



VERIFICATION / CERTIFICATION REPORT

“HAPUGASTENNE AND HULU GANGA SMALL HYDROPOWER PROJECTS” IN SRI LANKA

(UNFCCC Registration Ref. No. 0085)

Monitoring Period:
01 January 2010 to 31 December 2012

REPORT No. 2013-9451

REVISION No. 03

DET NORSKE VERITAS



VERIFICATION / CERTIFICATION REPORT

Date of first issue: 19 July 2013	Project No.: PRJC-477156-2013-CCS-IND	DNV CLIMATE CHANGE SERVICES AS Veritasveien 1, 1322 HØVIK, Norway Tel: +47 67 57 99 00 Fax: +47 67 57 99 11 http://www.dnv.com Org. No: NO 994 774 352 MVA
Approved by: Michael Lehmann	Organisational unit: Accredited Climate Change Services	
Client: C-Quest Capital, LLC	Client ref.: Ms. Isabel Alegre	
Summary: DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions reported for the project activity "Hapugastenne and Hulu Ganga Small Hydropower Projects" in Sri Lanka (UNFCCC Registration Ref. No. 0085) for the period 01 January 2010 to 31 December 2012. In our opinion, the GHG emission reductions reported for the project in the monitoring report (version 03) of 2 April 2014 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology AMS-I.D (version 05) and the monitoring plan contained in the revised Project Design Document version 04 of 27 November 2013 approved on 18 March 2014. DNV Climate Change Services AS is able to certify that the emission reductions from the project activity "Hapugastenne and Hulu Ganga Small Hydropower Projects" in Sri Lanka during the period 01 January 2010 to 31 December 2012 amount to 125 804 tonnes of CO ₂ equivalent.		

Report No.: 2013-9451		Subject Group: Environment	Indexing terms
Report title: "Hapugastenne and Hulu Ganga Small Hydropower Projects" in Sri Lanka		Key words Climate Change Kyoto Protocol Validation Clean Development Mechanism	Service Area Verification
			Market Sector
			Renewable Energy
Work carried out by: Ravi Kumar Prabhu, Govindarajulu Murali		<input checked="" type="checkbox"/> No distribution without permission from the client or responsible organisational unit <input type="checkbox"/> free distribution within DNV after 3 years <input type="checkbox"/> Strictly confidential <input type="checkbox"/> Unrestricted distribution	
Work verified by: Krishnan Namboodiri			
Date of this revision: 24 April 2014	Rev. No.: 03		
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***Abbreviations***

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CEB	Ceylon Electricity Board
CER	Certified Emission Reduction(s)
CL	Clarification request
CMP	Conference of Parties serving as the meeting of the parties to the Kyoto Protocol
CO ₂	Carbon dioxide
CO _{2e}	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
EPL	Eco Power (Private) Limited
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
PDD	Project Design Document
PS	Clean Development Mechanism Project Standard
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Clean Development Mechanism Validation and Verification Standard



1 INTRODUCTION

C-Quest Capital, LLC has commissioned DNV Climate Change Services AS (DNV) to carry out the verification and certification of emission reductions reported for the CDM project activity 0085 “Hapugastenne and Hulu Ganga Small Hydropower Projects” in Sri Lanka (the project) for the period 01 January 2010 to 31 December 2012. This report contains the findings from the verification and a certification statement for the certified emission reductions.

1.1 Objective

Verification is the periodic independent review and *ex post* determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period.

Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

The objective of this verification was to verify and certify emission reductions reported for the “Hapugastenne and Hulu Ganga Small Hydropower Projects” for the period 01 January 2010 to 31 December 2012.

1.2 Scope

The scope of the verification is to verify that:

- The project activity has been implemented and operated in accordance with the PDD;
- The monitoring plan complies with the monitoring methodology and the actual monitoring complies with the monitoring plan, including compliance with any guidance provided by the Board regarding deviations from the provisions of a registered plan and/or methodology;
- The data and calculation of GHG emission reductions have been assessed to correctly support the emission reductions being claimed.

1.3 Description of the project activity

Project Parties:	Sri Lanka (host),
Title of project activity:	Hapugastenne and Hulu Ganga Small Hydropower Projects
UNFCCC registration No:	0085
Baseline and monitoring methodology	AMS-I.D version 5
Sectoral scope(s):	1
Project Participants:	Eco Power (Private) Limited from host Party Sri Lanka
Location of the project activity:	The Hapugastenne Phase I and Phase II projects are located in Sabaragamuwa Province, Ratnapura District



and the Hulu Ganga I and Hulu Ganga II projects is in Central Province, Kandy District.

Project's crediting period: 1 January 2003 to 31 December 2012 (fixed crediting period).

Period verified in this verification: 01 January 2010 to 31 December 2012.

