GRID EMISSION FACTOR (GEF) VALIDATION REPORT
For

Belgian Development Cooperation

Clean Development Mechanism: Capacity Development & Projects Support – Validation of GEF for Uganda

In

Republic of Uganda

Report No: CCL202/UGANDAGEF

Revision number: 03

Report Date: 03/12/2013

Carbon Check (Pty) Ltd.
Block-A, Ground Floor
374 Rivonia Boulevard
Rivonia, Johannesburg
Republic of South Africa 2128

I. PROJECT DATA

Project title:	Clean Development Mechanism: Capacity Development & Projects Support – Validation of GEF for Uganda		
Host party:	Republic of Uganda		
Project location:	Republic of Uganda		
Methodology / Tool:	Tool to calculate the emission factor for an electricity system (version 03.0.0)		
Sectoral Scope/Technical Area	SS: 1 / TA: 1.2	**Scale: N/A**	☐Large Scale ☐Small Scale
GSC commenting period:	N/A		
Final Report:	Version 1.0; Dated 03/12/2013		
Grid Emission Factor:	The different values for Grid Emission Factor (depending upon the type of the project activity i.e., renewable or non-renewable and the crediting period i.e., first, second or third) is as:		

Data/Parameter	**Values (tCO_2/MWh)**
CM emission factor (Option I of the tool)[1] applicable to the wind and solar power projects for all the crediting periods	0.531
CM emission factor (Option II of the tool)[2] applicable to the wind and solar power projects only for the first crediting period	0.550
CM emission factor (Option II of the tool)[3] applicable to all other renewable energy power projects only for the first crediting period	0.529
CM emission factor applicable to all other projects only for the first crediting period	0.505
CM emission factor applicable to all other projects for the second and third crediting period	0.480

II. VALIDATION TEAM (compliance of § 148e of VVS)

Validation Team			**Role**									
Full name	Affiliation	Appointed for Sectoral Scopes (Technical Areas)	Team leader	Acting/trainee Team Leader	Local Expert	Team Member (Auditor)	Technical Expert	Acting/Trainee Tech. Expert	Trainee Auditor	Technical Reviewer	Expert to TR	Trainee TR
Amit Anand	RSA	1.2, 13.1	X				X		.			

[1] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[2] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)
[3] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Anubhav Dimri	RSA	1.2				X	X					
B. B. Sinha	Uganda	--			X							
Vikash Kumar Singh	RSA	1.2, 3.1, 13.1								X		

III. VALIDATION REPORT

Validation Phases and Status:

☒ Desk Review

☒ Follow up interviews, On Site Assessment

☒ Resolution of outstanding issues

☒ Corrective Actions / Clarifications Requested

☒ Full Approval

☐ Rejected

Final Approval Date	Approval	Distribution
2013-12-09	Priyesh Ramall **(Final Approval)**	☒ No distribution without permission from the Client or responsible organizational unit ☐ Limited Distribution ☐ Unrestricted distribution
2013-12-04	Vikash Singh **(Technical Reviewer)**	

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Abbreviations

BTC	Belgian Development Agency
BM	Build Margin
CA	Corrective Action / Clarification Action
CAR	Corrective Action Request
CCL	Carbon Check (Pty) Ltd.
CCU	Climate Change Unit
CDM	Clean Development Mechanism
CL	Clarification Request
CM	Combined Margin
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent
DNA	Designated National Authority
DOE	Designated Operational Entities
DVR	Draft Validation Report
EB	CDM Executive Board
EF	Emission Factor
ERA	Electricity Regulatory Authority
FA	Final Approval
FVR	Final validation Report
GEF	Grid Emission Factor
GHG	Greenhouse gas(es)
GoU	Government of Uganda
GWh	Giga Watt Hour
IPCC	Intergovernmental Panel on Climate Change
kV	Kilo Volts
kW	Kilowatt
kWh	kilowatt hour
LCMR	Low-Cost/Must Run
MEMD	Ministry of Energy and Mineral Development
MWE	Ministry of Water and Environment
MW	Megawatt
MWh	Mega Watt Hour
OM	Operating Margin
OSV	On Site Visit
QA/QC	Quality assurance / Quality control
TA	Technical Area
TR	Technical Review
UETCL	Uganda Electricity Transmission Company Limited
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Validation Opinion — summary

The validation team assigned by the DOE (Carbon Check (Pty) Ltd here after referred as CCL, has been contracted by “Belgian Development Agency (BTC) “to perform the validation of their project “Clean Development Mechanism: Capacity Development & Projects Support – Validation of GEF for Uganda”. The validation was performed on the basis of UNFCCC methodological tool “Tool to calculate the emission factor for an electricity system (version 03.0.0) /B01/.

The scope of validation is defined as an independent and objective review of the Grid Emission Factor for the Republic of Uganda based on the Version 03.0.0 of the United Nations Framework Convention Climate Change (UNFCCC) methodological tool: “Tool to calculate the emission factor for an electricity system”. The scope of validation includes the review of the project related data against the latest version of methodological tool.

The Validation team confirms the tender for “Clean Development Mechanism: Capacity Development & Projects Support – Validation of GEF for Uganda” was awarded to the DOE, Check (Pty) Ltd on 26/07/2013 by Belgian Development Agency (BTC).

Carbon Check (Pty) Ltd., is accredited to perform validation and verification of Clean Development Mechanism (CDM) projects under Sectoral scope 1 – Energy Industries (renewable/non-renewable sources) and is accredited to validate and verify such projects including the validation of related Grid Emission Factor. The team assigned for the validation complies with Carbon Check (Pty) Ltd internal procedures, the UNFCCC requirements for the team composition and competence and the requirements stipulated in the tender document by Belgian Development Agency. The validation team has conducted a thorough contract review as per UNFCCC and Carbon Check procedures and requirements.

<u>Validation methodology and process</u>

The validation has been performed as described in the VVS version 05.0 and constitutes the following steps:

- Document review of data and information (GEF report and review based on the approved methodological tool being applied and of the appropriateness of formulae and accuracy of calculations).
- Crosschecks between information provided in the GEF report and information from other sources.
- Follow up actions for cross checking data and on-site assessment (09/09/2013 – 10/09/2013).
- Issuance of Validation Report.

The validation protocol describes a total of Eleven (11) findings, which include Two (2) Corrective Action Requests (CARs) and Nine (9) Clarification Requests (CLs). All findings have been closed satisfactorily.

The report is based on the assessment of the Grid Emission Factor Report undertaken through stakeholder interviews, application of standard auditing techniques including but not limited to document reviews, site visit, and stakeholder interviews, review of the applicable/applied methodological tool and its underlying formulae and calculations.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

The summary of validated Grid Emission Factor for Uganda is as:

Grid Emission Factor for Republic of Uganda		
Data/Parameter	**Value**	**Unit**
Operating Margin (OM) Emission Factor		
Simple Adjusted OM emission factor (Option I of the tool)[4]	0.556	tCO_2/MWh
Simple Adjusted OM emission factor (Option II of the tool)[5]	0.572	tCO_2/MWh
Build Margin (BM) Emission Factor		
BM emission factor (Option I of the tool)[6]	0.454	tCO_2/MWh
BM emission factor (Option II of the tool)[7]	0.485	tCO_2/MWh
Combined Margin (CM) Emission Factor		
CM emission factor (Option I of the tool)[8] applicable to the wind and solar power projects for all the crediting periods	0.531	tCO_2/MWh
CM emission factor (Option II of the tool)[9] applicable to the wind and solar power projects only for the first crediting period	0.550	tCO_2/MWh
CM emission factor (Option II of the tool)[10] applicable to all other renewable energy power projects only for the first crediting period	0.529	tCO_2/MWh
CM emission factor applicable to all other projects only for the first crediting period	0.505	tCO_2/MWh
CM emission factor applicable to all other projects for the second and third crediting period	0.480	tCO_2/MWh

Carbon Check (Pty) Ltd hereby concludes that:

I. The methodological tool "Tool to calculate the emission factor for an electricity system (Version 03.0.0) /B01/ has been correctly applied.
II. The GEF for Uganda is both relevant and applicable to CDM projects seeking registration with UFCCC in the Republic of Uganda
III. Changes in host country generation data and revisions in the applied methodological tool need to be updated periodically.
IV. Vintage period of the data used to calculate the GEF is from 2010 to 2012.

2013-12-09	2013-12-04	2013-12-03
Priyesh Ramall Final Approver Carbon Check (Pty) Ltd	Vikash Kumar Singh Technical Reviewer Carbon Check (Pty) Ltd	Amit Anand Team Leader Carbon Check (Pty) Ltd

[4] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[5] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)
[6] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[7] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)
[8] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[9] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)
[10] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

TABLE OF CONTENTS

1. INTRODUCTION 8
1.1 Objective 8
1.2 Scope 8

2. METHODOLOGY 8
2.1 Desk review (compliance of § 21 of VVS) 9
2.2 Background documents: 10
2.3 On-site visit and follow-up interviews with project stakeholders 10
2.4 Resolution of outstanding issues 13
2.5 Internal quality control 14
2.6 Validation Team (compliance of § 148 e of VVS) 14

3. VALIDATION FINDINGS (COMPLIANCE OF § 148 B OF VVS) 15
3.1 Identification of relevant Electricity System/s 15
3.2 Selection of chosen set of power plants 17
3.3 Selection of a method to determine Operating Margin (OM) 19
3.4 Calculation of Operating Margin Emission Factor 20
3.5 Calculation of Build Margin (BM) Emission Factor 22
3.6 Calculation of Combined Margin Emissions Factor 23
APPENDIX A 25
APPENDIX B 48

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

1. INTRODUCTION

Belgian Development Agency (BTC) has commissioned the Carbon Check (Pty) Ltd. to perform an independent validation of the assignment "Clean Development Mechanism: Capacity Development & Projects Support – Validation of GEF for Uganda" in Republic of Uganda (hereafter referred to as "project activity"). This report summarises the findings of the validation of the assignment, performed on the basis of UNFCCC methodological tool "Tool to calculate the emission factor for an electricity system (version 03.0.0). This report contains the findings and resolutions from the validation and a validation opinion.

