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SHANDAN DONGLE BEITAN 50MW SOLAR POWER GENERATION PROJECT



ClimateBridge

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Shandan Dongle Beitan 50MW Solar Power Generation Project (hereafter simplified as “the project”) is a newly built grid-connected photovoltaic power plant with installed capacity of 50MWp, which is located in Dongle Beitan, Shandan County, Zhangye City, Gansu Province of China. The project is developed and operated by Shandan Xiehe Solar Power Generation Co., Ltd. (hereafter simplified as “the project owner”).

Purpose of the project is to generate electricity by using the renewable solar energy, and the electricity generated by the project will be delivered into NWPG to replace the equivalent electricity generated by fossil-fuel dominated NWPG, therefore the GHG emission reductions will be achieved.

During the first crediting period, the annual average GHG emission reductions are estimated to be 64,743 tCO₂e.

The start date of commercial operation of the project is dated on 28-December-2013. All project equipment and facilities as described in the registered VCS PD have been correctly installed. Please refer to section 3.1 for details;

This monitoring period covers the period from 28-December-2013 to 27-October-2019. The project operated in accordance with the registered VCS PD. Total GHG emission reduction achieved in this monitoring period is 299,774 tCO₂e.

Contribution to sustainable development

The project promotes local sustainable development through the following aspects:

- The project activity will displace the power generation of fossil fuel power plants, reducing CO₂, SO_x and NO_x emissions significantly, thus mitigating the air pollution and its adverse impacts on human health.
- Improvement of the fossil fuel dominated fuel mix of the electricity generation in the power grid by providing clean and renewable energy source, and help to energy supply security.
- Promote application and diffusion of the innovative/creative solar PV technology in China through the demonstrative practice of the project activity.

1.2 Sectoral Scope and Project Type

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

Project Type: Grid-connected renewable power generation

The project is not a grouped project.

1.3 Project Proponent

Organization name	Shandan Xiehe Solar Power Generation Co., Ltd.
Contact person	Zhan Bin
Title	Director
Address	The crossing of East Youth Street, Ganzhou District, Zhangye City, Gansu Province
Telephone	+86 936 8226684
Email	hhsdyinlongxing@vip.163.com

1.4 Other Entities Involved in the Project

Organization name	Climate Bridge Ltd.
Role in the Project	VCU buyer
Contact person	Gao Zhiwen
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120
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1.5 Project Start Date

28-December-2013 (commissioning start date).

1.6 Project Crediting Period

This project adopts renewable crediting periods of 25 years (from 28-December-2013 to 27-December-2039), and the first 10-year crediting period is from 28-December-2013 to 27-December-2023 (both days included).

1.7 Project Location

The Project is located in Dongle Beitan, Shandan County, Zhangye City, Gansu Province of China. The coordinates of the four site inflection points of the project are as below:

	Longitude	Latitude
A (North)	100°56'05" E	38°49'59" N
B (East)	100°57'25" E	38°49'52" N
C (South)	100°57'21" E	38°49'16" N
D (West)	100°56'01" E	38°49'21" N

The location of the Project is shown in the map of Figure 1.



Figure 1 The location of the project

1.8 Title and Reference of Methodology

ACM0002: "Grid-connected electricity generation from renewable sources" (Version 15.0);

The methodology also refers to:

"Tool for the demonstration and assessment of additionality" (Version 07.0.0);

"Tool to calculate the emission factor for an electricity system" (Version 04.0);

More information concerning the above methodology and tools can be referred to: <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

1.9 Participation under other GHG Programs

The project has been registered as a VCS project with registration number 1362. By checking online information for Chinese CCER projects (<http://cdm.ccchina.org.cn/ccer.aspx>), it is able to confirm the project is not a CCER project. The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading.

1.10 Other Forms of Credit

The project has been registered as a VCS project with registration number 1362. The project hasn't participated in any other form of emission trading programs.

1.11 Sustainable Development

The project will help reduce GHG emissions versus the high-growth, coal dominated business-as-usual scenario. The proposed project promotes local sustainable development through the following aspects:

- The project activity will displace the power generation of fossil fuel power plants, reducing CO₂, SO_x and NO_x emissions significantly, thus mitigating the air pollution and its adverse impacts on human health.
- Improvement of the fossil fuel dominated fuel mix of the electricity generation in the power grid by providing clean and renewable energy source, and help to energy supply security.
- Promote application and diffusion of the innovative/creative solar PV technology in China through the demonstrative practice of the project activity.