1.4 Methodology for determining emission reductions

According to the applied methodology AMS-I.D, version 05, the emission reductions for the project are determined as the difference between the baseline emissions, project emissions and leakage:

$$ER_y = BE_y - PE_y - L_y$$

PE_y and L_y are considered as to be zero as stated in the the PDD /14/. Therefore, the emission reductions are accounted as:

$$ER_y = BE_y = EG_y \times EF_y$$

where,

EF_y is the emission factor of the grid to which the project is connected, and was determined and validated *ex-ante* as 0.8496 tCO₂/MWh /14/ and will not be updated during the crediting period.

EG_y is the net electricity generation delivered to the grid, which is determined by the electricity exported to the grid minus the electricity imported from the grid.

2 METHODOLOGY

DNV has assessed and determined that the implementation and operation of the project activity, and the steps taken to report emission reductions comply with the CDM criteria and relevant guidance provided by the Board.

The assessment involved a desk review of relevant documentation as well as an on-site visit.

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the project. These include:

- i) Review of project documentation;
- ii) The net electricity supplied by the project to the grid which is multiplied with a fixed grid baseline combined emission factor of 0.8496 tCO₂e/MWh;
- iii) The actual installed capacity of the 13.568 MW (*renewable type*) power plant to ensure the conformance with the descriptions in the PDD /14/ ;

**Verification team**

Role	Last Name	First Name	Country	Type of involvement					
				Desk review	Site visit	Reporting	Supervision of work	Technical review	TA 1.2 competence
Team leader (Verifier)	Prabhu	Ravi Kumar	India	✓	✓	✓	✓		✓
Verifier	Govindarajulu	Murali	India	✓	✓	✓			✓
Technical reviewer	Namboodiri	Krishnan	India					✓	✓

Duration of verification

Monitoring report publication: 26 June 2013
 Desk review: 27 June 2013 to 13 July 2013
 On-site assessment: 15 July 2013 to 19 July 2013
 Reporting, calculation checks and QA/QC: 20 July to 24 April 2014

2.1 Desk review

The monitoring report, version 01 dated 31 May 2013, has been made publicly available on the CDM website. In addition to the monitoring report /1/ (version 01 dated 31 May 2013 and version 03 dated 2 April 2014), the verification has been performed based on the review of the following documentation provided by the project participants:

- The PDD version 03 dated 27 November 2013, including the monitoring plan /14/ and the corresponding validation opinion on the revised PDD and post registration changes dated 27 November 2013 /16/ and validation report /15/.
- The previous reports of 3rd and 4th verification /13/.
- The approved baseline and monitoring methodology AMS-I.D, version 05 /20/ applied by the project.
- Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board /17/.
- Other information and references relevant to the project activity's resulting emission reductions /2/.

During the desk review, DNV has applied standard auditing techniques to assess the quality of information provided. The following activities were performed:

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment



- including calibration requirements, and the quality assurance and quality control procedures; and
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

2.2 On-site assessment

During 15-19 July 2013, DNV performed on-site assessments. The key personnel of the project were interviewed or assisted the verification team /21/-/25/.

During the on-site assessment, DNV has applied standard auditing techniques to assess the quality of information provided. The following aspects of the CDM project activity have been verified:

- The implementation and operation of the CDM project activity ;
- The information flow for generating, aggregating and reporting of the monitoring parameters; and
- The operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD.

Further, the following activities were performed:

- A cross-check between information provided in the monitoring report and data from other sources;
- A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology;
- A review of calculations and assumptions made in determining the GHG data and emission reductions; and
- An identification that quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

The data presented in the monitoring report was assessed by review of the detailed project documentation and production records, as well as by interviews with personnel at the project sites /21/-/25/, and observation of collection of measurements, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. This has enabled the verification team to assess the accuracy and completeness of reported monitoring results; to verify the correct application of the approved monitoring methodology and the determination of the emission reductions.

In addition, all parameters required by the monitoring methodology AMS-I.D, version 05, and the management system were assessed during the site visit.

2.3 Closing out of verification findings

The objective of this phase of the verification was to resolve any issues which needed to be clarified prior to DNV's conclusion that i) the project activity has been implemented and operated in accordance with the registered PDD or any approved revised PDD, ii) the monitoring plan complies with the monitoring methodology and the actual monitoring



complies with the monitoring plan and iii) the data and calculation of GHG emission reductions are correct.

A corrective action request (CAR) is issued, where:

- i. Non-conformities with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;
- ii. Modifications to the implementation, operation and monitoring of the registered project activity has not been sufficiently documented by the project participants;
- iii. Mistakes have been made in applying assumptions, data or calculations of emission reductions which will impair the estimate of emission reductions;
- iv. Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

A clarification request (CL) shall be raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

A forward action request (FAR) is issued for actions if the monitoring and reporting require attention and/or adjustment for the next monitoring period.

The verification identified one CAR, one CL and no FARs. The Project participant addressed the CAR and CL by among others revising the monitoring report (please refer to Appendix A for further details). In addition to the changes made to the monitoring report as a result of the verification findings, following changes to the monitoring report (version 03 dated 2 April 2014) were made compared to the initial version of the monitoring report received for verification (version 01 dated 31 May 2013):

- The MR template has been changed to the version 03.2
- The MR updated in line with the revised PDD and the post registration changes approved by EB on 18 March 2014.