1.1 Objective

The purpose of a validation is to have a thorough and independent assessment of the assignment against the applicable requirements of approve/applied methodological tool "Tool to calculate the emission factor for an electricity system (version 03.0.0). These are validated in order to confirm that the assumptions, data, formulae and calculations are transparent and consistent and meet the requirement of the approved/applied methodological tool. Validation is seen as necessary to provide assurance to stakeholders of the quality of the report and Grid Emission Factor and its intended use for calculation of emission reductions (ERs) by projects seeking registration with UNFCCC in Republic of Uganda.

1.2 Scope

The scope of validation is defined as an independent and objective review of the Grid Emission Factor for the Republic of Uganda based on the latest version of the United Nations Framework Convention Climate Change (UNFCCC) methodological tool: "Tool to calculate the emission factor for an electricity system (version 03.0.0)". The scope of validation includes the review of the project related data against the latest version of methodological tool.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project report.

2. METHODOLOGY

The validation consists of the following four phases:

I A desk review of the project report documents
- A review of data and information;
- Cross checks between information provided in GEF report and information from sources with all necessary means without limitations to the information provided by the Client;

II On-site visit and follow-up interviews with relevant stakeholders
- Interviews with relevant stakeholders in host country with personnel's having knowledge with the project development via telephone, email or direct on-site visits;
- Cross checking between information provided by interviewed personnel with all necessary means without limitations to the information provided by the Client;

III Reference to available information's relating to GEF report and review based on the approved/applied methodological tool for the appropriateness of formulae and accuracy of calculations.

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

The following sections outline each step in more detail.

2.1 Desk review (compliance of § 21 of VVS)

The following table outlines the documentation reviewed during the validation:

Ref No.	*Reference Document*
/1/	1. Uganda Grid Emission Factor (GEF) 2013 Final Report (Uganda GEF Report 3Jun2013 final (Calibri).docx) – submitted via mail dated 08/08/2013. 2. Uganda GEF Report 2Sep2013 BH.docx - submitted via mail dated 02/09/2013. 3. Uganda GEF Report 27Sep2013 BH.docx - submitted via mail dated 27/09/2013 4. Uganda GEF Report 11Oct2013 BH.docx - submitted via mail dated 11/10/2013 5. Uganda GEF Report 28Oct2013 BH.docx - submitted via mail dated 28/10/2013 6. Uganda Grid Emission Factor (GEF) 2013, Version 1.0; Dated 28/10/2013 (Uganda GEF Report 28Oct2013 BH.docx) - submitted via mail dated 05/11/2013. 7. Uganda Grid Emission Factor (GEF) 2013, Version 1.0; Dated 28/10/2013 (Uganda GEF Report 22Nov2013 Calibri.docx) - submitted via mail dated 22/11/2013
/2/	Uganda Grid Emission Factor (GEF) 2013, Version 1.0; Dated 03/12/2013 (Uganda GEF Report 03Dec2013 (Revised TR comments) CF (clean).docx) - submitted via mail dated 03/12/2013
/3/	1. Uganda GEF Tool 3Jun2013 final.xlsx (submitted via mail dated 08/08/2013) 2. Uganda GEF Tool 2Sep2013 BH.xlsx (submitted via mail dated 02/09/2013) 3. Uganda GEF Tool 27Sep2013 BH.xlsx (submitted via mail dated 27/09/2013) 4. Uganda GEF Tool 22Nov2013 TR.xlsx (submitted via mail dated 22/11/2013)
/4/	Uganda GEF Tool 03Dec2013 TR.xlsx (Corresponding to /2/)
/5/	Letter titled “Emergency Evening/Night Load shedding Rotas for the Month of December 2010” (Reference No.: SHM/Lshed/1210/1; Dated 23/11/2010) from Sebugenyi H.M. (Principal Control Engineer- UETCL) to The Chief Technical Officer Umeme Limited.
/6/	Letter titled “Day time, Evening/Night and Emergency Load shedding Rotas for the Month of December 2011” (Reference No.: SHM/Lshed/1111/1; Dated 25/11/2011) from Sebugenyi H.M. (Principal Control Engineer- UETCL) to The Chief Technical Officer Umeme Limited.
/7/	Letter titled “Demand Management Plan for the Month of December 2012” (Reference No.: SHM/Lshed/1212/1; Dated 25/11/2012) from Sebugenyi H.M. (Principal Control Engineer- UETCL) to The Chief Technical Officer Umeme Limited.
/8/	UETCL: CDM Data 2010.xls
/9/	UETCL: CDM Data 2011.xls
/10/	UETCL: CDM Data 2012.xls
/11/	UETCL: Electricity Generating Plants - Uganda.xlsx
/12/	UETCL: Uganda Transmission Grid Map – Base Case (Drawing No.: UETCL/GDP/12/02); Dated: January 2013.
/13/	Presentation titled “Power Sector Reform in Uganda” by Hon. Eng. Simon D’Ujanga Member of Parliament, Parliament of Uganda
/14/	Report titled “Electricity Sector Performance Report for July 2011 – December 2011” by Electricity Regulatory Authority, Government of Uganda.
/15/	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1.4
/16/	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1.2
/17/	E-mail from Sebugenyi H.M. (Principal Control Engineer- UETCL) stating unavailability of data for off-grid power generation; Dated 23/09/2013

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

2.2 Background documents:

Ref No.	*Reference Document*
/B01/	Tool to calculate the emission factor for an electricity system (Version 03.0.0); Annex 22, EB 70.
/B02/	Clean Development Mechanism Validation and Verification Standard (Version 05.0)
/B03/	UNFCCC: www.unfccc.int http://unfccc.int/cooperation_and_support/ldc/items/3097.php
/B04/	UETCL: www.uetcl.com
/B05/	Umeme: www.umeme.co.ug
/B06/	Electricity Regulatory Authority: www.era.or.ug
/B07/	Ministry of Energy & Mineral Development: www.energyandminerals.go.ug
/B08/	Climate Change Unit: www.ccu.go.ug
/B09/	Ministry of Water and Environment: www.mwe.go.ug
/B10/	Belgian Development Agency: www.btcctb.org
/B11/	Intergovernmental panel on Climate Change (IPCC): www.ipcc.ch

2.3 On-site visit and follow-up interviews with project stakeholders

Validation team of Carbon Check performed an OSV from 09/09/2013 to 10/09/2013 at Kampala, Uganda. The following project representatives and stakeholders interviewed:

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Sl. #	Date	Type	Name (Organisation)	Topic
/i/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Daniel Lubanga (BTC)	• . • Discussion on GEF calculation approach
/ii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Nebeyu Shone (RR/BTC)	• Purpose of GEF calculation for Uganda. • Discussion on GEF calculation approach
/iii/	09/09/2013; 10/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Charles Baker (Climate Focus)	• Discussion on identification of the relevant electricity system/s. • Discussion on approach selected for chosen set of power plants (grid and off-grid power plants) • Discussion on selection of method to determine the operating margin (OM) and the calculation of operating margin emission factor according to the selected method • Discussion on identification of sample group and calculation of Build Margin (BM) emission factor
/iv/	09/09/2013; 10/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Bamshad Houshyani (Climate Focus)	• Discussion on identification of the relevant electricity system/s. • Discussion on approach selected for chosen set of power plants (grid and off-grid power plants) • Discussion on selection of method to determine the operating margin (OM) and the calculation of operating margin emission factor according to the selected method • Discussion on identification of sample group and calculation of Build Margin (BM) emission factor
/V/	09/09/2013; 10/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Issac Kifamulusi (BTC/CCU)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation
/Vi/	09/09/2013; 10/09/2013;	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Irene Chekwoti (BTC/CCU)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation
/Vii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Bbosa Henery K. (CCU/MWE)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation

/Viii/	09/09/2013; 10/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Ssebbugga Kimeze Arthur (BTC/CCU)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation
/Ix/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Paul Isabirye (CCU/MWE)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation
/x/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Sergw Innocente (FAO/CCU)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation
/xi/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Chebet Maikut (CCU/MWE)	• Delineation of electricity systems of Uganda • Type of Grids i.e., provincial / regional / national • Project Electricity System and connected electricity systems • Reliability and accuracy of data used in GEF calculation
/xii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Eng. Moses Murengeti (MEMD)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Energy generation sources.
/xiii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Eng. Henry Bidasala Igaga (MEMD)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Energy generation sources.
/xiv/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Bridget Nabagereka (MEMD)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Energy generation sources.
/xv/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Edward Baleke Ssekulima (MEMD)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Energy generation sources.
/xvi/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	John Tumuhimbise (MEMD)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Energy generation sources.
/xvii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Gerald Banaga Baing (MEMD)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Energy generation sources.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

/xviii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Kagaba Paul Mukiibi (ERA)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Electricity transmission systems • International inter-connections • Project Electricity System and connected electricity systems
/xix/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Peter Kityo (ERA)	• Electricity system of Uganda • Type of Grids i.e., provincial / regional / national • Electricity transmission systems • International inter-connections • Project Electricity System and connected electricity systems
/xx/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Sebugenyi H.M. (UETCL)	• Electricity system of Uganda • Electricity transmission systems • International inter-connections • Operational characteristics including load of Transmission lines for delineation of electricity systems. • Existence of spot market in the country. • Load shedding program
/xxi/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	Buhanga B. (UETCL)	• Electricity system of Uganda • Electricity transmission systems • International inter-connections • Operational characteristics including load of Transmission lines for delineation of electricity systems. • Existence of spot market in the country. • Load shedding program
/xxii/	09/09/2013	☒ On-site ☒ Face to Face ☐ Telephone ☐ Email ☐ Skype	John Othieno (UETCL)	• Electricity system of Uganda • Electricity transmission systems • International inter-connections • Operational characteristics including load of Transmission lines for delineation of electricity systems. • Existence of spot market in the country. • Load shedding program

2.4 Resolution of outstanding issues

The objective of this phase of the validation is to resolve any outstanding issues (issues that require further elaboration, research or expansion), which need be clarified prior to Carbon Check (Pty) Ltd' conclusion opinion on the project report.

