



**Verified Carbon  
Standard**

## 2<sup>ND</sup> MONITORING REPORT DAK PSI 3 AND 4 HYDROPOWER PROJECT

Document Prepared by Kyoto Energy Pte Ltd

|                          |                                              |
|--------------------------|----------------------------------------------|
| <b>Project Title</b>     | <i>Dak Psi 3 and 4 Hydropower Project</i>    |
| <b>Version</b>           | <i>1.4</i>                                   |
| <b>Report ID</b>         | <i>P1209010_VCS_Monitoring_Report_2</i>      |
| <b>Date of Issue</b>     | <i>22-April-2022</i>                         |
| <b>Project ID</b>        | <i>1031</i>                                  |
| <b>Monitoring Period</b> | <i>01-September-2012 to 31-December-2014</i> |
| <b>Prepared By</b>       | <i>Kyoto Energy Pte Ltd</i>                  |
| <b>Contact</b>           | <i>info@kyotoenergy.net</i>                  |

## CONTENTS

|          |                                                                      |           |
|----------|----------------------------------------------------------------------|-----------|
| <b>1</b> | <b>PROJECT DETAILS.....</b>                                          | <b>3</b>  |
| 1.1      | Summary Description of the Implementation Status of the Project..... | 3         |
| 1.2      | Sectoral Scope and Project Type .....                                | 3         |
| 1.3      | Project Proponent .....                                              | 3         |
| 1.4      | Other Entities Involved in the Project .....                         | 4         |
| 1.5      | Project Start Date .....                                             | 4         |
| 1.6      | Project Crediting Period .....                                       | 4         |
| 1.7      | Project Location .....                                               | 4         |
| 1.8      | Title and Reference of Methodology .....                             | 5         |
| 1.9      | Participation under other GHG Programs.....                          | 5         |
| 1.10     | Other Forms of Credit .....                                          | 6         |
| 1.11     | Sustainable Development Contributions .....                          | 6         |
| <b>2</b> | <b>SAFEGUARDS .....</b>                                              | <b>8</b>  |
| 2.1      | No Net Harm.....                                                     | 8         |
| 2.2      | Local Stakeholder Consultation .....                                 | 8         |
| 2.3      | AFOLU-Specific Safeguards .....                                      | 10        |
| <b>3</b> | <b>IMPLEMENTATION STATUS .....</b>                                   | <b>10</b> |
| 3.1      | Implementation Status of the Project Activity .....                  | 11        |
| 3.2      | Deviations .....                                                     | 12        |
| 3.3      | Grouped Projects.....                                                | 12        |
| <b>4</b> | <b>DATA AND PARAMETERS.....</b>                                      | <b>13</b> |
| 4.1      | Data and Parameters Available at Validation .....                    | 13        |
| 4.2      | Data and Parameters Monitored .....                                  | 14        |
| 4.3      | Monitoring Plan .....                                                | 16        |
| <b>5</b> | <b>QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS.....</b>   | <b>20</b> |
| 5.1      | Baseline Emissions.....                                              | 20        |
| 5.2      | Project Emissions.....                                               | 21        |
| 5.3      | Leakage .....                                                        | 22        |
| 5.4      | Net GHG Emission Reductions and Removals.....                        | 22        |
|          | <b>APPENDIX 1: INSTRUMENT MANIFEST .....</b>                         | <b>24</b> |

# 1 PROJECT DETAILS

## 1.1 Summary Description of the Implementation Status of the Project

The purpose of the project activity is to generate renewable electricity from a run-of-river hydropower plant. Renewable electricity is exported to the Vietnamese national grid system and, in doing so, the project reduces greenhouse gas emissions. This is achieved by displacing generation by more traditional, fossil fuel dependent methods that lead to anthropogenic emissions of carbon dioxide and other greenhouse gasses (the baseline scenario).

The project is a run-of-river hydropower project with 2 cascades namely Dak Psi 3 and Dak Psi 4. The project has an installed capacity of 45 MW. The power generated by the project is exported to the Viet Nam national grid through a 110 kV transmission line. Details of the equipment used in the project are provided in section 3.1.

The project was registered as a CDM project (number 4891) on 06-November-2011 and started commercial operations on 09-October-2010 (Dak Psi 4) and 29-August-2012 (Dak Psi 3). The monitoring period for this report is 01-September-2012 to 31-December-2014.

The project activity has generated a total of 254,428 tCO<sub>2</sub>e emission reductions during the current proposed VCS monitoring period.

## 1.2 Sectoral Scope and Project Type

Sectoral scope: 1. Energy industries (renewable - / non-renewable sources)

Project Type: Renewable Energy Projects

The project activity is not a grouped project.

