Sri Lanka® Carbon Crediting Scheme

# Monitoring Report

## Maduru Oya Left Bank Main Canal at 24+140 Drop 9 Mini Hydro Power Project

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| | |
|---|---|
| Project Title | *Maduru Oya Left Bank Main Canal at 24+140 Drop 9 Mini Hydropower Project* |
| Version | *03* |
| Report ID | *SLCCS/REG/0008/MR/01* |

| | |
|---|---|
| Report Title | *Monitoring Report of Maduru Oya Left Bank Main Canal at 24+140 Drop 9 Mini Hydropower Project* |
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| Project proponent/s | *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 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 reduction during specific period to obtain Sri Lanka Certified Emission Reduction units (SCER).

### 1.2. Summary Description of the Implementation of this Project

Maduru oya drop 9 project is located at the 24+240 m location of the left bank main canal. Discharge of the location is approximately 22.0 m3/sec and a fixed head of 11.0 meters. Capacity of the project is 2.0 MW, and the output in average is 10,336.8 MWh annually.

Existing drop structure is having 2 regulator gates for water level operations of the canal for a given discharge. LB canal is a well maintained concrete lined canal. The project was commissioned successfully on 19th December 2013.

| Location | Capacity | Energy Production | Costs of the Project |
|---|---|---|---|
| Regulator cum drop structure 9, at 24 + 140 of LB Main Canal | 2000 kW | 10,336.8 MWh/year | 130 MSLRs |

**Parameters relating to the implemented project activity**

Hydrology

| | |
|---|---|
| Maximum discharge observed | 19.3 cumecs |
| Minimum discharge observed | 1.01 cumecs |
| Average mean discharge | 11.55 cumecs |
| Rainfall | 1000 – 4000 mm |

Canal regulator cum drop head

| | |
|---|---|
| Maximum | 11.5 m |
| Designed head | 11.0 m |
| Outlet canal water level | 78.0 m |

Proposed power plant

| | |
|---|---|
| Installed Capacity | 2 MW (as proposed in LOI) |

| | |
|---|---|
| Expected Energy Output | 8.32 GWh annually |
| Type of the turbine | Dual operation Kaplan – Vertical Bulb turbine or K-tec |
| Efficiency of the flow variation | 60% |
| Generation | Synchronous/semi umbrella type |
| Generating Voltage | 6.6 kV |
| Frequency | 50 Hz |
| Line of connectivity and Voltage | 500 m/ 33 kV |

Cost and financial status

| | |
|---|---|
| Total Project Cost | 130 m SLRs |
| Equity of the Project Proponent | 40 % |
| Lending Banks | 60 % |
| Internal Rate of Return | > 18.46% |
| Royalty to MASL | 27 % from generated power |

Operational Conditions

Water operations - 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% |

Prior to this project activity, there was no hydropower plant belonging to project participant in that region. Hence the project should be considered as a Greenfield project activity. The project operates with irrigation water released from the Left Bank canal of Maduru Oya reservoir. The implementation project activity has not resulted in any increase of reservoir capacity or water level. Hence the project activity does not cause to emit methane emission from the seasonal flooding of the reservoir. Further, during the implementation of project activity, project proponent has not changed the initial design validated by the SLCCS GHG programme.

## 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 Wjesekara* |
| 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 | *Sustainability Analyst* |
| Address | *77, Sri Saranankara Rd, Dehiwala-Mount Lavinia (00600)* |
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| Fax | - |
| E-mail | *sithara@anunine.com* |

## 1.6. Project Start Date

Starting date of the Maduru Oya Left Bank Main Canal Drop at 24+140 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 of 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 Main Canal at 24+140 Drop 9 Mini Hydropower project intends to be registered under track II and issued carbon credits from project will only be used for internal offsetting of emissions.

