SARACBENDI HPP RUN-OF-RIVER HYDRO PROJECT

Document Prepared By FutureCamp Turkey

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Table of Contents

İÇINDEKILER

1 PROJECT DETAILS

1.1 Summary Description of Project

Saracbendi HPP is a 23.67 MWe low head run-of-river power plant using a new weir structure to deviate river water of the Kızılırmak River into an intake structure with three settlement basins. From there it enters an open trapezoidal canal of 25.6 km length which runs along the left bank of the river. At the end a head pond is located with an intake to two steel penstocks of 3.90 m diameter and 159.9 m length each which lead to the powerhouse with the turbines. From there the water is released to the Kızılırmak River by an open canal. The powerhouse is an open type in a rock cut and houses 4 units Francis turbines with vertical shaft and 5.918 MWe each, i.e. 23.67 MWe installed capacity.

The purpose of the Project is to export the generated electricity to the regional grid, thereby contributing to the Turkey's electricity demand and rapidly growing economy. Since the Project generates electricity from renewable energy resources, it makes a significant contribution to climate protection. According to the validated VCS-PD, the Project was expected to generate ca. 100,470 MWh of electricity annually, and to reduce 55,170 tonnes of CO2 emissions per year, by supplying renewable energy that would have been supplied by the existing power grid that generates electricity predominantly from fossil fuel powered thermal power plants.

This first monitoring period covers the 27 months from 06/05/2011 to 31/07/2013 (both days included). Total emission reductions achieved in this period are 83,794 tons of CO2e.

1.2 Sectoral Scope and Project Type

Sectoral Scope: Energy (Renewable / Non-Renewable), Not a Grouped Project

1.3 Project Proponent

The HPP is operated and owned by Camlıca Elektrik Üretim A.Ş. Camlıca is also VCS project proponent and for contact please refer to the directions given below.

Table 1: Project Contact Data-Camlıca

Organization:	Camlıca Elektrik Üretim A.Ş.
Street/P.O.Box:	Koza Sok.
Building:	No:22 GOP
City:	Ankara
State/Region:	Ankara
Postcode/ZIP:	06700

Country:	Turkey
Personal Contact:	Mustafa Kemal GÜNGÖR
Direct FAX:	0090 0312 441 68 14
Direct tel:	0090 312 408 10 00
Personal e-mail:	mgungor@akfen.com.tr

The project documentation at hand was defined by Camlıca in cooperation with FutureCamp Türkiye. FutureCamp Türkiye is not a participant of the project.

Table 2: Contact Data of PD Consultant

Organization:	FutureCamp İklim ve Enerji Ltd.
Street/P.O.Box:	Cetin Emec Bulvarı
Building:	Beste Apartmanı 19/18 Cankaya
City:	Ankara
State/Region:	Ankara
Postcode/ZIP:	06460
Country:	Turkey
Personal Contact:	Engin Mert
Direct FAX:	0090 312 480 88 10
Direct tel:	0090 312 481 21 42
Personal e-mail:	info@futurecamp.com.tr

1.4 Other Entities Involved in the Project

No other entities are involved in the project.

1.5 Project Start Date

The project activity consists of one site and has been implemented in one phase. Start date of the project activity is 06/05/2011[1].

1.6 Project Crediting Period

Start: 06/05/2011

End: 05/05/2021

10-years two-times renewed crediting period.

1.7 Project Location

The project is located downstream of Yamula River on Kızılırmak River; it lies within the boundaries of Gemerek municipality, Sivas province, in Central Anatolian Region of Turkey. The project area is 19 km northeast of Gemerek city (Sivas province), 22 km southwest of Şarkışla city (Sivas province) and 37 km north of Akkışla village (Kayseri province).

The geographical coordinates of the Weir and the Power plant are as follows:

Table 3: Geographical coordinates of the Weir and the Power plant

	Weir	Power Plant
Longitude	36° 9' 40.638" E	36° 6' 43.128" E
Latitude	39° 19' 28.184" N	39° 8' 30.730" N

[1] See Saracbendi Provisional Accaptance Letter

Figure 1: Location of the project

1.8 Title and Reference of Methodology

"Consolidated baseline methodology for grid connected electricity generation from renewable sources" (ACM0002 version 12.1.0)

The above methodology is hereafter referred to as the "Baseline Methodology". The Baseline Methodology is used in conjunction with the approved monitoring methodology ACM0002 version 12.1.0 (subsequently referred to as "Monitoring Methodology").