## 1.3 Project Proponent

|                   |                                                                   |
|-------------------|-------------------------------------------------------------------|
| Organization name | Dak Psi Hydropower Investment and Development Joint Stock Company |
| Contact person    | Mr. Vu Quang Bao                                                  |
| Title             | Director                                                          |

|           |                                                                                               |
|-----------|-----------------------------------------------------------------------------------------------|
| Address   | Thuy dien Dak Mi 1 building, Dak Choong commune, Dak Glei district, Kon Tum province, Vietnam |
| Telephone | +84 59 3867070                                                                                |
| Email     | -                                                                                             |

#### 1.4 Other Entities Involved in the Project

|                     |                                                           |
|---------------------|-----------------------------------------------------------|
| Organization name   | Kyoto Energy Pte Ltd                                      |
| Role in the Project | Consultant / Credit buyer                                 |
| Contact person      | Mr. Michel Buron                                          |
| Title               | Director                                                  |
| Address             | 2 Venture Drive #11-15 Vision Exchange, Singapore 608 526 |
| Telephone           | +33 6 38 94 97 87                                         |
| Email               | Michel.buron@kyotoenergy.net                              |

#### 1.5 Project Start Date

According to VCS Standard, the project start date is the date on which the project began generating GHG emission reductions or removals. Hence for the project, start date is considered as the Commercial Operation Date (COD) which is 09-October-2010.

#### 1.6 Project Crediting Period

The crediting period started on 09-October-2010 and ended on 05-November-2018 (the date when the CDM crediting period expired). This gives a total crediting period of 8 years, and 27 days. While the original VCS crediting period was 10 years and renewable twice, the final crediting period was determined by the CDM crediting period which was not extended.

#### 1.7 Project Location

- (a) Host Party(ies): Socialist Republic of Viet Nam
- (b) Region/ State/ Province, etc.: Kon Tum Province
- (c) City/ Town/ Community, etc.: Dak Ha and Tu Mo Rong Districts
- (d) Physical/ Geographical location: Latitude of 14°46'30"N and longitude of 107°59'50"E



As the project is registered under the Clean Development Mechanism, it employs the methodologies and tools as below:

ACM0002, Consolidated Methodology for Grid Connected Electricity Generation from Renewable Sources, Version 12.1.0.

- Tool for the demonstration and assessment of additionality (Version 5.2)
- Tool to calculate the emission factor of an electricity system (Version 1.1)

The project is registered under the Clean Development Mechanism. Details are as below:

5

Project Number: 4891

Date of Registration: 06-November-2011

Issuance details:

Date of Issuance: 27-March-2013

Monitoring period: 06-November-2011 to 31-August-2012

Amount of Certified Emission Reductions: 60,836

### 1.10 Other Forms of Credit

The project does not participate in any other Emission Trading Programs and the GHG emission reductions generated during the current crediting program have not been used for compliance under any programs or mechanisms.

No other forms of GHG related environmental credits have been sought for this project.

### 1.11 Sustainable Development Contributions

The project has positive impacts with respect to the environment (offsetting fossil fuel use and lowering greenhouse gas emissions), society (providing jobs, development of roads), technologically (technology transfer) and economy (satisfying growing energy demands to allow the country and region to develop and alleviate poverty).

Among these contributions, the avoidance of greenhouse gas emissions is quantifiable and is thus described below.

Table 1: Sustainable Development Contributions

| Row number | SDG Target | SDG Indicator                                         | Net Impact on SDG Indicator                                                                            | Current Project Contributions                                             | Contributions Over Project Lifetime                                                                                      |
|------------|------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1)         | 13.0       | Tonnes of greenhouse gas emissions avoided or removed | Implemented activities to avoid generation of electricity through more greenhouse gas intensive means. | For this period, a total of 254,428 tCO <sub>2</sub> e have been avoided. | Avoided a total of 394,808 tCO <sub>2</sub> e over the life of the project (up to and including this monitoring period). |

## 2 SAFEGUARDS

### 2.1 No Net Harm

As per the Environmental Impact Assessment developed prior to the implementation of this project, the potential environmental and socio-economic impacts of the project were not considered as significant and were mainly temporary (related to the development rather than the operation of the project).

In addition, the project owner follows an environmental monitoring plan and strictly complies with all related Vietnamese laws.

### 2.2 Local Stakeholder Consultation

The meeting with stakeholders for Dak Psi and 4 Hydropower projects was held at the project administration house on 09-April-2010, at 10 am by Dak Psi Hydropower Investment and Development Joint Stock Company in cooperation with their consultant. Prior to the consultation, an invitation advertisement was placed in the Lao Dong Newspaper and personal invitations made to local community leaders, media, and People's Committee representatives. The participants included representatives of the Department of National Resources and Environment of Tu Mo Rong district, the Chairman of Dak Ha communes and local inhabitants. During the consultation, besides the key points of the project activities, the presentation made by the project owner and consultant also explained, in a non-technical manner, about the environmental and other impacts of the project, climate change, the role of the Clean Development Mechanism as well as annual emission reductions potential of the project. At the end of the presentation, the attendees were encouraged to present their views and questionnaires were provided and opinions elicited from 24 participants.