3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the “Hapugastenne and Hulu Ganga Small Hydropower Projects” for the period 01 January 2010 to 31 December 2012.

3.1 Remaining issues, CARs, FARs from previous validation / verification

According to the validation report /15//16/ and the previous verifications report /13/, no issues were required to be closed out during the current verification. This has been confirmed by DNV.

3.2 Post registration changes

There were no post registration changes identified by DNV during verification of this fifth monitoring period from 01 January 2010 to 31 December 2012.

The post registration changes were identified by DNV during the 3rd verification. The post registration changes required prior approval by the CDM EB in accordance with Appendix 1 to the CDM Project Standard /18/. The changes obtained approval by the CDM EB prior to the request for issuance for this monitoring period /16/.



The assessment of compliance with the project description and the monitoring plan contained in the PDD, as described in the following sections, is based on the revised PDD (version 04 of 27 November 2013).

3.3 Project implementation

As part of the site visit DNV was able to confirm that the project implementation is in accordance with the project description contained in the PDD (version 04 of 27 November 2013) /14/.

Project component	Implementation in accordance with PDD	Description of how implementation was assessed by verification team
The capacity of the Turbo-generator at Hapugastenne I 5.052 MW (2.526 MW*2)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The capacity has been verified during the site visit and from the PPA /7/.
The capacity of the Turbo-generator at Hapugastenne II 2.526 MW	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The capacity has been verified during the site visit and from the PPA /7/.
The capacity of the Turbo-generator at Hulu Ganga I 3 MW (1.5 MW*2)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The capacity has been verified during the site visit and from the PPA /7/.
The capacity of the Turbo-generator at Hulu Ganga II 2.99 MW (1.495 MW*2)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The capacity has been verified during the site visit and from the PPA /7/.

As part of the site visit, DNV was able to confirm that the project implementation is in accordance with the project description contained in the revised PDD (version 04 of 27 November 2013) /14/. The verification team confirmed through visual inspection and document review that all physical features of the proposed CDM project activity including data collection systems and storage systems have been implemented in accordance with the revised PDD (version 04 of 27 November 2013) /14/. DNV confirmed during the on-site visit that the CDM project is completely operational.

The project is a bundle of four small-scale run-of-river hydro power plants in Sri Lanka. The projects are Hapugastenne I&II and Hulu Ganga I&II Mini hydro projects. Electricity generated is supplied to the national grid through Ceylon Electricity Board (CEB) /7/.

The Hapugastenne I&II projects are located in Sabaragamuwa Province, Ratnapura District. Hapugastenne I consist of two units each of 2.526 MW Pelton turbo-generators and the Hapugastenne II has one unit of 2.526 MW Pelton turbo-generator. The Hulu Ganga I&II projects are located near the village of Panwila, north of the town of Kandy. The Hulu Ganga I consist of two units each of 1.5 MW Francis type turbo-generators and Hulu Ganga II consist of two units each of 1.495 MW Francis type turbo-generators /7/. Thus the installed capacity of the project activity is 13.568 MW (5.052+2.526+ 3+2.99 MW).

The projects were commissioned and connected to the CEB grid on the following dates:

Site	Date of Commissioning
Hapugastenne Phase I	14/08/2001
Hapugastenne Phase II	09/09/2002
Hulu Ganga Phase I	03/06/2003



Hulu Ganga Phase II	25/10/2006
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The project's emission reductions are determined as the product of the net electricity generated and exported to the grid by the project and the validated *ex-ante* fixed grid emission coefficient of 0.8496 tCO₂/MWh /14/. Thus it has been verified that the implementation is in line with the project design indicated in the revised PDD dated 27 November 2013 /14/.

The electricity generated is supplied to national grid of Sri Lanka and the net electricity supplied to the grid by the project activity is measured using bidirectional meters installed at the grid interconnection points. All meters installed at the grid interconnection points are with 1% accuracy, all of which are used for measuring the electricity exported to and imported from the grid. The electricity meters are locked by the state utility CEB to guarantee the integrity of the instruments. This is in line with the monitoring plan of revised PDD dated 27 November 2013 /14/.

3.4 Information (data and variables) provided in the monitoring report that is different from that stated in the registered PDD

The net electricity generation reported in this monitoring period is 148 076.148 MWh for the period of 01 January 2010 to 31 December 2012 (i.e. 3 years). This comprises of 60 713.75 MWh from Hapugastenne I, 39 954.297 MWh from Hapugastenne II and 47 408.101 MWh from Hulu Ganga I&II. The expected annual generation in the revised PDD is 58 611.058 MWh, which corresponds to 175 833.174 MWh in 3 years. Hence, actual generation is 15.8% lower than expected. The variation is due to the lower PLF achieved during the verification period due to lesser water availability in the rivers for power generation.

As a result of lower electricity generation, actual emission reductions are also lower than the emission reductions estimated in the PDD.

