# FIRST VCS MONITORING REPORT

(Monitoring period is chosen from 01 Apr 2006 to 31 Dec 2009 -Both days Included)

**Ver. 03, 14 March 2011**

## Project Title:

4.5 MW Grouped Small Hydropower Projects for Grid system by Bhoruka Power Corporation Limited in Karnataka State, India.

**Net Emission Reductions: 35594 $tCO_2e$**

| Registered Office | Project Site |
|---|---|
| **Bhoruka Power Corporation Limited**<br>48, Lavelle Road<br>Bangalore – 560001, India<br>Ph:91+80-2227 2271 | **1 MW Mini Hydel Power Project of Shahapur-D9**<br>Banathihal Village, Shahapur Mandal, Gulbarga District, Karnataka, India. |
| | **2×1.75 MW Mini Hydel Power Project**<br>Mandagere village, Krishnarajpet<br>Mandal, Mandya District, Karnataka |

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## 1. Title of the Project

4.5 MW Grouped Small Hydropower Projects for Grid system by Bhoruka Power Corporation Limited in Karnataka State, India.

## 2. Introduction

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 (hereafter referred to as Shahapur-D9 Project) and 3 MW (2×1.75) Capacity Mini Hydel Power Project at Mandagere village, K.R.Pet Taluk, Madya 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 April 2006 to 31 December 2009

## 3. Reference

The project proponent has chosen the standards listed in **www.v-c-s.org** for the voluntary carbon units generated by the project activity.

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).**

For more information on methodology please refer the following web link:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Approved VCS PD: Ver.2, 10 Sep 2009 and Validation Report No.53601108 – 08/239 dated 2009-11-14 issued by TÜV NORD CERT GmbH

## 4. Abbreviations

| | | |
|---|---|---|
| CEA | : | Central Electricity Authority, Government of India. |
| VCS | : | Voluntary Carbon standard |
| VCU | : | Voluntary Carbon Unit |
| CDM | : | Clean Development Mechanism |
| DOE | : | Designated Operational Entity |
| GHG | : | Greenhouse Gases |

| | | |
|---|---|---|
| HR:MM | : | Hours:Minutes |
| IPCC | : | Intergovernmental Panel on Climate Change |
| KPTCL | : | Karnataka Power Transmission Corporation Limited |
| MR | : | Monitoring Report |
| BPCL | : | Bhoruka Power Corporation limited |
| VCS PD | : | Voluntary Carbon Standard Project Description |
| UNFCCC | : | United Nations Framework Convention on Climate Change |

## 5. General Description of the Projects

Bhoruka Power Corporation Limited has implemented two independent (Total 4.5 MW capacity) Small Hydro Power projects in the state of Karnataka. The brief description of these project activities are furnished below.

**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.

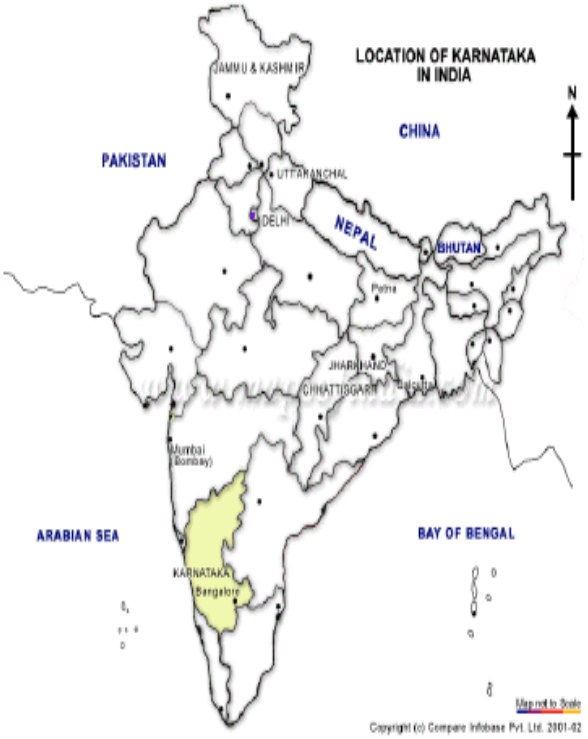
**Mandagere Project (2x1.75 MW):**

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 way from the Project site.