Stakeholders commented Pros and Cons of executing the mentioned hydropower projects and it was observed that the projects effect positively to environment and locals' lives as well. Opinion varied when mentioning adverse impacts of the projects that are listed below:

- Over 30% comments were about the impacts of construction and operation of hydropower project as it might have an effect on the natural resources or ecosystem as well as human habitat
- 20% of attendees said the projects would handle or release harmful waste substances (including solid waste) and hazardous materials which were harmful to human health and environment
- Nearly 50% of the attendees worried that the projects could contaminate land or water

- Nearly 40% of attendees thought that the projects would lead to changes in households and jobs. But it was clear that the projects will undoubtedly create jobs for local people both construction and operation phases.

- 20% of the attendees talked about the possibility of earthquakes in the region

A positive aspect about the project improving road and infrastructure was seen by nearly 30% of the respondents.

Concerns about noise and vibration of the projects, the possibility of accidents during construction and operation were raised by 4 people each. Several people (4) stated that areas important for their landscape, historic, cultural or other value may be affected by the project as well as were worried about the flora and fauna in the area. 3 people also commented on the visibility of the project, the presence of areas some are important or sensitive for reasons of their ecology near the project.

In general, the project received positive response from the local community. They foresaw positive impacts from the social, economic and environmental aspects of the project.

The project owner thanked everyone for coming to the meeting as well as those who contributed.

Following the questions raised by stakeholders, the project owner explained the following:

- The impact on natural resources such as water would be minimal and would be monitored as per Environmental law
- Wastes from the project, especially during construction, would be handled properly as per relevant laws and standards
- Proper measures would be taken to ensure that the project did not pollute the land or water, as per the EIA which had been approved by local authorities
- The project owner assured the people about the creation of jobs by the project

The project owner also explained that impact on local flora and fauna would be limited and monitored as per the EIA provisions. Also explained were strategies for compensating land losses and other assets, restoring income and livelihoods, relocating affected homes and assistance to be given to vulnerable groups in strict compliance with law. The project owner committed to provide adequate and appropriate compensation, commensurate with the needs, aspirations and demands of affected people. Advanced equipment and techniques would be used during both construction and operation to ensure that the impacts of noise, vibration, and accidents would be reduced.

The project has a representative at site who is in charge of receiving and acting upon any issues faced by the community members. As confirmed during an interview with local community leaders during the verification, no issues were raised during the monitoring period.



Figure 2: Picture of stakeholder consultation on 09 April 2010

### 2.3 AFOLU-Specific Safeguards

N/A as this is project does not involve AFOLU.

## 3 IMPLEMENTATION STATUS

### 3.1 Implementation Status of the Project Activity

The project has been operational since 09-October-2010.

The electricity generated from the hydropower plant is connected to the National Grid through a new 110 kV single circuit transmission line from 110 kV Transformer Station.

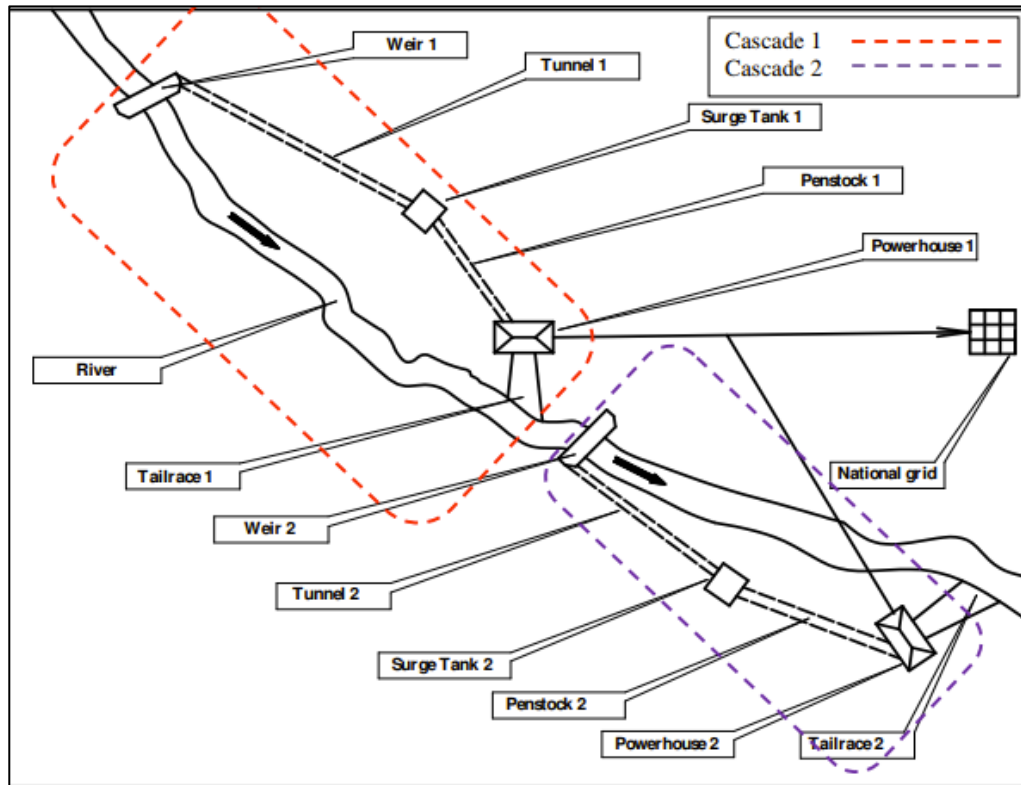


Figure 3: Project Overview

The project activity has a total installed capacity of 45 MW, with the Dak Psi 3 Cascade with 3 units each with an installed capacity of 5 MW and the Dak Psi 4 Cascade with 3 units each with an installed capacity of 10 MW.

