4.5 MW GROUPED SMALL HYDROPOWER PROJECTS FOR GRID SYSTEM BY BHORUKA POWER CORPORATION LIMITED IN KARNATAKA STATE, INDIA

Document Prepared By:

Sangameshwara GB, Bhoruka Power Corporation Limited.

Project Title	4.5 MW Grouped Small Hydropower Projects for Grid system by Bhoruka Power Corporation Limited in Karnataka State, India
Version	1.01
Report ID	BPCL-265-01
Date of Issue	23-September-2013
Project ID	VCSPD265
Monitoring Period	01-January-2010 to 31-December-2012 (Both days included)
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1 PROJECT DETAILS

1.1 Summary Description of Project

Bhoruka Power Corporation Limited (BPCL) has established 4.5 MW Grouped Small Hydro Power Project in the state of Karnataka, which includes the 1 MW Mini Hydel Power Project of Shahapur-D9 at Gulbarga district, (hereafter referred to as Shahapur-D9 Project) and 3.5 MW (2×1.75) Capacity Mini Hydel Power Project at Mandya Dist.(here after referred as Mandagere Project).

The purpose of this monitoring report is to calculate the Greenhouse Gas emission reduction achieved by the project activity for the following monitored period. The present monitoring period covers from the 01-01-2010 to 31-12-2012

Shahapur-D9 Project (1x1MW)

The Project is a canal based Mini Hydel scheme on the distributary-9 of Shahapur Branch canal (SBC). The length of the canal is 36 km. The project site is near the village Banathal, in the District of Gulbarga, Karnataka State. Shahapur –D9 Project (hereinafter also referred to as D-9) envisages the utilization of seven drops accounting for 11 m head and a chute structure of 10 m, totaling to 21 m gross head and the flow in the distributaries to generate 1 MW with single installed unit of capacity 1000 kW. The generated energy from the project after meeting its auxiliary equipment (dewatering pump, drainage pump, Oil Pumps, Cooling water pumps, plant lighting, etc.) requirement would be exported to the substation at Gugi which is 8 km away from the Project site.

Mandagere Project (2x1.75 MW):

The Project is located on the downstream of Mandagere anicut near Mandagere Village, Mandya district of Karnataka state. The scheme utilizes the flows which are spilling over the anicut from the regulated releases of Gorur dam in Hemavathi river and a gross head of 8 m available in the river due to the presence of Mandagere anicut and rapids in the downstream for power generation with two units of each 1750 kW installed capacity totaling to 3.5 MW.

The generated energy from the project after meeting its auxiliary equipment (dewatering pump, drainage pump, Oil Pumps, Cooling water pumps, plant lighting, etc.) requirement would be exported to the substation at Kikkere which is at 5 km far away from the Project site.

1.2 Sectoral Scope and Project Type

As per UNFCCC methodologies are mentioned in www.unfccc.int, the project is categorized in Sectoral scope 1: “Energy Industries (renewable / non-renewable)” and applied Approved Baseline methodology (AMS I.D, Version 13). The project is a grouped project.

1.3 Project Proponent

The project proponent is responsible for installation, commissioning and subsequent operation and maintenance of the project. The project proponent is also responsible for monitoring and keeping the records as required for the project activity.

The Bhoruka Power Corporation limited is the project participant and all communication with the verifier as well as with the registry would be the entity listed in the table below:.

Organization:	Bhoruka Power Corporation Limited.
Street/P.O.Box:	48, Lavelle Road
Building:	Hitananda 2
City:	Bangalore
State/Region:	Karnataka
Postfix/ZIP:	560 001
Country:	India
Telephone:	+ 91 80 2227 2271 – 74
FAX:	+ 91 80 2224 5246
E-Mail:	bhoruka@bhorukapower.com
Title:	Managing Director
Salutation:	Mr.
Last Name:	Chandrasekhar
Middle Name:	
First Name:	S.
Direct tel:	+ 91 80 2229 1259
Personal E-Mail:	sekhar@bhorukapower.com

1.4 Other Entities Involved in the Project

No other entities involved in the project

1.5 Project Start Date

The date of commissioning of respective project component is considered as start date of the project. i.e.,

- The start date of Shahapur-D9 project is August 29, 2003

- The start date of Mandagere project is September 16, 2004

Hence start date Shahapur-D9 project (i.e., August 29, 2003) is considered as start date of the bundle as the bundle start reducing the emission from August 29, 2003

1.6 Project Crediting Period

The credit period start date is considered from 1 April 2006 for each of the grouped project activity. The crediting period chosen is of 10 years (i.e. from 1 Apr 2006 to 31 Mar 2016).

1.7 Project Location

Details	Shahapur-D9 Project	Mandagere Project
Village	Banathihal	Mandagere
Mandal	Shahapur	Krishnarajpet
District	Gulbarga	Mandya
State	Karnataka	Karnataka
Latitude	16° 41'30"N	12°44’0” N
Longitude	76°45 30” E	76° 22'30"E

1.8 Title and Reference of Methodology

The project is applicable to use the AMS ID methodology:

Sectoral Scope : I – Renewable Energy Projects
Project Category : D – Grid connected renewable electricity generation
Reference : AMS I.D, Version 13, EB 36

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The Projects have been completed as planned and the monitoring equipments are installed to monitor the parameters as described in the VCS Project Description document (PD). The Plants are in operation continuously (with outages – forced & planned) since the date of commissioning of the projects and synchronized with grid (29 August 2003 for Shahapur-D9 project & 16 September 2004 for Mandagere project)

Shahapur-D9 Project

The details of forced shut down periods, planned shutdown periods and reasons for shut down are as detailed below.

S.No.	Monitoring	Unit-1

	period (Jan 01, 2010 to Dec 31, 2010)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
1	Jan-10	481:58	238:25	0:00	23:37	23:37
2	Feb-10	592:33	36:55	0:15	42:17	42:32
3	Mar-10	552:42	164:05	0:00	27:13	27:13
4	Apr-10	303:32	168:20	0:00	8:08	8:08
5	May-10	0:00	744.00	0:00	0:00	0:00
6	Jun-10	0:00	720.00	0:00	0:00	0:00
7	Jul-10	0:00	744.00	0:00	0:00	0:00
8	Aug-10	653:55	66:25	0:00	23:40	23:40
9	Sep-10	580:10	122:35	0:00	17:15	17:15
10	Oct-10	706:45	21:30	0:00	15:45	15:45
11	Nov-10	619:02	81:00	0:00	19:58	19:58
12	Dec-10	737:55	0:00	0:00	6:05	6:05
	Period (Jan 01, 2011 to Dec 31, 2011)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
13	Jan-11	736:15	0:00	0:00	7:45	7:45
14	Feb-11	655:58	4:10	0:05	11:47	11:52
15	Mar-11	609:09	115:25	0:00	19:26	19:26
16	Apr-11	135:46	337:35	0:00	6:39	6:39
17	May-11	0:00	744.00	0:00	0:00	0:00
18	Jun-11	0:00	720.00	0:00	0:00	0:00
19	Jul-11	0:00	744.00	0:00	0:00	0:00
20	Aug-11	630:44	80:25	0:00	32:51	32:51
21	Sep-11	684:08	0:00	3:55	31:57	35:52
22	Oct-11	705:27	10:48	0:00	27:45	27:45
23	Nov-11	681:28	19:30	0:00	19:02	19:02
24	Dec-11	523:40	203:45	0:30	16:05	16:35
	Period (Jan 01, 2012 to Dec 31, 2012)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
25	Jan-12	641:00	79:35	0:00	23:25	23:25
26	Feb-12	376:08	311:40	0:00	8:12	8:12
27	Mar-12	296:40	31:45	0:00	7:35	7:35
28	Apr-12	0:00	720.00	0:00	0:00	0:00