3.5 Compliance of monitoring plan with monitoring methodology

DNV is able to confirm that the monitoring plan contained in the revised PDD (version 04 of 27 November 2013) /14/ is in accordance with the approved methodology applied by the project activity, i.e. AMS-I.D (version 05) /20/.

3.6 Compliance of monitoring with the monitoring plan

The monitoring has been carried out in accordance with the monitoring plan contained in the PDD of 27 November 2013 /14/. All parameters stated in the validated monitoring plan are monitored and reported appropriately. The monitoring report lists each parameter required by the monitoring plan and the information flow (i.e. from data generation, aggregation, to recording, calculation and reporting) for these parameters is provided in the monitoring report. The information flow for each parameter is further verified in the following sections.

3.6.1 Monitoring parameters

According to the monitoring plan of the revised PDD /14/, there are 3 parameters to be monitored:

- Hapugastenne Phase I project net electricity output (H1-mmyy-kWh)
- Hapugastenne Phase II project net electricity output (H2-mmyy-kWh)



- Hulu Ganga Phase I and Hulu Ganga Phase II project net electricity output (HG1-mmyy-kWh) and (HG2-mmyy-kWh)

Since the emission factor of the national grid of Sri Lanka has been fixed *ex-ante*, monitoring of the emission factor is not necessary.

The below tables describe for each parameter, which is to be measured according to the monitoring plan, how DNV has verified that i) the actual monitoring complies with the monitoring plan and that ii) data have been assessed to correctly support the emission reductions being claimed.

	Assessment/ Observation		
Data / Parameter: (as in monitoring plan):	Hapugastenne Phase I project net electricity output (H1-mmyy-kWh)		
Measuring frequency:	Continuous		
Reporting frequency:	Monthly		
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes		
Type of monitoring equipment:	Bi-directional electricity meter.		
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer’s specification?	The monitoring plan does not indicate the accuracy of the meters /14/. However the meters installed in the project activity are of accuracy 1% /3/. The meter is installed and maintained by CEB and represents the good practice in the region and thereby complying with the requirements of CEB.		
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Yes, the accuracy is valid for the entire measuring range.		
Calibration frequency /interval:	Annual		
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer’s specifications	As per the monitoring plan, the meters installed as part of the project activity are calibrated annually. The details of calibration /3/ are given below:		
	Meter and Accuracy	Calibrated on	Valid Till
	Meter - 1%	3 June 2009	2 June 2010
	Serial	23 June 2010	22 June 2011
	Number:	5 April 2011	4 April 2012
207501155	20 March 2012	19 March 2013	
Is the calibration of measuring equipment carried out by an accredited person or institution?	The calibration was done by the state utility CEB /3/.		
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes		
Is(are) calibration(s) valid for the whole	The calibration was delayed from 3 to 22 June		



reporting period?	2010 and the subsequent calibration confirmed that the meters were working well within the permissible limits. The maximum inaccuracy (1%) of the metering equipment has been applied on the measured values of electricity export and imports for the entire month of June 2010 /2/. This is in line with the VVS /17/.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data has been cross checked with the monthly invoices raised by the project developer on CEB /5/ and the monthly bill for imports /6/.
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes /3/.
How were the values in the monitoring report verified?	The values were verified from the monthly bills of import issued by CEB /6/ and the monthly meter reading statements /4/.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	Not applicable

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	Hapugastenne Phase II project net electricity output (H2-mmyy-kWh)
Measuring frequency:	Continuous
Reporting frequency:	Monthly
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	Bi-directional electricity meter.
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The monitoring plan does not indicate the accuracy of the meters /14/. However the meters installed in the project activity are of accuracy 1% /3/. The meter is installed and maintained by CEB and represents the good practice in the region and thereby complying with the requirements of CEB.
Is the accuracy valid for the entire	Yes, the accuracy is valid for the entire



measuring range or do different accuracy levels apply to different measuring ranges?	measuring range.																	
Calibration frequency /interval:	Annual																	
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications	As per the monitoring plan, the meters installed as part of the project activity are calibrated annually. The details of calibration /3/ are given below: <table><tr><td>Meter and Accuracy</td><td>Calibrated on</td><td>Valid Till</td></tr><tr><td>Meter - 1%</td><td>3 June 2009</td><td>2 June 2010</td></tr><tr><td>Serial</td><td>23 June 2010</td><td>22 June 2011</td></tr><tr><td>Number:</td><td>5 April 2011</td><td>4 April 2012</td></tr><tr><td>207501184</td><td>20 March 2012</td><td>19 March 2013</td></tr></table>			Meter and Accuracy	Calibrated on	Valid Till	Meter - 1%	3 June 2009	2 June 2010	Serial	23 June 2010	22 June 2011	Number:	5 April 2011	4 April 2012	207501184	20 March 2012	19 March 2013
Meter and Accuracy	Calibrated on	Valid Till																
Meter - 1%	3 June 2009	2 June 2010																
Serial	23 June 2010	22 June 2011																
Number:	5 April 2011	4 April 2012																
207501184	20 March 2012	19 March 2013																
Is the calibration of measuring equipment carried out by an accredited person or institution?	The calibration was done by the state utility CEB /3/.																	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes																	
Is(are) calibration(s) valid for the whole reporting period?	The calibration was delayed from 3 to 22 June 2010 and the subsequent calibration confirmed that the meters were working well within the permissible limits. The maximum inaccuracy (1%) of the metering equipment has been applied on the measured values of electricity export and imports for the entire month of June 2010 /2/. This is in line with the VVS /17/.																	
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data has been cross checked with the monthly invoices raised by the project developer on CEB /5/ and the monthly bill for imports /6/.																	
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes /3/.																	
How were the values in the monitoring report verified?	The values were verified from the monthly bills of import issued by CEB /6/ and the monthly meter reading statements /4/.																	
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes																	
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	Not applicable																	