The key equipment utilized in the project is described in the table below:

Table 2 : Key technologies utilized

| Dak Psi 3 | Item     | Specification                    |
|-----------|----------|----------------------------------|
| Turbine   | Model    | Francis Turbine- horizontal axis |
|           | Quantity | 3                                |
|           | Capacity | 5.208 MW                         |

|                  |             |                                              |
|------------------|-------------|----------------------------------------------|
|                  | Rate speed  | 500 rpm                                      |
| <b>Generator</b> | Model       | 3 phase synchronization with horizontal axis |
|                  | Quantity    | 3                                            |
|                  | Capacity    | 5 MW                                         |
|                  | Rated speed | 500 rpm                                      |

| <b>Dak Psi 4</b> | <b>Item</b> | <b>Specification</b>                         |
|------------------|-------------|----------------------------------------------|
| <b>Turbine</b>   | Model       | Francis Turbine, horizontal axis             |
|                  | Quantity    | 3                                            |
|                  | Capacity    | 10.3093 MW                                   |
|                  | Rate speed  | 500 rpm                                      |
| <b>Generator</b> | Model       | 3 phase synchronization with horizontal axis |
|                  | Quantity    | 3                                            |
|                  | Capacity    | 10 MW                                        |
|                  | Rated speed | 500 rpm                                      |

No specific events have taken place during this monitoring period.

## 3.2 Deviations

### 3.2.1 Methodology Deviations

None

### 3.2.2 Project Description Deviations

None

## 3.3 Grouped Projects

N/A

## 4 DATA AND PARAMETERS

### 4.1 Data and Parameters Available at Validation

|                                                                                              |                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                                             | EF <sub>grid,CM,y</sub>                                                                                                                                                                                                                            |
| Data unit                                                                                    | tCO <sub>2</sub> /MWh                                                                                                                                                                                                                              |
| Description                                                                                  | Combined margin CO <sub>2</sub> emission factor for grid connected power generation                                                                                                                                                                |
| Source of data                                                                               | As per “Tool to calculate the emission factor for an electricity system” and Combined Margin defined in issued “Study, Definition of Viet Nam Grid Emission Factor, 2009 by the Department of Meteorology, Hydrology and Climate and issued by DNA |
| Value applied                                                                                | 0.5764                                                                                                                                                                                                                                             |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated as per “Tool to calculate the emission factor of an electricity system”                                                                                                                                                                 |
| Purpose of Data                                                                              | Calculation of baseline emissions                                                                                                                                                                                                                  |
| Comments                                                                                     | -                                                                                                                                                                                                                                                  |

|                                                                                              |                                                      |
|----------------------------------------------------------------------------------------------|------------------------------------------------------|
| Data / Parameter                                                                             | EF <sub>Res</sub>                                    |
| Data unit                                                                                    | kg CO <sub>2</sub> e/MWh                             |
| Description                                                                                  | Default emission factor for emission from reservoirs |
| Source of data                                                                               | Decision by EB23                                     |
| Value applied                                                                                | 90                                                   |
| Justification of choice of data or description of measurement methods and procedures applied | As per methodology                                   |
| Purpose of Data                                                                              | Calculation of baseline emissions                    |
| Comments                                                                                     | -                                                    |

|                  |                   |
|------------------|-------------------|
| Data / Parameter | CAP <sub>BL</sub> |
| Data unit        | W                 |

|                                                                                              |                                                                                                                                               |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Description                                                                                  | Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero |
| Source of data                                                                               | Project site                                                                                                                                  |
| Value applied                                                                                | 0                                                                                                                                             |
| Justification of choice of data or description of measurement methods and procedures applied | This is a greenfield power plant                                                                                                              |
| Purpose of Data                                                                              | Calculation of baseline emissions                                                                                                             |
| Comments                                                                                     | -                                                                                                                                             |

|                                                                                              |                                                                                                                                                             |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                                             | A <sub>BL</sub>                                                                                                                                             |
| Data unit                                                                                    | m <sup>2</sup>                                                                                                                                              |
| Description                                                                                  | Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m <sup>2</sup> ) |
| Source of data                                                                               | Project site                                                                                                                                                |
| Value applied                                                                                | 0                                                                                                                                                           |
| Justification of choice of data or description of measurement methods and procedures applied | This is a greenfield power plant with new reservoirs.                                                                                                       |
| Purpose of Data                                                                              | Calculation of baseline emissions                                                                                                                           |
| Comments                                                                                     | -                                                                                                                                                           |