Project falls within System B of Mahaweli Project and;

- Authorised Officer - Resident Project Manager (System B)
- Mahaweli Unit Manager office – Medagama
- Mahaweli Block Manager office – Sevanapitiya & the general information is as;
- Province – North Central Province
- District – Polonnaruwa
- DS office – Dimbulagala
- GN office – 256, Medagama
- Village – Medagama

The project site is located at 324 km from Colombo.

| | |
|---|---|
| Location of Project Activity | *Maduru Oya Left Bank Main Canal Sliuce* |
| Province | *North Central Province* |
| District | *Pollonnaruwa* |
| DS Division | *Maduru Oya* |
| City/Town | *Aralaganwilla* |
| Community | *Medagama* |
| Coordinates | *Latitudes - $7^0$ 86' 11 52" N*<br>*Longitudes - $81^0$ 16' 37" E* |

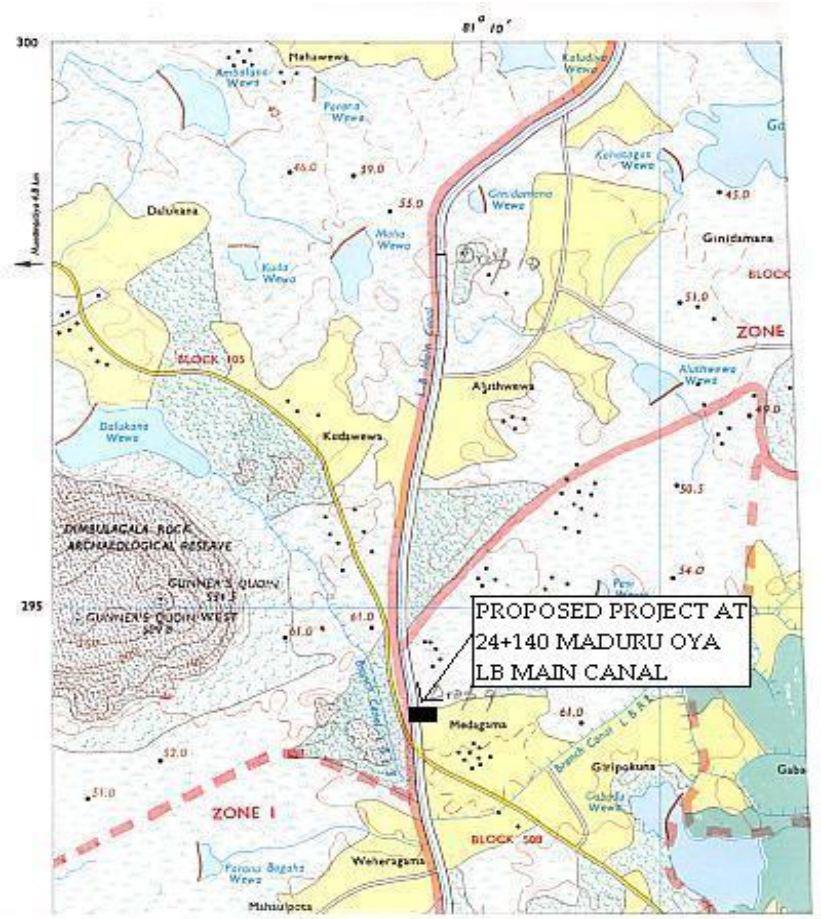


**Figure 1:** Location map on 1:50000 scale map (Source – Survey Department)

## 1.10. Title and Reference of Methodology

AMS-1.D "Grid connected renewable electricity generation" Version 18.0 & Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, version 03.3

## 1.11 Participation under other GHG Programs

This project is not registered under any other GHG programs.

## 1.12 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 2.0 MW grid connected hydro power project in Maduru Oya, Medagama, Dimbulagala, Polonnaruwa District in Sri Lanka and this project is intended to be registered as a renewable energy generation project under Sri Lanka Carbon Crediting Scheme (SLCCS). The project activity received all national and regional approval needed for the operation and subsequently commissioned successfully on 19th December 2013. The entire power generated from this project is being sold to Ceylon Electricity Board through a power purchase agreement with CEB. During the monitoring

period, project has generated and exported 11,633.507 MWh of electricity to the national grid. As a result of this contribution, the project has effectively reduced emissions by 8,736 $tCO_{2e}$, which would have otherwise been released into the environment in the absence of the project activity.

| **Eagle Power Project** | **Technical specification** | | |
|---|---|---|---|
| **General** | Catchment Area | | 453 km2 |
| | Average Annual Catchment Rainfall | | 1000 mm – 4000mm |
| | Average Flow | | 22 $m^3/s$ |
| | Gross Head | | 11.5 m |
| | Installed Capacity | | 2 MW |
| | Mean Annual energy generation | | 10.5 GWh |
| **Outlet Channel** | Type | | Reinforced concrete, |
| | Length | | 100m |
| | Height | | 4300mm |
| | Inner Width | | 6000mm |
| | Flow depth at design flow | | |
| | Hydraulic slope | | 0.001 |
| **Penstock** | Type | | Single welded steel pipe |
| | Length | | 15m |
| | Inner diameter | | 3120mm |
| | Gross Head | | 11.5 m |
| **Powerhouse** | Size of Building | | 13 m x 25 m x 30 m |
| | Hydraulic Turbine | Type | Horizontal – Kaplan, 2000kW |
| | | Rated Flow | 22 $m^3/s$ |
| | Generator | Type | Synchronous, 2500kVA |
| | | Operating Speed | 250RPM |