**Location of the grouped project**

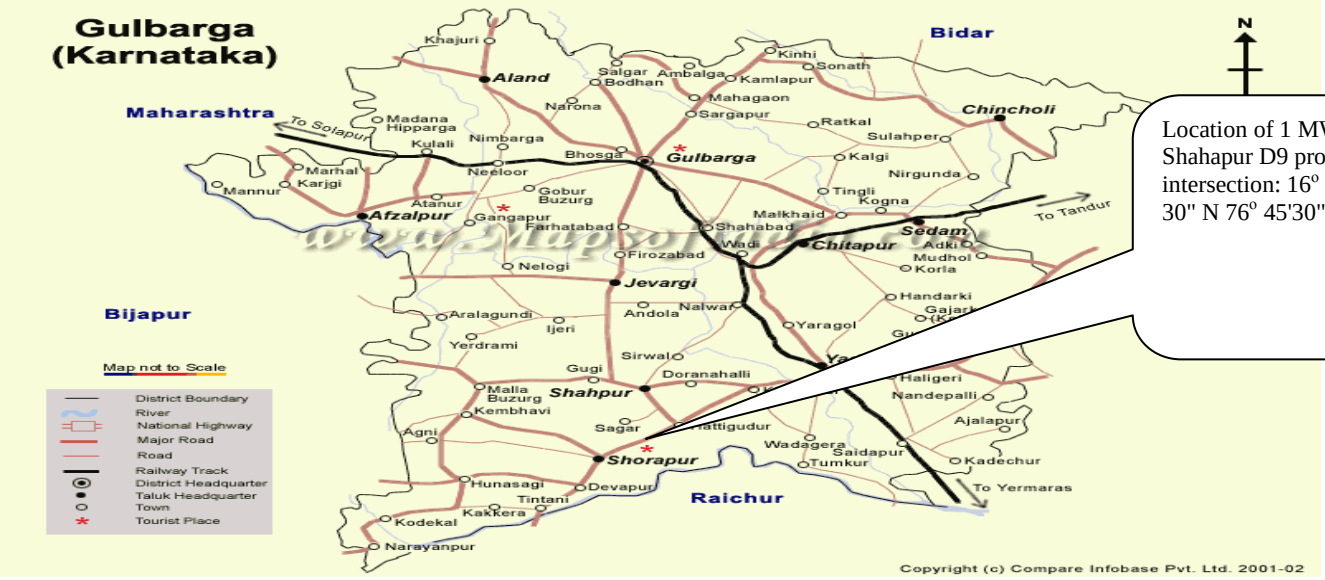
Geographical & Physical information of the grouped activity