29	May-12	0:00	744.00	0:00	0:00	0:00
30	Jun-12	0:00	720.00	0:00	0:00	0:00
31	Jul-12	0:00	744.00	0:00	0:00	0:00
32	Aug-12	564:39	31:15	0:00	28:06	28:06
33	Sep-12	634:43	40:55	0:00	44:22	44:22
34	Oct-12	742:14	7:25	0:00	43:01	43:01
35	Nov-12	578:53	130:10	0:00	34:57	34:57
36	Dec-12	614:04	56:00	0:00	73:55	73:55

Mandagere Project

The details of forced shut down periods, planned shutdown periods and reasons for shut down are as detailed below.

S.No.	Monitoring period (Jan 01, 2010 to Dec 31, 2010)	Unit-1				
		Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
1	Jan-10	364:34:00	376:11:00	0:00:00	3:15:00	3:15:00
2	Feb-10	120:46:00	540:08:00	0:00:00	11:06:00	11:06:00
3	Mar-10	325:24:00	403:51:00	0:00:00	14:45:00	14:45:00
4	Apr-10	263:52:00	433:05:00	0:00:00	23:03:00	23:03:00
5	May-10	0:00:00	744:00:00	0:00:00	0:00:00	0:00:00
6	Jun-10	0:00:00	720:00:00	0:00:00	0:00:00	0:00:00
7	Jul-10	165:40:00	558:11:00	5:30:00	14:39:00	20:09:00
8	Aug-10	223:16:00	475:58:00	23:02:00	21:44:00	44:46:00
9	Sep-10	506:37:00	202:08:00	7:26:00	3:49:00	11:15:00
10	Oct-10	665:22:00	57:05:00	12:30:00	9:03:00	21:33:00
11	Nov-10	575:00:00	8:45:00	105:50:00	30:25:00	136:15:00
12	Dec-10	561:15:00	175:36:00	0:00:00	7:09:00	7:09:00
	Monitoring Period (Jan 01, 2011 to Dec 31, 2011)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
13	Jan-11	491:53:00	240:43:00	0:00:00	11:24:00	11:24:00
14	Feb-11	30:08:00	637:33:00	0:00:00	4:19:00	4:19:00
15	Mar-11	557:18:00	140:23:00	0:00:00	46:19:00	46:19:00
16	Apr-11	75:00:00	644:00:00	0:00:00	1:00:00	1:00:00
17	May-11	95:23:00	648:37:00	0:00:00	0:00:00	0:00:00

18	Jun-11	278:51:00	425:51:00	0:00:00	15:18:00	15:18:00
19	Jul-11	203:24:00	538:41:00	0:00:00	1:55:00	1:55:00
20	Aug-11	697:35:00	19:42:00	16:38:00	10:05:00	26:43:00
21	Sep-11	565:09:00	136:32:00	5:58:00	12:21:00	18:19:00
22	Oct-11	708:22:00	0:00:00	0:16:00	35:22:00	35:38:00
23	Nov-11	412:27:00	281:49:00	0:00:00	25:44:00	25:44:00
24	Dec-11	624:28:00	117:03:00	0:00:00	2:29:00	2:29:00
	Monitoring Period (Jan 01, 2012 to Dec 31, 2012)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
25	Jan-12	439:49:00	286:15:00	0:00:00	17:56:00	17:56:00
26	Feb-12	116:20:00	576:42:00	0:20:00	2:38:00	2:58:00
27	Mar-12	141:30:00	601:25:00	0:00:00	1:05:00	1:05:00
28	Apr-12	66:16:00	653:44:00	0:00:00	0:00:00	0:00:00
29	May-12	8:30:00	735:30:00	0:00:00	0:00:00	0:00:00
30	Jun-12	0:00:00	720:00:00	0:00:00	0:00:00	0:00:00
31	Jul-12	0:20:00	743:40:00	0:00:00	0:00:00	0:00:00
32	Aug-12	185:03:00	545:28:00	0:00:00	13:29:00	13:29:00
33	Sep-12	454:59:00	225:15:00	1:25:00	38:21:00	39:46:00
34	Oct-12	307:24:00	393:15:00	8:06:00	35:15:00	43:21:00
35	Nov-12	273:51:00	438:55:00	0:00:00	7:14:00	7:14:00
36	Dec-12	242:10:00	492:10:00	0:00:00	9:40:00	9:40:00

S.No.	Monitoring period (Jan 01, 2010 to Dec 31, 2010)	Unit-2				
		Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
1	Jan-10	563:53:00	176:55:00	0:00:00	3:12:00	3:12:00
2	Feb-10	0:00:00	672:00:00	0:00:00	0:00:00	0:00:00
3	Mar-10	0:00:00	744:00:00	0:00:00	0:00:00	0:00:00
4	Apr-10	0:00:00	720:00:00	0:00:00	0:00:00	0:00:00
5	May-10	93:33:00	645:52:00	0:00:00	4:35:00	4:35:00
6	Jun-10	44:05:00	675:35:00	0:00:00	0:20:00	0:20:00
7	Jul-10	129:51:00	600:17:00	5:36:00	8:16:00	13:52:00
8	Aug-10	421:00:00	277:50:00	17:30:00	27:40:00	45:10:00
9	Sep-10	418:04:00	290:42:00	7:36:00	3:38:00	11:14:00

