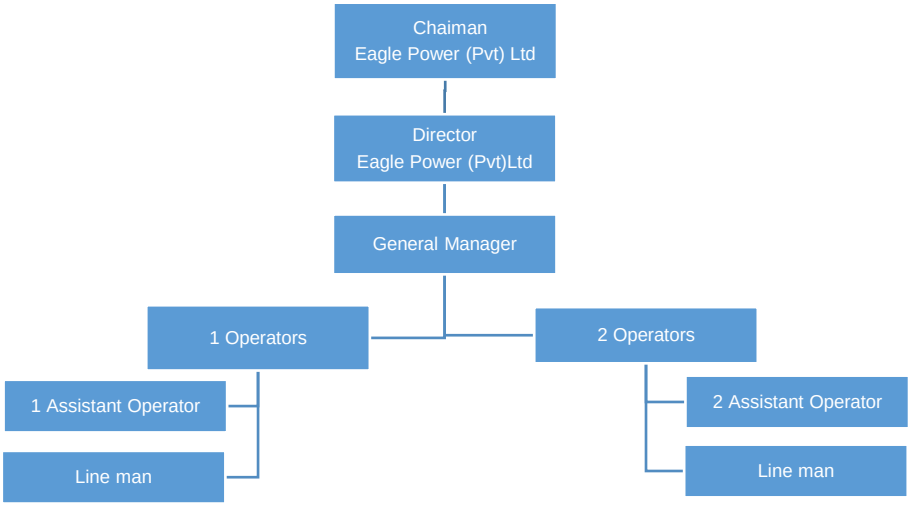
QA/QC procedures to be applied	The fuel gauge was properly calibrated by the responsible party for achieving required accuracy level. The fuel quantities consumed by generator was cross-checked with the purchased quantities in the monitoring period.
Purpose of data	Calculate project emission for the operation of on-site diesel generator
Calculation method	N/A
Comments	The recorded data were periodically reviewed and authorized by the project manager.

4.3 Description of the Monitoring Plan

The authority and responsibility for registration and overall monitoring would rest with the Director of the Eagle Power (Pvt) Ltd. Power plant operational staff team is headed by a Director from VS hydropower, has worked as consultant for the project, in the capacity of operational and maintenance supervisors after commissioning of the plant. VS hydropower consists an experienced team in various disciplines and would undertake periodic inspections to ensure the quality of the data collected by the team and initiate steps in case of any abnormal conditions.

The Plant Manager was assisted by operators and labourers. Power house operating staff operated the plant safely and kept records of plant operations. The responsibility of review, storage and archiving of information in good condition lies with the Plant Manager. Also, it is the responsibility of the Plant Manager to make sure that routine maintenance of plant equipment is carried out in line with the instructions given in operations and maintenance manuals provided by the suppliers of respective equipment and recorded in given formats. Plant assistant operating staff was assisted by senior operators whose primary responsibility was to attend to day-to-day works.

Organization Structure



Parameters Requiring Monitoring

As indicated in the validated monitoring plan, the plant has monitored data and parameter required for the net emission reduction of the project activity. The energy export and import data are obtained from the CEB vouchers/ bills and recorded for the verification. In addition to the main meter installed by CEB, the plant has installed a check meter at the output side of the transformer. Export energy metered through this meter is routinely recorded and used for cross-checking purposes. Fuel consumption in on-site diesel generator is another critical parameter to be monitored during the crediting period. This was measured and monitored through a ruler gauge installed in the generator.

Training of monitoring person

The top management of the project is highly concerned with the integrity of monitoring system validated for this project activity. The project has employed qualified and experienced persons for plant operations. As indicated in the validated CMA, the responsible officers and plant operators have been using the proper log sheets and format for the data recording. The project Manager has functioned as the designated person to verify, compile and archive all the monitored data. The parameters monitored during the crediting period have been provided in approved tabular format to the designated person for verification purpose. Following the implementation of the project, the management has provided necessary training to the personnel in engaging data reading and reporting. The training modules have specifically covered the monitoring procedures of following parameters.