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) of this project completed by Lanzhou University has been examined and approved by Gansu Environmental Protection Bureau (Ganhuanpingbiaozi [2012] No.118) on October 23rd of 2012. According to the approval comments of the EIA Report by the Environmental Protection Bureau of Gansu Province, the environmental impacts likely to be caused by the project are analyzed.

This project will not cause significant impact on the environment as to the conclusion of the EIA. The conclusions of EIA are documented below:

1) Construction period

- Air pollution

The project is located in wide gobi desert, where the airflow condition is well, therefore by controlling the appropriate number of the construction vehicles, the waste gas from vehicles was reduced and diffused quickly, and after the construction work finished, the impact of the air pollution was disappeared accordingly.

- Waste water

The waste water mainly came from the living area. The waste water from washing was collected and processed with precipitation tank and the clean water was purled around the construction area to deduce the dust. The excrement was composted for fertilizer. Based on the fact that the living waste water was little and the climate was dry, after the above treatment the impact of the waste water was limited.

- Noise

The noise mainly came from the operation of the machines, which was controlled by measures like maintenance of the machines, layout of the construction area, operation time management.

- Solid waste

The solid waste mainly came from the excavation for the base of support of the module, main transformer, inverter and the cable, and there was some living rubbish. The excavation waste was backfilled properly, and the living rubbish was collected and transported to landfill treatment plant of Shandan County. Therefore, the solid waste was very limited.

2) Operation period

- Waste water

The waste water mainly comes from the living area, which is about 1.3m³ per day, and collected and piped to the septic tank with the volume of 15 m³, after digestion in the tank, it is supposed to meet the standard of GB5084-2005, and is used for plants in the project and no waste water will be emitted outside the project. The waste water from washing of the module is recycled to water the plants along the road to the project.

- Noise

The noise mainly comes from the running of the water pump with 82dB(A) and the main transformer with 64 dB(A), which are about 1000m far away from the residents and it meets the standard II of GB12348-2008.

- Solid waste

After 15 years of operation, some of the solar modules will be changed for update, and the waste module will be recycled by the production company and used for remanufacturing and other purpose. The solid waste of the living area is about 7.01 ton per year, and it is collected and transported to landfill treatment plant of Shandan County.

Thus, being a solar power generation project, there are no negative environmental and/or socio-economic impacts due to the project.

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project preparation stage:

In September 2013, the project owner carried out a survey of the local villagers and residents in the area using a questionnaire, with the results of the survey indicating support for the project. The following people are considered as the stakeholders of this project:

- Residents of the nearby village;
- Staff of the project station;
- Relevant administrative staff of the local government.

The one page questionnaire was designed with the following sections:

- 1) Brief introduction of the project
- 2) Basic information of respondent
- 3) Major question issues

- Whether the project will cause water pollution?
- Whether the project will cause air pollution?
- Whether the project will cause noise pollution?
- Whether the project will impact on soil environment?
- Whether the project will impact on the surrounding animals and plants?
- Impact on the local residents' employment opportunities and income.
- Impact on the local economic development.
- Impact on the local power grid and NWPG.
- Attitude on developing the project.

30 questionnaires have been handed in total and all of them have been received successfully from the stakeholder representatives, respectively from the local government, and surrounding villages. The representatives covered different ages, different occupations and different education levels. Comments of the respondents are shown in **Table 1** as below:

Table 1 The result of stakeholders' comments

Item	Options	Results	Percentage
Whether the project will cause water pollution?	Yes	0	0.00%
	No	30	100.00%
	Don't know	0	0.00%
Whether the project will cause air pollution?	Yes	0	0.00%
	No	28	93.33%
	Don't know	2	6.67%
Whether the project will cause noise pollution?	Yes	0	0.00%
	No	25	83.33%
	Don't know	5	16.67%
Whether the project will impact on soil environment?	Yes	0	0.00%
	No	26	86.67%
	Don't know	4	13.33%
Whether the project will impact on the surrounding animals and plants?	Yes	0	0.00%
	No	25	83.33%
	Don't know	5	16.67%
Impact on the local residents' employment opportunities and income.	Advantageous	26	86.67%
	No impact	4	13.33%
	Disadvantageous	0	0.00%
Impact on the local economic development.	Advantageous	28	93.33%
	No impact	2	6.67%
	Disadvantageous	0	0.00%
	Advantageous	27	90.00%

Impact on the local power grid and NWPG.	No impact	3	10.00%
	Disadvantageous	0	0.00%
Attitude on developing the project.	Support	30	100.00%
	Oppose	0	0.00%
	Don't know	0	0.00%

As described above, most of the stakeholders interviewed expressed the project will benefit the local environment, economy and social development, some of them thought there is no significant impact on those, and no negative impact were raised by stakeholders.