10	Oct-10	666:48:00	54:45:00	12:32:00	9:55:00	22:27:00
11	Nov-10	642:28:00	35:59:00	9:01:00	32:32:00	41:33:00
12	Dec-10	605:21:00	132:13:00	0:00:00	6:26:00	6:26:00
	Monitoring Period (Jan 01, 2011 to Dec 31, 2011)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
13	Jan-11	94:58:00	648:47:00	0:00:00	0:15:00	0:15:00
14	Feb-11	213:05:00	441:54:00	0:00:00	17:01:00	17:01:00
15	Mar-11	27:02:00	709:43:00	0:00:00	7:15:00	7:15:00
16	Apr-11	350:38:00	362:24:00	0:00:00	6:58:00	6:58:00
17	May-11	221:10:00	519:55:00	0:00:00	2:55:00	2:55:00
18	Jun-11	83:50:00	636:10:00	0:00:00	0:00:00	0:00:00
19	Jul-11	463:47:00	278:15:00	0:00:00	1:58:00	1:58:00
20	Aug-11	651:28:00	70:02:00	13:28:00	9:02:00	22:30:00
21	Sep-11	581:10:00	119:31:00	3:45:00	15:34:00	19:19:00
22	Oct-11	417:40:00	137:04:00	153:02:00	36:14:00	189:16:00
23	Nov-11	593:14:00	96:36:00	0:00:00	30:10:00	30:10:00
24	Dec-11	672:08:00	65:26:00	0:00:00	6:26:00	6:26:00
	Monitoring Period (Jan 01, 2012 to Dec 31, 2012)	Total available hours during monitored period	Non-availability of water(Off season) (Hours)	Planned (Hrs)	Forced (Hrs) outage	Total outages
25	Jan-12	239:58:00	501:48:00	0:00:00	2:14:00	2:14:00
26	Feb-12	299:30:00	289:28:00	93:00:00	14:02:00	107:02:00
27	Mar-12	104:50:00	638:10:00	0:00:00	1:00:00	1:00:00
28	Apr-12	66:37:00	653:23:00	0:00:00	0:00:00	0:00:00
29	May-12	0:00:00	744:00:00	0:00:00	0:00:00	0:00:00
30	Jun-12	0:00:00	720:00:00	0:00:00	0:00:00	0:00:00
31	Jul-12	0:25:00	743:35:00	0:00:00	0:00:00	0:00:00
32	Aug-12	269:49:00	464:19:00	0:00:00	9:52:00	9:52:00
33	Sep-12	622:11:00	0:00:00	44:56:00	52:53:00	97:49:00
34	Oct-12	544:35:00	127:36:00	8:05:00	63:44:00	71:49:00
35	Nov-12	154:10:00	510:56:00	0:00:00	54:54:00	54:54:00
36	Dec-12	254:36:00	431:01:00	0:00:00	58:23:00	58:23:00

2.2 Project Description Deviations

No temporary deviations occurred to monitoring plan or methodology.

2.3 Grouped Project

The 4.5 MW Grouped Small Hydro Power Project in the state of Karnataka, which includes the 1 MW Mini Hydel Power Project of Shahapur-D9 (hereafter referred to as Shahapur-D9 Project) and 3.5 MW (2×1.75) Capacity Mini Hydel Power Project at Mandagere village, K.R.Pet Taluk, Madya Dist.(here after referred as Mandagere Project). There are no new instances in the project activity after the validation.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$EF_{grid, CM,y}$ or EF_y
Data unit:	tCO_2/MWh
Description:	Baseline Grid emission factor
Source of data:	CO_2 Baseline Database for the Indian Power Sector Version Ver.03, 15 Dec 2007
Value applied:	0.8545
Purpose of the data:	baseline emission calculations
Any comment:	--

Data Unit / Parameter:	NCV_{Diesel}
Data unit:	TJ/Gg
Description:	Net calorific value of diesel
Source of data:	IPCC default value
Value applied:	43 (Source IPCC 2006)
Purpose of the data:	IPCC values have been used for diesel since no country specific data is available.
Any comment:	--

Data Unit / Parameter:	EF_{CO_2}
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of diesel
Source of data:	IPCC default values
Value applied:	74.1
Purpose of the data:	The Indian specific emission factor value is used for data parameter. The emission factor is conservative since it specific to the country and the applied value is high from IPCC emission factor.
Any comment:	--

Data Unit / Parameter:	OXID
Data unit:	Not applicable (constant)
Description:	Oxidation Factor of Diesel
Source of data:	IPCC 2006 default values
Value applied:	1
Purpose of the data:	IPCC value have been used for the fuel type since no country specific oxidation factor is available
Any comment:	--

Data Unit / Parameter:	Density
Data unit:	kg/lit
Description:	Density of diesel
Source of data:	Society of Indian Automobile Manufacturers (SIAM) http://www.siamindia.com/scripts/Diesel.aspx
Value applied:	0.82
Purpose of the data:	The SIAM value is considered as it is publicly available and can be referred as authentic source.
Any comment:	--

3.2 Data and Parameters Monitored

Data Unit / Parameter:	EG_{grossy}
Data unit:	kWh (or MWh)
Description:	Total electricity generated by the project in the year y.
Source of data:	On-site measurements
Description of measurement methods and procedures to be applied:	Measured monthly using calibrated meters and aggregated annually.
Frequency of monitoring/recording:	Continuous monitoring and monthly recording
Value monitored:	**Shahapur-D9 Project (Mtr Sl No:3201100158)** **Year 2010** | **Year 2011** | **Year 2012** 3165641 | 3458136 | 2731626 **Mandagere Project (Mtr Sl No: 7175067 for Unit 1 & 7175068 for Unit 2)** **Year 2010** | **Year 2011** | **Year 2012**

	7271470 | 9963560 | 5298940
Monitoring equipment:	*Details are provided in below Table-1
QA/QC procedures to be applied:	Meters will be calibrated as per industry Standards
Calculation method:	---
Any comment:	Data archived: Crediting period + two years. Instruments : kWh meter

Data Unit / Parameter:	**EG**export,y
Data unit:	kWh (or MWh)
Description:	Quantity of Electricity exported to the grid by the grouped project during the year y
Source of data:	On-site measurements
Description of measurement methods and procedures to be applied:	The readings of electric power exported to grid are measured monthly using calibrated Main meter & Check meter by both project proponent and KPTCL as specified in the PPA and records maintained.
Frequency of monitoring/recording:	Continuous monitoring and monthly recording
Value monitored:	| | **Measured** | **Adjusted*** | | D9 | 9157.88 MWh | 9145.64 MWh | | Mandagere | 22293.00 MWh | 22266.56 MWh | | Total | 31450.88 MWh | 31412.20 MWh | *adjusted due to calibration delay
Monitoring equipment:	*Details are provided in below Table-1
QA/QC procedures to be applied:	Meters are calibrated as per PPA. Sales records to the grid and other records are used to ensure consistency.
Calculation method:	--
Any comment:	Data archived: Crediting period + two years. Instruments : Trivector energy meter