- Electricity Export
- Electricity Import
- Grid emission factors and other coefficients
- Fuel consumption of the on-site diesel generator
- Gross electricity generated
- Parameter of the plant, such as bearing temperature, electrical properties, etc
- Fault/Breakdown recording

Procedures for documentation and storage

Recorded data in monitoring sheets carried out by operators was periodically checked by the Plant manager to identify any abnormalities. During the monitoring period considered for this monitoring period, any abnormality was not found to be reported. In ensuring the accuracy and completeness of data, as per the validated CMA, electronic data reporting system was adopted. This is kept as a back-up of monitoring data in case loss of the physically reported data. This system was also periodically checked by the Project Manager.

Procedures for Corrective actions

The parameters monitored during the crediting period was compiled as internal report and submitted to the Designated Director for review. The parameters included the Gross

generation, Auxiliary consumption, Energy export and Import, generator fuel consumption. Following each review, the director has recommended actions for improvements in the data recording and reporting.

QA & QC Procedures

The project has employed equipment and instruments that measure, record, report, monitor and control of various key parameters of the plant. For measuring the energy exported / imported main meter and a check meter as required installed by the power plant. The check meter reading was used to measure electricity export/import in case of failure of the main meter. As per the contractual arrangement entered into with CEB, the responsible officials are obligated to replace the main meter immediately on PP request.

Data Storage & Archiving

Export & Import readings from main meter was collected under the supervision of the project Manager. Export and Import data were recorded and stored in logs as well as in electronic form. The records are checked periodically by the Project Manager. The period of storage of the monitored data is for 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later. The baseline emission factor was obtained from the Energy Balance report of SLSEA available at https://www.energy.gov.lk/images/energy-balance/energy-balance-2020.pdf. The third-party assurance required for the monitored data and parameters are requested from the verification team serving for SLCCS.

Maintenance of Equipment

All the equipment used in the project activity have been undergone scheduled maintenance as specified in the operational manual of the equipment supplier. During the monitoring period, meters were periodically tested for defects, there were not any defects to be reported in the metering equipment. Further, the meters and rulers used to measure the data and parameters were calibrated at the frequency recommended by the supplier.

5. Quantification of GHG Emission Reductions and Removals

5.1 Baseline Emissions

The baseline emissions are the product of electrical energy baseline $EG_{BI,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{PJ,y} \times EF_{grid,y}$$ Equation (1)

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2)
$EG_{PJ,y}$	=	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)
$EF_{grid,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

Calculation of baseline emission factor

As per paragraph 22 of AMS I.D. Ver 18.0, for project activities that do not displace captive electricity generated by an existing plant but displace grid electricity import and/or supply electricity to a grid, the emission factor of the grid shall be calculated as per the procedures detailed in AMS-I.D.

As per AMS I.D, the grid emission factor was calculated using the latest approved version of "Tool to calculate the emission factor for an electricity system" CDM methodology. The grid emission factor calculated and published by the Sustainable Energy Authority in Sri Lanka is used.

5.2 Project Emissions

Project emissions to be considered as per paragraph 39 & 40 of AMS I.D. Ver18.0 and discussion of their relevance for the project are presented in below.

Power plant is to be equipped with a diesel generator as a back-up power source. The emission due to operation of this back-up generator is estimated using the Methodological tool: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, version 03.0

As per the tool, the CO_2 emissions from fossil fuel combustion should be calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y} \qquad \text{Equation (1)}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr)
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr)
$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

Tool has also provided guidance on the calculation of CO_2 emission coefficient $COEF$

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \qquad \text{Equation (4)}$$

Where:

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
i	=	Are the fuel types combusted in process *j* during the year *y*

Considering the frequency of power cuts and other system emergencies, annual diesel consumption was estimated for the on-site diesel generator as 400 litres. The resulting emission from the combustion of estimated diesel consumption is as follows.