The validation protocol serves the following purposes:

- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.
- It ensures that the issues are accurately identified, formulated, discussed and concluded in the validation report.
- It ensures the determination of credible Grid Emission Factor for the specific host country.

The validation protocol consists of a single table. The completed validation protocol for this project is enclosed in Appendix A to this report.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Findings established during the validation can either be seen as a non-fulfillment of a criterion of the approved/applied methodological tool or where a risk to the fulfillment of project objectives is identified.

Corrective action requests (CAR) are issued, where:

- ✓ The project participants have made mistakes that will influence the accuracy of calculated grid emission factor;
- ✓ The applicable CDM requirements have not been met;

A request for clarification (CL) may be issued 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.

The validation protocol consists of a single table; Table 2 (i.e. tables of findings).

The findings of validation process are summarized in the tables below.

Finding (reference section of table 1)			
Classification	☐ CAR	☐ CL	☐ FAR
Description of finding *(DOE)*			
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*			
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*			
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the first periodic verification ☐ Outstanding finding (not closed) ☐ The finding is closed		

2.5 Internal quality control

The final validation report has passed a technical review and quality reviewer before being submitted to the Client. A technical reviewer qualified in accordance with CCL's qualification scheme for CDM validation and verification performed the technical review.

2.6 Validation Team **(compliance of § 148 e of VVS)**

Carbon Check has appointed a competent team as per the Accreditation Standard and; Carbon Check's internal procedures. The team is outlined below:

Validation Team			Type of Involvement						
Full name	**Location**	**Appointed for Sectoral Scopes (Technical Areas)**	Supervising the work	Desk review	Site Visit + Interview	Report and protocol Writing	Technical Expert Input	Reporting Support	Technical Reviewer
Amit Anand	RSA	1.2, 13.1	X			X	X		

Anubhav Dimri	RSA	1.2		X	X		X	X	
B. B. Sinha	Uganda	--			X				
Vikash Kumar Singh	RSA	1.2, 3.1, 13.1					X		X

3. VALIDATION FINDINGS (COMPLIANCE OF § 148 B OF VVS)

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of validation and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A.

3.1 Identification of relevant Electricity System/s

The host country i.e., Republic of Uganda has not published any delineation of the project electricity system (PES) and connected electricity system (CES). The same was confirmed through interviews conducted during OSV with the officials of DNA (Climate Change Unit) of Uganda /v/, /vi/, /vii/, /viii/, /ix/; MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/; ERA /xviii/, /xix/ and UETCL /xx/, /xxi/, /xxii/.

The GEF report /02/ identifies Uganda electricity network i.e., the national grid of Uganda as defined by UETCL as the Project Electricity System (PES) in accordance with § 14 of the applied tool /B01/ and the description of the PES in the report was confirmed to be accurate through interviews conducted during OSV with the DNA (Climate Change Unit) of Uganda /v/, /vi/, /vii/, /viii/, /ix/; MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/; ERA /xviii/, /xix/ and UETCL /xx/, /xxi/, /xxii/ and through reviewing the data provided by the UETCL /8/, /9/, /10/, /11/.

The GEF report /02/ in section 2.1 states that Uganda's 132 kV line is extended to Kenya in the east through Tororo, which is used for limited power export and import to and from Kenya, considered as the only international interconnected transmission line in Uganda. Electricity trade between Kenya and Uganda is very limited. The average import from and export to Kenya is approximately 1.24 % and 1.26% respectively of total grid generation in Uganda. The import and export figures were confirmed through review of the data provided by UETCL /8/, /9/, /10/. The same is illustrated in the table below:

Year	Kenya		Total grid generation in Uganda (GWh)	% of Total grid generation in Uganda	
	Import (GWh)	Export (GWh)		Import	Export
2010	29.211	29.236	2456	1.19	1.19
2011	36.313	32.162	2556	1.42	1.26
2012	31.515	37.944	2829	1.11	1.34
Average				**1.24**	**1.26**

Similarly, Uganda's 132 kV line in the south extends towards Bukoba in Tanzania for the purpose of power export. Electricity trade between Tanzania and Uganda is very limited. There is no import of electricity from Tanzania to national grid of Uganda. Uganda exports electricity to certain areas of Tanzania because these regions are nearer to and more accessible to Uganda grid and are not connected to the national grid of Tanzania. The same was validated during OSV through interview with officials of MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/; ERA /xviii/, /xix/ and UETCL /xx/, /xxi/, /xxii/ and further confirmed through review of the data provided by UETCL /8/, /9/, /10/. The export to Tanzania is approximately 1.96 % of total grid generation in Uganda. The import and export figures were confirmed through review of the data provided by UETCL /8/, /9/, /10/.

The same is illustrated in the table below:

Year	Tanzania		Total grid generation in Uganda (GWh)	% of Total grid generation in Uganda	
	Import (GWh)	Export (GWh)		Import	Export
2010	0	45.269	2456	0	1.84
2011	0	50.939	2556	0	1.99
2012	0	57.751	2829	0	2.04
Average				**0**	**1.96**

Hence the national grid of Tanzania is not considered as a Connected Electricity System (CES).

Similarly, Uganda also exports limited amount of electricity to Rwanda using a 33 kV line at Katuna and imports power from Rwanda using a 33 kV line at Kyanika. Electricity trade between Rwanda and Uganda is very limited. Uganda exports electricity to certain areas of Rwanda because these regions are nearer to and more accessible to Uganda grid and are not connected to the national grid of Rwanda. Similarly Rwanda exports electricity to certain areas of Uganda because these regions are nearer to and more accessible to Rwanda grid and are not connected to the national grid of Uganda. The same was validated during OSV through interview with officials of MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/; ERA /xviii/, /xix/ and UETCL /xx/, /xxi/, /xxii/ and further confirmed through review of the data provided by UETCL /8/, /9/, /10/. The average import from and export to Rwanda is approximately 0.08% and 0.07% respectively of total grid generation in Uganda. The import and export figures were confirmed through review of the data provided by UETCL /8/, /9/, /10/. The same is illustrated in the table below:

Year	Rwanda		Total grid generation in Uganda (GWh)	% of Total grid generation in Uganda	
	Import (GWh)	Export (GWh)		Import	Export
2010	0.267	0.103	2456	0.01	0.004
2011	2.751	3.31	2556	0.11	0.13
2012	3.202	1.834	2829	0.11	0.06
Average				**0.08**	**0.07**

Hence the national grid of Rwanda is not considered as a Connected Electricity System (CES).

Similarly, Uganda exports power to Société nationale d'électricité (SNEL) of Congo (DRC) as well through 33 kV line. Electricity trade between DRC and Uganda is very limited. There is no import of electricity from DRC to national grid of Uganda. Uganda exports electricity to certain areas of DRC because these regions are nearer to and more accessible to Uganda grid and are not connected to the national grid of DRC. The same was validated during OSV through interview with officials of MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/; ERA /xviii/, /xix/ and UETCL /xx/, /xxi/, /xxii/ and further confirmed through review of the data provided by UETCL /8/, /9/, /10/. The export to DRC is approximately 0.05 % of total grid generation in Uganda. The import and export figures were confirmed through review of the data provided by UETCL /8/, /9/, /10/. The same is illustrated in the table below:

Year	Congo		Total grid generation in Uganda (GWh)	% of Total grid generation in Uganda	
	Import (GWh)	Export (GWh)		Import	Export
2010	0	0	2456	0	0
2011	0	1.603	2556	0	0.063
2012	0	2.448	2829	0	0.087
Average				**0**	**0.05**

Hence the national grid of DRC is not considered as a Connected Electricity System (CES).

The validation team confirms that the project electricity system (PES) is the Uganda electricity network i.e., national grid of Uganda as defined by UETCL and the description of the PES in the GEF report /02/ was confirmed to be accurate through interviews conducted during OSV with officials of DNA (Climate Change Unit) of Uganda /v/, /vi/, /vii/, /viii/, /ix/; MEMD /xii/, /xiii/,

/xiv/, /xv/, /xvi/, /xvii/; ERA /xviii/, /xix/ and UETCL /xx/, /xxi/, /xxii/ and review of data provided by UETCL /8/, /9/, /10/, /12/. Furthermore, based on the review of the above mentioned evidences, DOE confirms that there are no connected electricity systems.

Electricity trade between Uganda and other neighbouring countries such as Kenya, Tanzania, Rwanda and Uganda is very limited and small. However the import of electricity from the neighbouring countries such as Kenya and Rwanda have been included in estimation of OM emission factor and an emission factor of 0 tCO_2/MWh has been used for the net imported electricity in the grid emission factor calculations in the GEF report /02/ and GEF tool /04/. The same is in accordance with guidance provided under § 21 (a), section 6.1 of the applied methodological tool /B01/.

CAR 1 was raised in this regard and satisfactorily closed (please refer to Appendix A for detailed closure).

3.2 Selection of chosen set of power plants {grid and off-grid power plants in the project electricity system}

Section 6.2 of the applied methodological tool /B01/ under § 24, provides an option to choose whether to include off-grid power plants in calculation of operating and build margin emission factors:

Option I: Only grid power plants included in the calculation (§ 25, section 6.2.1 of tool /B01/).
Option II: Both grid power plants and off-grid power plants are included in the calculation (§ 26, section 6.2.2 of tool /B01/).

In the section 2.2 of GEF report /02/, **Option II** has been chosen i.e., off-grid power plants have been included for calculation of both OM and BM emission factor, which is in accordance with § 26 of section 6.2.2 of the applied tool /B01/.

Furthermore, the applied methodological tool /B01/ under section 6.2.2, § 27 provides options for two alternative approaches that can be used to determine the electricity generation by the off-grid power plants and CO_2 emission factor.