	Assessment/ Observation											
Data / Parameter: (as in monitoring plan):	Hulu Ganga Phase I and Hulu Ganga Phase II project net electricity output (HG1-mmyy-kWh) and (HG2-mmyy-kWh)											
Measuring frequency:	Continuous											
Reporting frequency:	Monthly											
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes											
Type of monitoring equipment:	Bi-directional electricity meter.											
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The monitoring plan does not indicate the accuracy of the meters /14/. However the meters installed (old and new) in the project activity are of accuracy 1% /3/. The old meter was replaced with a new meter on 8 January 2010. The meter is installed and maintained by CEB and represents the good practice in the region and thereby complying with the requirements of CEB.											
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Yes, the accuracy is valid for the entire measuring range											
Calibration frequency /interval:	Annual											
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications	As per the monitoring plan, the meters installed as part of the project activity are calibrated annually. The details of calibration /3/ are given below: <table><tr><td>Meter and Accuracy</td><td>Calibrated on</td><td>Valid Till</td></tr><tr><td>Meter (replaced) -1% Serial Number: 9200208</td><td>13 November 2009, 8 January 2010</td><td>12 November 2010</td></tr><tr><td>Meter - 1% Serial Number: 209070598</td><td>8 January 2010 7 December 2010 3 August 2011 5 September 2012</td><td>7 January 2011 6 December 2011 2 August 2012 4 September 2013</td></tr></table>			Meter and Accuracy	Calibrated on	Valid Till	Meter (replaced) -1% Serial Number: 9200208	13 November 2009, 8 January 2010	12 November 2010	Meter - 1% Serial Number: 209070598	8 January 2010 7 December 2010 3 August 2011 5 September 2012	7 January 2011 6 December 2011 2 August 2012 4 September 2013
Meter and Accuracy	Calibrated on	Valid Till										
Meter (replaced) -1% Serial Number: 9200208	13 November 2009, 8 January 2010	12 November 2010										
Meter - 1% Serial Number: 209070598	8 January 2010 7 December 2010 3 August 2011 5 September 2012	7 January 2011 6 December 2011 2 August 2012 4 September 2013										
Is the calibration of measuring equipment carried out by an accredited person or institution?	The calibration was done by the state utility CEB /3/.											
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes											
Is(are) calibration(s) valid for the whole reporting period?	The calibration was delayed from 3 August 2012 to 4 September 2012 and the subsequent calibration confirmed that the meters were											



	working well within the permissible limits. The maximum inaccuracy (1%) of the metering equipment has been applied on the measured values of electricity export and imports for the entire months of August 2012 and September 2012 /2/. This is in line with the VVS /17/.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data has been cross checked with the monthly invoices raised by the project developer on CEB /5/ and the monthly bill for imports /6/.
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes /3/.
How were the values in the monitoring report verified?	The values were verified from the monthly bills of import issued by CEB /6/ and monthly meter reading statements /4/
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	Not applicable

Calibration records /3/ have been provided to the verification team. DNV can confirm that the meters were calibrated covering this monitoring period as per the monitoring plan.

As per Appendix 5 of the PDD of version 04 of 27 November 2013 /14/ the following project social benefit indicators are also monitored

- Project employment benefits at Hapugastenne I&II and Hulu Ganga I&II mini hydro power projects.
- Community development project financing at Hapugastenne I&II and Hulu Ganga I&II mini hydro power projects.

Under the project social benefit indicators, the total short and long-term employment positions created and project sponsor financial contributions to local development projects are being monitored and have been evidenced by DNV during the site visit /12/.

The project participant also monitors environmental parameters such as surface water phosphates, total inorganic nitrogen, BOD and COD levels; flora and fauna; river bank erosion and sediment deposits at the project sites. The monitoring of these parameters have been evidenced by DNV during the site visit /8/9/10/11/.



3.7 Assessment of data and calculation of emission reductions

DNV confirms that appropriate methods and formulae for calculating baseline emissions, project emissions and leakage have been followed, and the assumptions, emission factors and default values that are applied in the calculation have been justified.

As stated in the section 1.4, the emission reductions ER_y by the project activity during the monitoring period is the difference between the baseline emission, project emissions or leakage.

$$ER_y = BE_y - PE_y - L_y$$

3.7.1 Baseline emissions

Baseline emissions (BE_y in tCO_2) are the product of the baseline emission factor (EF_y in tCO_2/MWh) times the net electricity supplied by the project activity to the grid (EG_y in MWh).