## 2.2 Deviations

### 2.2.1 Methodology Deviations

No any methodological deviations to be reported for this project activity

### 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 drop at 24 + 140 | 2 | 31st December 2007 |

These clearances by CEA reflect the finding that the environment impacts of this projects 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.

Environmental impact assessment

- 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

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 2 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 November 2008. 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 LB Main Canal Drop at 24+140 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 participant 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.

### 3.3 AFOLU-Specific Safeguards

Not applicable

## 4. Data and Parameters

### 4.1 Data and Parameters Available at Validation

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 tCO2e/MWh |
| 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 | Mass unit/ Volume unit |
| Description | Weighted average density of generator fuel (Diesel) |

| | |
|---|---|
| Source of data | Values provided by national fuel supplier, Ceylon Petroleum Corporation (CEYPETCO) |
| Value applied | 840 kg/$m^3$ |
| 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 are 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 GJ/kg |
| 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 Chapter1 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 CO2 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/year |
| 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 | 11,633.507 MWh |
| Monitoring equipment | Energy meters<br>Accuracy class of the meters- class 01<br>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.<br>Testing/Calibration interval : Annually by CEB<br>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/year |
| 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 L |
| 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.<br><br>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. |

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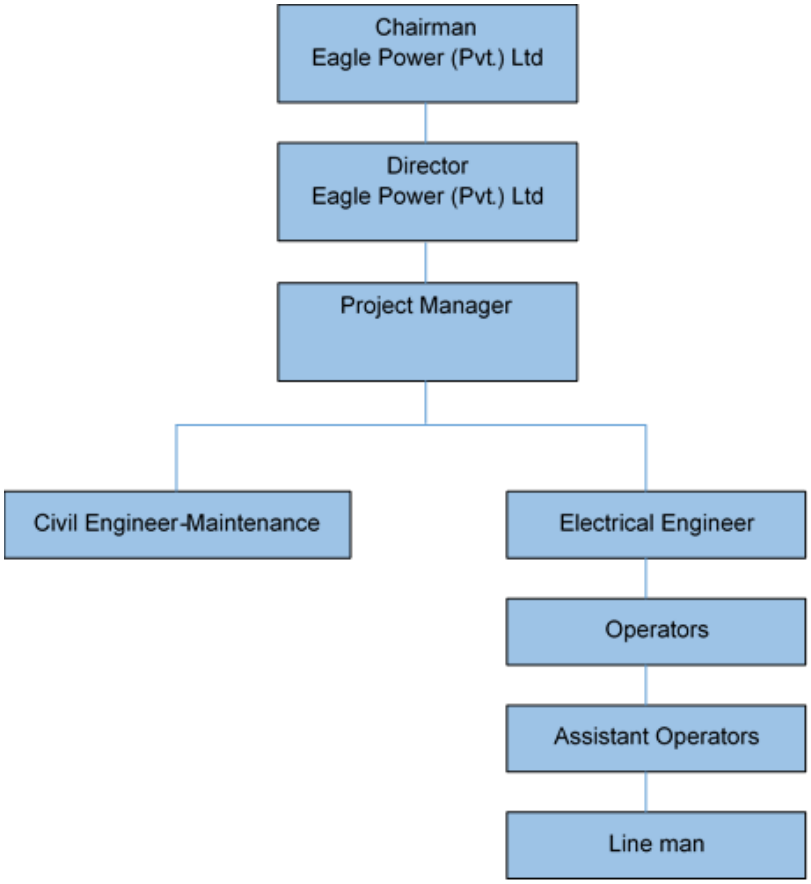
### 4.3 Description of the Monitoring Plan

The authority and responsibility for registration and overall monitoring rested with the Director of the Eagle Power (Pvt.) Ltd. Subsequently, the management of the power plant delegated the authority to the Project Manager, who was tasked with ensuring the proper operation of the power plant and its monitoring activities. The project Manager is assisted by a group of staff including engineers and operators. Power house operating staff are responsible for maintaining records and formats required for the monitoring mechanism. 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 are 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.

