VALIDATION OPINION - CREDITING PERIOD RENEWAL

EL CANADÀ HYDROELECTRIC PROJECT IN GUATEMALA

(UNFCCC Registration Ref. No. 0606)

REPORT NO. 2012-0063

REVISION NO. 02

DET NORSKE VERITAS

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VALIDATION OPINION - CREDITING PERIOD RENEWAL

Date of first issue: 2011-06-12	ConCert Project No.: PRJC-199027-2009-CCS-NOR	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
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Client: International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)	Client ref.: Claudia Croce	

Summary:

Project Name: El Canadà Hydroelectric Project
Registration Ref. No.: 0606
Country: Guatemala
Methodology: ACM0002 **Version:** 13.0.0
GHG reducing Measure/Technology: Electricity generation from renewable energy
ER estimate: 96 463 tCO_2e per year (average)

Size

☒ Large Scale ☐ Small Scale

Validation Phases:

☒ Desk Review
☒ Follow up interviews
☒ Resolution of outstanding issues

Validation Status

☐ Corrective Actions Requested ☐ Clarifications Requested
☒ Full Approval and request for renewal ☐ Rejected

In summary, it is DNV's opinion that the project activity "El Canadà Hydroelectric Project" in Guatemala, as described in the PDD, version 11 of 1 May 2013, meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence DNV requests the renewal of the crediting period of the project.

Report No.: 2012-0063	Subject Group: Environment	**Indexing terms**
Report title: El Canadà Hydroelectric Project in Guatemala		Key words Climate Change Kyoto Protocol Validation Clean Development Mechanism
Work carried out by: Francisco V. Chavez, Peter Molin, Agnes Dudek, Wen, Bo		☒ No distribution without permission from the client or responsible organisational unit ☐ free distribution within DNV after 3 years ☐ Strictly confidential ☐ Unrestricted distribution
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Abbreviations

AMELEC	Asesoria y Medicion Electrica
AMM	Administrador del Mercado Mayorista
ANSI	American National Standards Institute
BM	Build margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CH_4	Methane
CNEE	Comisión Nacional de Energía Eléctrica, República de Guatemala (National energy commission, Republic of Guatemala)
CL	Clarification request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
FAR	Forward Action Request
GHG	Greenhouse gas(es)
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of approval
NGO	Non-governmental Organisation
ODA	Official Development Assistance
OM	Operating margin
PDD	Project Design Document
PS	Clean Development Mechanism Project Standard
tCO_2e	Tonnes of CO_2 equivalents
UNFCCC	United Nations Framework Convention on Climate Change
GWP	Global Warming Potential
VVS	Clean Development Mechanism Validation and Verification Standard

1 EXECUTIVE SUMMARY – VALIDATION OPINION

DNV Climate Change Services AS (DNV) has performed an assessment of the request by the International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) to renew the crediting period of CDM project activity 0606 "El Canadà Hydroelectric Project" in Guatemala. The assessment was performed in accordance with the Validation and Verification Standard (Version 03.0) and the CDM Project Standard (Version 03.0) and included an assessment of:

(a) An impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period;

(b) The correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period.

The review of the project design documentation and the subsequent follow-up interviews have provided DNV with sufficient evidence to determine the validity of the original baseline and its update through an assessment. The project correctly applies the baseline and monitoring methodology ACM0002, version 13.0.0 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

The total emission reductions from the project are estimated to be on the average 96 463 tCO_2e per year over the 2nd renewable crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project's emission reductions. The monitoring arrangements described in the monitoring plan are feasible within the project design and it is DNV's opinion that the project participants are able to implement the monitoring plan.

In summary, it is DNV's opinion that the CDM project activity 0606 "El Canadà Hydroelectric Project" in Guatemala meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence DNV requests the renewal of the crediting period of the project.

Oslo, 2013-06-10

Wen, Bo
CDM Validator
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Michael Lehmann
Director of Services and Technologies
DNV Climate Change Services AS

2 INTRODUCTION

DNV Climate Change Services AS (DNV) was commissioned by the International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) to perform an assessment of the request by to renew the crediting period of CDM project activity 0606 "El Canadà Hydroelectric Project" in Guatemala.

The assessment was performed in accordance with the Validation and Verification Standard (Version 03.0) and the CDM Project Standard (Version 03.0) and included an assessment of:
(a) An impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period;

(b) The correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period.

3 METHODOLOGY

The validation consisted of the following three phases:

I a desk review of the project design documents

II follow-up interviews with project stakeholders

III the resolution of outstanding issues and the issuance of the final validation report and opinion.

The following sections outline each step in more detail.

3.1 Desk review of the project design documentation

The following tables list the documentation that was reviewed during the validation.

3.1.1 Documentation provided by the project participants

/1/ The International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF): *CDM-PDD for project activity "El Canadà Hydroelectric Project" in Guatemala*,

- Version 3 dated 30 August 2006,
- Version 3 dated 15 March 2010 (CDM-PDD submitted in June 2010 to DNV for validation for the purpose of requesting a renewal of the crediting period)
- And final version 11 dated 1 May 2013.

/2/ The International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF): Revised monitoring plan for the *"El Canadà Hydroelectric Project" in Guatemala*. Undated. Available on the UNFCCC web pages: http://cdm.unfccc.int/Projects/DB/DNV-CUK1158755634.57/view

/3/ DNV: *Validation report for the "El Canadà Hydroelectric Project" in Guatemala*, Report No. 2005-1508, Revision No. 02, dated 7 September 2006.

/4/

- The International Bank for Reconstruction and Development (IBRD) as Trustee

of the Prototype Carbon Fund (PCF): *WB El Canada 10.10.2010.xls*, Spreadsheet with calculations of the combined emission factor. 10 October 2010; and

- The Prototype Carbon Fund: *El Canada – 2nd Crediting Period 25Sept2012.xls* for the revised grid emission factor calculation.
- El Canada Hydroelectric Project: Excel sheet *El Canada - 2nd CP 1.May.2013 v2.xls* for the revised grid emission factor calculation (updated after the incompleteness message of 18 December 2012)

/5/ Ministerio de Energia y Minas: *Informe Estadísticas Energéticas Subsector Eléctrico 2001 – 2008* http://www.mem.gob.gt/viceministerio-del-area-energetica-2/direccion-general-del-area-energetica/estadisticas/

/6/ Administrador del Mercado Mayorista: Annual generation reports 2006 – 2008. Website: http://www.amm.org.gt/ ⟶ Left Menu "Generacion - Generacion mensual por planta".