Data Unit / Parameter:	EGimport,y

<table>
<tr><td>Data unit:</td><td>kWh</td></tr>
<tr><td>Description:</td><td>Grid electricity import to the project activity during the year y</td></tr>
<tr><td>Source of data:</td><td>On-site measurements</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The readings of electric power imported from grid are measured monthly using calibrated Main meter & Check meter by both project proponent and KPTCL as specified in the PPA and records maintained.</td></tr>
<tr><td>Frequency of monitoring/recording:</td><td>Continuous monitoring and monthly recording</td></tr>
<tr><td>Value monitored:</td><td><table><tr><th></th><th>Measured</th><th>Adjusted*</th></tr><tr><td>D9</td><td>38.48 MWh</td><td>38.52 MWh</td></tr><tr><td>Mandagere</td><td>83.80 MWh</td><td>83.93 MWh</td></tr><tr><td>Total</td><td>122.28 MWh</td><td>122.46 MWh</td></tr></table>*adjusted due to calibration delay</td></tr>
<tr><td>Monitoring equipment:</td><td>*Details are provided in below Table-1</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Meters are calibrated as per PPA. Sales records to the grid and other records are used to ensure consistency.</td></tr>
<tr><td>Calculation method:</td><td>--</td></tr>
<tr><td>Any comment:</td><td>Data archived: Crediting period + two years.
Instruments : Tri-vector energy meter</td></tr>
</table>

<table>
<tr><td>Data Unit / Parameter:</td><td>EGy</td></tr>
<tr><td>Data unit:</td><td>kWh (or MWh)</td></tr>
<tr><td>Description:</td><td>Net Electricity supplied to the grid by the grouped project during the year y</td></tr>
<tr><td>Source of data:</td><td>From the certified joint meter readings</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Calculated as the difference of the electricity export to grid and electricity import from grid by the project activity</td></tr>
<tr><td>Frequency of monitoring/recording:</td><td>Continuous monitoring and monthly recording</td></tr>
<tr><td>Value monitored:</td><td><table><tr><th></th><th>Measured</th><th>Adjusted*</th></tr><tr><td>D9</td><td>9119.40 MWh</td><td>9107.12 MWh</td></tr><tr><td>Mandagere</td><td>22209.20 MWh</td><td>22182.63 MWh</td></tr></table></td></tr>
</table>

	<table><tr><td>Total</td><td>31328.60 MWh</td><td>31289.75 MWh</td></tr></table> *adjusted due to calibration delay
Monitoring equipment:	*Details are provided in below Table-1
QA/QC procedures to be applied:	Meters are calibrated as per PPA. Sales records to the grid and other records are used to ensure consistency.
Calculation method:	$EG_y = EG_{export,y} - EG_{import,y}$ (calculated for every month which is reflected in the B-Form)
Any comment:	Electricity exported and Imported to the grid will be measured by Main Meter and Check Meter by both project proponent and KPTCL as specified in the PPA and records maintained. To be cross-checked with monthly invoices or receipts of payments. Data archived: Crediting period + two years.

Data Unit / Parameter:	$F_{d,y}$
Data unit:	Liters
Description:	Quantity of diesel used in DG set during the year,y
Source of data:	On-site measurements/store issues
Description of measurement methods and procedures to be applied:	HSD quantities are recorded daily and aggregated to monthly. The total quantity of HSD procured and quantity of HSD consumed is considered for estimation of project emissions.
Frequency of monitoring/recording:	*Monthly*
Value monitored:	D9: 165 liters Mandagere: 1439 liters Grand total:1604 liters
Monitoring equipment:	*Details are provided in below Table-1
QA/QC procedures to be applied:	The data recorded can be cross checked against the fuel purchase receipts.
Calculation method:	The data on quantity of HSD procured would be collected separately. Instruments : Level gauge/Ruler
Any comment:	--

*Shahapur-D9 Project

Description	Main meter	Check meter
Period	*01-01-2010 to 31-12-2012*	
Type	Tri-vector Meter	Tri-vector Meter
Make	L & T	L & T
Class	0.2	0.2
Multiplication Constant	7.5	7.5
CT Ratio	75/1A	75/1A
PT Ratio	11 KV/√3/110V/√3	11 KV/√3/110V/√3
Serial No.	08002008	08002025

Calibration of monitoring instruments with due date of calibration, calibration procedure and traceability of calibration meters with national and international standards:

Description	Main meter	Check meter
Date of Calibration	8.03.2010, 05.01.2011, 24.05.2011, 23.12.2011; 16.08.2012	8.03.2010, 05.01.2011, 24.05.2011, 23.12.2011; 16.08.2012
Calibration Procedure & Standards	Calibration procedure for energy meters is as per Article 7 of PPA signed between BPCL & KPTCL approval.	

Mandagere Project

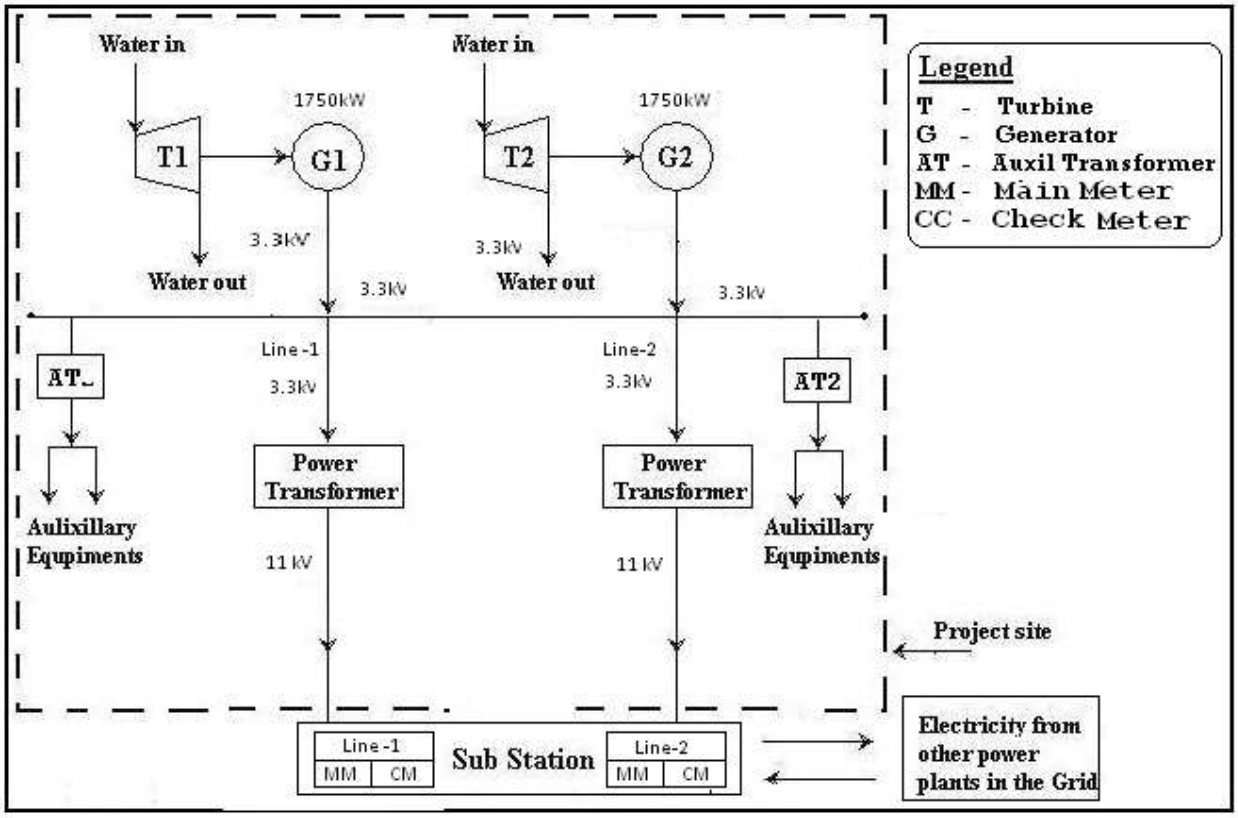
Description	Line-1		Line-2	
	Main meter	Check meter	Main meter	Check meter
Period	*01-01-2010 to 31-12-2012*			