**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 team**

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 $EG_{p,j,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor "

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

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. Ver18.0, 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.

**Baseline Emission Calculation**

*Project Emissions –year 2021*

| Parameter | Value | Units | Source |
|---|---|---|---|
| Average Energy Output | 5,162.929 | MWh/year | Calculated |
| Emission Factor | 0.7512 | tCO2e/MWh | Energy Balance-2020, SLSEA |
| Emission Reduction | 3,878 | tCO2e/year | Calculated |

*Project Emissions –year 2022*

| Parameter | Value | Units | Source |
|---|---|---|---|
| Average Energy Output | 6,470.578 | MWh/year | Calculated |
| Emission Factor | 0.7512 | tCO2e/MWh | Energy Balance-2020, SLSEA |
| Emission Reduction | 4,860 | tCO2e/year | Calculated |

## 5.2 Project Emissions

As per the validated CMA, project emissions was calculated using the methodological guidance of *CDM tool: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, version 03.0*

*Project Emissions –year 2021*

| Parameter | Value | Units | Source |
|---|---|---|---|
| Quantity of fuel combustion | 200 | L | Calculated |
| | 0.2 | $m^3$ | |
| 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 | tCO2e/GJ | IPCC Guideline, 2006 |
| Project emission from combustion of diesel | 0.54 | tCO2e/year | Calculated |
| Rounded emission for conservativeness | 1 | tCO2e/year | Calculated |

*Project Emissions –year 2022*

| Parameter | Value | Units | Source |
|---|---|---|---|
| Quantity of fuel combustion | 200 | L | Calculated |
| | 0.2 | $m^3$ | |
| 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 | tCO2e/GJ | IPCC Guideline, 2006 |
| Project emission from combustion of diesel | 0.54 | tCO2e/year | Calculated |
| Rounded emission for conservativeness | 1 | tCO2e/year | Calculated |

**Hence,** PEy = 2 tCO2e

Overview of project emissions as per paragraph 39 & 40 of AMS I.D. Ver18.0 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.<br><br>○ Emissions related to the operation of geothermal power plants (e.g. non condensable gases, electricity/fossil fuel consumption);<br><br>○ Emissions from water reservoirs of hydropower plants. | No.<br><br>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 Main Canal at 24+140 Drop 9 Mini Hydro Power Project located in the Maduru Oya Left Bank Main Canal Regulator 09, at 24 + 140 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.<br><br>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. No fossil fuels consumption for the project activity.

Hence,

LEy =0

## 5.4 Net of GHG Emission Reductions and Removals

Emissions reductions are calculated as follows:

ERy = BEy – PEy - LEy

Since LEy = 0;

ERy = BEy – PEy

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)** | 3878 | 1 | 0 | 3877 |
| Year 2022 **(01.01.2022-31.12.2022)** | 4860 | 1 | 0 | 4859 |
| Total | 8738 | 2 | 0 | 8736 |

## 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 ($tCO_2e$) | 8272 | 8,736 |

### 5.6 Remarks on difference from estimated value in the CMA

The variance between the theoretical and practical 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 to support agricultural activities. As a result, the actual plant factor has experienced a marginal rise (36.1%), surpassing the initially designated plant factor of 34.3% used in the ex-ante emission reduction calculations of CMA version 03.

**APPENDIX:** Contact information on 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) |
| City: | Polonnaruwa |
| State/Region: | North central Province |
| Country: | Sri Lanka |
| Telephone: | 0777 260660 |
| Fax: | |
| E-Mail: | |
| URL: | |
| Represented by: | |
| Title: | |
| Last Name: | |
| Middle Name: | |
| First Name: | |
| Department: | |
| Mobile: | |
| Direct FAX: | |
| Direct tel: | |
| Personal E-Mail | |

Document Information

| | |
|---|---|
| Title of document | Monitoring Report |
| Document No | SLCCS-MON-FRM |
| Document Type | Form |

| | |
|---|---|
| Business Function | Monitoring the Project Activity |
| Version | 03.0 |

Revisions

| Version | Date | Description |
|---|---|---|
| 01.0 | 21-08-2019 | Initial issuance |
| 02.0 | 20-10-2019 | Editorial changes |
| 03.0 | 02-02-2021 | Editorial changes |