## 4.2 Data and Parameters Monitored

|                                    |                                                                                                      |
|------------------------------------|------------------------------------------------------------------------------------------------------|
| Data / Parameter                   | EG <sub>facility,y</sub>                                                                             |
| Data unit                          | MWh                                                                                                  |
| Description                        | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y      |
| Source of data                     | Project activity site                                                                                |
| Description of measurement methods | Bi-directional electricity meters to account for both export and import to arrive at net electricity |

| and procedures to be applied      |                                                                                                                                                                                                                                                                                |      |                  |      |        |      |         |      |         |       |         |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|------|--------|------|---------|------|---------|-------|---------|
| Frequency of monitoring/recording | Continuous measurement and at least monthly recording                                                                                                                                                                                                                          |      |                  |      |        |      |         |      |         |       |         |
| Value monitored                   | <table border="1"> <thead> <tr> <th>Year</th><th>Generation (MWh)</th></tr> </thead> <tbody> <tr> <td>2012</td><td>64,126</td></tr> <tr> <td>2013</td><td>199,552</td></tr> <tr> <td>2014</td><td>177,731</td></tr> <tr> <td>Total</td><td>441,408</td></tr> </tbody> </table> | Year | Generation (MWh) | 2012 | 64,126 | 2013 | 199,552 | 2014 | 177,731 | Total | 441,408 |
| Year                              | Generation (MWh)                                                                                                                                                                                                                                                               |      |                  |      |        |      |         |      |         |       |         |
| 2012                              | 64,126                                                                                                                                                                                                                                                                         |      |                  |      |        |      |         |      |         |       |         |
| 2013                              | 199,552                                                                                                                                                                                                                                                                        |      |                  |      |        |      |         |      |         |       |         |
| 2014                              | 177,731                                                                                                                                                                                                                                                                        |      |                  |      |        |      |         |      |         |       |         |
| Total                             | 441,408                                                                                                                                                                                                                                                                        |      |                  |      |        |      |         |      |         |       |         |
| Monitoring equipment              | Main meter (MM) and backup meters (BM1 and BM2) in case of failure<br>See Appendix 1 for details.                                                                                                                                                                              |      |                  |      |        |      |         |      |         |       |         |
| QA/QC procedures to be applied    | Cross check measurement results with records for sold and purchased electricity. Meters calibrated at least every two years <sup>1</sup> .                                                                                                                                     |      |                  |      |        |      |         |      |         |       |         |
| Purpose of the data               | Calculation of baseline emissions                                                                                                                                                                                                                                              |      |                  |      |        |      |         |      |         |       |         |
| Calculation method                | -                                                                                                                                                                                                                                                                              |      |                  |      |        |      |         |      |         |       |         |
| Comments                          | -                                                                                                                                                                                                                                                                              |      |                  |      |        |      |         |      |         |       |         |

|                                                                 |                                                                                                      |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                | CAP <sub>BJ</sub>                                                                                    |
| Data unit                                                       | W                                                                                                    |
| Description                                                     | Installed capacity of the hydro power plant after the implementation of the project activity         |
| Source of data                                                  | Project Site                                                                                         |
| Description of measurement methods and procedures to be applied | Determine the installed capacity based on recognized standards (Name plates of generating equipment) |
| Frequency of monitoring/recording                               | Yearly                                                                                               |
| Value monitored                                                 | 45,000,000                                                                                           |
| Monitoring equipment                                            | N/A                                                                                                  |
| QA/QC procedures to be applied                                  | -                                                                                                    |

<sup>1</sup> Following the first CDM verification, calibration frequency of once in two years as per decision no. 25/2007/QD-BKHCN has been adopted.

|                     |                                  |
|---------------------|----------------------------------|
| Purpose of the data | Calculation of project emissions |
| Calculation method  | Not applicable                   |
| Comments            | -                                |

|                                                                 |                                                                                                                                       |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                | A <sub>PJ</sub>                                                                                                                       |
| Data unit                                                       | m <sup>2</sup>                                                                                                                        |
| Description                                                     | Surface area of the reservoir measured after the implementation of the project activity, when the reservoir is full (m <sup>2</sup> ) |
| Source of data                                                  | Project Site                                                                                                                          |
| Description of measurement methods and procedures to be applied | Measured from topographical surveys, maps, satellite pictures, etc<br>Yearly measurement                                              |
| Frequency of monitoring/recording                               | Annual measurement                                                                                                                    |
| Value monitored                                                 | 475,000                                                                                                                               |
| Monitoring equipment                                            | N/A                                                                                                                                   |
| QA/QC procedures to be applied                                  | -                                                                                                                                     |
| Purpose of the data                                             | Calculation of project emissions                                                                                                      |
| Calculation method                                              | Not applicable                                                                                                                        |
| Comments                                                        | -                                                                                                                                     |

## 4.3 Monitoring Plan

### Description of the monitoring system

The system is composed of three energy meters (1 main and 2 backups) belonging to the grid operator EVN and used as the source of data for the calculation of emission reductions.

The location of each instrument is indicated schematically in the monitoring diagram shown in Figure 4.