/7/ AMELEC: *Certificacion de calibration*, main meter at the El Canadá substation, dated 30 July 2008

/8/ AMELEC: *Certificacion de calibration*, support meter at the El Canadá substation, dated 30 July 2008

/9/ AMELEC: *Certificacion de calibration*, main and support meter at the El Canadá substation, dated 12 November 2009

/10/ AMELEC: *Certificacion de calibration*, main meter at the Montecristo substation, dated 30 July 2008

/11/ AMELEC: *Certificacion de calibration*, support meter at the Montecristo substation, dated 30 July 2008

/12/ AMELEC: *Certificacion de calibration*, main and support meter at the Montecristo substation, dated 12 November 2009

/13/ Balasha-Jalon Infrastructure systems Ltd.: *El Canada hydroelectric power plant – Reservoir site general plan* and *Final elevations plan*. Technical maps of the reservoir, dated March 2002 and November 2002.

/14/ Ingeniero Agronomo D.A.B. Juárez: *Embalse de Regularizacion Planta Hidroelectrica Canada*, technical map of the reservoir, dated January 2012.

/15/ Comisión Nacional de Energía Eléctrica República de Guatemala (CNEE): *Memoria de labores*. Periodic report of the labor market in the electricity sector for the period May 2008 – April 2009.

/16/ Ministerio de Energia y Minas and Comisión Nacional de Energía Eléctrica República de Guatemala (CNEE): *Indicative expansion plan of the generation system 2008 – 2022*. Undated.

/17/ The International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF): *Revised monitoring plan for the El Canadá hydroelectric project*, dated 2010.

/18/ Tüv Nord: *Request for revision of monitoring plan for the El Canadá hydroelectric project*, dated 24 August 2010.

3.1.2 Methodologies, tools and other guidance by the CDM Executive Board

/19/ CDM Executive Board: *Clean Development Mechanism Validation and Verification Standard*, version 03.0

/20/ CDM Executive Board: Methodological Tool *"Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"*, version 03.0.1

/21/ CDM Executive Board: *Clean Development Mechanism Project Standard*, version 03.0

/22/ CDM Executive Board: *Clean Development Mechanism Project Cycle Procedure*, version 03.2

/23/ CDM Executive Board: Baseline and monitoring methodology ACM0002, *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, version 13.0.0.

/24/ CDM Executive Board: *Tool to calculate the emission factor for an electricity system*, Version 3.0.0.

/25/ CDM Executive Board: *Request for guidance: Application of AM0015 (and AMS-I.D) in Brazil, dated 7th October 2005*.

/26/ CDM Executive Board: *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*, version 2.

/27/ The International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF): E-mail to the UNFCCC Secretariat informing about the intention to request renewal of the crediting period of the El Canadá project, dated 26 May 2010.

3.1.3 Documentation used by DNV to validate / cross-check the information provided by the project participants

/28/ IPCC: *2006 IPCC Guidelines for National Greenhouse Gas Inventories*

/29/ American National Standards Institute (ANSI): *ANSI C12.20 Electricity meters 0.2 and 0.5 accuracy class – 2010 edition*. Webpage: http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+C12.20-2010

/30/ Ministerio de Energia y Minas, Comision nacional de energía eléctrica: *Ley General de Elecridad Decreto No. 93-96*. The general electricity law of 1996.

/31/ Ministerio de Energia y Minas: *Ley de incentivos para el desarrollo de proyectos de energia renovable, Decreto 52-2003 and 211-2005*. The Renewable energy incentives law of 2003 and 2005.

/32/ SGS United Kingdom Ltd.: *Verification and certification report for the El Canada hydroelectric project*, dated 7 August 2008.

3.2 Follow-up interviews with project stakeholders

On 12 – 15 October 2010 DNV visited ENEL's offices in Guatemala City and the project site and performed interviews with project stakeholders.

	Date	Name	Organization	Topic
/33/	12 – 15 October 2010	Fernando Rafael Rios Villatro	Generadora de Occidente Ldta.	Technical details about the power plant and

				equipment. Monitoring equipment and calibration. Monitoring plan.
/34/	12 – 15 October 2010	Claudia Croce	International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)	Baseline methodology, monitoring plan, emission reduction calculations.

3.3 Closing out of validation findings

The objective of this phase of the assessment was to resolve any outstanding issues which needed be clarified prior to DNV's positive conclusion on the project design.

In order to ensure transparency a validation protocol was customised for the project. The protocol shows in a transparent manner the criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of four tables. The different columns in these tables are described in the figure below. The completed validation protocol for the project activity "El Canadà Hydroelectric Project" in Guatemala is enclosed in Appendix A to this report.

A corrective action request (CAR) is raised if one of the following occurs:

(a) The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;

(b) The CDM requirements have not been met;

(c) There is a risk that emission reductions cannot be monitored or calculated.

A clarification request (CL) is 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 raised during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

The validation identified nine CARs, no CLs and no FARs. The CARs and CLs were satisfactorily addressed by the project participants by among other revising the PDD (please refer to Table 2 in Appendix A for further details).

Note: In response of the incompleteness message received from UNFCCC secretariat dated 18 December 2012, the calculation of grid emission factor was updated based on the electricity data from the years 2006-2008 /6/, DNV confirms that this was the latest data available at the

time of submission of the CDM-PDD to the DOE for validation in June 2010 and is thus in line with "Tool to calculate the emission factor for an electricity system" /24/ (for more details refer to CAR 4 in Table 2 of Appendix A).

Validation Protocol Table 1: Requirement Checklist				
Checklist question	***Reference***	***Means of verification (MoV)***	***Assessment by DNV***	***Draft and/or Final Conclusion***
The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the CDM-PDD	*Gives reference to documents where the answer to the checklist question or item is found.*	*Means of verification (MoV) are **document review (DR)**, **interview (I)** or any other follow-up actions (e.g., on site visit and telephone or email interviews) and **cross-checking (CC)** with available information relating to projects or technologies similar to the proposed CDM project activity under validation.*	*The discussion on how the conclusion is arrived at and the conclusion on the compliance with the checklist question so far.*	*OK is used if the information and evidence provided is adequate to demonstrate compliance with CDM requirements. A **corrective action request (CAR)** is raised when project participants have made mistakes, the CDM requirements have not been met or there is a risk that emission reductions cannot be monitored or calculated. A **clarification request (CL)** is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met. A **forward action request (FAR)** during validation is raised to highlight issues related to project implementation that require review during the first verification of the project activity.*

Validation Protocol Table 2: Resolution of Corrective Action and Clarification Requests			
Corrective action and/ or clarification requests	***Ref. to checklist question in table 2***	***Response by project participants***	***Validation conclusion***
*The **CARs** and/ or **CLs** raised in Table 2 are repeated here.*	*Reference to the checklist question number in Table 2 where the CAR or CL is explained.*	*The responses given by the project participants to address the CARs and/or CLs.*	*The validation team's assessment and final conclusions of the CARs and/or CLs.*

Validation Protocol Table 3: Forward Action Requests		
Forward action request	***Ref. to checklist question in table 2***	***Response by project participants***
The FARs raised in Table 2 are repeated here.	*Reference to the checklist question number in Table 2 where the FAR is explained.*	*Response by project participants on how forward action request will be addressed prior to first verification.*

Figure 1 Validation protocol tables

3.4 Internal quality control

This validation opinion underwent a technical review performed by a technical reviewer qualified in accordance with DNV's qualification scheme for CDM validation and verification.