Type	Trivector Meter	Trivector Meter	Trivector Meter	Trivector Meter
Make	L&T Ltd.,	L&T Ltd.,	L&T Ltd.	L&T Ltd.
Class	0.2	0.2	0.2	0.2
MF	1.0	1.0	1.0	1.0
Current	300/1 A	300/1 A	300/1 A	300/1 A
Voltage	11kV/110v	11kV/110v	11kV/110v	11kV/110v
Serial No.	03157703	03157704	03157705	03157706

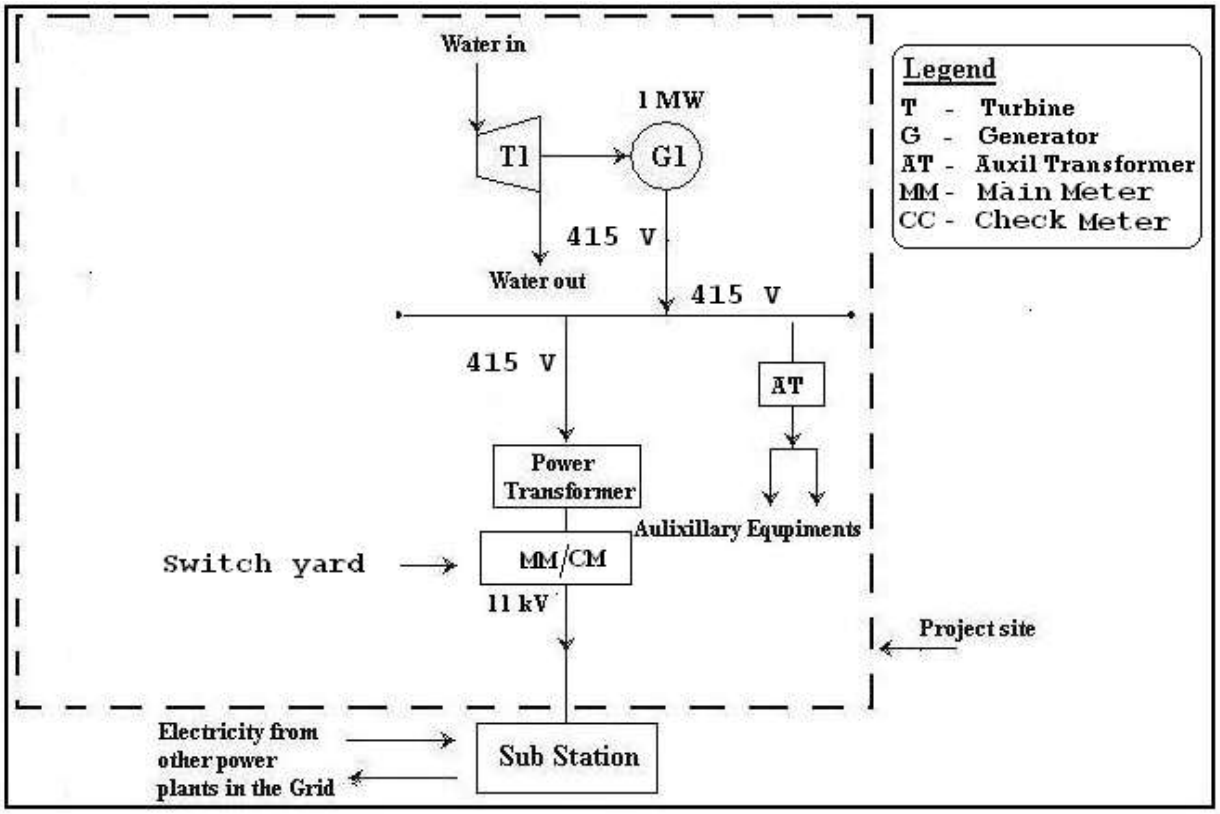
Description	**Line-1**		**Line-2**	
	Main meter	**Check meter**	**Main meter**	**Check meter**
Date of Meter Recalibration	01.01.2010, 08.09.2010, 09.03.2011, 11.11.2011, 24.09.2012	01.01.2010, 08.09.2010, 09.03.2011, 11.11.2011, 24.09.2012	01.01.2010, 08.09.2010, 09.03.2011, 11.11.2011, 24.09.2012	01.01.2010, 08.09.2010, 09.03.2011, 11.11.2011, 24.09.2012
Calibration procedure	As per Article 7 of PPA signed between BPCL & KPTCL approval.			
Calibration frequency	Every calendar quarter			

3.3 Description of the Monitoring Plan

Detailed technical process diagram of the Mandagere project activity is furnished below:-



Detailed technical process diagram of the Shahapur-D9 project activity is furnished below:-



The energy exported by grouped activity is recorded from independent main meter installed at the respective project. In the event, the main meter is not in operation, and the reading from check meter is used for billing. The accuracy clause of these meters is 0.2.

The calibration of monitoring equipment is being maintained as per the requirement of Electricity Board and the same is being done regularly. Both meters are of same specifications & frequency and approved by KPTCL. Energy Export and Energy import are being recorded continuously through two way energy meter at the substation. Every month the energy meter readings are recorded by KPTCL representative in presence of PP and the same is recorded and made reflected in the monthly joint meter reading statement (ie, B-Form). The net electricity is calculated in the B-Form for every month and it is singed by officials. Hence the B-Form is considered as source for the energy export, import and net energy export which is used for emission reduction calculation.