The assessment on suitability of options selected to determine the electricity generation by the off-grid power plants and CO_2 emission factor is provided below:

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Options provided in the methodological tool "Tool to calculate the emission factor for an electricity system (Version 03.0.0; Dated: 04/10/2013) /B01/.	Option selected	Assessment by the validation team
Option II a: requires collecting data on off-grid power generation as per appendix 2 and can only be used if the conditions outlined therein are met. (§ 28, Section 6.2.3)	☐ Yes ☒ No	This option has not been selected to determine the electricity generation by the off-grid power plants and CO_2 emission factor due to lack of availability of data in accordance with appendix 2 of the applied tool /B01/. The lack of availability of data on off-grid power generation was confirmed by UETCL through a mail dated 23/09/2013 from Sebugenyi H.M. (Principal Control Engineer- UETCL) /17/.
Option II b: As an alternative approach, the default CO_2 emission factor and the default value of the electricity generated by the off-grid power plants can be applied for the first crediting period. This option can be used if the following conditions can be met (§ 30, Section 6.2.4): (a) The project activity is located in (i) a Least Developed Country (LDC); or (ii) a Small Island Developing States (SIDS) or in (iii) a country with less than 10 registered CDM projects at the starting date of validation; and (b) The project activities consist of grid-connected renewable power generation; and (c) It can be demonstrated that there is a load shedding program in place to compensate the deficit of the generation capacities.	☒ Yes ☐ No	In section 2.2 of the GEF report /02/, PP has opted for **Option II b** (section 6.2.4) of the applied methodological tool for inclusion of off-grid power plants in the PES to calculate the GEF. The fulfilment of all the requirements as stipulated under § 30 of the applied tool is discussed below: a) Uganda is a LDC country as per UNFCCC, which was also confirmed through review of UNFCCC website /B03/. Hence the condition has been adequately met. b) GEF calculated using option II b (inclusion of off-grid plants for GEF calculation), will only be used for estimation of emission reductions by the grid connected renewable energy generation power projects was confirmed during OSV through interviews with officials of DNA (Climate Change Unit) of Uganda /v/, /vi/, /vii/, /viii/, /ix/ and project consultants /iii/, /iv/. The same was further substantiated through review of GEF report /02/, GEF tool /04/. Hence the condition has been adequately met. *c)* A load shedding program is in place in Republic of Uganda to compensate the deficit of the generation capacities was substantiated through review of letters written by "Principal Control Engineer - UETCL" to "Chief Technical Officer – Umeme" (Umeme is the operator of the national grid system of Uganda) /5/, /6/, /7/. The same was further authenticated through review of Electricity Sector performance Report (07/2011 – 12/2011) /14/ by ERA which under section

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Options provided in the methodological tool "Tool to calculate the emission factor for an electricity system (Version 03.0.0; Dated: 04/10/2013) /B01/.	Option selected	Assessment by the validation team
		3.2.3.5 (on page 24) states *"Based on the quarterly reporting, a total of 3,549 hours were lost to load shedding in 2010 which was equivalent to 25,856MWhrs in lost energy. For the first three (3) quarters of 2011, 1,226 hours were lost to load shedding which translated into 8,927 MW hrs in lost energy. Outages were caused by system failure."* Furthermore, the PP has used the default values as stated in § 31 and § 32 of the tool to calculate the GEF for the first crediting period. The same was confirmed through review of GEF report /02/ and GEF tool /04/.

The validation team confirms that selection of **Option II b** to determine the electricity generation by the off-grid power plants and CO_2 emission factor for calculation of OM and BM emission factors meets the requirements of the "Tool to calculate the emission factor for an electricity system (version 03.0.0)" /B01/ and is deemed appropriate.

CAR 2, CL1 and CL 9 were raised in this regard and satisfactorily closed (please refer to Appendix A for detailed closure).

3.3 Selection of a method to determine Operating Margin (OM)

The UNFCCC Tool /B01/ provides four methods for the calculation of the operating margin emission factor:

a) Simple OM; or
b) Simple adjusted OM; or
c) Dispatch data analysis OM; or
d) Average OM.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either ex-ante or ex-post data vintages as per "Tool to calculate the emission factor for an electricity system (version 03.0.0)" /B01/.

For the calculation of the operating margin the GEF report /02/ applies simple adjusted OM method utilizing ex-ante option using the three year data average for the most recent three years for which data is available (2010 – 2012) in accordance with § 36 (a) of the applied tool /B01/.

The simple adjusted OM is only applicable in cases, where low-cost/must-run resources constitute more than 50% of the total generation. In Uganda the only power resources, which are considered to be low/cost must run resources are hydropower and bagasse based plants. The same was validated during OSV through interviews with officials of ERA /xviii/, /xix/; UETCL /xx/, /xxi/, /xxii/ and MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/. The share of low-cost/must run plants to total generation in the national grid of Uganda (PES) is summarized below:

Data/Parameter	Year				
	2008	2009	2010	2011	2012
Total gross generation (GWh)	2,042	2,251	2,456	2,556	2,829

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Generation from LCMR plants (GWh)	1,452	1,354	1,432	1,598	2,554
Share of LCMR plants (%)	71.1	60.2	58.3	62.5	90.3
Average share of LCMR plants in gross generation (%)	**68.5**				

As can be seen from the table above the share of LCMR plants to the total generation in national grid of Uganda is 68.5%, which is more than 50%. Hence, selection of Simple Adjusted OM method to calculate Operating Margin (OM) emission factor is in accordance with the "Tool to calculate the emission factor for an electricity system (version 03.0.0)" /B01/.

CL 3 was raised in this regard and satisfactorily closed (please refer to Appendix A for detailed closure).

3.4 Calculation of Operating Margin Emission Factor

The simple adjusted OM is a variation of the simple OM, where the power plants/units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m). It calculates the net electricity generation of each power unit and an emission factor for each power unit in accordance with the tool /B01/. The net quantity of electricity generated and delivered to the grid by each power unit and the CO_2 emission factor of each power unit are calculated using Option A of the simple OM method in accordance with § 41 (a) of the applied tool /B01/. As data on fuel consumption and electricity generation of individual plants is available, the emission factor for each power unit (m) was calculated using Option A1 in accordance with § 44 (a) of the applied tool /B01/.

$$EF_{grid,OM-adj,y} = \left(1-\lambda_y\right) * \frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y * \frac{\sum_k EG_{k,y} * EF_{EL,k,y}}{\sum_k EG_{k,y}} \quad \textbf{(1)}$$

Where:

$EF_{grid,OM-adj,y}$	=	Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
λ_y	=	Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year *y*
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{EL,k,y}$	=	CO_2 emission factor of power unit *k* in year *y* (tCO_2/MWh)
m	=	All grid power units serving the grid in year *y* except low-cost/must-run power units
k	=	All low-cost/must run grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

In Uganda the only power resources, which are considered to be low/cost must run resources are hydropower and bagasse based plants. The same was validated during OSV through interviews with officials of ERA /xviii/, /xix/; UETCL /xx/, /xxi/, /xxii/ and MEMD /xii/, /xiii/, /xiv/, /xv/, /xvi/, /xvii/. So, CO_2 emission factor of all low-cost/must run grid power units serving the grid in year *y* (power unit *k*) is considered to be zero i.e., $EF_{EL,k,y} = 0$.

Hence the equation 1 above to calculate Simple Adjusted OM ($EF_{grid,OM-adj,y}$) becomes:

$$EF_{grid,OM-adj,y} = \left(1-\lambda_y\right) * \frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(2)}$$

As discussed above in section 3.2 of the validation report that the GEF report /02/ opts for inclusion of Off-grid power plant for calculation of OM emission factor. In accordance with § 53 of the applied tool /B01/ off-grid power plants have been considered as grid power units

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

serving the grid in year y (power unit m). Furthermore, $EG_{m,y}$ and $EF_{EL,m,y}$ have been calculated using the Option A of the simple OM method in accordance with § 41 (a) of the applied tool /B01/.

As per § 54 of the applied tool /B01/, net electricity imports must be considered as low-cost must run units for estimation of OM emission factor. However, as electricity trade between Uganda and other neighbouring countries such as Kenya, Tanzania, Rwanda and Uganda is very limited and small and therefore the net electricity imports to Uganda grid are not accounted in the grid emission factor calculations in the GEF report /02/, as the amount is negligible. The same is in accordance with guidance provided under § 21 (a), section 6.1 of the applied methodological tool /B01/.

The parameter λ_y is defined as follows:

λ_y (%) = (number of hours low-cost/must-run sources are on margin in year y) / 8760 hours per year

In accordance with § 56 of the tool /B01/, λ_y is calculated as follows:

(a) Step (i) Plotting a load duration curve. Chronological load data (in MW) for each hour of the year y was collected, and the load data was sorted from the highest to the lowest MW level. MW were plotted against 8760 hours in the year, in descending order.
(b) Step (ii) Collecting power generation data from each power plant / unit. The total annual generation (in MWh) from low cost/ must-run power plants / units was calculated.
(c) Step (iii) Filling the load duration curve. A horizontal line was plotted across the load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from low-cost/must-run power plants / units (i.e. $\sum_k EG_{k,y}$).
(d) Step (iv) Determining the "Number of hours for which low-cost/must-run sources are on the margin in year y". First, the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i) was located. The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low cost/must-run sources are on the margin. λy (%) equals the number of hours low-cost/must-run sources are on margin in year y divided by 8760 hours per year.

In accordance with § 57 of the applied tool /B01/, no off-grid power plants have been considered in estimating the parameter λ_y. The same has been confirmed through review of GEF tool /04/.