3.5 Validation team

				Type of involvement					
Role	***Last Name***	***First Name***	***Country***	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	TA 1.2 competence
Team leader (Validator) since 1 May 2013	Wen	Bo	Norway	✓		✓	✓		✓
Team leader (Validator) from 31 July 2012 to 30 April 2013	Dudek	Agnes	Norway	✓		✓	✓		✓
Team leader (Validator) until 30 July 2012	Molin	Peter	Norway	✓		✓	✓		✓
Validator	Chavez	Francisco V.	Norway	✓	✓	✓			✓
Technical reviewer	Shome	Sharmistha	India					✓	✓

The qualification of each individual validation team member is detailed in Appendix B to this report.

4 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The final validation findings relate to the project design as documented and described in the PDD, version 11 dated 1 May 2013.

4.1 Validity of selected baseline and monitoring methodology

The registered PDD used the consolidated baseline and monitoring methodology ACM0002 version 6, while the revised PDD uses the latest version 13.0.0 of the same methodology /23/.

DNV hence confirms that the project uses the latest version of the methodology applied in the original PDD in accordance with the VVS /19/ and the latest version of the methodological tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period /20/. In accordance with Procedure for renewal of the crediting period of a registered CDM project activity paragraph 4, the project participants have notified the UNFCCC about their intention to request a renewal of the crediting period for the project activity and the selection of DNV as DOE of the request. The notification was sent to the UNFCCC on 26 May 2010 /27/. The CDM PDD was submitted to DNV for request of renewal of crediting period in June 2010 /1/.

4.2 Applicability of selected baseline and monitoring methodology

The selected baseline and monitoring methodology has been updated from ACM0002 version 6 in the registered PDD, to ACM0002, version 13.0.0 in the PDD revised for the request for renewal of the crediting period /1/. The applicability criteria that have changed between these two versions of the methodology are:

- *In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of the baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.*

  The project activity was a new hydropower plant when it was registered as a CDM activity. The above criterion is hence not relevant to the project activity.

- *In the case of hydro power plants, one of the following conditions must apply:*
  - *The project activity is implemented in an existing reservoir, with no change in the volume of the reservoir; or*
  - *The project activity is implemented in an existing reservoir, where the volume of the reservoir is increased and the power density of the project activity is greater than 4 W/m^2; or*
  - *The project activity results in new reservoirs and the power density of the power plant is greater than 4 W/m^2.*

  DNV confirmed by visual inspection during site visit and document review of technical maps of the project's reservoir /13//14/ that a small run-of-river reservoir was constructed for the project with a surface area of 28 273 m^2 at maximum capacity. When dividing the installed capacity of 48.11 MW by the surface area, we obtain the power density of 1701.62 W/m^2, which is by far greater than 4 W/m^2. No changes to

the reservoir have been made after the commissioning of the power plant. The third point of this criterion is hence satisfied.

- *The methodology is not applicable to the following:*
  - *Biomass fired power plants:* The project activity is a hydropower plant.
  - *Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2:* As stated above, the power density of the run-of-river reservoir is 1701.62 W/m^2, which is by far greater than 4 W/m^2. No changes have been made after the commissioning of the power plant. This criterion is hence satisfied.

In conclusion, the project activity meets the new applicability criteria in the latest version of the methodology, and DNV is hence of the opinion that this version of the methodology is applicable to the project.

4.3 Validity of the original baseline or its update

At the start of a second and third crediting period, the applied methodology ACM0002 version 13.0.0 /23/ requires the project proponent to address two issues:

- Assess the continued validity of the baseline; and
- Update the baseline

These two issues are further detailed in the methodological tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period /20/, where a stepwise procedure is given. The validation of these steps is described below.

Step 1: Assess the validity of the current baseline for the next crediting period

In the first step the project proponent must assess the impact of new relevant national and/or sectoral policies and circumstances on the baseline.

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

Guatemala has two laws that are relevant to this project activity: the General Electricity Law of 1996 /30/ and the Renewable Energy Incentives Law of 2005 /31/. The General Electricity Law opened for a de-centralization of the Guatemalan electricity sector, allowing private investors to enter, and separated electricity generation, transmission and distribution. It was implemented before the start of the project activity and is still in effect. There have however not been any changes in the law since the project was implemented, and the law does not affect the project's baseline scenario.

The Renewable Energy Incentives Law was created to promote the development of renewable energy through fiscal, economic and administrative incentives. The law was constructed to enable renewable energy generation to compete with fossil fuelled generation e.g., by introducing a ten-year income tax exemption for renewable energy. The law does however not make renewable energy sources mandatory in energy production, and does in this way not affect the project's baseline scenario.

DNV has cross-checked the information stated in the PDD against the laws, and can confirm that none of the two laws mentioned affect the baseline scenario after the registration of the

project. It can then be confirmed that the current baseline scenario complies with the relevant mandatory national and sectoral policies in Guatemala.

Step 1.2: Assess the impact of circumstances

Over the past ten years, and after the Indicative Expansion Plan of the Generation System 2008 – 2022 /16/ was created by the Electricity National Commission in 2008, a gradual increase in the share of hydropower have been seen in Guatemala /5/. The electricity generation is however dominated by fossil fuelled power plants (54.5% in 2008 /5/), and the Guatemalan authorities are struggling to attract investors to the renewable energy sector. The project proponent has provided DNV a labour market report published by the national electricity commission in Guatemala CNEE, which confirms the difficulties to attract investors to the renewable energy sector /15/. DNV is of the opinion that the circumstances have not considerably changed since the time of the registration of the project activity, and does not contradict the validity of the baseline scenario.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

The current baseline scenario of the project activity is electricity delivered from the grid, which is operated by several grid-connected power plants. Over the course of the first and second crediting periods some power plants may be shut down, while other may be built. However, the operation of the grid as a whole is technically possible, and does not contradict the baseline scenario.

The project activity is a new hydropower plant which was commissioned in 2003 /32/. Based on DNV's experience with hydropower projects, DNV confirm that a hydropower plant has a technical lifetime of 20 – 50 years, and there is no reason to assume that the main equipment of the project activity should need replacement during the second crediting period.

DNV is hence of the opinion that the continuation of the current baseline equipment is technically possible.

Step 1.4: Assessment of the validity of the data and parameters

The combined margin emission factor was fixed ex-ante for the first crediting period. This has been updated in line with the Tool to calculate the emission factor for an electricity system /24/ to obtain a new *ex-ante* combined margin emission factor for the second crediting period. The updated emission factor is described in detail in Section 4.5 below.

Conclusion on step 1

The conclusion on this step is that the baseline is still valid for the second crediting period, but parameters and data has to be updated in accordance with the methodology ACM0002 version 13.0.0. The updated data and parameters will be discussed in Step 2 below.