All the energy meters should be calibrated once in 3 months as per PP. However the energy meters are not calibrated as per the frequency mentioned in the PPA (ie, once in 3 months). Hence the energy meter export and import readings are adjusted to the maximum possible error (ie, error resulted in next calibration or 0.2% whichever is higher) as below
Adjusted Export value = measured export value * (1- Error%)
Adjusted import value = measured import value * (1+ Error%)
The calibration non-validity period and the adjustment details are given below:
Shahapur_D9:

Delayed calibration period	Adjusted (B-Form) reading period	Error in the next calibration report	Applied error %
08.06.2010 to 5.01.2011	01.06.2010 to 31.01.2011	Main: -0.07% Check: 0.04%	0.2%
05.03.2011 to 24.05.2011	01.03.2011 to 31.05.2011	Main: 0.14% Check: 0.1%	0.2%
24.08.2011 to 23.12.2011	01.08.2011 to 31.12.2011	Main: -0.01% Check: 0.03%	0.2%
23.03.2012 to 16.08.2012	01.03.2012 to 31.08.2012	Main: -0.04% Check: 0.055%	0.2%
16.11.2012 to 07.12.2012	01.11.2012 to 31.12.2012	Main: -0.06% Check: 0.08%	0.2%

Mandagere:

Delayed calibration period	Adjusted (B-Form) reading period	Line -1		Line -2	
		Error in the next calibration report	Applied error %	Error in the next calibration report	Applied error %

19.03.2010 to 08.09.2010	01.03.2010 to 30.09.2010	Main: 0.056% Check: 0.0825%	0.2%	Main: 0.1155% Check: 0.024%	0.2%
08.12.2010 to 09.03.2011	01.12.2010 to 31.03.2011	Main: 0.006% Check: 0.091%	0.2%	Main: 0.184% Check: 0.051 %	0.2%
09.06.2011 to 11.11.2011	01.06.2011 to 30.11.2011	Main: 0.003% Check: 0.105%	0.2%	Main: 0.150% Check: 0.058%	0.2%
11.02.2012 to 24.09.2012	01.02.2012 to 30.09.2012	Main: 0.200% Check: 0.490%	0.5%	Main: 0.5% Check: 0.180%	0.5%

A team has been formed in Bhoruka Power Corporation Limited (BPCL) grouped activities separately for each plant for monitoring and verification of all the monitoring parameters as per the guidelines formulated by the management of Bhoruka Power Corporation Limited (BPCL).Qualified and trained people monitor the parameters and emission reduction calculations. In the complete implementation and monitoring plan, BPCL is the sole agency responsible.

1. Managing Director
2. Head –O & M
3. Plant Manager
4. Shift In charges

Roles and Responsibilities – Monitoring Team
Managing Director

Managing Director is responsible for the total monitoring plan. He examines the reports generated by the Head-O & M w.r.t, the monthly electricity generated, exported and diesel consumptions as per the monitoring plan.

During the monitoring period internal audits were conducted on the following dates the reports of which will be submitted to DOE for review.

Head- O & M

Head- O & M is assisting and reporting to Managing Director for completing the task discussed above. The Head- O & M is responsible for the electricity generations at their individual locations. He reviews the plant data regularly and report to Managing Director for any abnormality. The calibration of the meters installed are taken care by him as per the monitoring plan.

The responsibility of storage and archiving of information in good condition also lies with the Head- O & M. He also generate internal audit reports as per the monitoring plan and whenever necessary, and will be submitted to the Managing Director.

Plant Manager

Plant Manager is responsible for the review of the monitored parameters for correctness, corrective measures in case of minor errors in the monitored data and preparation of a daily summary on project operation and electricity generation to the Head- O & M on daily basis.

Shift In charges

Shift In charges are responsible for recording the total electricity generation, electricity export, electricity import, plant shut down times, diesel consumption, if any etc. The monthly reports will be generated and submitted to the Head- O & M for verification and emission reduction calculations.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The baseline emissions are calculated based on the net energy provided to the grid (in MWh/year), and an emission factor for the displaced grid electricity (in tCO_2 /MWh). The baseline scenario is electricity delivered to the grid by the project that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

$$BEy = EGy \times EFy$$

Month wise baseline emission calculation for Shahapur-D9 Project for reported period.

S.No.	Monitored Period	Electricity Exported to Grid		Electricity Imported from Grid		Net Electricity Displaced		Baseline Emission Factor	Baseline Emissions
		Measured	Adjusted*	Measured	Adjusted*	Measured	Adjusted*		
		kWh	kWh	kWh	kWh	MWh	MWh	tCO_2/ MWh	tCO_2e
1	01.01.2010 to 31.01.2010	308700	308700	900	900	307.8	307.8	0.8545	263.0
2	01.02.2010 to 28.02.2010	384975	384975	225	225	384.8	384.8	0.8545	328.8
3	01.03.2010 to 31.03.2010	380700	380700	750	750	380.0	380.0	0.8545	324.7
4	01.04.2010 to 30.04.2010	131325	131325	1575	1575	129.8	129.8	0.8545	110.9
5	01.05.2010 to 31.05.2010	0	0	2850	2850	-2.9	-2.9	0.8545	-2.4
6	01.06.2010 to 30.06.2010	0	0	2625	2630.25	-2.6	-2.6	0.8545	-2.2
7	01.07.2010 to 31.07.2010	0	0	2625	2630.25	-2.6	-2.6	0.8545	-2.2
8	01.08.2010 to 31.08.2010	269625	269086	600	601.2	269.0	268.5	0.8545	229.4
9	01.09.2010 to 30.09.2010	304275	303666	450	450.9	303.8	303.2	0.8545	259.1
10	01.10.2010 to 31.10.2010	489750	488771	150	150.3	489.6	488.6	0.8545	417.5
11	01.11.2010 to 30.11.2010	370800	370058	300	300.6	370.5	369.8	0.8545	316.0
12	01.12.2010 to 31.12.2010	457350	456435	0	0	457.4	456.4	0.8545	390.0
Sub-total		**3097500**	**3093716**	**13050**	**13063.5**	**3084.5**	**3080.7**		**2632.4**
13	01.01.2011 to 31.01.2011	482175	481211	0	0	482.2	481.2	0.8545	411.2
14	01.02.2011 to 28.02.2011	376200	376200	75	75	376.1	376.1	0.8545	321.4
15	01.03.2011 to 31.03.2011	383550	382783	375	375.75	383.2	382.4	0.8545	326.8
16	01.04.2011 to 30.04.2011	142875	142589	1800	1803.6	141.1	140.8	0.8545	120.3
17	01.05.2011 to 31.05.2011	0	0	3000	3006	-3.0	-3.0	0.8545	-2.6