The value of Simple Adjusted OM emission factor is summarized below:

Data/Parameter	Unit	Ex-ante (2010-2012)
Simple Adjusted OM emission factor (Option I of the tool)[11]	(tCO_2/MWh)	0.556
Simple Adjusted OM emission factor (Option II of the tool)[12]	(tCO_2/MWh)	0.572

Validation team has reviewed the data provided by UETCL /8/, /9/, /10/, /11/ and this is considered appropriate. Power plant specific data for Net Calorific Value (NCV) and Emission Factor (EF) for each type of fossil fuel were not available and hence IPCC 2006 default values /15/, /16/ were used. The values used and the calculation of the Simple Adjusted OM

[11] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[12] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

emission factor is considered to be reasonable, and is in line with official data provided by the UETCL /8/, /9/, /10/, /11/.

CL 2, CL 4, CL 6, CL 7 and CL 8 were raised in this regard and satisfactorily closed (please refer to Appendix A for detailed closure).

3.5 Calculation of Build Margin (BM) Emission Factor

The GEF report /02/ calculates the build margin utilizing ex-ante option using the three year data average for the most recent three years for which data is available (2010 – 2012) in accordance with § 68 (a) of the applied tool /B01/. As per the GEF report /02/, the emission factor will be updated annually for the rest of the crediting period during the monitoring.

The applied tool /B01/ requires that the sample group of power units m used to calculate the build margin consists of set of power units that compromise the larger annual electricity generation of either of the following :

(a) The set of five power units that have been built most recently; or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The GEF report /02/ opts for the set of five most recently built power plants (option a), which comprises of the larger annual electricity generation:

Name of Power Plant	Type of Power Plant	Type of fuel	Date of commissioning	Net Electricity Generation (MWh)
Mpanga	Mini Hydro	Renewable	2011	78 828.60
Kasese Cobalt (Mubuku III)	Mini Hydro	Renewable	2009	4 615.90
Tororo	Thermal	Diesel and Heavy Fuel oil	2009	70 133.10
Namanve	Thermal	Heavy Fuel Oil	2008	148 697.10
Aggreko Mutundwe	Thermal	Light Diesel Oil	2008	56 571.56

Data /Parameter	Unit	Value
Total generation in national grid of Uganda[13]	MWh	1750909.26
Total generation by $SET_{5\ units}$	MWh	358846.26
Contribution of $SET_{5\ units}$ to total generation in national grid of Uganda[14]	%	20.5

The same is in accordance with § 71 (c) of the applied tool /B01/. The list of power plants, their date of commissioning and the generation figures were validate through review of official data provided by the UETCL /8/, /9/, /10/, /11/. In accordance with § 70 of the applied tool /B01/, capacity additions from retrofits of power plants are not included in the calculation of the build margin emission factor.

According to the "Tool to calculate the emission factor for an electricity system (version 03.0.0)" /B01/ the build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(3)}$$

[13] Excluding power plants registered as CDM project activities
[14] Excluding power plants registered as CDM project activities

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

The validation team confirmed that this equates the BM emission factor calculated according to equation 13 in the tool, by determining the CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) as per the guidance in Step 4 (a) of the tool for the simple OM, using options A1, as validated above, using for y the most recent historical year for which power generation data is available, and using m for the power units included in the build margin.

The value of BM emission factor is summarized below:

Data/Parameter	Unit	Ex-ante (2010-2012)
BM emission factor (Option I of the tool)[15]	(tCO_2/MWh)	0.454
BM emission factor (Option II of the tool)[16]	(tCO_2/MWh)	0.485

The validation team confirms that the values used and the calculation of the BM emission factor is considered to be reasonable, and is in line with official data provided by the UETCL /8/, /9/, /10/, /11/.

CL 5 was raised in this regard and satisfactorily closed (please refer to Appendix A for detailed closure).

3.6 Calculation of Combined Margin Emissions Factor

Section 6.6 of the applied methodological tool /B01/ under § 77, provides an option to choose between two methods to calculate the Combine Margin (CM) emission factor. The assessment on suitability of options selected to determine the Combine Margin (CM) emission factor is provided below:

Options provided in the methodological tool "Tool to calculate the emission factor for an electricity system (Version 03.0.0; Dated: 04/10/2013) /B01/.	**Option selected**	**Assessment by the validation team**
Option a: Weighted average CM (§ 77)	☒ Yes ☐ No	This option has been selected to determine the Combine Margin (CM) emission factor. The same is the most preferred option for calculation of CM in accordance with § 78 of the applied tool /B01/. The same is deemed acceptable to the validation team.
Option b: Simplified CM (§ 77) The simplified CM method (Option b) can only be used if (§ 79, Section 6.6): (a) The project activity is located in: (i) a Least Developed Country (LDC); or in (ii) a country with less than 10 registered CDM projects at the starting date of	☐ Yes ☒ No	This option has not been used for estimation of Combine Margin (CM) emission factor. Moreover in section 2.3 of the GEF report /02/ the operating margin emission factor ($EF_{grid,OM,y}$) has been calculated using simple adjusted OM (option (b) in step 3).

[15] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[16] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Options provided in the methodological tool "Tool to calculate the emission factor for an electricity system (Version 03.0.0; Dated: 04/10/2013) /B01/.	Option selected	Assessment by the validation team
validation; or (iii) a Small Island Developing States (SIDS); and (b) The data requirements for the application of Step 5 above cannot be met. Moreover as per § 86 of the tool /B01/ under the simplified CM, the operating margin emission factor ($EF_{grid,OM,y}$) must be calculated using the average OM (Option (d) in Step 3).		Hence this is deemed appropriate by the validation team.

As per § 80 of section 6.6.1 of the applied tool /B01/, the combined margin emissions factor is finally calculated as weighted sum of the operating margin emissions factor and the build margin emissions factor:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \quad \textbf{(4)}$$

Where:

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor in year *y* (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)

W_{OM} = Weighting of operating margin emissions factor (per cent)

W_{BM} = Weighting of build margin emissions factor (per cent)

Section 3 of the GEF report /02/ provides the value for combined margin emission factor calculated using different default values provided under § 81 (a) and (b) of the applied tool /B01/ for parameter W_{OM} and W_{BM} (depending upon the type of the project activity i.e., renewable or non-renewable and the crediting period i.e., first, second or third).

The value of CM emission factor is summarized below:

Data/Parameter	Unit	Ex-ante (2010-2012)
CM emission factor (Option I of the tool)[17] applicable to the wind and solar power projects for all the crediting periods	(tCO_2/MWh)	0.531
CM emission factor (Option II of the tool)[18] applicable to the wind and solar power projects only for the first crediting period	(tCO_2/MWh)	0.550
CM emission factor (Option II of the tool)[19] applicable to all other renewable energy power projects only for the first crediting period	(tCO_2/MWh)	0.529
CM emission factor applicable to all other projects only for the first crediting period	(tCO_2/MWh)	0.505
CM emission factor applicable to all other projects for the second and third crediting period	(tCO_2/MWh)	0.480

The validation team confirms that the values used and the calculation of the CM emission factor is considered to be reasonable, and is in line with official data provided by the UETCL /8/, /9/, /10/, /11/.

[17] Includes only grid power plants (§25, Section 6.2.1 of tool /B01/)
[18] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)
[19] Includes both grid power plants and off-grid power plants (§26, Section 6.2.2 of tool /B01/)

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

APPENDIX A

Carbon Check
Validation Protocol

Clean Development Mechanism: Capacity Development & Projects Support – Validation of GEF for Uganda

Report No. CCL202/UGANDAGEF

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Table-1: List of findings (compliance of § 148 b of VVS)