| *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** |

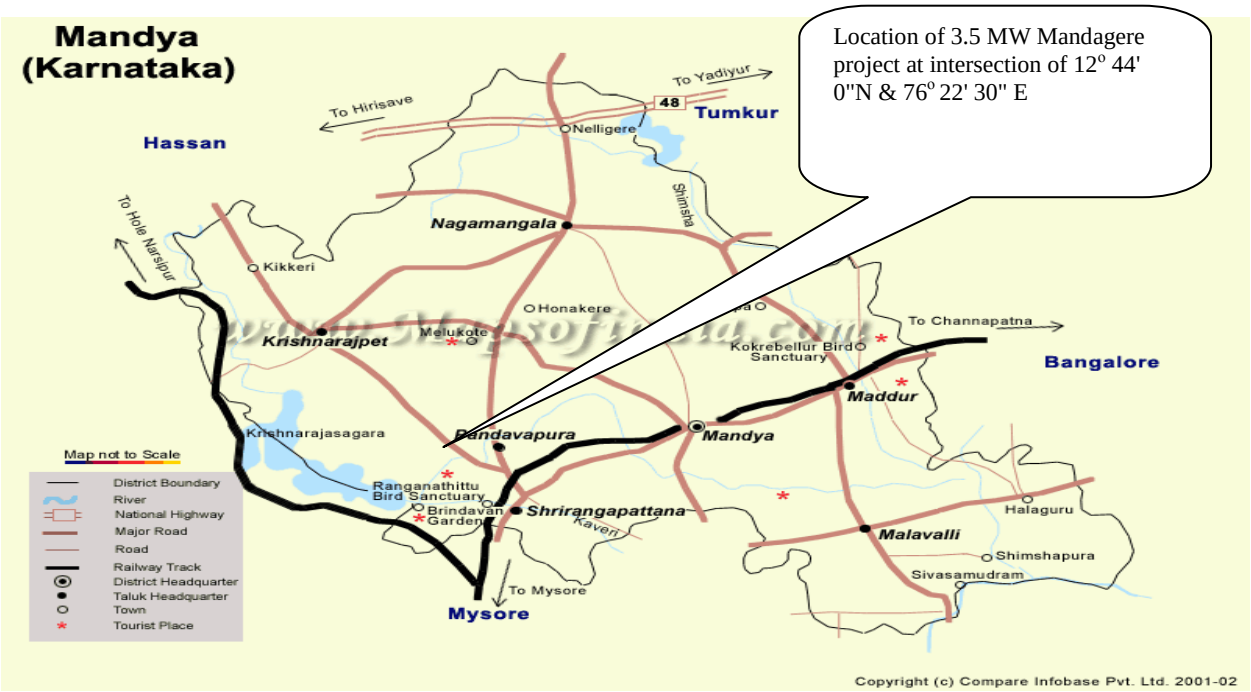



**Map1: Location of Karnataka in India**

**Map2: Location of Gulbarga & Mandya Districts in Karnataka**




**Map3: Location of 1 MW Shahapur-D9 Project in Gulbarga District of Karnataka**




**Map3: Location of 3.5 MW Mandagere Project in Mandya District of Karnataka**

## 6. Details of Major Equipment of the Projects

The details of major equipment of the project and suppliers are presented below:

**Table 1 – Detail of Plant Major Equipments and Suppliers of Grouped activity**

| S.No | Project | Equipment details |
|---|---|---|
| 1 | Shahapur-D9 project | **Turbine :** 1400 KW Horizontal Francis Turbine, 210 R.P.M. along with indicating and recording instruments, etc,<br>Supplier: **M/s Jyoti Limited, vadodara**<br>**Generator:**Squirrel cage Induction of 3 Phase,3.3 kV, 50 c/s, 1010 RPM, 0.8 PF and rated output 1000 kW<br>Make: **Jyoti Limited,Vadodara**<br>**Transformer:** 1250 kVA, 3-phase, 11kV ONAN cooling.<br>Make: **Volt-Amp transformer, Baroda.** |
| 2 | Mandagere project | 2 x 1860 KW Horizontal Kaplan Turbine, 210 RPM, Fixed runner & adjustable guide vanes along with indicating and recording instruments, etc.<br><br>Make : **Alstom projects India Limited**<br><br>Synchronous generator of 3 Phase, 3.3 kV, 50 c/s, 750 RPM, 0.85 pf and rated output 1750 kW/2059 KVA with 10% continous overload capablity<br>Make: **Crompton Greaves LM divison , Mumbai**<br><br>**Transformer:** 2700 kVA, 3-phase, 11kV/3.3 kV ONAN cooling.<br>Make: **Crompoton Greaves, Gwalior.** |

## 7. Statement to what extent the Project has been implemented as planned

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)