EF_y is emission factor of the grid, which was calculated *ex-ante* and will not be updated during the crediting period. EF_y of the proposed project in the PDD is $0.8496 tCO_2/MWh$ /14/, which has been verified to be correct based on the availability of grid data.

EG_y is the net electricity generation supplied to the grid, which is determined by the electricity supplied to the grid minus the imported electricity from the grid. The electricity exported to and imported from the grid was derived from the main meters in the period 01 January 2010 to 31 December 2012 /2/, which was verified by DNV and cross-checked with the invoices raised for sale of power /4/.

The calibration was delayed for the meters at Hapugastenne I Hapugastenne II from 3 June 2010 to 22 June 2010 and at Hulu Ganga I&II from 3 August 2012 to 4 September 2012. The subsequent calibrations confirmed that the meters were working well within the permissible limits. The maximum inaccuracy (1%) of the metering equipment has been applied on the measured values of electricity export (1-1%) and imports (1+1%) for the readings of the corresponding entire months /2/. DNV confirms that this is in line with the VVS /17/.

$$BE_y = EF_y * EG_y = 125\,804\,tCO_2e$$

3.7.2 Project emissions

The project emissions are regarded as zero according to the methodology AMS-I.D ver 5 /20/.

The project activity is a greenfield project activity and hence no leakage is envisaged as per the PDD /14/ and no fossil fuel usage has been envisaged in the project activity while in operation, thus no project emissions indicated in the PDD during the crediting period. However, the PDD indicates that the project emissions accrued during the site preparation and construction stage of the project need to be deducted during the verification of the project activity. The project emissions related to site preparation and construction have been deducted during the 3rd monitoring period of 1 January 2007 to 30 September 2008 /13/.

3.7.3 Leakage

There are no leakages that need to be considered in applying the methodology AMS-I.D ver 5 /20/.

3.7.4 Emission reductions

Therefore, the emission reductions in this monitoring period are:

$$ER_y = BE_y - PE_y - L_y = 125\,804 - 0 - 0 = 125\,804\,tCO_2e.$$



The yearly expected emission reductions in the revised PDD /14/ are 49 796 tonnes of CO₂ equivalents, which correspond to the emission reductions of 149 388 tonnes of CO₂ equivalents in 3 years, the reported emission reductions are considerably lower than the expected (ref section 3.4).

As outlined above, the input data for calculating the emission reductions, the calculating process and the result are complete and transparent. Therefore, DNV is able to confirm the accuracy of the emission reductions.

3.8 Quality of evidence to determine emission reductions

DNV confirms that a complete set of data for this monitoring period was available to be verified and was in accordance with the PDD.

All necessary documentation were collected, referenced and aggregated and were easily accessible in hard-copy and electronic format. Measurements are performed by calibrated equipment, and the key data were cross-checked via other sources /5//6/. No assumptions are used that have any material influence on reported emission reductions.

3.9 Management system and quality assurance

Eco Power (Private) Limited. is responsible for the operation and maintenance of the project, the monitoring equipments and data collection. The management system for the project has been verified to be in place by DNV on site. The organization structure with the responsibilities, personnel competencies, monitoring procedure and monitoring management have been properly identified and put into operation.

DNV confirms that the responsibilities and authorities in the management and operational system for monitoring and reporting are in accordance with the responsibilities and authorities stated in the PDD and monitoring plan /14/.



4 CERTIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions that have been reported for the CDM project activity 0085 “Hapugastenne and Hulu Ganga Small Hydropower Projects” in Sri Lanka for the period 01 January 2010 to 31 December 2012.

The project participants are responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project activity.

It is DNV’s responsibility to express an independent verification statement on the reported GHG emission reductions from the project activity. DNV does not express any opinion on the selected baseline scenario for the project activity.

DNV conducted the verification on the basis of the baseline and monitoring methodology AMS-I.D (version 05), the monitoring plan contained in the PDD (version 04 of 27 November 2013) and the monitoring report (version 03) dated 2 April 2014. The verification included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.

DNV’s verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. DNV planned and performed the verification by obtaining evidence and other information and explanations that DNV considers necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In our opinion the GHG emissions reductions reported for the project activity for the period 01 January 2010 to 31 December 2012 are fairly stated in the monitoring report (version 03) dated 2 April 2014.

The GHG emission reductions were calculated correctly on the basis of the approved baseline and monitoring methodology AMS-I.D (version 05) and the monitoring plan contained in the PDD (version 04 of 27 November 2013).

DNV Climate Change Services AS is able to certify that the emission reductions from the CDM project activity 0085 “Hapugastenne and Hulu Ganga Small Hydropower Projects” in Sri Lanka during the period 01 January 2010 to 31 December 2012 amount to 125 804 tonnes of CO₂ equivalent.