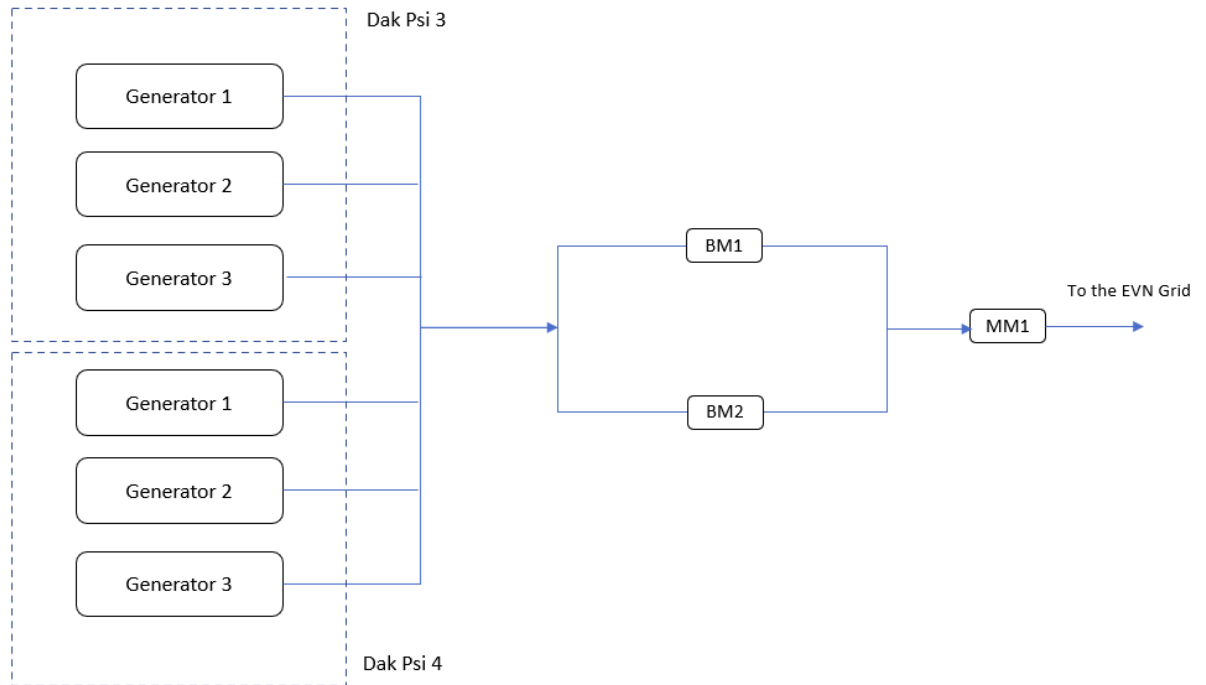


**Figure 4: Schematic representation of the meters location on the electric circuit**

### Organizational structure, responsibilities, and competencies.

The monitoring team is composed of the following staff:

| Report to:                                                        | Position                        |
|-------------------------------------------------------------------|---------------------------------|
| Dak Psi Hydropower Investment and Development Joint Stock Company | Site manager                    |
|                                                                   | Site supervisor                 |
|                                                                   | Operator Head of Shift          |
|                                                                   | Operators (3 per shift)         |
| Kyoto Energy Pte Ltd                                              | CDM Consultant/ Project manager |

**Table 2: CDM Monitoring Team Details**

| #                          | Tasks description (and frequency) | Operator | Supervisor | Site manager / Project director | CDM consultant Project manager |
|----------------------------|-----------------------------------|----------|------------|---------------------------------|--------------------------------|
| <b>Monitoring activity</b> |                                   |          |            |                                 |                                |

| #                                                           | Tasks description (and frequency)                                                                                                 | Operator | Supervisor | Site manager / Project director | CDM consultant Project manager |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|------------|---------------------------------|--------------------------------|
| 1                                                           | Rec\ "?,l '/.ording of manual data                                                                                                | ✓        |            |                                 |                                |
| <b>Quality Assurance &amp; Quality Control</b>              |                                                                                                                                   |          |            |                                 |                                |
| 2                                                           | Verification of data monitored (consistency and completeness)                                                                     |          | ✓          |                                 |                                |
| 3                                                           | Ensuring adequate training of staff                                                                                               |          | ✓          |                                 |                                |
| 4                                                           | Ensuring adequate maintenance                                                                                                     |          | ✓          |                                 |                                |
|                                                             | Ensuring calibration of monitoring instruments                                                                                    |          | ✓          |                                 |                                |
| 5                                                           | Data archiving: ensuring adequate storage of data monitored (integrity and backup): 2 years after the end of the crediting period |          |            | ✓                               |                                |
| 6                                                           | Identification of non-conformance and corrective/preventive actions and monitoring plan improvement                               |          | ✓          |                                 |                                |
| 7                                                           | Emergency procedures                                                                                                              |          | ✓          |                                 |                                |
| 8                                                           | External audit                                                                                                                    |          |            |                                 | ✓                              |
| <b>Calculation of GHG emission reductions and reporting</b> |                                                                                                                                   |          |            |                                 |                                |
| 9                                                           | Processing of data and calculation of emission reductions                                                                         |          |            | ✓                               |                                |
| 10                                                          | Monitoring report: management review of monitoring report (internal audit)                                                        |          |            | ✓                               |                                |

**Table 3: Allocation of monitoring responsibilities**

The monitoring staff are trained engineers and/or technicians who are well versed with the operations of the power plant and are responsible for monitoring not only for the purposes of emission reduction accounting but also for the sale of electricity which is the core business of the facility. In addition to technical knowledge and experience, annual training is given to the monitoring team to teach/refresh the procedures for monitoring in accordance with the monitoring plan.