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

**Table -2a: Plant Operating Hours details for Shahapur-D9 Project for the Reported Period**

**(in HR:MM)**

| Particulars | Shahapur-D9 | | | |
|---|---|---|---|---|
| | Year 2006 (from Apr to Dec) | Year 2007 | Year 2008 | Year 2009 |
| Total No. of hours | 6600:00 | 8760:00 | 8784:00 | 8760:00 |
| Non-availability of water | 2220:00 | 1116:00 | 2973:16 | 3122:56 |
| Planned Shut down hours | 0:00 | 0:00 | 0:00 | 0:00 |
| Forced Shut down hours | 120:00 | 132:00 | 274:46 | 453:41 |
| Total Non-available hours | 2340:00 | 1248:00 | 3248:02 | 3576:37 |
| **Total No of hours Plant operated** | **4260:00** | **7512:00** | **5535:58** | **5183:23** |

**Table -2b: Plant Operating Hours details for Mandagere Project for the Reported Period**

**(in HR:MM)**

| Particulars | Unit-1 | | | |
|---|---|---|---|---|
| | Year 2006 (from Apr to Dec) | Year 2007 | Year 2008 | Year 2009 |
| Total No. of hours | 6600:00 | 8760:00 | 8784:00 | 8760:00 |
| Non-availability of water | 3139:00 | 4380:00 | 5030:09 | 4002:32 |
| Planned Shut down hours | 31:00 | 0:00 | 15:19 | 20:57 |
| Forced Shut down hours | 254:00 | 53:00 | 205:06 | 701:25 |
| Total Non-available hours | 3424:00 | 4433:00 | 5250:34 | 4724:54 |
| **Total No of hours operated** | **3176:00** | **4327:00** | **3533:26** | **4035:06** |

| Particulars | Unit-2 | | | |
|---|---|---|---|---|
| | Year 2006 (from Apr to Dec) | Year 2007 | Year 2008 | Year 2009 |

| | | | | |
|---|---|---|---|---|
| Total No. of hours | 6600:00 | 8760:00 | 8784:00 | 8760:00 |
| Non-availability of water | 3487:00 | 4339:00 | 4112:21 | 4655:48 |
| Planned Shut down hours | 7:00 | 0:00:00 | 23:45 | 15:11 |
| Forced Shut down hours | 326:00 | 172:00 | 401:38 | 305:09 |
| Total Non-available hours | 3820:00 | 4511:00 | 4537:44 | 4976:08 |
| **Total No of hours Plant operated** | **2780:00** | **4249:00** | **4246:16** | **3783:52** |

## 8. Sustainability – Economic and Social Well Being

The project activity has resulted in sustainable development in the region as follows:

- Alleviation of poverty by generating direct and indirect employment in the area. The project generated indirect employment during the construction of the project activity and also permanent employment during operation of the project.
- The power generation from the project activity stabilizes the local grid and helped in providing uninterrupted power for farmers.
- The project activity contributed to the development of infrastructure in and around the project like roads, buildings and communication systems in the rural area.
- The project activity reduced the migration of the rural populace to urban areas, as the project activity generated employment opportunities.
- The project does not lead to any GHG emissions. So, the project doesn't have its influence on the microclimate of the region by non-polluting, entails no wastes or production of toxic gases; environmentally benign and reduce global warming impacts.

## 9. Parameters being monitored according to monitoring plan

Monitoring Methodology – "**Grid Connected Renewable Electricity Generation" version-13, EB-36**. It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html).

The following parameters were monitored on continuous basis

**a) Energy**

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| **Data / Parameter:** | $EG_{grossy}$ |
|---|---|
| Data unit: | kWh (or MWh) |
| Description: | Total electricity generated by the project in the year y. |
| Source of data to be used: | On-site measurements |
| Value of data applied for the purpose of calculating expected emission reductions | D9:12106889 kWh<br>Mandagere:30106020 kWh<br>Grand total:42212909 kWh |
| Description of measurement methods and procedures to be applied: | Measured monthly using calibrated meters and aggregated annually. |
| QA/QC procedures to be applied: | Meters will be lcalibrated as per industry standards |
| Any comment: | Data archived: Crediting period + two years.<br>Instruments : kWh meter |