Step 2: Update the current baseline and the data and parameters

Step 2 is valid as data and parameters must be updated in accordance with the methodological tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period /20/.

Step 2.1: Update the current baseline

The baseline scenario remains the same as in the registered PDD, in accordance with the methodological tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period /20/, and is 'Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin calculations described in the Tool to calculate the emission factor for an electricity system', as defined in ACM0002 version 13.0.0 /23/.

Step 2.2: Update the data and parameters

The *ex-ante* grid emission factor was updated for the second crediting period in accordance with the methodological tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period /20/. The procedure to determine the emission factor from Tool to calculate the emission factor for an electricity system has been followed as described in section 4.5 below.

4.4 Validity of monitoring plan

The project applies the approved baseline and monitoring methodology ACM0002 version 13.0.0 /23/. The parameters, data and management system are described further below.

The monitoring plan is in DNV's opinion in accordance with the methodology and allows for the opportunity for real measurements of achieved emission reductions. The project proponent is also in DNV's opinion able to implement the monitoring plan as described in the PDD version 11 of 1 May 2013.

4.4.1 Parameters determined *ex-ante*

The following parameters are determined *ex-ante* and remain fixed throughout the second crediting period:

$EG_{m,y}$ – *Electricity by generation units*. The annual electricity produced by grid-connected plants in the years 2006, 2007 and 2008 were sourced from annual generation reports published by Administrador del Mercado Mayorista /6/. The data is also presented in the excel sheet /4/. DNV has cross-checked the references and confirm that the values have been correctly applied in the calculations of the operating and build margin emission factors.

$NCV_{i,y}$ – *Net calorific values*. The net calorific values of fossil fuels used in electricity production to the grid have been sourced from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories /28/. The applied values are diesel oil (43 TJ/Gg), fuel oil No. 6 (40.4 TJ/Gg), orimulsion (27.5 TJ/Gg), coking coal (28.2 TJ/Gg) and natural gas (48 TJ/Gg). DNV has cross-checked the values and can confirm that they have been correctly applied.

$EF_{CO2,j,y}$ – *CO_2 emission factor of fossil fuel type i in year y*. This parameter is sourced from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories /28/. The lower limit of uncertainty at the 95% confidence interval have been used, and the applied values are diesel (72.6 tCO_2/TJ), fuel oil No.6 (75.5 tCO_2/TJ) and coking coal (87.3 tCO_2/TJ). DNV has cross-checked the values and can confirm that they have been correctly applied.

$FC_{i,m,y}$ – *Fuel consumption of fossil fuel type i consumed by power plant m in year y*. The fuel consumption from different power plants has been calculated from data from annual generation reports published by Administrador del Mercado Mayorista /6/ and the energy

conversion efficiency $\eta_{m,y}$ as described below. DNV has cross-checked the references and calculations and confirm that the values have been correctly applied in the calculations of the operating and build margin emission factors.

$\eta_{m,y}$ – Average net energy conversion efficiency of power unit m in year y. Where public information regarding efficiencies of power plants was not available, default values have been sourced from Appendix A of the Tool to calculate the emission factor for an electricity system /24/. DNV has cross-checked the values with the respective source and confirms that values have been correctly applied.

$EF_{OM,y}$ – Operating margin emission factor. The operating margin emission factor has been calculated from the parameters $EG_{m,y}$ and $EF_{CO2,j,y}$ which both are described above. DNV has verified that the calculations are in accordance with the Tool to calculate the emission factor for an electricity system /24/. The applied value of the operating margin emission factor is 0.841 tCO_2/MWh /4/.

$EF_{BM,y}$ – Build margin emission factor. The build margin emission factor has been calculated from the parameters $EG_{m,y}$, $FC_{i,m,y}$, $EF_{CO2,j,y}$ and $\eta_{m,y}$ which are described above. DNV has verified that the calculations are in accordance with the Tool to calculate the emission factor for an electricity system /24/. The applied value of the build margin emission factor is 0.38 tCO_2/MWh.

$EF_{grid,CM,y}$ – Combined margin CO_2 emission factor for grid connected power generation in year y. The combined margin emission factor of the electricity displaced has been calculated based on the operating and build margin grid emission factors as described below. DNV has verified the calculations and confirm that they are correctly made in accordance with the Tool to calculate the emission factor for an electricity system /24/. The applied value of the combined margin emission factor is 0.495 tCO_2/MWh.

4.4.2 Parameters monitored *ex-post*

The following parameters are monitored *ex-post*:

$EG_{PJ,y}$ – Net electricity supplied to the grid by the project. The amount of electricity generated by the project and supplied to the grid is calculated as a difference between 2 measured data E1 and E2. The meter at the El Canadá substation (E1) is shared with another hydropower plant, i.e. the Montecristo hydropower station. In order to determine the electricity supplied from El Canadá, the meter at the Montecristo substation (E2) will be read, and this value will be subtracted from the reading at the El Canadá substation in the following way: $EG_{PJ,y}$ = E1 – E2.

The meters at both substations are bi-directional and thus provide net electricity generation values. DNV has checked the meters during site visit, and is of the opinion that the parameter is correctly determined in accordance with the methodology ACM0002 version 13.0.0 /23/ and the revised monitoring plan of 2010 /17//18/.

E1: Net electricity supplied to the grid by both El Canada and Montecristo power plants. This parameter will be measured continuously with a bidirectional meter at the El Canada substation and recorded monthly.

The meter is bi-directional and thus provide net electricity generation values. The data will be aggregated weekly, monthly and yearly and will be archived for two years after the last issuance of CERs for this project activity. The data will be cross-checked against sales invoices.

E2: Net electricity supplied to the grid by the Montecristo power plant. This parameter will be measured continuously with a bidirectional meter at the Montecristo substation and recorded monthly. The meter is bi-directional and thus provide net electricity generation values. The data will be aggregated weekly, monthly and yearly and will be archived for two years after the last issuance of CERs for this project activity. The data will be cross-checked against sales invoices.

The project has a run-of-river reservoir with a power density of 1701.62 W/m^2. DNV is of the opinion that as this is not an accumulation reservoir, and the power density is very far from the threshold were emissions is to be accounted for, no monitoring of the surface area is required. If the power density should reach 10 W/m^2 with the same installed capacity, the surface area of the run-of-river reservoir would have to increase 170 times, which is unrealistic. DNV interpret the methodology to require monitoring of the surface areas of accumulation reservoirs, and hence is the monitoring of the surface area for this project activity not required.

In accordance with the methodology ACM0002 version 13.0.0, project emissions from the back up diesel generator can be neglected.

4.4.3 Management system and quality assurance

The project proponent has developed a management system with clearly defined procedures and responsibility structures. The management system, procedures and responsibilities are described in the PDD and are in DNV's opinion in accordance with the methodology ACM0002 version 13.0.0 /23/.