## Description of methods for generating, recording, storing, aggregating, collating and reporting data on monitored parameters

The log files are kept for a minimum of 2 years after the end of the last crediting period by using paper documents and electronic files.

The log files are stored on various media (CD-ROM and hard disks) at several locations (plant, headquarters and consultant server).

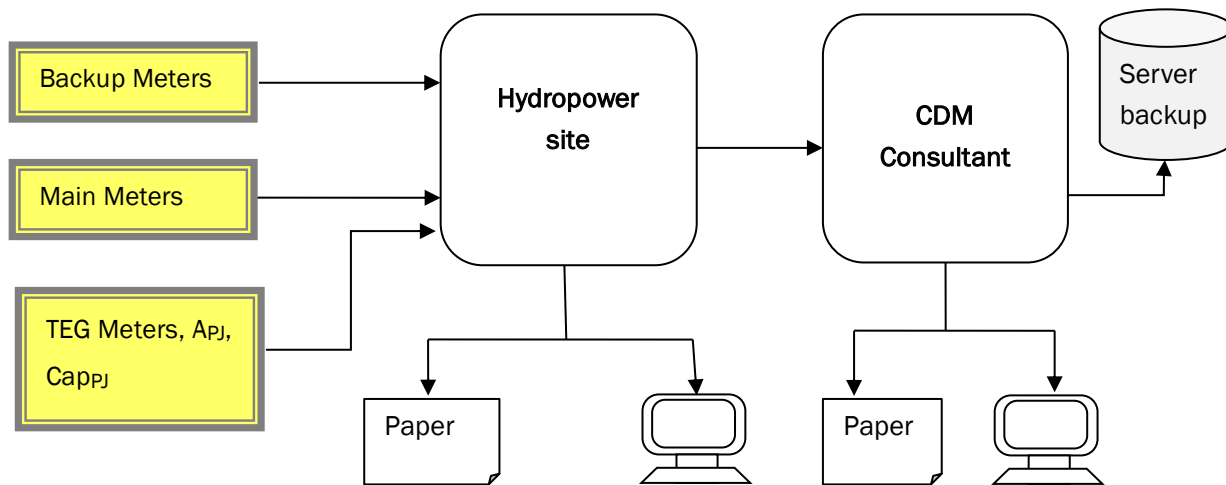


Figure 5: Monitoring data flow chart

The daily internal record procedure is as follows: Everyday at midnight the operator on duty takes the current reading of the 3 main meters and records the values.

The preparation of the EVN receipt is as follows: At the end of every month, representatives of the project and of Central Power Company come to the site. The meters keep in their memory the values recorded at the end of the last day of previous month, so that they can take a joint reading and prepare the receipt together. Readings are taken for both main and backup meters. The sale receipt prepared at the site serves as basis for the payment.

The external audit was performed by the consultant for the crediting period. The internal audit of the monitoring report was performed by the responsible entity of the project participant.

## Internal auditing and non-conformities

### Internal auditing:

- **Data treatment and verification:**

A verification of the data recorded was performed by:

- The spot check of field instruments by staff; and

- The comparison between the main meter and backup meters.
- **Maintenance and calibration of monitoring instrument:**  
Calibration takes place to ensure that the monitoring equipment is correctly installed and functioning properly.

## Non-conformities

Non-conformities are internally defined as any incidents affecting the project's monitoring. (e.g.: calibration delay, data loss, instrument malfunction, change in project implementation, etc.) They feature various severities and some of them may lead to data reconstruction (emergency procedure), request for deviation or revision of the monitoring plan, whereas some others may not require any particular corrective measures (e.g.: temporary grid outage).

In the event that the metering system suffers any failure, damage and unexpected problems, or if any errors in the main metering systems are detected during calibration, the electricity exported will be identified as follows.

- Using the results of the backup system
- Should the backup system also suffer a breakdown, the electricity exported is proposed by reconstructing data by means of trend analysis (taking a conservative approach)

The above is also in line with the procedures stipulated in the power purchase agreement (PPA).