The monitoring report also draws upon the:

· "Tool for assessment and demonstration of additionality", Version 5.2
· "Tool to calculate the emission factor for an electricity system", Version 2.2.0

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

Saraçbendi HPP started to generate and provide electricity to the Turkish National Grid on 06/05/2011. During the monitoring period, there was no event or situation that occurred, which may impact the applicability of the methodology.

2.2 Project Description Deviations

There is no project description deviations.

2.3 Grouped Project

N/A

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	**$EF_{grid,CM,y}$**
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data:	As per "Tool to calculate the emission factor for an electricity system"
Value applied:	**0.5491 tCO_2/MWh**
Purpose of the data:	For calculation emission factor
Any comment:	

Data Unit / Parameter:	**Gross electricity generation**
Data unit:	MWh
Description:	Gross Electricity supplied to the grid by relevant sources (2006-2008)
Source of data:	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Turkey's Gross Electricity Generation of Primary Energy Resources (1975-2008) TEİAŞ, see; http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/32(75-08).xls
Value applied:	131,681,100 MWh; 154,982,500 MWh;163,919,400 MWh
Purpose of the data:	Combined Margin Calculations
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	**Net Electricty Generation**
Data unit:	MWh
Description:	Net electricity fed into the grid. Used for the calculation of the net/gross relation (Including Import and Export figures)
Source of data:	Turkish Electricity Transmission Company (TEİAŞ), Annual Development of Electricity Generation-Consumption and Losses in Turkey (1984-2008) TEİAŞ, see http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/30(84-08).xls
Value applied:	169,543.1 GWh; 183,339.7 GWh; 189,761.9 GWh
Purpose of the data:	Combined Margin Calculations
Any comment:	This data is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants. Import and Export data is used to identify total net electricity fed into the grid in the years of 2006, 2007 and 2008. TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	**Sample Group for BM emission factor**
Data unit:	Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning.
Description:	Most recent power plants which compromise 20% of total generation
Source of data:	Annual Development of Fuels Consumed in Thermal Power Plants in Turkey by the Electric Utilities, TEİAŞ: For plants in 2004: http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202005.pdf

	For plants in 2005: http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202006.pdf For plants in 2006: http://www.teias.gov.tr/KAPASITE%20PROJEKSIYONU%202007.pdf For plants in 2007: http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2008.pdf For plants in 2008: http://www.teias.gov.tr/KAPASITEPROJEKSIYONU2009.pdf
Value applied:	See Validated VCS-PD
Purpose of the data:	Combined Margin Calculations
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey. The latest data available during PD preparation was for 2008.

Data Unit / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	Emission factor for fuel type i
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the IPCC Guidelines on National GHG Inventories. See http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied:	See Validated VCS-PD
Purpose of the data:	Combined Margin Calculations
Any comment:	

Data Unit / Parameter:	$\eta_{m,y}$

Data unit:	-
Description:	Average energy conversion efficiency of power unit m in year y
Source of data:	Annex I the "Tool to calculate the emission factor for an electricity system"
Value applied:	See Validated VCS-PD
Purpose of the data:	Combined Margin Calculations
Any comment:	

Data Unit / Parameter:	$HV_{i,y}$
Data unit:	Mass or volume unit
Description:	Heating Values of fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data:	Heating Values Of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/46.xls
Value applied:	There is no national NVC data in Turkey. However, TEİAŞ announces Heating values of fuels. This data is used to calculate annual NCVs for each fuel type.
Purpose of the data:	Combined Margin Calculations
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	$FC_{i,y}$
Data unit:	Mass or volume unit
Description:	Fuels consumed for electricity generation in the years of 2006, 2007 and 2008
Source of data:	Annual Development of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEİAŞ. See:

	http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2008/44.xls
Value applied:	See Validated VCS-PD
Purpose of the data:	Combined Margin Calculations
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.