Local Stakeholder Consultation during the project implementation stage:

Communications with Local stakeholders are being carried out at periodic intervals. Key implementation schedules or changes of the project will be communicated to the local authority, who will inform the neighbourhood committee and the local residents, the comments and suggestions from residents will be collected by the local authority meanwhile. And the local government agencies and competent authorities will conduct spot checks on the implementation of the project from time to time, and give suggestions on the involved rectification problems. There are no negative comments received for the project. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

2.3 AFOLU-Specific Safeguards

The project is a non-AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project was put into full operation on 28-December-2013. The electricity generated by the Project is delivered to NWPG.

During this monitoring period, the project is operated and implemented in accordance with the registered VCS PD version 2.0 dated 14-October-2014. Neither emergencies (including of overhaul times, downtimes of equipment, exchange of equipment, etc.) happened to the monitoring system in this monitoring period, nor did events or situations occur during the monitoring period which may impact the applicability of the methodology.

The installed capacity of the Project is about 50 MWp which form 50 sets of power generation units (sub-systems), each sub-system is about 1MW and is equipped with two inverters. The technical parameters of the main equipment for the project are shown in **Table 2**. The expected grid-in electricity in the first operation year is about 78,386 MWh and the accumulative decay rate during the whole lifetime in 25 years is 20%. Therefore the expected annual grid-in electricity in 25 years is 70,861.15 MWh, at 1,417 operational hours with a PLF of 16.18%; and the annual grid-in electricity in the first 10 years is 75,564.33 MWh, at 1,511 operational hours with a PLF of 17.25%. For the first 10-year crediting period, use annual grid-in electricity of 75,564.33 MWh for GHG reduction calculation.

Table 2 Parameters of the equipment used in the proposed project

Photovoltaic Modules (Polysilicon)			
Manufacturer	Tianwei New Energy (Yangzhou) Co., Ltd.	Shandong Dahai Group Co., Ltd.	Jinko Solar Holding Co., Ltd.
Quantity	3,014	44,273	153,658
Type	TW245P660	DHP60-245	JKM250P-60
Rated maximum power (Pmax)	245 W	245 W	250 W
Maximum power voltage (Vmp)	30.0 V	31.00 V	30.4 V
Maximum power current (Imp)	8.17 A	7.90 A	8.23 A
Open circuit voltage (Voc)	37.2 V	37.35 V	37.6 V
Short circuit current (Isc)	8.74 A	8.56 A	8.81 A
Lifetime	25 years	25 years	25 years
Inverter			
Manufacturer	Sungrow Power Supply Co., Ltd		
Quantity	100		
Type	SG500MX		
Rated power	500 kW		
Rated output voltage	3-315 V		
Max output current	1,008 A		

Lifetime	25 years
Box transformer	
Manufacturer	Jiangsu Huapeng Transformer Co., Ltd.
Quantity	50
Type	ZGSF11-Z.G-1100/35
Rated power	1100/550 - 550 kVA
Rated voltage	38.5±2×2.5%/0315 - 0.315 kV
Rated current	16.5/1008.1 - 1008.1 A
Rated frequency	50 Hz
Lifetime	25 years

The electricity generated from inverters is transformed to 35kV by box transformers before supplied to the switching station via five 35kV lines (every ten sub-systems connect to one line), and then transformed to 110kV through the main transformer before delivered to Beitan 110kV Substation and finally to NWPG. Electricity meters are installed in high voltage side of the main transformer to monitor the quantity of electricity generated in this project and delivered to the grid.

3.2 Deviations

3.2.1 Methodology Deviations

There is no deviation applied to this monitoring period.

3.2.2 Project Description Deviations

There is no project description deviation applied to this monitoring period.