In order to determine the electricity supplied from El Canadá, the meter at the Montecristo substation will be read, and this value will be subtracted from the reading at the El Canadá substation. The procedure is detailed in the PDD and is in DNV's opinion in accordance with the methodology ACM0002 version 13.0.0 /23/. DNV has verified calibration certificates from 2008 and 2009 for the main and support meters at both the El Canadá and the Montecristo substations, and confirm that the meters have an accuracy of ±0.20% /7/-/12/.

All data collected as part of the monitoring will be archived electronically and kept for at least two years after the end of the last crediting period.

The monitoring plan contains all necessary parameters described in accordance with the monitoring methodology. The monitoring plan, including data management and QA/QC procedures, will give opportunity for real measurements of achieved emission reductions, which can hence be reported *ex post* and verified. The application of the monitoring methodology is transparent and DNV considers the project participants able to implement the monitoring plan.

4.5 Estimation of GHG emissions

The applied methodology ACM0002 version 13.0.0 /23/ defines the GHG emission reductions of the project activity as:

$$ER_y = BE_y - PE_y$$

Where ER_y is the emission reductions in year y, BE_y is the baseline emissions in year y and PE_y is the project emissions in year y.

As the project only has a run-of-river reservoir (and no accumulation reservoir), and the power density is above 10 W/m^2, the project emissions are zero according to the methodology. The emission reductions are hence equal to the baseline emissions BE_y which are given as:

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

Where $EG_{PJ,y}$ is the net electricity generation generated by the project activity and supplied to the grid in year *y* and $EF_{grid,CM,y}$ is the combined margin emission factor for the relevant grid in year *y*.

The emission factor of the grid is calculated using the Tool to calculate the emission factor for an electricity system /24/. When calculating the emission factor, the project proponent has selected Guatemala's national grid as the relevant electricity system. This is in DNV's opinion reasonable and in accordance with the Tool to calculate the emission factor for an electricity system /24/. The project proponent has further chosen to only include grid-connected power plants in the calculations and also to calculate both the operating and build margin emission factors *ex-ante*.

The emission factor has been calculated as follows:

- For the operating margin (OM), the 'simple OM' has been selected. This is deemed appropriate, as LCMR facilities on average constitute less than 50% of the generation based on the data available during the most recent 5 years (2004-2008) at the time of the submission of the CDM-PDD to the DNV for validation in June 2010, i.e. 49.44% during the period 2004-2008 /5/.

  Option A of the simple OM has been used, where the emission factor is calculated based on the net electricity generation and an emission factor of each power unit. The generation data is sourced from the annual reports of the electricity market administrator of Guatemala AMM /6/, and the emission factors for each power unit are sourced from the IPCC 2006 report /28/. DNV has cross-checked the data used in the calculations with the reference and can confirm that the data has been correctly applied in the calculations.

  The emission factor for each power unit has been determined using Option A2 in the Tool to calculate the emission factor for an electricity system /24/. Furthermore the carbon emission factor for electricity imports from El Salvador interconnected system has been set to zero, while the export of electricity has been included in the total generation for each plant, and hence using the individual plant's emission factors. For co-generators, 70% of the fuel comes from bagasse during the harvesting season, while heavy fuel oil No. 6 has been used for the remaining time. CO_2 emission factors were selected in accordance with respective fuel type default values outlined in the IPCC 2006 Guidelines /28/. DNV has confirmed this from the annual generation reports of the electricity market administrator of Guatamala AMM /6/. The resulting simple operating margin emission factor is 0.841 tCO_2/MWh.
- When determining the build margin (BM) the project proponent has compared the annual electricity generation in the year 2008 of the five power plants that were built most recently with the set of power capacity that comprises 20% of the total generation and that have been built most recently, both excluding power units registered as CDM project activities. The latter option represents the larger annual

electricity generation, and has been used for the calculation of the BM. The year 2008 is the most recent year for which information is available on units already built at the time of submission of PDD for request of renewal of crediting period to DNV in June 2010. The generation data are sourced from the annual generation reports of the electricity market administrator of Guatamala AMM /6/. DNV has cross-checked the data used in the calculations with the reference and can confirm that the data has been correctly applied in the calculations. The build margin emission factor has been determined to be 0.380 tCO_2/MWh.

- The resulting combined margin emission factor has then been calculated as a weighted average emission factor, with the following weights: w_{OM} = 0.25 and w_{BM} = 0.75. The combined margin emission factor is then 0.495 tCO_2/MWh. DNV confirm that this is in accordance with the Tool to calculate the emission factor for an electricity system /24/ for second crediting period of hydropower projects.

Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average ex-ante estimation of emission reduction conservatively calculated to be 96 463 tCO_2e per year for the selected crediting period.

All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources. All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD. All values used in the PDD are considered reasonable in the context of the proposed CDM project activity. The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions. All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD.