Data Unit / Parameter:	**NCVi,y**
Data unit:	TJ/kton, TJ/million m^3
Description:	Net Calorific Value of fuel types in the years of 2006, 2007 and 2008
Source of data:	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey.
Value applied:	See Validated VCS-PD
Purpose of the data:	Combined Margin Calculations
Any comment:	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey.

3.2 Data and Parameters Monitored

Data Unit / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh/yr
Description:	Quantity of electricity generation supplied by the project plant/unit to the grid in year y
Source of data:	The data from the Electricity Meters are the basis for the settlement notification of PMUM. Data are gathered electronically from the meters by TEIAS and stored in secured website of PMUM, which is accessible to project developer with a private password. For monitoring, the monthly settlement notification of PMUM shall be used as source of

	data.
Description of measurement methods and procedures to be applied:	Two electricity meters is placed at the substation in the Sizir Municipality. One is the main meter (Aktaris SL761B071 with serial number 53064431) and the other one is the backup meter (Actaris SL761B071 with serial number 53064432). The meters have the accuracy of 0.5s. First Calibrating date of the meters is 22.01.2010. These meters are sealed by distribution company and intervention by project proponent is not possible. The meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications. Two meters will backup each other. These meters will be chosen according to national regulations and approved and sealed by TEIAS at start up of the plant. Maintenance and calibration of the metering devices will be made by TEIAS periodically. In addition to invoices and metering devices, the electricity delivered to the grid can be cross checked through TEIAS web page (https://dgpys.pmum.gov.tr/dgpys/) using the ID and password of the project owner. All records will be kept for at least two years as requested by the applied methodology. All meters kept the data for four months in case of any breakdown.[2] If any meter is found to be out of calibration, accurate energy amounts shall be detected via substitute counter group since registry values of the main counter group is the same as of the substitute group in the last measurement.[3]
Frequency of monitoring/recording:	The primary and back-up measurement devices measure, read and record various data such as electricity generated and consumed, in real-time. The measurements and recordings are made continuously. The readings are performed in monthly intervals.

[2] http://www.epdk.org.tr/documents/10157/81c16fc9-7777-46d6-a1bf-15c5ac8795c7 article 6 page2

[3] See; http://www.teias.gov.tr/sistemkullanim1.doc page 3

	There is no sampling involved.
Value monitored:	152,603.35 MWh
Monitoring equipment:	**Calibration frequency:** According to the Article 9 of the relevant regulation[4], periodical inspections of "gauges for electric, water, coal gas, natural gas and, current and voltage measuring transformers will be made once in 10 years". This is in line with the monitoring plan and national requirements. TEIAS will decide when to carry out the next calibration. The Project owner has no control over or access to the measurement devices and is not entitled to perform any type of maintenance or calibration. **Date of last calibration:** Last calibration date is 22.01.2010. Calibration tests are performed by ITRON FRANCE. In addition to the first calibration TEİAŞ was performed tests on the both main and backup meters. The date of the first test is 01.07.2012 and the date of the second test is 31/03/2013. Frequency of the tests is determined by TEİAŞ. **Responsible personnel:** TEIAS is responsible for monitoring and ensuring that the measurement devices satisfy the requirements. TEIAS is also responsible for the calibration of the measurement devices. In case of any detected problem (e.g. failure of one of the measurement devices, inconsistency between the readings of the primary and the back-up meter etc.), the plant manager in the name of the Project owner is responsible for coordinating the necessary maintenance and calibration procedure with TEIAS.
QA/QC procedures to be applied:	Maintenance and calibration of the metering devices will be made by TEIAS periodically. If there is a significant difference between the readings of two devices, maintenance and tests of the metering devices and the associated equipment will be done before waiting for the periodical maintenance.
Calculation method:	The net electricity amount supplied to the grid will be calculated by electricity supplied minus

[4] See; Measurement and Measuring Tools Inspection Regulation", Date: 24/07/1994, Official Gazette Number: 22000

	electricity withdrawn.
Any comment:	

Data Unit / Parameter:	**Cap_{PJ}**
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Equipment specifications that described in the equipment contracts
Description of measurement methods and procedures to be applied:	Cross-checking of instrument specifications of the installed turbines/generators (MW) and the indication in the PD.
Frequency of monitoring/recording:	Yearly
Value monitored:	23,672,000 W
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	