| **Data / 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 to be used: | On-site measurements |
| Value of data applied for the purpose of calculating expected emission reductions | See Table-3.1 for Shahapur-D9 and<br>Table-3.2 for Mandagere project |
| 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. |
| 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. |
| Any comment: | Data archived: Crediting period + two years.<br>Instruments : Trivector energy meter |

| **Data / Parameter:** | $EG_{import,y}$ |
|---|---|
| Data unit: | kWh |
| Description: | Grid electricity import to the project activity during the year y |
| Source of data to be used: | On-site measurements |

| | |
|---|---|
| Value of data applied for the purpose of calculating expected emission reductions | See Table-3.1 for Shahapur-D9 and Table-3.2 for Mandagere project |
| Description of measurement methods and procedures to be applied: | 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. |
| 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. |
| Any comment: | Data archived: Crediting period + two years.<br>Instruments : Trivector energy meter |

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | kWh (or MWh) |
| Description: | Net Electricity supplied to the grid by the grouped project during the year *y* |
| Source of data to be used: | From the certified joint meter readings |
| Value of data applied for the purpose of calculating expected emission reductions | See Table-3,1 for Shahapur-D9 and Table-3.2 for Mandagere project |
| Description of measurement methods and procedures to be applied: | Calculated as the difference of the electricity export to grid and electricity import from grid by the project activity |
| QA/QC procedures to be applied: | -- |
| 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.<br><br>Data archived: Crediting period + two years. |

| **Data / Parameter:** | $F_{d,y}$ |
|---|---|
| Data unit: | Liters |
| Description: | Quantity of diesel used in DG set during the year, y |
| Source of data to be used: | On-site measurements/store issues |
| Value of data applied for the purpose of calculating expected emission reductions | See Table-3.1 for Shahapur-D9 and Table-3.2 for Mandagere project |
| 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. |

| | |
|---|---|
| QA/QC procedures to be applied: | The data recorded can be cross checked against the fuel purchase receipts. |
| Any comment: | The data on quantity of HSD procured would be collected separately.<br>Instruments : Level gauge/Ruler |

b) IPCC default values/ Country Specific Values if available

| **Data / Parameter:** | $NCV_{Diesel}$ |
|---|---|
| Data unit: | TJ/Gg |
| Description: | Net calorific value of diesel |
| Source of data to be used: | IPCC default value |
| Value of data applied for the purpose of calculating expected emission reductions | 43 (Source IPCC 2006) |
| Description of measurement methods and procedures to be applied: | IPCC values have been used for diesel since no country specific data is available. |
| QA/QC procedures to be applied: | Project participants have no control on the parameter. Hence, No QA/QC procedures are applicable |
| Any comment: | -- |

| **Data / Parameter:** | $EF_{CO2}$ |
|---|---|
| Data unit: | $tCO_2/TJ$ |
| Description: | $CO_2$ emission factor of diesel |
| Source of data to be used: | IPCC default values |
| Value of data applied for the purpose of calculating expected emission reductions | 74.1 |
| Description of measurement methods and procedures to be applied: | 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. |
| QA/QC procedures to be applied: | -- |
| Any comment: | -- |

| **Data / Parameter:** | OXID |
|---|---|
| Data unit: | Not applicable (constant) |
| Description: | Oxidation Factor of Diesel |
| Source of data to be used: | IPCC 2006 default values |
| Value of data applied for the purpose of calculating expected emission reductions | 1 |
| Description of measurement methods and procedures to be applied: | IPCC value have been used for the fuel type since no country specific oxidation factor is available |
| QA/QC procedures to be applied: | -- |

| | |
|---|---|
| Any comment: | -- |

| | |
|---|---|
| **Data / Parameter:** | Density |
| Data unit: | kg/lit |
| Description: | Density of diesel |
| Source of data to be used: | Society of Indian Automobile Manufacturers (SIAM) http://www.siamindia.com/scripts/Diesel.aspx |
| Value of data applied for the purpose of calculating expected emission reductions | 0.82 |
| Description of measurement methods and procedures to be applied: | The SIAM value is considered as it is publicly available and can be referred as authentic source. |
| QA/QC procedures to be applied: | -- |
| Any comment: | -- |