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APPENDIX A

CDM VALIDATION PROTOCOL

Table 1 Requirements checklist

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A Application of a baseline and monitoring methodology	/1/				
A.1 Methodology applied (VVM para 65-76)	/1/				
A.1.1 Does the project apply an approved methodology and the correct version thereof?	/1/	DR	The project was registered using the methodology ACM0002 ver. 6 and has been updated to ACM0002 ver. 13.0.0 for the request for renewal of the crediting period. *The methodology must be updated to the latest version.*	~~CAR 1~~	OK
A.2 Applicability of methodology (and tools) (VVM para 65-76) *Insert a row for each applicability criteria of the applied methodology (and tools)*					
A.2.1 How was it validated that project complies with the following applicability criteria: *The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit?*	/1/	DR SV	The project activity is a new hydropower plant in Guatemala. This was confirmed during site visit and by checking technical maps of the project site /13/.		OK
A.2.2 How was it validated that project complies with the following applicability criteria: *In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum*	/1/	DR	The project is a new hydropower plant, and no capacity additions, retrofits or replacements are relevant in regards to the applicability criteria of the methodology.		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	historical reference period and the implementation of the project activity?					
A.2.3	How was it validated that project complies with the following applicability criteria: *In case of hydro power plants, one of the following conditions must apply:* • *The project activity is implemented in an existing reservoir, with no change in the volume of the reservoir; or* • *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or* • *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.*	/1/	DR SV	It was confirmed by visual inspection during site visit and document review of technical maps of the project's reservoir /13/ that a small reservoir was constructed for the project with a power density greater of 1701.62 W/m^2, which is larger than 4 W/m^2.		OK
A.2.4	Is the selected baseline one of the baseline(s) described in the methodology and this hence confirms the applicability of the methodology?	/1/	DR	The baseline in the PDD at the time of the request for renewal of the crediting period is similar as in the registered PDD: *Electricity delivered to the grid by the project activity would otherwise have been generated by the operation of grid-connected power plants and by the addition of new generation sources.* This is in accordance to, and confirms the applicability of the methodology.		OK
A.3	**Project boundary (VVM para 77-79)**					
A.3.1	What are the project's system boundaries (components and facilities used to mitigate GHGs)? Are they clearly defined and in accordance with the methodology?	/1/	DR SV	The project's system boundaries are the project site itself including tunnel, the regulating pond, penstock and the powerhouse and all power plants physically connected to the Guatemalan power grid. This is as in accordance with the		OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			methodology.		
A.3.2 Which GHG sources are identified for the project? Does the identified boundary cover all possible sources linked to the project activity? Give reference to documents considered to arrive at this conclusion.	/1/	DR	The only GHG included in the project boundary is CO_2 from fossil fuelled power plants connected to the Guatemalan power grid. This was confirmed from the site visit, and is in accordance to the methodology.		OK
A.3.3 Does the project involve other emissions sources not foreseen by the methodologies that may question the applicability of the methodology? Do these sources contribute with more than 1% of the estimated emission reductions of the project?	/1/	DR	No other emission sources have been identified during validation.		OK
A.4 Baseline scenario determination (VVM para 80-87, 103-105)					
A.4.1 Which baseline scenarios have been identified? Is the list of baseline scenarios complete?	/1/	DR	No new baseline scenarios have been identified in the PDD revised for the request for renewal of the crediting period, compared to the registered PDD. The baseline scenario is "*Electricity delivered to the grid by the project activity would otherwise have been generated by the operation of grid-connected power plants and by the addition of new generation sources"* in accordance with the methodology. There is no new assessment of the selection of the baseline scenario, which is in accordance to the *VVS* /19/.		OK
A.4.2 How have the other baseline scenarios been eliminated in order to determine the baseline?	/1/	DR	No new baseline scenarios have been identified in the PDD revised for the request for renewal of the crediting period.		OK
A.4.3 What is the baseline scenario?	/1/	DR	The baseline scenario is "*Electricity delivered to the grid by the project activity would otherwise have been generated by the operation of grid-connected power plants and by the addition of new generation sources"* in accordance with the		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				methodology.		
A.4.4	Is the determination of the baseline scenario in accordance with the guidance in the methodology?	/1/	DR	Yes, the baseline scenario has been determined in accordance with the methodology.		OK
A.4.5	Has the baseline scenario been determined using conservative assumptions where possible?	/1/	DR	Yes, conservative assumptions have been used in the determination of the baseline scenario.		OK
A.4.6	Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	/1/	DR	The PP has provided an analysis of the current Guatemalan legislation affecting the registered project activity. None of the legislation changes the circumstances under which the project activity is operating. DNV has cross-checked the laws /30//31/ and can confirm that no change of circumstances has occurred as a result of new legislation.		OK
A.4.7	Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/1/	DR	Yes, the determination of the baseline scenario is compatible with available data, and references to all data and literature is given.		OK
A.4.8	Is the baseline determination adequately documented in the PDD? • All assumptions and data used by the project participants are listed in the PDD and related document to be submitted for registration. The data are properly referenced. • All documentation is relevant as well as correctly quoted and interpreted. • Assumptions and data can be deemed reasonable • Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD. • The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity	/1/		Yes, the baseline determination is adequately documented. No new assessment of the baseline scenario is required when requesting a renewal of the crediting period. However, the PP has followed the *Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period* and assessed the validity of the current baseline scenario. All assumptions and data used have been listed and referenced in the PDD and the information given and assumptions made are reasonable. The relevant legislation affecting the project has been listed and analysed in the PDD, and the methodology has been correctly applied in the assessment of the baseline scenario.		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A.5	**Calculations of GHG emission reductions**					
	Data and parameters that are available at validation and that are not monitored (VVM para 198-200)					
A.5.1	How was the $EG_{m,y}$ verified?	/1/	DR	The electricity generated by the generating units *m* in year *y* was verified by crosschecking the references with data publically available on the web pages of the Guatemalan power market administrator AMM /6/. *It must be confirmed if the latest available data for electricity generation in Guatemala have been used in the OM calculations.*	~~CAR 4~~	OK
A.5.2	How was the *NCV* verified?	/1/ /28/	DR	The *NCV* of the fossil fuels included in the calculations of the *CM* were crosschecked against the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* /28/.		OK
A.5.3	How was the EF_y verified?	/1/ /10/	DR	The emission factor EF_y has been calculated using data from the Guatemalan power market administrator, which have been cross-checked with publically available sources /6/. The calculations have been verified and found in accordance with the *Tool to calculate the emission factor for an electricity system*.		OK
A.5.4	How was the $EF_{OM,y}$ verified?	/1/	DR	The operating margin emission factor $EF_{OM,y}$ has been calculated using data from the Guatemalan power market administrator, which have been cross-checked with publically available sources /6/. The calculations have been verified and found in accordance to the *Tool to calculate the emission factor for an electricity system*. *It must be confirmed if the latest available data for electricity generation in Guatemala have been*	~~CAR 4~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			used in the OM calculations.		
A.5.5 How was the $EF_{BM,y}$ verified?	/1/	DR	The build margin emission factor $EF_{BM,y}$ has been calculated using data from the Guatemalan power market administrator /6/, which have been cross-checked with publically available sources. The calculations have been verified and found in accordance to the *Tool to calculate the emission factor for an electricity system*. *The operating and build margin in the spreadsheet provided to DNV is not consistent with the values in the PDD. The project participant must ensure that these values are consistent and correct.*	~~CAR 5~~	OK
A.5.6 How was the $FC_{i,m,y}$ verified?	/1/	DR	The fuel consumption $FC_{i,m,y\eta}$ of the fuels consumed in the electricity system was calculated from the electricity generated on a power station unit level, and then converted to amounts of fuels using default efficient factors $\eta_{m.y}$ as described below. The electricity generation on a unit level $EG_{m,y}$ was cross-checked with data publically available on the web pages of the Guatemalan power market administrator AMM /6/ and the conversion factor $\eta_{m.y}$ has been sourced from Appendix A of the *Tool to calculate the emission factor for an electricity system* version 3.0.0 /24/. The calculations of the $FC_{i,m,y\eta}$ have been verified and found correct by DNV.		OK
A.5.7 How was the $EF_{CO2,i,y}$ verified?	/1/ /28/	DR	The $EF_{CO2,i,y}$ of the fossil fuels included in the calculations of the *CM* were crosschecked against the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* /28/.		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A.5.8	How was the $\eta_{m,y}$ verified?	/1/	DR	The efficiency factors of the different generation technologies have been sourced from Appendix A of the *Tool to calculate the emission factor for an electricity system* version 3.0.0 /24/. DNV confirm that the values have been correctly applied and are of the opinion that the values used are reasonable.		OK
	Baseline emissions (VVM para 88-92)					
A.5.9	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	The baseline emissions are calculated as the product of the electricity generation of the project activity and the combined margin emission factor of the Guatemalan grid. The calculations are made in accordance to the methodology and in a complete and transparent manner. *It must be confirmed if the latest available data for electricity generation in Guatemala have been used in the OM calculations.*	~~CAR 4~~	OK
A.5.10	Have conservative assumptions been used when calculating the baseline emissions?	/1/	DR	Yes, conservative assumptions have been used when calculating the baseline emissions.		OK
A.5.11	Are uncertainties in the baseline emission estimates properly addressed?	/1/	DR	Yes, conservative default values have been used throughout the calculations to address uncertainties in the data used for the baseline emission estimates.		OK
	Project emissions (VVM para 88-92)					
A.5.12	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	The project activity does not cause any project emissions. *The project participant is requested to provide a justification of why the project does not have any project emissions.* *The project participant is requested to provide an evidence of the size of the reservoir/pond to DNV*	~~CAR 2~~ ~~CAR 3~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			for verification.		
A.5.13 Have conservative assumptions been used when calculating the project emissions?	/1/	DR	The project activity does not cause any project emissions.		OK
A.5.14 Are uncertainties in the project emission estimates properly addressed?	/1/	DR	The project activity does not cause any project emissions.		OK
Leakage (VVM para 88-92)					
A.5.15 Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	No leakage is considered in accordance to the methodology. No transfer of equipment has occurred in connection with the renewal of the crediting period.		OK
A.5.16 Have conservative assumptions been used when calculating the leakage emissions?	/1/	DR	No leakage is considered in accordance to the methodology.		OK
A.5.17 Are uncertainties in the leakage emission estimates properly addressed?	/1/	DR	No leakage is considered in accordance to the methodology.		OK
Emission Reductions (VVM para 88-92)					
A.5.18 Algorithms and/or formulae used to determine emission reductions: • All assumptions and data used by the project participants are listed in the PDD and related document submitted for registration. The data are properly referenced • All documentation is correctly quoted and interpreted. • All values used can be deemed reasonable in the context of the project activity • The methodology has been correctly applied to calculate the emission reductions and this can be replicated by the data provided in the PDD and supporting files to be submitted for registration.	/1/ /4/	DR	• The assumptions and data used for the emission reduction calculations are listed in the PDD and the corresponding spreadsheet with the actual calculations. The data are properly referenced. • The documentation have been quoted and interpreted correctly from the original sources to the calculations. • The values are deemed reasonable in the context of the project activity. • The emission reduction calculations have been made in accordance to the methodology, and the spreadsheet submitted along the PDD allows for replication of the calculations.		OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A.6	**Monitoring plan (VVM para 120-122)**					
	Data and parameters monitored					
A.6.1	Do the means of monitoring described in the plan comply with the requirements of the methodology?	/1/	DR	The electricity supplied from the project activity to the grid is monitored, as in accordance with the methodology.		OK
A.6.2	Does the monitoring plan contains all necessary parameters, and are they clearly described?	/1/	DR	Only the electricity generation from the project activity is monitored which is in accordance with the methodology. The parameter has been adequately described in the monitoring plan.		OK
A.6.3	In case parameters are measured, is the measurement equipment described? Describe each relevant parameter.	/1/	DR	The electricity generation is measured with a watt-hour meter. Two meters are connected to the power station: one main meter and a reserve meter.		OK
A.6.4	In case parameters are measured, is the measurement accuracy addressed and deemed appropriate? Describe each relevant parameter.	/1/	DR	The watt-meter has an error range of ±0.2%. This is confirmed from the calibration certificates /7//8//9/ and it was confirmed from the certificates that this is in accordance with the ANSI standard C12.20 for electricity meters /29/.		OK
A.6.5	In case parameters are measured, are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate? Describe each relevant parameter.	/1/ /7/ /8/ /9/	DR	The calibration frequency complies with the national requirements.		OK
A.6.6	Is the monitoring frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	One hundred percent of the data will be monitored, and it will be measured monthly, which is in accordance to the methodology. The meter readings will be recorded monthly.		OK
A.6.7	Is the recording frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	The electricity generation will be recorded monthly, as in accordance with the methodology.		OK
	Ability of project participants to implement monitoring plan					
A.6.8	How has it been assessed that the monitoring arrangements	/1/	DR	The monitoring arrangements are in accordance		OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	described in the monitoring plan are feasible within the project design?			with the project design.		
A.6.9	Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)?	/1/		Yes, procedures for the day-to-day records have been defined and are deemed adequate.		OK
A.6.10	Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/1/	DR	Records are electronically archived and kept for two years. QA/QC procedures have been defined, and a project manager is in charge of the generation and monitoring of data, record keeping and computation of emission reductions.		OK
A.6.11	Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?	/1/	DR	Yes, all data will be kept for minimum two years after the end of the last crediting period.		OK