Finding	CAR-1		
Classification	☒ CAR	☐ CL	☐ FAR
	In section 2.1 of the report: 1. In accordance with § 14 and 15 of the "Tool to calculate the emission factor for an electricity system (version 03.0.0)" relevant Project Electricity System (PES) and Connected Electricity System (CES) have not been clearly identified and described in the report. 2. In accordance with § 16 of the applied tool, PES and CES have not been clearly defined and no justification along with any underlying assumption has been provided. 3. It is stated, *"While no detailed information has been provided regarding transmission constraints in Uganda, the low electrification rate in the country indicates transmission constraints are present."* a. However as PES and CES are not clearly defined, assuming that electricity system in Uganda has been chosen as Project Electricity System (PES). PP shall explain how it meets the requirement to be identifies as PES in accordance with § 10 (e) of the applied tool. b. Moreover, the existence or non-existence of transmission constraints has not been justified in accordance with the criteria stipulated as per § 16 (a) and 16 (b). 4. It is stated, *"The 132 kV network extends to Bukoba in neighbouring Tanzania in the south and to Kenya via Tororo in the east."* Moreover Electricity Sector Performance Report (July 2011 – December 2011) by Electricity Regulatory Authority (ERA): a. In section 4.1 mentions that UETCL imports electricity from Kenya and Rwanda b. In section 4.2 mentions that UETCL exports electricity to Tanzania, Kenya, and Rwanda and has also started exporting to Democratic Republic of Congo (DRC) from the second half of 2010. However the same has net been considered in identifying PES and CES as earlier mentioned in point 1 above. Moreover in accordance with § 17 of the applied tool it has not been clearly described and justified whether any legal restrictions exist or not for international electricity exchange.		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-1
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	1. Please note that the electricity system elaborated in the report is defined based on the latest information available through official channels in Uganda including the UETCL and ERA. For this the authors of the report used the latest available grid map of the country that is included in the report. The information on PES and CES in this report is updated information that the authors included for Bujagali hydropower project that was successfully validated and registered end of 2011. 2. Further informaiton on import/export connections within the national grid has been included in the reprot. 3. The report used the most accessibel and avaiallbe information through the Ugandan transmission authorities. Some detail informaiton such as transmisssion constraints is not accessible thus the authors considered the introduced transmission grid map by UETCL as the grid/project electricity system. 4. Further informaiton availalbe on import/export in Uganda's electric grid is included under "Import/export" sub-section in the report. The amount of import as presneted in the datasheet is very small and thus not included in the GEF calculations. Please note that there is no international interconnection line in Uganda as the import/export lines are only limited to bilateral agreements between some countries. As per paragraph 17 of the tool the international interconnection is a transmission line between different countries and the project electricity system covers national grids of interconnected countries. This is not the case in Uganda as the import/export tranmission lines in Uganda are not covering national grids of other countries but only transfer very limited of power each year over the borders. In case further information is required, it can be doulbe checked again through UETCL and ERA authorities, however, please note that Uganda as a LDC has restricted data availability.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-1
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	1. Section 2.1 of the revised report states that DNA of Uganda has not published any delineation of the PES and CES. It also states that Uganda Electricity Transmission Company Limited (UETCL) defines the relevant electricity system. However during the site visit and through interview/discussions with relevant regulatory authorities (UETCL & MEMD), validation team learnt that the national grid of Uganda is interconnected with national grid of Kenya. Hence PP needs to clearly describe in the report how relevant PES and CES has been identified in accordance with the requirement of § 14, 15 and 16 of the applied methodological tool. CAR point is not closed. 2. CAR point not closed. Pending closure of point 1 above. 3. Section 2.1 of the report has been revised and statement with regards to presence of transmission constraint within Uganda has been omitted. However CAR point is not closed. Pending closure of point 1 above. 4. During the site visit and through interview/discussions with relevant regulatory authorities (UETCL and MEMD), Validation team learnt the following: a. National grid of Uganda is interconnected with national grid of Kenya i.e., the two grids are connected through transmission lines. b. Mutual export and import of electricity takes place between the two countries. c. Uganda exports electricity to certain areas of Tanzania, Rwanda and Congo because these regions are nearer to and more accessible to Uganda grid rather than their respective countries. Moreover these regions are not connected to their respective national grid. d. Rwanda imports electricity to certain areas of Uganda because these regions are nearer to and more accessible to Rwanda grid rather than Uganda grid. Moreover these areas are not connected to their national grid of Uganda. However, CAR point not closed. Pending closure of point 1 above.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-1
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	1. Agreed. The information on PES and CES has been included and further explained in accordance with section 6.1. of the tool to address the raised comment. 2. Agreed. Further informaiton on import/export connections within the national grid has been included in the reprot. 3. Agreed. The report used the most accessibel and avaiallbe information through the Ugandan transmission authorities. The report has been revised to address the raied comment based on crdible availalbe information on Uganda's national grid some of which was gained through interviews which can be also confirmed through the DOE's visit. 4. Agreed. Further informaiton availalbe on import/export in Uganda's electric grid is included in the report. The amount of import as presneted in the report is very small (between 1.0 - 1.5% between 2010 and 2012) and thus not included in the GEF calculations. There is one major international interconnection line between Uganda and Kenya and in general the import/export transmission lines are limited to 132 kV (between Uganda, Kenya and Tanzania) and 33 kV for others. Uganda's import/export comprise very limited amount of power each year over the borders.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-1
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	1. Section 2.1 of the revised report clearly defines PES and CES in accordance with § 14 and 15 of the applied methodological tool. It states that national grid system of Uganda is identified as PES and there are no transmission constraints within the grid. Moreover it states that there is no connected electricity system in Uganda other than the national grid system. The same was confirmed to be accurate through interviews conducted with the Ministry of Energy and Mineral Development (MEMD), the Electricity Regulatory Authority (ERA) and the Ugandan Electricity Transmission Company Limited (UETCL). CAR point is closed. 2. Section 2.1 of the revised report states that DNA of Uganda has not published any delineation of the PES and CES. It also states that Uganda Electricity Transmission Company Limited (UETCL) defines the relevant electricity system. Furthermore the section 2.1 of the revised report states that national grid system of Uganda is identified as PES and there are no transmission constraints within the grid. Moreover it states that there is no connected electricity system in Uganda other than the national grid system. The same was confirmed to be accurate through interviews conducted with the Ministry of Energy and Mineral Development (MEMD), the Electricity Regulatory Authority (ERA) and the Ugandan Electricity Transmission Company Limited (UETCL). The same is in line with requirements of § 16 of the applied methodological tool. CAR point is closed. 3. CAR point is closed (refer assessment of CAR point 1 and 2 above). 4. Section 2.1 of the revised report states, “UETCL confirmed that other than the 132 kV transmissions line that is used for occasional import/export from/to Kenya, there is no so called international interconnection between Uganda and other neighbouring countries where the Ugandan grid can cover national grids of interconnected countries.” Moreover electricity export to Tanzania, Rwanda and Congo and import from Rwanda can’t be considered as international connections the national grid system of Uganda doesn’t cover the national grid of interconnected countries. CAR point is closed.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-1
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CAR-2		
Classification	☒ CAR	☐ CL	☐ FAR
	In section 2.2 of the report it is stated, *"In Uganda off-grid diesel-based power generation is significant and can be partially displaced by CDM project activities, therefore it is recommended to be included in the GEF calculation."* However the extent of contribution of off-grid power plant to the electricity system has not been described and substantiated in the report in accordance with § 20 (a) and (b) of Appendix 2 of the applied tool. Moreover PP needs to provide a detailed list of the off-grid power plants in the report as well as in the sheet named "Step 2" of the excel sheet titled "Uganda GEF Tool 3Jun2013 final".		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Please note that the report is using Option II b (Section 6.2.3) of the tool, which allows LDCs (Uganda is a LDC) to use a simplified method to include off-grid systems in GEF calculation. Thus demonstration of the data availability is not required according to the tool.		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-2
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	Yes, the report "Uganda Grid Emission Factor (GEF) 2013" under section 2.2 opts for Option II b to apply default CO_2 emission factor and the default vale of electricity generated by off-grid power plants. However, the applied methodological tool under section 6.2 provides an option to the user of the tool to choose whether to include off-grid plants in PES or not. As already stated in section 2.2 of Uganda GEF report, PP has opted for option II (section 6.2.2.) of the applied methodological tool. So, PP shall: 1. Substantiate with documentary evidence that either of the requirements of § 20 (a) or (b) of Appendix 2 have been met for inclusion of off-grid plants for grid emission factor calculation. Else, in accordance with § 21 of Appendix 2 of applied methodological tool the off-grid plants can't be included in GEF calculation. Moreover a mail dated 23/09/2013 from Principal Control Engineer; UETCL clearly states that the data on off-grid power plants and their generation is not available with UETCL. In light of this observation the inclusion of off-grid power plants for calculation of grid emission factor needs to be properly explained. CAR is not closed.
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Kindly note that the authors are solely referring to section 6.2 and opt for the inclusion of off-grid plants voluntarily and according to option II b (which has no link to Appendix 2 of the tool and does not ask for following this Appendix). Option II b offers a simplified approach for the inclusion of off-grid plants by referring to default values. UETCL saying there is no information on off-grid cannot ban our client in using option II b of the tool to include off-grid plants. For further clarification the section has been improved and elaborates the issue further. Please let us know if this issue is not yet clear, we shall arrange a discussion through a phone call if the comment remains open.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CAR-2
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	In section 2.1 and 2.2 of the revised report PP states, ***"off-grid power constitutes a significant portion of power generation in Uganda …"*** PP shall explain: • How it defines "significant" i.e., what is the benchmark against which evaluation of significance is carried out? • In the absence of data on off-grid power plants, how it has been determined that their contribution to national grid system of Uganda is significant? CAR is not closed.
Corrective Action or clarification #3 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	These statements were based on several interviews through official channels in Uganda; however, they are not necessary and are deleted from the report in order to avoid further confusions.
DOE Assessment #3 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	PP has revised the section 2.1 and 2.2 of the report and removed the word significant to emphasize the contribution of off-grid power plants to the total power generation in the national grid of Uganda. PP has opted for option (section 6.2.4) of the applied methodological tool for inclusion of off-grid power plants in the PES to calculate the GEF. PP has clearly demonstrated in the report that GEF calculation meets all the requirements as stipulated under § 30 of the applied tool. Furthermore, the PP has used the default values as stated in § 31 and § 32 of the tool to calculate the GEF for the first crediting period. The same is found acceptable by the validation team.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CL-1		
Classification	☐ CAR	☒ CL	☐ FAR

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-1
	In section 2.2 of the report PP states that as per step 2 of the applied tool Option II b has been chosen for off-grid power plants but in the same section (§ 4, Page 10) it is stated, *"When the necessary conditions to use Option are met …"* Both these statements are contradictory to each other and needs to be clarified. A clear statement on which option has been chosen along with justification needs to be documented in the report.
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	The language in the report has been revised to clarify the raised issue.
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	The text under section 2.2 of the report has been revised to make it consistent and justification provided with respect to the approach selected for determination of electricity generation by off-grid power plants and CO_2 emission factor.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CL-2		
Classification	☐ CAR	☒ CL	☐ FAR
	In section 2.3 of the report PP needs to provide a detailed list of all the plants included as low-cost/must run in order to justify the choice of method used to determine the Operating Margin (OM).		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Please see Annex 1 where all the relevant power plants for the choice of OM are listed. In this table Low Cost Must Run plants (LCMR) are indicated in column "LC-MR (Y/N)". Please indicate if this table has to be repeated for LCMR within the report's text.		
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	Yes, a detailed list of all the plants included as low-cost/must run has been provided in Annex 1 of the report in order to justify the choice of method used to determine the Operating Margin (OM).		
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-3		
Classification	☐ CAR	☒ CL	☐ FAR
	In section 2.4 of the report PP has used both Simple adjusted OM and average OM methods to calculate the operating margin emission factor. This doesn't provide clarity on which OM emission factor will be used for calculation of Combined Margin (CM) emission factor and under which circumstances. PP needs to provide a clear justification on the same.		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	The report as per the request of the client (Belgian Development Agency, BTC and Ugandan Climate Change Unit, CCU) calculates, where meeting the required conditions, all possible ways to compute the CM EF for the first, second and third crediting period for different technologies depending on BM and OM weight factors. Thus the report and the tool are not introducing a unique grid EF number, but depending on the conditions of the projects they can choose an applicable method resulting in more than one combined margin EF.		
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	§ 33, section 6.3 of the applied methodological tool provides the user with a choice to select any one of the methods to calculate OM. The conditions under which different options can be used are also provided in the applied tool. As per the applied tool the choice of method to calculate OM is not project specific rather it is based on the power generation characteristics of the grid/electricity system and also availability of data. So, application of this tool shall result in a fixed and unique value for GEF. CL is not closed.		
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Agreed. The report is now focusing only on simple adjusted method.		
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	PP has revised section 2.3 and section 2.4 of the report and now uses "Simple Adjusted OM" method to calculate the Operating Margin Emission Factor. The same is found to be in accordance with § 33 of section 6.3 of the applied methodological tool.		
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-4		
Classification	☐ CAR	☒ CL	☐ FAR
	Section 2.4 of the report (§ 4, Page 12) states, *"The second term in the equation cancels out as low-cost/must-run resources by definition are characterized by EFEL,k,y= 0 (tCO2/MWh)"* PP needs to provide the reason and suitable justification for the same in a transparent manner in the report.		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	The sentence is revised to clarify the raised issue further.		
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	Section 2.4 of the report (§ 4, page 12) has been revised. It states that the low-cost/must-run in the Ugandan electricity system are renewable power resources and are characterized by $EF_{EL,k,y}$= 0 (tCO_2/MWh), The justification is acceptable by the validation team.		
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed		