18	01.06.2011 to 30.06.2011	0	0	2625	2625	-2.6	-2.6	0.8545	-2.2
19	01.07.2011 to 31.07.2011	675	675	2925	2925	-2.3	-2.3	0.8545	-1.9
20	01.08.2011 to 31.08.2011	333300	332633	300	300.6	333.0	332.3	0.8545	284.0
21	01.09.2011 to 30.09.2011	425175	424325	75	75.15	425.1	424.2	0.8545	362.5
22	01.10.2011 to 31.10.2011	470775	469833	75	75.15	470.7	469.8	0.8545	401.4
23	01.11.2011 to 30.11.2011	454350	453441	75	75.15	454.3	453.4	0.8545	387.4
24	01.12.2011 to 31.12.2011	314625	313996	600	601.2	314.0	313.4	0.8545	267.8
Sub-total		**3383700**	**3377686**	**11925**	**11937.6**	**3371.8**	**3365.7**		**2876.0**
25	01.01.2012 to 31.01.2012	429150	429150	300	300	428.9	428.9	0.8545	366.5
26	01.02.2012 to 29.02.2012	250125	250125	975	975	249.2	249.2	0.8545	212.9
27	01.03.2012 to 31.03.2012	138375	138098	1950	1953.9	136.4	136.1	0.8545	116.3
28	01.04.2012 to 30.04.2012	0	0	2325	2329.65	-2.3	-2.3	0.8545	-2.0
29	01.05.2012 to 31.05.2012	0	0	1800	1803.6	-1.8	-1.8	0.8545	-1.5
30	01.06.2012 to 30.06.2012	0	0	2250	2254.5	-2.3	-2.3	0.8545	-1.9
31	01.07.2012 to 31.07.2012	0	0	2250	2254.5	-2.3	-2.3	0.8545	-1.9
32	01.08.2012 to 31.08.2012	381300	380537	525	526.05	380.8	380.0	0.8545	324.7
33	01.09.2012 to 30.09.2012	356100	356100	225	225	355.9	355.9	0.8545	304.1
34	01.10.2012 to 31.10.2012	423150	423150	75	75	423.1	423.1	0.8545	361.5
35	01.11.2012 to 30.11.2012	349650	348951	450	450.9	349.2	348.5	0.8545	297.8
36	01.12.2012 to 31.12.2012	348825	348127	375	375.75	348.5	347.8	0.8545	297.2
Sub-total		**2676675**	**2674239**	**13500**	**13523.85**	**2663.2**	**2660.7**		**2273.6**
Grand -Total		**9157875**		**38475**		**9119**	**9107**		**7782**

Month wise baseline emission for Mandagere Project for reported period.

S.No.	Monitored Period	Electricity Exported to Grid		Electricity Imported from Grid		Net Electricity Displaced		Baseline Emission Factor	Base line Emissions
		Measured	Adjusted*	Measured	Adjusted*	Measured	Adjusted*		
		kWh	MWh	kWh	MWh	MWh	MWh	tCO_2/ MWh	tCO_2e
1	01.01.2010 to 31.01.2010	729900	729900	800	800	729.1	729.1	0.8545	623.0
2	01.02.2010 to 28.02.2010	49400	49400	3900	3900	45.5	45.5	0.8545	38.9
3	01.03.2010 to 31.03.2010	170500	170159	3200	3206.4	167.3	167.0	0.8545	142.7
4	01.04.2010 to 30.04.2010	144200	143912	3500	3507	140.7	140.4	0.8545	120.0
5	01.05.2010 to 31.05.2010	65500	65369	5200	5210.4	60.3	60.2	0.8545	51.4
6	01.06.2010 to 30.06.2010	36500	36427	5200	5210.4	31.3	31.2	0.8545	26.7
7	01.07.2010 to 31.07.2010	330600	329939	4300	4308.6	326.3	325.6	0.8545	278.3
8	01.08.2010 to 31.08.2010	668900	667562	2500	2505	666.4	665.1	0.8545	568.3
9	01.09.2010 to 30.09.2010	1027900	1027900	200	200	1027.7	1027.7	0.8545	878.2
10	01.10.2010 to 31.10.2010	1385400	1385400	400	400	1385	1385.0	0.8545	1183.5
11	01.11.2010 to 30.11.2010	1305600	1305600	400	400	1305.2	1305.2	0.8545	1115.3
12	01.12.2010 to 31.12.2010	1251500	1248997	0	0	1251.5	1249.0	0.8545	1067.3
Sub-total		**7165900**	**7160565**	**29600**	**29648**	**7136**	**7130.9**		**6093.4**
13	01.01.2011 to 31.01.2011	485300	484329	1100	1102.2	484.2	483.2	0.8545	412.9
14	01.02.2011 to 28.02.2011	228700	228243	3400	3406.8	225.3	224.8	0.8545	192.1
15	01.03.2011 to 31.03.2011	503300	502293	1500	1503	501.8	500.8	0.8545	427.9
16	01.04.2011 to 30.04.2011	331400	331400	2400	2400	329	329.0	0.8545	281.1
17	01.05.2011 to 31.05.2011	247900	247900	4900	4900	243	243.0	0.8545	207.6
18	01.06.2011 to 30.06.2011	330700	330039	3300	3306.6	327.4	326.7	0.8545	279.2

19	01.07.2011 to 31.07.2011	813500	811873	1200	1202.4	812.3	810.7	0.8545	692.7
20	01.08.2011 to 31.08.2011	1558300	1555183	400	400.8	1557.9	1554.8	0.8545	1328.6
21	01.09.2011 to 30.09.2011	1285200	1282630	800	801.6	1284.4	1281.8	0.8545	1095.3
22	01.10.2011 to 31.10.2011	1374700	1371951	100	100.2	1374.6	1371.9	0.8545	1172.2
23	01.11.2011 to 30.11.2011	1285500	1282929	100	100.2	1285.4	1282.8	0.8545	1096.2
24	01.12.2011 to 31.12.2011	1415600	1415600	100	100	1415.5	1415.5	0.8545	1209.5
Sub-total		**9860100**	**9844370**	**19300**	**19324**	**9841**	**9825.0**		**8395.5**
25	01.01.2012 to 31.01.2012	708600	708600	400	400	708.2	708.2	0.8545	605.2
26	01.02.2012 to 29.02.2012	352900	351136	3200	3216	349.7	347.9	0.8545	297.3
27	01.03.2012 to 31.03.2012	277200	275814	3500	3517.5	273.7	272.3	0.8545	232.7
28	01.04.2012 to 30.04.2012	225800	224671	3900	3919.5	221.9	220.8	0.8545	188.6
29	01.05.2012 to 31.05.2012	8200	8159	7500	7537.5	0.7	0.6	0.8545	0.5
30	01.06.2012 to 30.06.2012	0	0	5400	5427	-5.4	-5.4	0.8545	-4.6
31	01.07.2012 to 31.07.2012	300	299	4000	4020	-3.7	-3.7	0.8545	-3.2
32	01.08.2012 to 31.08.2012	523100	520485	1800	1809	521.3	518.7	0.8545	443.2
33	01.09.2012 to 30.09.2012	1299000	1292505	700	703.5	1298.3	1291.8	0.8545	1103.8
34	01.10.2012 to 31.10.2012	933800	933800	1000	1000	932.8	932.8	0.8545	797.1
35	01.11.2012 to 30.11.2012	413500	413500	1900	1900	411.6	411.6	0.8545	351.7
36	01.12.2012 to 31.12.2012	524600	524600	1600	1600	523	523.0	0.8545	446.9
Sub-total		**5267000**	**5253568**	**34900**	**35050**	**5232**	**5218.5**		**4459.2**
Grand Total		**22293000**	**22258502**	**83800**	**84022**	**22209**	**22174**		**18948.1**

4.2 Project Emissions

PE $_{diesel,y}$ = ($Fd_{,y}$ × Density × NCV × EF_{CO_2} × OXID)/10^6

Where $Fd_{,y}$ = Quantity of diesel used during the year (Ltrs)

Density of diesel (0.82 kg/Ltr. as per Society of Indian Automobile Mfgs.)