Table 2 Resolution of corrective action requests and clarification requests

Corrective action and/ or clarification requests	Reference to Table 1	Response by project participants	Validation conclusion
CAR 1 The methodology must be updated to the latest version.	B.1.1	The PDD has been updated accordingly as per the latest version of the approved consolidated methodology ACM0002.	The methodology has been updated to the latest version 13.0.0. DNV confirm that this is a valid version at the time of validation. **CAR is closed.**
CAR 2 The project participant is requested to provide a justification of why the project does not have any project emissions.	B.5.12	The PDD has been revised accordingly (see PDD Section 6.3, page 32).	The project is a hydropower plant where the size of the reservoir is not increased. It was confirmed by DNV during site visit that a reservoir was built for the project, but no changes have been made to the reservoir after the commission of the power plant. Hence, the project emissions are zero as in accordance with the methodology. **CAR is closed.**

Corrective action and/ or clarification requests	Reference to Table 1	Response by project participants	Validation conclusion
CAR 3 The project participant is requested to provide an evidence of the size of the reservoir/pond to DNV for verification.	B.5.12	Evidence of the size of the run-of-river reservoir has been provided. See document "Surface area of El Canada run-of-rive reservoir".	DNV confirmed by visual inspection during site visit and document review of technical maps of the project's reservoir /13//14/ that a small run-of-river reservoir was constructed for the project with a surface area of 28 273 m^2 at maximum capacity. When dividing the installed capacity of 48.11 MW by the surface area, we obtain the power density of 1701.62 W/m^2. **CAR is closed.**
CAR 4 It must be confirmed if the latest available data for electricity generation in Guatemala has been used in the OM calculations.	B.5.1 B.5.4 B.5.9	The PDD has been revised accordingly (see PDD, version 11).	Data from the Guatemalan electricity administrator AMM (from the years 2006 – 2008) has been used in the latest version of PDD and Excel sheet /1/ /4/. In the previous version of the PDD that resulted in the incompleteness message received from UNFCCC secretariat dated 18 December 2012, electricity data for the period from 2008-2010 was used for calculation of grid emission factor. As 2009 and 2010 data were not available at the time of first submission of the PDD to the DOE for validation in June 2010, data from 2006-2008 (available at the start of the validation) are used to update the grid emission factor according to "Tool to calculate the emission factor for an electricity