3.3 Grouped Projects

The Project is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF _{grid,CM} .y
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Data unit	tCO ₂ e/MWh
Description	Combined margin CO ₂ emission factor for grid connected power generation in year <i>y</i>
Source of data	China DNA
Value applied	0.8568
Justification of choice of data or description of measurement methods and procedures applied	Official and authoritative statistic data
Purpose of Data	Calculation of baseline emissions
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year <i>y</i>
Source of data	Calculated
Description of measurement methods and procedures to be applied	Calculated based on the electricity delivered to the grid by the project ($EG_{out,y}$) and the electricity consumed by the project which is imported from the grid ($EG_{in,y}$).
Frequency of monitoring/recording	Measured continuously and recorded monthly
Value monitored	349,879.471
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions
Calculation method	$EG_{facility,y} = EG_{out,y} - EG_{in,y}$
Comments	-

Data / Parameter	$EG_{out,y}$
Data unit	MWh

Description	Quantity of the electricity delivered to the grid by the project in year <i>y</i>		
Source of data	On-site measurement		
Description of measurement methods and procedures to be applied	Use calibrated electric meters. The accuracy of the meter(s) is no less than 0.5. The calibration will be conducted annually subject to national standards. Data monitored continuously and aggregated monthly.		
Frequency of monitoring/recording	Measured continuously and recorded monthly		
Value monitored	355,307.971		
Monitoring equipment	Electric meters		
		Main meter M1	Backup meter M1'
	Type	MK6E	MK6E
	Serial No.	213211573	213211574
	Accuracy	0.2S	0.2S
	Calibration frequency	Annually	Annually
	Date of calibration	03-December-2013; 03-December-2014; 03-December-2015; 03-December-2016; 03-December-2017; 03-December-2018	03-December-2013; 03-December-2014; 03-December-2015; 03-December-2016; 03-December-2017; 03-December-2018
	Validity	02-December-2014 02-December-2015; 02-December-2016; 02-December-2017; 02-December-2018; 02-December-2019	02-December-2014 02-December-2015; 02-December-2016; 02-December-2017; 02-December-2018; 02-December-2019
QA/QC procedures to be applied	Cross check measurement results with records for sold electricity		
Purpose of the data	Calculation of baseline emissions		
Calculation method	-		
Comments	-		

Data / Parameter	$EG_{in,y}$		
Data unit	MWh		
Description	Quantity of the electricity consumed by the project which is imported from the grid in year y		
Source of data	On-site measurement		
Description of measurement methods and procedures to be applied	Use calibrated electric meters. The accuracy of the meter(s) is no less than 0.5. The calibration will be conducted annually subject to national standards. Data monitored continuously and aggregated monthly.		
Frequency of monitoring/recording	Measured continuously and recorded monthly		
Value monitored	5,428.500		
Monitoring equipment	Electric meters		
		Main meter M1	Backup meter M1'
	Type	MK6E	MK6E
	Serial No.	213211573	213211574
	Accuracy	0.2S	0.2S
	Calibration frequency	Annually	Annually
	Date of calibration	03-December-2013; 03-December-2014; 03-December-2015; 03-December-2016; 03-December-2017; 03-December-2018	03-December-2013; 03-December-2014; 03-December-2015; 03-December-2016; 03-December-2017; 03-December-2018
	Validity	02-December-2014 02-December-2015; 02-December-2016; 02-December-2017; 02-December-2018; 02-December-2019	02-December-2014 02-December-2015; 02-December-2016; 02-December-2017; 02-December-2018; 02-December-2019
QA/QC procedures to be applied	Cross check measurement results with records for purchased electricity		
Purpose of the data	Calculation of baseline emissions		

Calculation method	-
Comments	-

4.3 Monitoring Plan

1) Operation and management structure

Overall responsibility for daily monitoring and reporting lies with the project owner. A monitoring group will be established within the project company to carry out the monitoring work. The structure of the monitoring group is as follows:

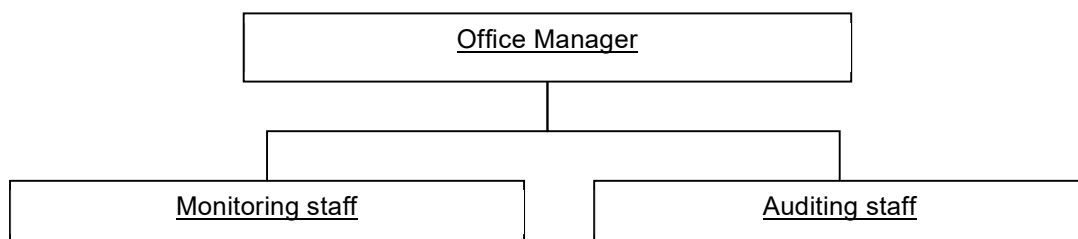


Figure 2 Organization structure of the monitoring team

The responsibilities of each role in the team structure are:

- Office manager has the overall management responsibility, especially supervising the implementation of the monitoring plan
- Monitoring staff measures the electricity imported to and exported from the project
- Auditing staff performs internal verification of the measurement, collects relevant receipts and calculates emission reductions

Finally, the monitoring reports will be reviewed by the General Manager.

2) Monitoring equipment and installation

The project is connected to the Beitan 110kV Substation through a 110kV transmission line. And two bi-directional meters M1 and M1' have been installed in the Beitan substation to measure the electricity delivered to the grid by the project ($EG_{out,y}$) and the electricity consumed by the project which is imported from the grid ($EG_{in,y}$). The readings from main meter M1 will be used for ER calculation, and when M1 is out of order, the readings from the back-up meter M1' shall be used for reference. The main meter and back-up meter is owned, operated and maintained by the grid company. The total electricity delivered to the grid by the project: $EG_{facility,y} = EG_{out,y} - EG_{in,y}$

The meters were configured to meet the technology requirements of "Management Regulations for Power Metered Device Technology" (DL/T448-2000) and the subsequent industrial standards.

These meters installed for power measurement should reach 0.5 or above in accuracy degree. And before the electric energy metering equipment was put into operation, the project owner and power grid company have checked and accepted the equipment according to the regulation.

The power line diagram of the project is shown as follows:

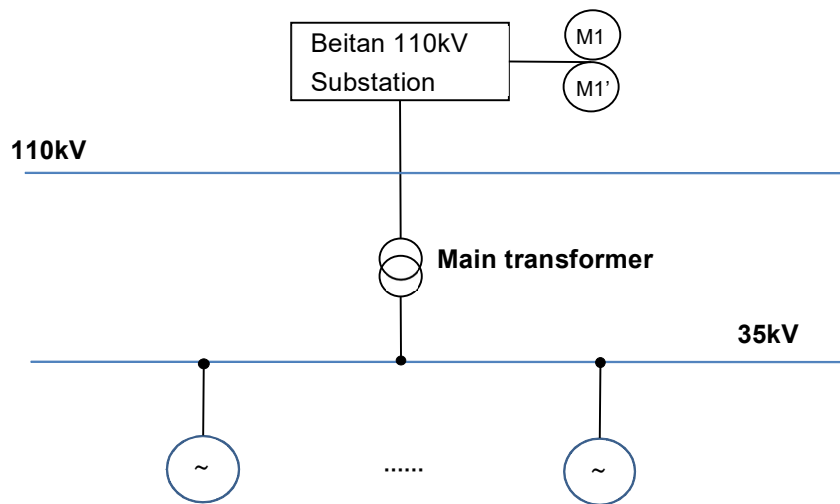


Figure 3 Power line diagram of the monitoring system

3) Data collection system

The procedures of data recording and collecting are listed below:

- The project owner reads the main meter (M1) every month and then submits the reading results to the grid company. Upon agreement on the electricity reading from both parties, the power grid pays the project owner for exported electricity and the project owner provides the grid company with a sale receipt.
- The project owner files the meter readings in the monthly report, a data collection form designed for monitoring. The data on this monthly report which can be cross-checked with the electricity sale receipt are used to calculate emission reductions.
- The project owner collects and keeps on file maintenance records, meter calibration documents.