Bangalore and Oslo, 24 April 2014

Ravi Kumar Prabhu
Verifier
DNV India, Bangalore

Michael Lehmann
Director of Services and Technologies
DNV Climate Change Services AS



5 REFERENCES

Documentation provided by the project participants

- /1/ C-Quest Capital, LLC: *CDM monitoring report for project activity 0085 "Hapugastenne and Hulu Ganga Small Hydropower Projects" for the monitoring period 01 January 2010 to 31 December 2012*, Version 01 dated 31 May 2013 and version 03 dated 2 April 2014.
- /2/ C-Quest Capital, LLC: Emission reduction Calculations Version 01 dated 31 May 2013.
- /3/ CEB: Calibration certificates of the Hapugastenne I & Hapugastenne II done on 3 June 2009, 23 June 2010, 5 April 2011 and 20 March 2012; certificates of the Hulu Ganga I&II done on 13 November 2009, 8 January 2010, 7 December 2010, 3 August 2011 and 5 September 2012.
- /4/ EB: Monthly meter reading reports of Hapugastenne I & Hapugastenne II and Hulu Ganga I&II for the verification period 01 January 2010 to 31 December 2012.
- /5/ EPL: Records of Invoices raised by the project participant for the sale of power of both Hapugastenne I & Hapugastenne II and Hulu Ganga I&II covering the current monitoring period 01 January 2010 to 31 December 2012.
- /6/ CEB : Monthly bills of electricity exported and consumed (imported) in the plants Hapugastenne I & Hapugastenne II and Hulu Ganga I&II covering the current monitoring period 01 January 2010 to 31 December 2012.
- /7/ EPL: Power Purchase Agreements dated 24 April 2001 for Hapugastenne I & II and Hulu Ganga I&II.
- /8/ EPL: River bank erosion and sedimentation records done by plant operating personnel for the monitoring period.
- /9/ Devaka K Weerakoon: Ecological Flora and Fauna monitoring report "Consultancy Services Report on the Post Construction Monitoring of 6 Mini hydro Projects Operated by Eco Power Pvt Ltd." March 2010, March 2011 and March 2012.
- /10/ EPL: Reports of Surface water analysis for BOD and COD done by National Technology Institute (NTI), September 2010, October 2010, January 2012, March 2013.
- /11/ EPL: Reports of Surface Water nutrient levels done by National Technology Institute (NTI), September 2010, October 2010, January 2012 and February 2013.
- /12/ EPL: Employment registers at site and receipts of expenditure made towards community development dated 20 January 2010, 20 December 2010, 30 March 2011, 13&20 October 2011, Hapugastenne I & Hapugastenne II and 20 January 2010, 29 June 2010, 8&14 February 2011, 30 May 2011, 21 June 2011, 13&20 October 2011, 1 February 2012 and 19 June 2012 for Hulu Ganga I&II.

Other project documents or documents used by DNV to verify the information provided by the project participants

- /13/ DNV Climate Change Services AS: Previous *Verification / Certification report for*



project activity, 2010-0428 dated 22 April 2014 for the 3rd verification and 2010-0427 dated 22 April 2014 for the 4th verification

- /14/ EPL: CDM PDD for project activity “Hapugastenne and Hulu Ganga Small Hydropower Projects, version 01 and version 04 dated 27 November 2013
- /15/ SGS: Validation Report No. CDM Val 0023
- /16/ DNV: Validation opinion on the revised PDD and Post registration changes, dated 27 November 2013 approved by UNFCCC EB on 18 March 2014.

Methodologies, tools and other guidance by the CDM Executive Board

- /17/ CDM Executive Board: *Clean Development Mechanism Validation and Verification Standard*, version 05.0
- /18/ CDM Executive Board: *Clean Development Mechanism Project Standard*, version 05
- /19/ CDM Executive Board: *Clean Development Mechanism Project Cycle Procedure*, version 05.0
- /20/ CDM Executive Board: *Baseline and monitoring methodology AMS-I.D ver 5*

Persons interviewed during the verification

- /21/ Mr. M Firdowsy M Ismail, Chief Financial Officer, Eco Power (Private) Limited
- /22/ Mr. Bhatiya Ranatunga, Chief Executive Officer, Eco Power (Private) Limited
- /23/ Mr. Meneka Kithsiri Seneviratne Operations Engineer, Eco Power (Private) Limited.
- /24/ Mr. Illu Kumar, Site Engineer, Eco Power (Private) Limited.
- /25/ Mr. Ang Kong Nian, Senior Manager, C-Quest Capital, Malaysia

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APPENDIX A

CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS

Corrective action requests

CAR ID	Corrective action request	Response by Project Participants	DNV's assessment of response by Project Participants
CAR 1	In section E.7 of the MR, the actual CER values achieved upto 31 December 2012 is stated to be 405 854 tCO ₂ e, which is higher than the total CERs of 125 804 tCO ₂ e for the verification period.	Correction has been made in MR.	OK The actual CERs achieved upto 31 December 2012 has been corrected to 125 804 tCO ₂ e in revised MR /1/. CAR is closed.