Corrective action and/ or clarification requests	Reference to Table 1	Response by project participants	Validation conclusion
			system" /24/. The data is sourced from the records of AMM and was verified from their website/6/. Therefore, DNV confirms that the data used for calculation in the latest version 11 of the PDD (for the period from 2006-2008) was the latest available data at the time of submission of the CDM-PDD to the DOE for validation in June 2010 and this approach is as per the "Tool to calculate the emission factor for an electricity system" /24/. **CAR is closed.**

Corrective action and/ or clarification requests	Reference to Table 1	Response by project participants	Validation conclusion
CAR 5 The operating and build margin in the spreadsheet provided to DNV is not consistent with the values in the PDD. The project participant must ensure that these values are consistent and correct.	B.5.5	The values have been revised, and PDD's OM and BM values are now consistent with the values in the spreadsheet.	The spreadsheet and PDD have been revised and are now consistent. **CAR is closed.**
CAR 6 The Procedures for renewal of the crediting period of a registered project activity used in the PDD is not the latest version.		The Procedures for renewal of the crediting period of a registered CDM project activity have been updated to the latest version (see PDD, Section B.4). The version of the methodological Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" has been updated accordingly, and is now in accordance with version 6 of the "Procedures for renewal of the crediting period of a registered CDM project activity".	The PDD has been updated to use the latest version of the Procedures for renewal of the crediting period of a registered CDM project activity. The version of the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" used in the PDD is not in accordance with version 6 of the Procedures for renewal of the crediting period of a registered CDM project activity. The Procedures for renewal of the crediting period of a registered CDM project activity has been updated to version 6 in the PDD. **CAR is closed.**
CAR 7 The PDD specifies the parameters used in the calculation of the emission factors that are not monitored (the *ex-ante* parameters). The NCV		The NCV value for coal has been included in the ER calculation spreadsheet.	The NCV for coal has been added to the ER calculation spreadsheet and the PDD. Section B.7.1 in the PDD lists NCV of

Corrective action and/ or clarification requests	Reference to Table 1	Response by project participants	Validation conclusion
of coal is not specified in the ER calculation spreadsheet.		Parameters "NCV of fuel type i in year y" and the "emission factor of fuel type i in year y" have been moved to Section B.6.2."Data and parameters that are available at validation".	fuel type i in year y and the emission factor of fuel type i in year y as a monitored parameter. However, these parameters are not monitored as default values are used. The parameter NCV has been correctly listed as a parameter available at validation in the PDD. **CAR is closed.**
CAR 8 The methodology ACM0002 requires the net electricity delivered to the grid to be multiplied with the emission factor in order to obtain the emission reduction calculations. The monitoring plan only account for the electricity supplied to the grid, and not for possible electricity imports to the project.		PDD has been revised accordingly, and the monitoring plan is now consistent (see PDD Section B.7.1). Electricity meters at both, El Canada & Montecristo substations, are bi-directional meters designed to separately record both the imported and exported electricity (see PDD, Section B.7.1.).	It must further be clarified how the amount of imported electricity to the power plant is determined. The PDD has been revised to clarify that the electricity meters at the El Canada and the Montecristo substations are bi-directional so that imported and exported electricity is measured separately. **CAR is closed.**
CAR 9 In order to determine whether there are project emissions that need to be accounted for, it must be clarified whether there is a backup diesel generator connected to the project activity or not.		PDD has been updated accordingly (see PDD, sections B.6.1, B.6.2, B.7.1 and B.7.2)	Monitoring of the emissions from an on-site diesel generator is included in the monitoring plan. **CAR is closed.**

Table 3 Forward action requests

Forward action request	Reference to Table 1	Response by project participants
No FARs identified.	-	-

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APPENDIX B

CURRICULA VITAE OF THE VALIDATION TEAM MEMBERS

Agnes Dudek *holds a PhD Degree in applied physics. Having an overall experience of around 11 years. Prior to joining DNV having 7 years of experience in scientific research covering satellite remote sensing, mesoscale weather forecast modelling and air pollution dispersion modelling and monitoring. She has experience of around 4 years in validation and verification of numerous CDM projects.*

Her qualification, research experience and experience in CDM demonstrate her sufficient sectoral competence in energy generation from renewable energy sources.

Peter Molin *holds a MSc Degree in physics. Having an overall experience of around 6 years. Prior to joining DNV having 1.5 years of experience in analysis of the carbon market covering the EU ETS.*

He has experience of around 4.5 years in validation and verification of CDM projects/JI and other 3rd party validation/verification services. His qualifications and experience in CDM demonstrate his sectoral competence in the renewable energy sector.

Francisco Chávez V. *holds a Technical Degree in Electricity, a Bachelor Degree in Engineering Physics with specialization in Thermodynamics and IT systems, and a Master Degree in Business Administration with special focus in Strategy, Leadership, Marketing and Project Management. He has an overall working experience of around 27 years. Prior to joining DNV having 10 years of experience in hydro power and renewable energy projects, electricity systems (transmission, distribution, supply, demand, generation and rural electrification) and electricity markets, electrical equipment and installations, and 10 years of experience within the oil and gas industry, and around 5 years of business experience in several areas. During these years he has covered the areas of: Project Management, Manufacturing, Supervision, Consultancy and Advisory, Research and Testing of prototype equipment, Field, Maintenance and Repair work, etc.*

He has approximately 2 years of experience in validation and verification of CDM projects/JI and other 3rd party validation/verification services. His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in: Energy generation from renewable energy sources, electricity distribution, Energy demand, Manufacturing of electrical equipment, and Oil and Gas industry.

Francisco Chávez V. holds the following degrees: Electrician (Technical level), Engineering Physics (to Master level) with specialisation in Thermodynamics and IT systems, and Business Administration (Master level). In addition he has broad international experience from European, American, Latin American and Asian business cultures through 25 years of field work in O&M and construction, and consultancy assignments in the areas of hydropower and oil &gas exploration and production, both on- and offshore. His experience also covers the assessment of environmental and social impact analysis, biogas systems for production of methane, data and voice communication, economic evaluation of renewable energy projects, assessment of electricity markets and its transition to competitive markets, formulation of energy policies, analysis of business concepts, formulation of business strategy and design e implementation of management systems.

In DNV he is leading a portfolio of CDM validation and certification projects worldwide, and is performing as sector expert for hydropower projects with GHG emission reduction.

Wen, Bo *holds a Master Degree on International Business and a Master Degree on Business Administration. Having an overall working experience of more than 10 years, Ms.Wen first worked for auto industry before joining DNV, covering product management and fleet sales marketing. She has experience of around 4 years in validation and verification of numerous CDM projects since she joined DNV in year 2008.*
Her qualifications and experience in CDM demonstrate her sectoral competence in the renewable energy sector

Sharmistha Shome*, holds a Master Degree in Energy Systems. She has experience of around 3 years in validation and verification of CDM projects/JI and other 3rd party validation/verification services. She has completed the ISO14001 EMS Lead Auditor course.*
Her qualification and experience in CDM facilitate to assess renewable energy based projects.