# 5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 5.1 Baseline Emissions

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

Since:  $EG_{PJ,y} = EG_{facility,y}$

Hence:  $BE_y = EG_{facility,y} * EF_{grid,CM,y}$

| Where:            | Description                                                                                                                | Units                  | ID/value |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------|----------|
| $BE_y$            | Baseline Emissions                                                                                                         | tCO <sub>2e</sub>      | 254,428  |
| $EG_{facility,y}$ | Quantity of net electricity generation supplied by the project plant/unit to the grid during the current monitoring period | MWh                    | 441,408  |
| $EF_{grid,CM,y}$  | CO <sub>2</sub> emission factor in year y                                                                                  | tCO <sub>2e</sub> /MWh | 0.5764   |

## 5.2 Project Emissions

| <b>Power density:</b> $PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$ |                                                                                                                                                                                                           |                  |            |
|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------|
| Where:                                                                   | Description                                                                                                                                                                                               | Units            | ID/value   |
| PD                                                                       | Power density of the project activity                                                                                                                                                                     | W/m <sup>2</sup> | 94.7       |
| $Cap_{PJ}$                                                               | Installed capacity of the hydropower plant after the implementation of the project activity                                                                                                               | W                | 45,000,000 |
| $Cap_{BL}$                                                               | Installed capacity of the hydropower plant before the implementation of the project activity (W). For new hydropower plants, this value is zero                                                           | W                | 0          |
| $A_{PJ}$                                                                 | Area of the reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoirs are full                                                               | m <sup>2</sup>   | 475,000    |
| $A_{BL}$                                                                 | Area of the reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoirs are full (m <sup>2</sup> ). For the new reservoir, this value is zero | m <sup>2</sup>   | 0          |

Because the power density of the project is greater than 10 W/m<sup>2</sup>, the project emissions are zero.

### 5.3 Leakage

As per the registered methodology, no leakage emissions are to be considered.

$$LE_y = 0$$

### 5.4 Net GHG Emission Reductions and Removals

| Year  | Baseline emissions or removals (tCO <sub>2</sub> e) | Project emissions or removals (tCO <sub>2</sub> e) | Leakage emissions (tCO <sub>2</sub> e) | Net GHG emission reductions or removals (tCO <sub>2</sub> e) |
|-------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------|--------------------------------------------------------------|
| 2012  | 36,962                                              | 0                                                  | 0                                      | 36,962                                                       |
| 2013  | 115,022                                             | 0                                                  | 0                                      | 115,022                                                      |
| 2014  | 102,444                                             | 0                                                  | 0                                      | 102,444                                                      |
| Total | 254,428                                             | 0                                                  | 0                                      | 254,428                                                      |

This monitoring period consisted of 851 days. As per the registered PDD, the average annual emission reductions were 88,752 tCO<sub>2</sub>e which implies ex-ante reductions of 206,926 tCO<sub>2</sub>e over the monitoring period implying an overperformance of nearly 23%. However, the annual ex-ante emission reductions considered two stages – the first stage with only one cascade operational expected annual reductions of 64,576 tCO<sub>2</sub>e and the second stage with both cascades operational achieving 98,423 tCO<sub>2</sub>e. As both cascades were operational during this monitoring period, a more accurate estimate of ex-ante emission reductions is 229,474 tCO<sub>2</sub>e (based on 98,423 tCO<sub>2</sub>e per annum). Based on this value, the achieved emission reductions were somewhat higher (~11%) than expected.

On an annual basis, the ex-ante emission reductions (and net electricity generation), were 13% higher than predicted in 2012, 17% higher in 2013, and 4% higher in 2014. Given that the net generation and ex-ante emission reductions are based on plant load factors probabilistically determined over the life of the project, it is appropriate to consider variations over the longer periods (in this case the monitoring period) rather than on an annual basis. Annual variations are quite normal and to be expected – especially with projects, such as this one, with small run of the river reservoirs whose generation is directly and strongly affected by rainfall patterns. The predicted values of plant load factor at the time of registration of the project were 45.60% and 43.5% for the first and second cascades respectively. While over the long term, the generation and emission reductions are expected to approach the estimated values, annual variations are quite normal. For the period under consideration the combined plant load

factor is found to be 48% which, while higher than expected, is quite close to the predicted values and well within the variation expected.

# APPENDIX 1: INSTRUMENT MANIFEST

| Meter Id     | Tag | Model, Serial number and manufacturer                    | Accuracy Class | Date of Initial Calibration (prior to calibration period) <sup>2</sup> | Date of Subsequent Calibration | Validity Date of Calibration | Event |
|--------------|-----|----------------------------------------------------------|----------------|------------------------------------------------------------------------|--------------------------------|------------------------------|-------|
| Main meter   | MM1 | Manufacturer: Elster<br>Model: A1700<br>Serial: 10001847 | 0.2S           | 14/07/2012                                                             | 02/08/2013                     | 02/08/2015                   | -     |
| Backup Meter | BM1 | Manufacturer: Elster<br>Model: A1700<br>Serial: 11311803 | 0.5S           | 01/08/2012                                                             | 02/08/2013                     | 02/08/2015                   | -     |
| Backup Meter | BM2 | Manufacturer: Elster<br>Model: A1700<br>Serial: 11311804 | 0.5S           | 01/08/2012                                                             | 02/08/2013                     | 02/08/2015                   | -     |

<sup>2</sup> Calibration frequency is 2 years as per decision no. 25/2007/QD-BKHCN, dated 05/10/2007