Data Unit / Parameter:	**A_{PJ}**
Data unit:	m^2
Description:	Area of the reservoir measured with topographic drawings in the surface of the water, after implementation of the project activity, when reservoir full
Source of data:	Technical drawings from consultants
Description of measurement methods and procedures to be applied:	Measured from topographical surveys or maps
Frequency of monitoring/recording:	Yearly
Value monitored:	992,982.5263 m^2
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	

3.3 Description of the Monitoring Plan

As described above, the relevant data that has to be monitored is the electricity supplied to the grid (EG_y) per year, the installed capacity of the hydro power plant and the area of the reservoir.

EG_y:
These data are subject to the accounting quality systems of both parties to the power purchase agreement, TEİAŞ and Camlıca Elektrik Üretim A.Ş. With this, no additional structures or processes have to be implemented to insure the availability of necessary data for monitoring.

At the end of one monitoring period, which is planned to generally last one year, the data from the monthly meter reading records will be added up to the yearly electricity generation and multiplied with the combined margin emission factor with the help of an excel spreadsheet that also contains the combined margin calculation. Thus, the complete baseline approach is always transparent and traceable. For the elaboration and quality assurance of the monitoring report, FutureCamp Türkiye is assigned for supporting related procedures.

Cap_{PJ} and A_{PJ}
These data will be stated for monitoring yearly. Power density of the project is greater than 10 W/m2 so there is no GHG emission due to project activity which is explained under section 4.3.

Currently 15 people are working in the plant. Currently the following information on staff and responsibilities at Saracbendi HPP can be seen below:

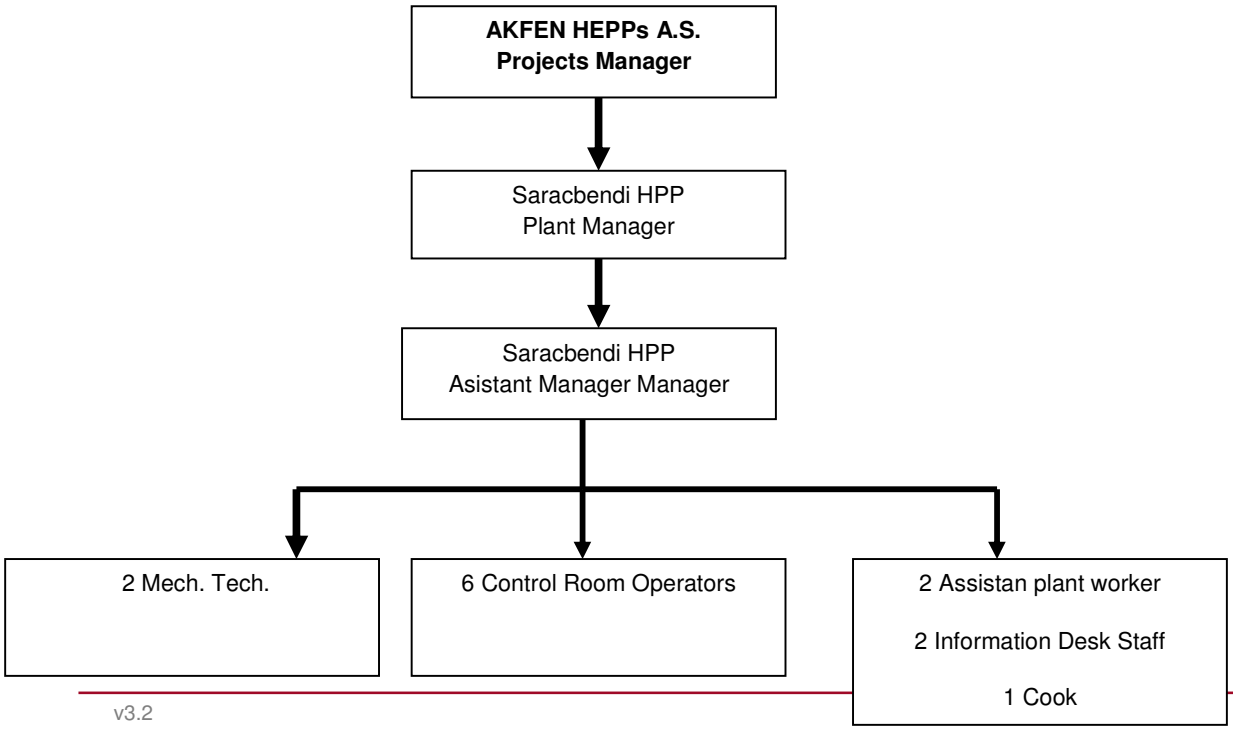

Figure 2: Organization chart

All data monitored under the monitoring plan will be kept in electronic form and hard copy for 2 years after the end of the crediting period.

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4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As per ACM0002 baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. This is calculated as per formula 6:

$BE_y = (EG_{PJ,y}) \times EF_{grid,CM,y}$ **(6)**

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the .Tool to calculate the emission factor for an electricity system. (tCO_2/MWh)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

The project activity is the installation of a new grid-connected renewable power plant, thus $EG_{PJ,y} = EG_{facility,y}$ (ACM0002 page 9, equation 7).

It follows that:

$BE_y = EG_{facility} * EF_{grid,CM,} = 152{,}603.35$ MWh * 0.5491 tCO2/MWh
= **83,794 tCO_2**

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4.2 Project Emissions

Project emissions are calculated as follows:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$

Where:

PE_y = Project emissions in year y (tCO_2e/yr)

$PE_{FF,y}$ = project emissions from fossil fuel consumption in year y (tCO_2/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

$PE_{FF,y}$ is zero as there will be no fossil fuel consumption to generate electricity and $PE_{GP,y}$ is zero as the project is not a geothermal project activity.

In order to calculate project emissions from water reservoir of the plant, power density should be calculated. The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \textbf{(5)}$$

PD= Power density of the project activity

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For the new hydro power plants, this value is zero

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity when reservoir is full (m2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

As the project acitivity is not extension of another project, Cap_{BL} and A_{BL} are zero, then

$$PD = \frac{Cap_{PJ}}{A_{PJ}}$$

As in the case of Saracbendi HPP this density is well above the 10W/m^2 threshold (~23.84 W/m^2; reservoir size: 992,982.5263 m^2, installed capacity: 23.672 MW), emissions (CH_4 and CO_2) from the reservoir are zero (ACM0002, page 8).According to the tool (page 7), for the projects having power density more than 10 W/m2 threshold is zero. Hence, the project emission (PE_y) is zero.

Emission reductions due to project activity have to be calculated as per formula 11 of ACM0002:

$ER_y = BE_y - PE_y$ **(11)**

Where:

ER_y = Emission reductions in year y (tCO_2/yr).

BE_y = Baseline emissions in year y (tCO_2/yr).

PE_y = Project emissions in year y (tCO_2/yr).

Then:

$ER_y = BE_y$

4.3 Leakage

As described in the methodology ,no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

4.4 Summary of GHG Emission Reductions and Removals

PE_y is 0 (see 4.2 above), the emission reduction is equivalent to the determined baseline emissions. Thus emission reductions amount to **83,794.6 tCO_2**

Table 4: Summary of the Emission Reductions

Total Generation (May 2011-July 2013)	152,603.35 MWh		
Total Emission reductions (May2011-July 2013)	**2011 (tCO_2)**	**2012 (tCO_2)**	**2013 (tCO_2)**
	14,707.3	31,197.9	37,889.4
Project Emissions	0	0	0
Net Emission Reductions	**83,794.6 tCO_2**		

Expected amount of emission reduction is calculated as 55,170 tCO_2 per year and 4597.5 tCO_2 per month in the validated VCS-PD. As the monitoring period of the project is selected as 27 months, total emission reduction should be 124,132.5 tCO_2 (27*4597.5) according to the VCS-PD. However because of the changing rain regimes and maintanence during November and October

2011, total emission reduction of the project cannot achieve the figure stated in the VCS-PD. Project reduces 67.5% of the value stated in the VCS-PD.

5 ADDITIONAL INFORMATION