4) Quality assurance and quality control (QA/QC)

QA/QC practice involves:

- The metering equipment will be calibrated and checked annually for accuracy;

- Calibration will be carried out by qualified parties with the records being supplied to the project owner, and the calibration shall ensure sufficient accuracy so that any error resulting from such equipment shall not exceed the allowable error of full-scale rating.
- When M1 is out of work, M1' will be used for measurement, and no emission reduction will be claimed when both M1 and M1' are out of work.
- All data collected as part of monitoring is archived electronically. All information should be stored by the technology department of the project owner and all the material has a physical copy for backup. In order to facilitate auditors' reference of relevant literature relating to the project, the project material and monitoring results are indexed. And all data including calibration records is kept until 2 years after the end of the crediting period, or the last issuance of VCUs, whichever is later.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to ACM0002 and the registered VCS PD of the Project, the baseline emission BE_y during the monitoring period results from:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (1)$$

And for greenfield power plant,

$$EG_{PJ,y} = EG_{facility,y} = EG_{out,y} - EG_{in,y} \quad (2)$$

Where

BE_y	=	Baseline emission in year y (tCO ₂ e)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)
$EG_{out,y}$	=	Quantity of the electricity delivered to the grid by the project in year y (MWh/yr)
$EG_{in,y}$	=	Quantity of the electricity consumed by the project which is imported from the grid 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 " <i>Tool to calculate the emission factor for an electricity system</i> " (tCO ₂ e/MWh)

The monthly electricity data and baseline emission are listed in the table 3 and table 4.

Table 3 The monthly electricity data for $EG_{out,y}$ and $EG_{in,y}$

Monitoring period	$EG_{out,y}$ (MWh)			$EG_{int,y}$ (MWh)			$EG_{facility,y}$ (MWh)
	Monthly reports	ETN Data	Data for Calculation	Monthly reports	ETN Data	Data for Calculation	
	A	B	C=min(A,B)	D	E	F=max(D,E)	
28-12-2013~27-01-2014	1,363.956	1,363.956	1,363.956	21.120	21.120	21.120	1,342.836
28-01-2014~27-02-2014	1,313.136	1,313.136	1,313.136	25.080	25.080	25.080	1,288.056
28-02-2014~27-03-2014	3,496.020	3,496.020	3,496.020	23.760	23.760	23.760	3,472.260
28-03-2014~27-04-2014	2,835.360	2,835.360	2,835.360	33.000	33.000	33.000	2,802.360
28-04-2014~27-05-2014	5,120.148	5,120.148	5,120.148	33.000	33.000	33.000	5,087.148
28-05-2014~27-06-2014	4,972.704	4,972.704	4,972.704	30.360	30.360	30.360	4,942.344
28-06-2014~27-07-2014	3,478.200	3,478.200	3,478.200	3.300	3.300	3.300	3,474.900
28-07-2014~27-08-2014	5,154.732	5,154.732	5,154.732	38.280	38.280	38.280	5,116.452
28-08-2014~27-09-2014	4,805.460	4,805.460	4,805.460	34.320	34.320	34.320	4,771.140
28-09-2014~27-10-2014	6,384.576	6,384.576	6,384.576	35.640	35.640	35.640	6,348.936
28-10-2014~27-11-2014	5,270.232	5,270.232	5,270.232	42.240	42.240	42.240	5,227.992
28-11-2014~27-12-2014	6,137.868	6,137.868	6,137.868	48.840	48.840	48.840	6,089.028
Subtotal	50,332.392	50,332.392	50,332.392	368.940	368.940	368.940	49,963.452
28-12-2014~27-01-2015	1,756.260	1,756.260	1,756.260	55.440	55.440	55.440	1,700.820
28-01-2015~27-02-2015	3,253.008	3,253.008	3,253.008	46.200	46.200	46.200	3,206.808