Parameter	Value	Units	Source
Quantity of fuel combustion	400	L	Calculated
	0.4	m^3	
Mass unit/volume unit (Fuel Density)	840	Kg/ m^3	Ceylon Petroleum Corporation (CEYPETCO)
Net Calorific Value (NCV)	0.043	GJ/kg	IPCC Guideline, 2006
CO_2 emission factor	0.0741	tCO_2e/GJ	IPCC Guideline, 2006
Project emission from combustion of diesel	1.08	tCO_2e/year	Calculated

Rounded emission for conservativeness	2	tCO_2e/year	Calculated

Hence, PE_y = 2

T**able 2:** Overview of project emissions as per paragraph 39 & 40 of AMS I.D. Ver 18.0 and their relevance for the project

Para 39 & 40 of AMS I.D. Ver18.0: Project emissions include:	**Relevance for project activity**
For most renewable energy project activities, *PEy*=0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002. ○ Emissions related to the operation of geothermal power plants (e.g., non condensable gases, electricity/fossil fuel consumption); ○ Emissions from water reservoirs of hydropower plants.	No. As per the latest version of ACM0002, version 10, Consolidated baseline methodology for grid-connected electricity generation from renewable sources, the hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents requires to account for CH_4 and CO_2 emissions from the reservoir. The Maduru Oya Left Bank Canal Sluice Small Scale Hydropower Project located in the Maduru Oya Left Bank Main Canal Sluice has not changed or altered the capacity of the reservoir. In this backdrop, emission from water reservoir is not required to be accounted under the project emissions.
CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the tool to calculate project or leakage CO_2 emissions from fossil fuel combustion.	Yes. A back-up generator has been installed at the power plant to cater to essential power demands in the event of grid failure or sudden power outages. The emission arising from this source has been duly estimated and is reported as a project emission.

5.3 Leakage

As per the paragraph 42 of selected methodology, leakage emission is typically attributable to the operation and processes relating to the biomass project activities. The current project activity does not involve biomass plantation, processing and any treatment after harvesting, hence, no leakage emissions applicable to this project activity. Hence,

$$LE_y = 0$$

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5.4 Net of GHG Emission Reductions and Removals

Emissions reductions are calculated as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Since $LE_y = 0$;

$$ER_y = BE_y – PE_y$$

Table 5: Summery of emission reduction calculation

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 2021 (01.03.2021-31.12.2021)	*10,718*	*2*	*0*	*10,716*
Year 2022 (01.01.2022-31.12.2022)	*14,322*	*2*	*0*	*14,320*
Total	*25,040*	*4*	*0*	*25,036*

5.5 Comparison of actual emission reductions with estimates in the CMA

Item	Values applied in ex-ante calculation of the registered CMA	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	*22,025*	*25,036*

5.6 Remarks on difference from estimated value in the CMA

The variance between the estimated and actual values of plant output primarily arises from fluctuations in the amount of rainfall received within the reservoir's catchment area, coupled

with increased water discharge from the reservoir into the Maduru Oya Left Bank Canal Sluice to support agricultural activities. As a result, the actual plant factor has experienced a marginal rise (42.09%), surpassing the initially designated plant factor of 36.52% used in the ex-ante emission reduction calculations of CMA version 02.

APPENDIX: Contact information of the participants in the project activity

Since this project comes under the Eagle Power (Pvt) Ltd, it is responsible for managing carbon assets. Therefore, contact information on Eagle Power (Pvt) Ltd is given below for more clarification.

Organization:	Eagle Power (Pvt) Ltd
Street/P.O.Box:	No 09, Modarawila Industrial Zone, Panadura, Sri Lanka. (Head Office)
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Fax:	
E-Mail:	
URL:	
Represented by:	
Title:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail	

Document Information

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