NCV = Calorific value of diesel (43 TJ/Gg as per IPCC 2006 default value)

EF_{CO_2} = CO_2 emission factor of Diesel (74.1 t CO_2/TJ as per IPCC 2006 default value)

OXID = Oxidation factor of the diesel (1 as per IPCC 2006 default value)

S.No.	Monitored Period	Shahapur_D9		Mandagere	
		Diesel consumption	Project Emissions	Diesel consumption	Project Emissions
		Ltrs	tCO_2e	Ltrs	tCO_2e
1	01.01.2010 to 31.01.2010	2.5	0.01	94	0.25
2	01.02.2010 to 28.02.2010	2.0	0.01	34	0.09
3	01.03.2010 to 31.03.2010	3.5	0.01	133	0.35
4	01.04.2010 to 30.04.2010	1.0	0.00	75	0.20
5	01.05.2010 to 31.05.2010	13.0	0.03	16	0.04
6	01.06.2010 to 30.06.2010	12.0	0.03	45	0.12
7	01.07.2010 to 31.07.2010	11.0	0.03	15	0.04
8	01.08.2010 to 31.08.2010	2.5	0.01	0	0.00
9	01.09.2010 to 30.09.2010	2.0	0.01	15	0.04
10	01.10.2010 to 31.10.2010	3.5	0.01	24	0.06
11	01.11.2010 to 30.11.2010	2.0	0.01	73	0.19
12	01.12.2010 to 31.12.2010	2.5	0.01	160	0.42
Sub-total		**58**	**0.15**	**684**	**1.79**
13	01.01.2011 to 31.01.2011	2.0	0.01	34	0.09
14	01.02.2011 to 28.02.2011	1.0	0.00	27	0.07
15	01.03.2011 to 31.03.2011	1.5	0.00	29	0.08
16	01.04.2011 to 30.04.2011	1.0	0.00	44	0.11
17	01.05.2011 to 31.05.2011	6.5	0.02	43	0.11
18	01.06.2011 to 30.06.2011	28.5	0.07	81	0.21
19	01.07.2011 to 31.07.2011	0.0	0.00	23	0.06
20	01.08.2011 to 31.08.2011	2.5	0.01	20	0.05
21	01.09.2011 to 30.09.2011	2.0	0.01	29	0.08

22	01.10.2011 to 31.10.2011	1.0	0.00	24	0.06
23	01.11.2011 to 30.11.2011	1.5	0.00	17	0.04
24	01.12.2011 to 31.12.2011	0.0	0.00	26	0.07
Sub-total		**48**	**0.1**	**397**	**1.04**
25	01.01.2012 to 31.01.2012	1.0	0.00	44	0.11
26	01.02.2012 to 29.02.2012	2.0	0.01	20	0.05
27	01.03.2012 to 31.03.2012	0.5	0.00	29	0.08
28	01.04.2012 to 30.04.2012	15.0	0.04	17	0.04
29	01.05.2012 to 31.05.2012	16.0	0.04	17	0.04
30	01.06.2012 to 30.06.2012	0.0	0.00	56	0.15
31	01.07.2012 to 31.07.2012	12.0	0.03	50	0.13
32	01.08.2012 to 31.08.2012	4.5	0.01	22	0.06
33	01.09.2012 to 30.09.2012	2.5	0.01	27	0.07
34	01.10.2012 to 31.10.2012	2.0	0.01	22	0.06
35	01.11.2012 to 30.11.2012	2.0	0.01	25	0.06
36	01.12.2012 to 31.12.2012	2.0	0.01	29	0.07
Sub-total		**60**	**0.16**	**358**	**0.93**
Grand Total		**165**	**0.43**	**1439**	**3.76**

Hence, $PE_{diesel,y} = 0.43 + 3.76 = 4.19\ tCO_2e$

4.3 Leakage

The energy generating equipment is not transferred from another activity. Hence, the leakage emissions are considered zero

Using the above formulas, the Emission reductions from the project activity are shown below.

4.4 Summary of GHG Emission Reductions and Removals

Summary of Net Emission Reductions for the Reported Period

Description	Unit	Shahapur-D9 Project				Mandagere Project				Total for Grouped Activity
		Year 2010	Year 2011	Year 2012	Total	Year 2010	Year 2011	Year 2012	Total	
Electricity Export to Grid	MWh	3098	3384	2677	9157.88	7166	9860	5267	22293.00	31450.88
Electricity Export to Grid (Adjusted)	MWh	3094	3378	2674	9145.64	7161	9844	5254	22258.50	31404.14
Electricity Import from Grid	kWh	13.05	11.93	13.50	38.48	29.60	19.30	34.90	83.80	122.28
Electricity Import from Grid (Adjusted)	MWh	13.06	11.94	13.52	38.52	29.65	19.32	35.05	84.02	122.55
Net Electricity Displaced	MWh	3084	3372	2663	9119.40	7136	9841	5232	22209.20	31328.60
Net Electricity Displaced (Adjusted)	MWh	3080.7	3366	2661	9107.12	7131	9825	5219	22174.48	31281.60
Diesel Consumption	Lts	58	47.5	60	165	684	397	358	1439	1603
Baseline Emission Factor	tCO_2 /MWh	0.8545	0.8545	0.8545	0.8545	0.8545	0.8545	0.8545	0.8545	0.8545
Baseline Emissions	t CO_2e	2632	2876	2274	7782	6093	8396	4459	18948	26730
Project Emissions	t CO_2e	0.15	0.12	0.16	0.43	1.79	1.04	0.93	3.8	4.19
Leakage	t CO_2e	0	0	0	0	0	0	0	0	0
Net Emission Reductions	**t CO_2e**	**2632**	**2875**	**2273**	**7780**	**6091**	**8394**	**4458**	**18943**	**26723**

In summary

The year wise emission reduction achieved during the monitoring period by the grouped project activity (Shahapur-D9 Project + Mandagere Project) is as follow:

Year	Emission Reduction (tCO_2)
2010	8723
2011	11269
2012	6731
Total	**26723**

5 ADDITIONAL INFORMATION

Comparison between actual emission reductions achieved and the ex-ante ER estimated in the VCD-PD:

There is no increase in VERs in this monitoring period compared to estimated in the registered PDD, comparison table furnished below.

Vintage year	Values applied in ex-ante calculation of the registered VCS-PD (tCO_2e)			Actual values reached during the monitoring period (tCO_2e)		
	Shahapur-D9 Project	Mandagere Project	Total for Grouped Activity	Shahapur-D9 Project	Mandagere Project	Total for Grouped Activity
2010	3640	13227	**16867**	2632	6091	**8723**
2011	3640	13227	**16867**	2875	8394	**11269**
2012	3640	13227	**16867**	2273	4465	**6731**