28-02-2015~27-03-2015	4,113.912	4,113.912	4,113.912	36.960	36.960	36.960	4,076.952
28-03-2015~27-04-2015	4,392.168	4,392.168	4,392.168	36.960	36.960	36.960	4,355.208
28-04-2015~27-05-2015	4,292.772	4,292.772	4,292.772	34.320	34.320	34.320	4,258.452
28-05-2015~27-06-2015	4,840.572	4,840.572	4,840.572	30.360	30.360	30.360	4,810.212
28-06-2015~27-07-2015	5,104.308	5,104.308	5,104.308	23.760	23.760	23.760	5,080.548
28-07-2015~27-08-2015	6,050.352	6,050.352	6,050.352	31.680	31.680	31.680	6,018.672
28-08-2015~27-09-2015	4,585.152	4,585.152	4,585.152	35.640	35.640	35.640	4,549.512
28-09-2015~27-10-2015	3,588.552	3,588.552	3,588.552	38.280	38.280	38.280	3,550.272
28-10-2015~27-11-2015	3,381.312	3,381.312	3,381.312	43.560	43.560	43.560	3,337.752
28-11-2015~27-12-2015	4,012.404	4,012.404	4,012.404	48.840	48.840	48.840	3,963.564
Subtotal	49,370.772	49,370.772	49,370.772	462.000	462.000	462.000	48,908.772
28-12-2015~27-01-2016	3,947.527	3,947.527	3,947.527	88.440	88.440	88.440	3,859.087
28-01-2016~27-02-2016	4,074.543	4,074.543	4,074.543	105.600	105.600	105.600	3,968.943
28-02-2016~27-03-2016	3,810.664	3,810.664	3,810.664	88.440	88.440	88.440	3,722.224
28-03-2016~27-04-2016	5,281.408	5,281.408	5,281.408	80.520	80.520	80.520	5,200.888
28-04-2016~27-05-2016	6,004.471	6,004.471	6,004.471	76.560	76.560	76.560	5,927.911
28-05-2016~27-06-2016	6,446.911	6,446.911	6,446.911	79.200	79.200	79.200	6,367.711
28-06-2016~27-07-2016	6,483.956	6,483.956	6,483.956	71.280	71.280	71.280	6,412.676
28-07-2016~27-08-2016	5,187.697	5,187.697	5,187.697	87.120	87.120	87.120	5,100.577
28-08-2016~27-09-2016	5,418.998	5,418.998	5,418.998	93.720	93.720	93.720	5,325.278
28-09-2016~27-10-2016	3,536.956	3,536.956	3,536.956	104.280	104.280	104.280	3,432.676

28-10-2016~27-11-2016	2,364.046	2,364.046	2,364.046	125.400	125.400	125.400	2,238.646
28-11-2016~27-12-2016	3,070.491	3,070.491	3,070.491	130.680	130.680	130.680	2,939.811
Subtotal	55,627.668	55,627.668	55,627.668	1,131.240	1,131.240	1,131.240	54,496.428
28-12-2016~27-01-2017	4,244.563	4,244.563	4,244.563	139.920	139.920	139.920	4,104.643
28-01-2017~27-02-2017	4,200.597	4,200.597	4,200.597	132.000	132.000	132.000	4,068.597
28-02-2017~27-03-2017	4,998.716	4,998.716	4,998.716	108.240	108.240	108.240	4,890.476
28-03-2017~27-04-2017	5,185.676	5,185.676	5,185.676	95.040	95.040	95.040	5,090.636
28-04-2017~27-05-2017	6,754.532	6,754.532	6,754.532	75.240	75.240	75.240	6,679.292
28-05-2017~27-06-2017	5,052.140	5,052.140	5,052.140	68.640	68.640	68.640	4,983.500
28-06-2017~27-07-2017	4,355.645	4,355.645	4,355.645	72.600	72.600	72.600	4,283.045
28-07-2017~27-08-2017	5,296.820	5,296.820	5,296.820	84.480	84.480	84.480	5,212.340
28-08-2017~27-09-2017	5,144.081	5,144.081	5,144.081	95.040	95.040	95.040	5,049.041
28-09-2017~27-10-2017	5,271.779	5,271.779	5,271.779	96.360	96.360	96.360	5,175.419
28-10-2017~27-11-2017	5,553.020	5,553.020	5,553.020	120.120	120.120	120.120	5,432.900
28-11-2017~27-12-2017	4,925.166	4,925.166	4,925.166	137.280	137.280	137.280	4,787.886
Subtotal	60,982.735	60,982.735	60,982.735	1,224.960	1,224.960	1,224.960	59,757.775
28-12-2017~27-01-2018	4,923.177	4,923.177	4,923.177	135.960	135.960	135.960	4,787.217
28-01-2018~27-02-2018	6,009.694	6,009.694	6,009.694	133.320	133.320	133.320	5,876.374
28-02-2018~27-03-2018	7,113.622	7,113.622	7,113.622	104.280	104.280	104.280	7,009.342
28-03-2018~27-04-2018	6,849.460	6,849.460	6,849.460	109.560	109.560	109.560	6,739.900
28-04-2018~27-05-2018	6,216.091	6,216.091	6,216.091	91.080	91.080	91.080	6,125.011