Clarification requests

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
CL 1	The delay in meter calibrations has been included in section B.2.1 of the MR as "Temporary deviations from registered monitoring plan or applied methodology", which does not come under the definition of deviations.	The information under Section B.2.1 has been removed.	OK The section B.2.1 has been corrected in revised MR /1/. CL is closed.

Forward action requests from previous verification

FAR ID	Forward action request	Summary of how FAR has been addressed in this reporting period	Assessment of how FAR has been addressed
	No FAR was raised		

Forward action requests from this verification

FAR ID	Forward action request	Response by Project Participants
	No FAR raised	

APPENDIX B

POST REGISTRATION CHANGES

Type of post registration change	Description of post registration change*	Is prior approval by CDM EB required**?	In case prior approval by CDM EB is required, when was post registration change approved?
Corrections	Not applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable	Not applicable
Temporary deviations from the registered monitoring plan and/or monitoring methodology (Applicable for the period of 1 January 2007 and 30 April 2009)	Not applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable	Not applicable
Permanent changes from the registered monitoring plan or applied methodology	Not applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable	Not applicable
Changes to the project design of a registered project activity	Not applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable	Not applicable

* For further details refer to the “Post-registration changes request form” (F-CDM-PRC) and DNV’s assessment opinion on the changes

** Refer to Appendix 1 Appendix 1 to the CDM Project Standard /18/

APPENDIX C

CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS

Ravi Kumar Prabhu holds Bachelor's Degree in Chemical Engineering and has done Post Graduate Diploma course in Management and has an overall working experience of around twenty five years. Prior to joining DNV has around twenty three years of experience in Chemical process industry (fertilizer & petrochemical manufacturing) covering production, technical services including energy audits and efficiency studies, waste heat recovery, efficiency studies of boilers, power plants, safety audits, pollution control activities and waste water treatment. With respect to the Thermal Power Plant, the job assignment included the monitoring of flue gas stack temperatures and excess air, efficiency of fuel additives, condition of boiler refractory and insulation of steam lines, residual life assessment of boilers etc. His experience also includes 7 years in the Process design of fertilizer & petrochemical plants, wherein he was involved in the development of process flow diagrams, development of P&IDs, equipment design, HAZOP studies, procurement and commissioning activities.

He has six years of experience in validation and verification of CDM projects in DNV and is also an EMS lead auditor. His qualification, industrial experience and experience in CDM projects demonstrate sufficient sectoral competence in Chemical Process Industries (TA 5.1), Thermal Energy Generation from fossil fuels (TA1.1), Heat distribution (TA 2.2), Energy generation from Renewable Energy sources (TA 1.2) and Waste handling and disposal (TA 13.1).

Murali Govindarajulu holds a Bachelor's Degree in Chemical Engineering and has done a Short term diploma course in Management. Having an overall experience of around thirteen years. Prior to joining DNV having around seven years experience in Chemical process industry covering production, energy efficiency improvement and erection and commissioning of projects in the plant. His experience also covers the fields of environmental management and resource conservation including identification of alternative fuels. He has also been actively involved in implementation of Management Systems such as ISO 14001 and OHSAS 18001 standards in chemical process industry for more than three years.

He has experience of around 6 years in validation and verification of numerous CDM projects in DNV, both in India & abroad. He has completed national training on "Wind Energy Technology" conducted by Center for Wind Energy Technology, Ministry of New and Renewable Energy. His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in energy generation from renewable energy sources.

Krishnan Namboodiri, Senior CDM Specialist, DNV Kochi, India. Holds graduate degree in chemical engineering and has done a short term diploma course in Management. Prior to joining DNV in 2008, has had 24 years of direct work experience in the fertilizer and chemicals industry. Work experience covers 5 years in process design & engineering for chemical industry 7 years in technical services including environment management activities, 7 years in project management and 5 years in training & corporate planning in fertilizer & petrochemical manufacturing units. Has been actively involved in Management System Audits as per ISO 14001 for more than 8 years.

The above work experience includes-(a) experience in steam system optimisation & trouble shooting, development of improvement schemes in large fertiliser & caprolactum complex (b) Design and engineering, efficiency studies and development of efficiency improvement schemes for fossil fuel fired steam & power generation plants (c) Implementation of energy

saving measures in Ammonia plants , sulphuric acid plant etc (d) Monitoring, trouble shooting and development & implementation of of improvement schemes for of pollution control facilities (chemical, aerobic & anaerobic treatment systems) in Fertiliser and petrochemical complex. Development & implementation of landfill facilities for solid and hazardous wastes from fertiliser & caprolactam manufacturing complex.

He has received extensive training in the CDM validation and verification process. He is an appointed GHG auditor for the CDM validation and verification program of DNV and has performed validation & verification and Technical Review of several CDM, VCS and GS projects in India and other countries.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in (1) Thermal energy generation from fossil fuels as well as thermal electricity from solar and (2) waste handling and disposal. (3) Energy demand (4) Chemical process industries (5) Household end use energy efficiency and (6) Energy generation from renewable energy sources.