Finding	CL-5		
Classification	☐ CAR	☒ CL	☐ FAR

2. In section 2.5 of the report PP needs to provide detailed step-wise approach used to determine sample group of power units (m) used to calculate the build margin in accordance with § 71 of the applied tool.

3. Section 2.5 of the report identifies SET $_{sample}$ plants as which contribute to 23% of annual electricity generation of the PES (AEG_{total}) for BM emission factor determination:

Power Plant (m)	In-service year	Project Type	2012 EGm,y (MWh)
Mpanga	2011	Mini Hydro	78,829
Kinyara Sugar Works	2011	Bagasse	8,783
Kakira Sugar Works	2010	Bagasse	85,313
Kasese Cobalt (Mubuku III)	2009	Mini Hydro	4,616

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Tororo	2009	Thermal	70,133
Namanve	2008	Thermal	148,697
Total			**396370**

But the validation team on analysis of the data provided in excel sheet titled "Uganda GEF Tool 3Jun2013 final" observed:

- Tororo Plant was commissioned in 2009 with an installed capacity of 20 MW. The recent capacity addition was:
  - Unit 2: 66 MW (2012)

- Kinyara Sugar works power unit 1 and 2 was commissioned in 1976 with individual capacity of 1 MW each and a total capacity of 2 MW. The capacity additions were:
  - Unit 3: 7.5 MW (2008)
  - Unit 4: 5 MW (2011)

- Kakira Sugar Works power unit 1 was commissioned in 1994 with installed capacity of 3. The capacity additions were:
  - Unit 2: 20.1 MW (2007)
  - Unit 3: 3 MW (2010)
  - Unit 4: 30 MW (2013)

So, in light of the above observation PP needs to justify why power plants and not individual power units (m) that started to supply electricity to the grid most recently were selected for calculation of Build margin (BM) emission factor in accordance with § 71 of the applied tool.

Corrective Action or clarification #1

(PP shall write a detailed and clear corrective action or further information for clarification as per finding)

Please see the details of the power plants generation share in the spreadsheet "Step 5". Kindly indicate whether the detail information needs to be transferred to the report as well or the tool can remain as an attachment.

Please note that the authors had to use the most credible available data for the calculations. The authors will review the data once more to make sure that the calculations are up to date. Please find our response regarding the comments on:

- Tororo plant: No power generation was reported for the new capacity addition in 2012 by UETCL; please see that the power generation for this plant did not change much from 2011 to 2012. Thus the capacity addition was not yet in-line the grid in 2012;
- Kinyara sugar works: the data on 2011 is included in the calculations, the data on 2008 was older and less conservative than the thermal plant Namanve;
- Kakira sugar works: The calculation is based on the capacity addition in 2010; the unit of 2007 was older than the other most recent power plants. Regarding the 2013 addition, as

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

	the GEF calculation is implemented for 2010-2012, therefore data of the current year (2013) is excluded from the grid baseline calculations. We hope this clarifies, please let us know if there is any other issue that remains unclear.
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	1. In section 2.5 of the report PP has not provide detailed step-wise approach used to determine sample group of power units (m) used to calculate the build margin in accordance with § 71 of the applied tool. The detailed step by step calculation approach needs to be illustrated in the report. CL point is not closed. 2. During the site visit and through interview/discussions with relevant regulatory authorities (UETCL & MEMD), validation team was informed that the generation figure presented for Tororo, Kinyara and Kakira were higher than the actual value and not hence not correct. PP shall provide the correct values for power generation along with evidences and use the same for calculation of BM emission factor. Furthermore, PP needs to justify why power plants and not individual power units (m) that started to supply electricity to the grid most recently were selected for calculation of Build margin (BM) emission factor in accordance with § 71 of the applied tool. CL point is not closed. 3. The installed capacity of Tororo, Kinyara and Kakira power plants as provided in in excel sheet titled “Uganda GEF Tool 3Jun2013 final” are not the same with the values provided in excel sheet titled “Electricity Generating Plants – Uganda”. PP shall provide the correct and updated values for the same.
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	1. Power plants chosen for BM calculation are now listed in the report, their power generation share is now demonstrated in a separate table and the step wise diagram from the tool is inserted to show that the approach used in the calculation is in compliance with article 71-72 of the tool. 2. The figures for the named power plants have been revised to represent the most recent data shared by UETCL. For the second part of your comment please note that capacity addition in old power plants should be excluded from the BM calculation according to paragraph 70 of the applied tool. Therefore based on the new numbers and changes in the BM list the authors have made a revision to the BM calculation and the list of power plants *m* under BM. These changes are made both to the report and the spreadsheet tool. 3. The installed capacity of the power plants Tororo, Kinyara and Kakira are corrected in the

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

	spreadsheet.
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	1. In section 2.5 of the revised report provides detailed step-wise approach used to determine sample group of power units (m) used to calculate the build margin in accordance with § 71 of the applied tool. CL point is closed. 2. The generation figure presented for Tororo, Kinyara and Kakira power plants is based on the CDM Data excel sheet provided by Principal Control Engineer, UETCL through mail dated 23/09/2013. However, PP shall explain why unit 3 and 4 of Kinyara sugar works (with an installed capacity of 16 MW) and commissioned in June 2009, not considered for BM calculation in accordance with § 72 of the tool. CL point is not closed. 3. The installed capacity of Tororo, Kinyara and Kerkira power plants have been revised in excel sheet titled "Uganda GEF Tool 27Sep2013 BH" and are the same with the values provided in excel sheet titled "Electricity Generating Plants – Uganda". CL point closed. CL is not closed.
Corrective Action or clarification #3 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	2. Please note that Kinyara is an old plant commissioned in 1976 with 2MW capacity and later has added 16MW units in 2009 when retrofitted; please see the plants' table in sheet "Step 1" column J "Additions from Retrofits (MW)" in the spreadsheet. This is the information we gained through UETCL that can be confirmed. This according to § 70 of the applied tool should be excluded from the BM calculations.
DOE Assessment #3 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	PP has provided the excel sheet titled "Uganda GEF Tool 27Sep2013 BH.xlsx", which is sheet titled "Step 1"; column J clearly states that Kinyara Power plant was commissioned in 1976 and had an installed capacity of 2 MW. Later in 2008 and 2009 two units with installed capacity of 8 MW each (total 16 MW) were added through retrofitting to increase the capacity of plant to 18 MW. PP has not included unit 3 and 4 of Kinyara sugar works (with an installed capacity of 16 MW) in calculation of BM as this is the case of capacity addition through retrofitting of power plant and is in accordance with § 70 of the applied tool. The same is deemed acceptable by the validation team.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CL-6		
Classification	☐ CAR	☒ CL	☐ FAR
	In the spreadsheet titled "Uganda GEF Tool 3Jun2013 final" submitted by PP: 1. Worksheet "Raw Data – Thermal 2" in cells: G 42, K 51 and K 52 states "missing data". PP needs to clarify the reasons for the same with proper justification. 2. Worksheet "Step 1" in row 13: total installed capacity of Kakira Sugar Works is given as 53.1 MW whereas the addition of capacities of individual units provides a total installed capacity of 56.1 MW. Explain the reason for the same. 3. Worksheet "Step 1" in row 14: total installed capacity of Kinyara Sugar Works is given as 14 MW whereas the addition of capacities of individual units provides a total installed capacity of 14.5 MW. Explain the reason for the same.		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	1. The spreadsheet is from the Ugandan authorities, the empty cells indicate no data availability for those dates; this can be double checked with the Ugandan authorities; Aggreko generated power in Feb and Mar 2012. The figures for Feb and Mar 2012 are included in Row 23 on sheet "Raw Data - Generation". 2. Agreed. Corrected. 3. Agreed. Corrected.		
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	1. The data for generation was provided by the relevant authorities in Uganda. The period for which no data was available has been indicated as missing data in the worksheet. The same was confirmed during the site visit. CL point is closed. 2. Pending closure of point 3 of CL 5 above. 3. Pending closure of point 3 of CL 5 above.		
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Please see the revised spread sheet tool with corrected figures as per the latest data/information shared by UETCL.		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-6
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	1. The data for generation was provided by the relevant authorities in Uganda. The period for which no data was available has been indicated as missing data in the worksheet. The same was confirmed during the site visit. CL point is closed. 2. The installed capacity of Tororo, Kinyara and Kakira power plants have been revised in excel sheet titled "Uganda GEF Tool 27Sep2013 BH" and are the same with the values provided in excel sheet titled "Electricity Generating Plants – Uganda". CL point is closed. 3. The installed capacity of Tororo, Kinyara and Kakira power plants have been revised in excel sheet titled "Uganda GEF Tool 27Sep2013 BH" and are the same with the values provided in excel sheet titled "Electricity Generating Plants – Uganda". CL point is closed.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CL-7		
Classification	☐ CAR	☒ CL	☐ FAR
	Check the values for Tororo thermal power plant. The rated capacity is given as 86 MW (out of which 66 MW was added through unit 2 in 2012) and the total electricity generation as 82562 MWh for year 2010. It seems highly unlikely that a 20 MW thermal power plant (or even 86 MW) is able to give such high values. Gives a PLF of almost 109 % for 86 MW, year 2010. For 2011 and 2012 it is below 100 % for 86 MW.		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Please note that power generation of 82,562 MWh for an 18MW power plant is indeed possible with a PLF of about 52.36%. (18x50.36%x8760=82,561 MWh). The capacity addition of 32MW for this power plant did not become in-line the grid in 2012. This can be seen from the power generation sheet "Raw Data – Generation" from UETCL included in the spreadsheet. Please see that the power generation data for this plant does not change considerably from 2011 (69.95 GWh) to 2012 (70.13 GWh).		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-7
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	Pending closure of point 2 of CL 5 above. CL is not closed.
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	Installed capacity of Tororo in sheet "Step 1" in the spreadsheet tool is corrected. The previous response to this CL is still valid: Please note that power generation of 82,562 MWh for an 18MW power plant is indeed possible with a PLF of about 52.36%. (18x50.36%x8760=82,561 MWh). The capacity addition of 32MW for this power plant did not become in-line the grid in 2012. This can be seen from the power generation sheet "Raw Data – Generation" from UETCL included in the spreadsheet. Please see that the power generation data for this plant does not change considerably from 2011 (69.95 GWh) to 2012 (70.13 GWh).
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	The installed capacity for Tororo plant has been revised in the provided GEF calculation sheet i.e., "Uganda GEF Tool 27Sep2013 BH". Moreover, power generation figure presented for Tororo, power plant is based on the CDM Data excel sheet provided by Principal Control Engineer, UETCL through mail dated 23/09/2013.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CL-8		
Classification	☐ CAR	☒ CL	☐ FAR
	Justify why Residual Fuel oil values have been used from IPCC default values for HFO (Heavy Fuel Oil) and not Gas/Diesel Oil. Also justify the usage of values from lower limit of the confidence interval for Diesel and HFO in the spreadsheet.		