28-05-2018~27-06-2018	6,325.841	6,325.841	6,325.841	85.800	85.800	85.800	6,240.041
28-06-2018~27-07-2018	6,162.191	6,162.191	6,162.191	81.840	81.840	81.840	6,080.351
28-07-2018~27-08-2018	5,866.336	5,866.336	5,866.336	88.440	88.440	88.440	5,777.896
28-08-2018~27-09-2018	5,510.569	5,510.569	5,510.569	93.720	93.720	93.720	5,416.849
28-09-2018~27-10-2018	6,828.340	6,828.340	6,828.340	101.640	101.640	101.640	6,726.700
28-10-2018~27-11-2018	6,196.577	6,196.577	6,196.577	120.120	120.120	120.120	6,076.457
28-11-2018~27-12-2018	5,198.541	5,198.541	5,198.541	132.000	132.000	132.000	5,066.541
Subtotal	73,200.439	73,200.439	73,200.439	1,277.760	1,277.760	1,277.760	71,922.679
28-12-2018~27-01-2019	5,932.048	5,932.048	5,932.048	139.920	139.920	139.920	5,792.128
28-01-2019~27-02-2019	5,412.652	5,412.652	5,412.652	129.360	129.360	129.360	5,283.292
28-02-2019~27-03-2019	7,432.454	7,432.454	7,432.454	104.280	104.280	104.280	7,328.174
28-03-2019~27-04-2019	6,883.248	6,883.248	6,883.248	99.000	99.000	99.000	6,784.248
28-04-2019~27-05-2019	6,937.998	6,937.998	6,937.998	81.840	81.840	81.840	6,856.158
28-05-2019~27-06-2019	6,449.920	6,449.920	6,449.920	75.240	75.240	75.240	6,374.680
28-06-2019~27-07-2019	7,043.148	7,043.148	7,043.148	71.280	71.280	71.280	6,971.868
28-07-2019~27-08-2019	6,917.266	6,917.266	6,917.266	83.160	83.160	83.160	6,834.106
28-08-2019~27-09-2019	6,329.743	6,329.743	6,329.743	89.760	89.760	89.760	6,239.983
28-09-2019~27-10-2019	6,455.488	6,455.488	6,455.488	89.760	89.760	89.760	6,365.728
Subtotal	65,793.965	65,793.965	65,793.965	963.600	963.600	963.600	64,830.365
Total	355,307.971	355,307.971	355,307.971	5,428.500	5,428.500	5,428.500	349,879.471

Table 4 Calculation of the baseline emission

Monitoring period	$EG_{\text{facility},y}(\text{MWh})$	$EF_{\text{grid},CM,y}$	$BEy(\text{tCO}_2)$
28-12-2013~27-12-2014	49,963.452	0.8568	42,808
28-12-2014~27-12-2015	48,908.772	0.8568	41,905
28-12-2015~27-12-2016	54,496.428	0.8568	46,692
28-12-2016~27-12-2017	59,757.775	0.8568	51,200
28-12-2017~27-12-2018	71,922.679	0.8568	61,623
28-12-2018~27-10-2019	64,830.365	0.8568	55,546
Total	349,879.471	0.8568	299,774

5.2 Project Emissions

As per the registered VCS PD, the Project emission (PE_y) is 0 tCO₂ e.

5.3 Leakage

No leakage emissions are considered as per the applied methodology ACM0002 and the registered VCS PD.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
28-12-2013~27-12-2014	42,808	0	0	42,808
28-12-2014~27-12-2015	41,905	0	0	41,905
28-12-2015~27-12-2016	46,692	0	0	46,692
28-12-2016~27-12-2017	51,200	0	0	51,200
28-12-2017~27-12-2018	61,623	0	0	61,623
28-12-2018~27-10-2019	55,546	0	0	55,546
Total	299,774	0	0	299,774

Comparison of actual emission reductions with estimates during validation:

The emission reductions achieved in the 1st monitoring period are about 20.66%¹ less than the estimated value 377,815 tCO₂e² which is calculated in line with the registered PD. It is mainly because of the unstable performance due to the initial operation of the project.

¹ $(299,774 - 377,815) / 377,815 = -20.66\%$

² As per the registered PD, the annual emission reduction is 64,743 tCO₂e, thus the estimated emission reduction in the monitoring period (covering 2,130 days) is 377,815 tCO₂e, ie. $377,815 = 64,743 \times 2,130 / 365$.