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-8
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	HFO is not listed in IPCC; however, the closest fuel specification to HFO is Residual Fuel Oil and not diesel. Lower limits EF for fuels are used to result in a conservative outcome in accordance with the guidelines and the tool (lower limits of EF for fuels result in lower grid EF).
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	*2006 IPCC Guidelines for National Greenhouse Gas Inventories* doesn't define and provide default values (NCV, CO_2 emission factor) for Heavy Fuel Oil (HFO). By definition HFO is a fraction obtained from petroleum distillation, either as a distillate or a residue and its chemical properties closely resemble that of Residual Fuel Oil. The same was also confirmed through review of information available at http://en.wikipedia.org/wiki/Fuel_oil The use of lower limit of the 95% confidence interval for NCV or CO_2 emission factor results is lower emissions and is deemed a conservative approach. Hence acceptable to validation team.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

Finding	CL-9		
Classification	☐ CAR	☒ CL	☐ FAR
	For off grid power plants, OM and BM has used default values. Clarify if conditions stated in § 30 are met?		
Corrective Action or clarification #1 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	The conditions under article 30 can be met as follows: - Uganda is a LDC country; - The use of this condition and the grid CM EF resulting from this method can be applicable for grid connected project activities and not off-grid CDM activities; - The country has a load shedding program in place that can be checked with the authorities during the site visit;		

Finding	CL-9
DOE Assessment #1 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	d) Uganda is a LDC country as per UNFCCC, which was also confirmed through review of UNFCCC website (http://unfccc.int/cooperation_and_support/ldc/items/3097.php). Hence the condition has been adequately met. CL point is closed. e) As PP has opted for option II b (inclusion of off-grid plants for GEF calculation), which states that GEF calculated using this approach can only be used for the grid connected renewable energy generation power projects. So, PP needs to clearly justify whether the GEF would only be used for grid connected renewable energy projects as per Option selected under section 6.2.4 of the applied methodological tool. CL point is not closed. f) PP needs to clearly substantiate through documentary evidences that there is a load shedding program in place in Uganda to compensate the deficit of generation capacities. CL point is not closed.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-9
Corrective Action or clarification #2 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	b) Indeed, the inclusion of off-grid plants in grid emission factor calculation is only possible in the case where the project is grid connected renewable power generation. This condition is repeated in sheet "Step 2" of the tool to warn the users to turn the off-grid inclusion on if they meet the conditions, The tool in fact calculates the combined margin emission factor based on the project type/technology and crediting periods. Please see sheet "Project Guidance" where by choosing the project type, crediting period and data vintage, the combined margin is calculated appropriately based on the results from Step 1 to Step 6. For instance, if you switch on the inclusion of off-grid in sheet "Step 2", and select "Energy efficiency" projects in sheet "Project Guidance" you will see that there will be no results in table "off-grid included" as final CM EF result. The same goes if the project is in its sub-sequent crediting period, when the inclusion of off-grid is not allowed. These conditions have been integrated and incorporated in the tool and can be tested for different conditions. Please let us know in case of further questions. C) UETCL has confirmed through the interviews that there has been a load-shedding program in place between 2010 and 2012. Additional evidence is also provided with this response to support this argument. Please see the report "The Energy and Mineral Development Joint Sector Review (JSR)": http://www.energyandminerals.go.ug/uploads/reports/JSR_REPORT.pdf , and http://kampala.usembassy.gov/media/pdfs/uganda_2011_investment_climate_statement.pdf, and http://www.umeme.co.ug/index.php?page=MjM0 where some information about load-shedding in Uganda can be found. UETCL and ERA are willing to provide further evidence if need be.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-9
DOE Assessment #2 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	b) Pending closure of CAR 2. CL point is not closed. *c)* PP has provided letter written by "Principal Control Engineer - UETCL" to "Chief Technical Officer – Umeme" to substantiate that a load shedding program exists in Uganda. Umeme is the operator of the national grid system of Uganda. The same was further authenticated through review of Electricity Sector performance Report (07/2011 – 12/2011) by ERA which under section 3.2.3.5 (on page 24) states *"Based on the quarterly reporting, a total of 3,549 hours were lost to load shedding in 2010 which was equivalent to 25,856MWhrs in lost energy. For the first three (3) quarters of 2011, 1,226 hours were lost to load shedding which translated into 8,927 MW hrs in lost energy. Outages were caused by system failure."* This clearly establishes the fact there is a load-shedding program in place in Uganda. CL point is closed. CL is not closed.
Corrective Action or clarification #3 *(PP shall write a detailed and clear corrective action or further information for clarification as per finding)*	b) Please see our response for CAR2.

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Finding	CL-9
DOE Assessment #3 *The assessment shall encompass all open issues in the finding. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	In section 2.2 of the revised report, PP has opted for option (section 6.2.4) of the applied methodological tool for inclusion of off-grid power plants in the PES to calculate the GEF. PP has clearly demonstrated in the report that GEF calculation meets all the requirements as stipulated under § 30 of the applied tool. Furthermore, the PP has used the default values as stated in § 31 and § 32 of the tool to calculate the GEF for the first crediting period. PP has clearly stated in the report that GEF calculated using option (inclusion of off-grid plants for GEF calculation); will only be used for estimation of emission reductions by the grid connected renewable energy generation power projects. The same is deemed acceptable by validation team.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the next periodic verification ☐ Outstanding finding (not closed) ☒ The finding is closed

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

APPENDIX B

Certificates of Competence

374 Rivonia Boulevard, Ground Floor, Block A, Rivonia, Johannesburg, RSA, 2128

Carbon Check (Pty) Ltd

Amit Anand

is hereby certified as a qualified

Assessor
Lead Assessor
Technical Reviewer
Technical Expert for Technical Area 1.2; 13.1

with Carbon Check (Pty) Ltd, under the regulations of the UNFCCC and Carbon Check's qualification criteria .

Approval date: 15 November 2013

Technical Executive	Executive Director
Mr Vikash Kumar Singh	Mr Priyesh Ramlall

The above competence is valid for one year from the date of approval and is subject to review as per changes in CCL and UNFCCC requirements and procedures.

Carbon Check (Pty) Ltd

Anubhav Dimri

is hereby certified as a qualified

Assessor
Lead Assessor
Technical Expert for Technical Area 1.2

with Carbon Check (Pty) Ltd, under the regulations of the UNFCCC and Carbon Check's qualification criteria .

Approval date: 15 November 2013

Technical Executive
Mr Vikash Kumar Singh

Executive Director
Mr Priyesh Ramlall

The above competence is valid for one year from the date of approval and is subject to review as per changes in CCL and UNFCCC requirements and procedures.

Carbon Check (Pty) Ltd

BB Sinha

is hereby certified as a qualified

Technical Expert
Local Expert, Uganda

In the following Technical Areas
9.1

with Carbon Check (Pty) Ltd, under the regulations of the UNFCCC and Carbon Check's qualification criteria .

Approval date: 15 November 2013

Technical Executive
Mr Vikash Kumar Singh

Executive Director
Mr Priyesh Ramlall

The above competence is valid for one year from the date of approval and is subject to review as per changes in CCL and UNFCCC requirements and procedures.

Carbon Check (Pty) Ltd

Vikash Kumar Singh

is hereby certified as a qualified

Assessor
Lead Assessor
Technical Expert
Technical Reviewer

In the following Technical Areas
1.2; 3.1; 13.1

with Carbon Check (Pty) Ltd, under the regulations of the UNFCCC and Carbon Check's qualification criteria .

Approval date: 15 November 2013

Chief Executive Officer
Mr Adam Simcock

Executive Director
Mr Priyesh Ramlall

The above competence is valid for one year from the date of approval and is subject to review as per changes in CCL and UNFCCC requirements and procedures.