**Information Used for Emission Reduction Calculations**

| S. No. | Key information/ Data used | Source of data/information |
|---|---|---|
| 1. | Net Electricity supplied (Exported) to grid | Monthly energy meter readings certified by KPTCL & Plant personnel |
| 2. | Baseline emission factor Southern Regional Grid | EF had been chosen as ex-ante in Approved VCS PD. |
| 3. | HSD consumption | Diesel consumption records maintained at project site |

**Methods of data transfer and archiving policy**

The data have been recorded both at the project site as well as at the grid sub-station, which is under the control of KPTCL. The electricity export / import readings have been measured using calibrated tri-vector meters and recorded manually by the representatives of KPTCL and BPCL as a proof of export and import of electricity by the project activity. Those meter readings are the basis for the invoices raised by BPCL. These readings are also considered for emission estimations. Sales bills / receipts may be compared as an alternative proof of the electricity exported to the grid. And the data will be stored for a period of 2 years after the crediting period.

**Technical details of monitoring instruments like make, type, class, PF,current, voltage range, year of manufacturing, serial no, etc.**

**Shahapur-D9 Project**

| Description | Main meter | Check meter | Main meter | Check meter |
|---|---|---|---|---|
| Period | **1st April 2006- 20th December 2008** | | **20th December 2008 to 31st December 2009** | |
| Type | Trivector Meter | Trivector Meter | Trivector Meter | Trivector Meter |
| Make | Secure Meters | Secure Meters | L & T | L & T |
| Class | 0.2 | 0.2 | 0.2 | 0.2 |
| Multiplication Constant | 1 | 1 | 7.5 | 7.5 |
| CT Ratio | 75/1A | 75/1A | 75/1A | 75/1A |
| PT Ratio | 11 KV/√3/110V/√3 | 11 KV/√3/110V/√3 | 11 KV/√3/110V/√3 | 11 KV/√3/110V/√3 |
| Serial No. | KAB01428 | KAB01429 | 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 | 05.09.2006<br>15.11.2006<br>18.01.2007<br>23.10.2007<br>14.05.2008<br>09.09.2008<br>12.08.2009<br>19.12.2009 | 05.09.2006<br>15.11.2006<br>18.01.2007<br>23.10.2007<br>14.05.2008<br>09.09.2008<br>12.08.2009<br>19.12.2009 |
| Calibration Procedure & Standards | Calibration procedure for energy meters is as per Article 7 of PPA signed between BPCL & KPTCL approval. | |
| Results of calibration | For all calibration tests carried out, it is certified by the testing authorities that working of meters was satisfactory as the errors notified were within the limits of accuracy range. Details of such results for the latest test are given below for your ready reference | |

**Mandagere Project**

| Description | Line-1 | | Line-2 | |
|---|---|---|---|---|
| | Main meter | Check meter | Main meter | Check meter |

| Period | 1st April 2006- 31st December 2009 | | | |
|---|---|---|---|---|
| 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 | 31.05.2006 | 31.05.2006 | 31.05.2006 | 31.05.2006 |
| | 12.09.2006 | 12.09.2006 | 12.09.2006 | 12.09.2006 |
| | 04.07.2007 | 04.07.2007 | 04.07.2007 | 04.07.2007 |
| | 04.03.2008 | 04.03.2008 | 04.03.2008 | 04.03.2008 |
| | 25.09.2008 | 25.09.2008 | 25.09.2008 | 25.09.2008 |
| | 25.07.2009 | 25.07.2009 | 25.07.2009 | 25.07.2009 |
| Calibration procedure | As per Article 7 of PPA signed between BPCL & KPTCL approval. | | | |
| Results of calibration | For all calibration tests carried out, it is certified by the testing authorities that working of meters was satisfactory as the errors notified were with in the limits of accuracy range. Details of such results for the latest test are given below for your ready reference | | | |

**Management system and quality assurance:**

Electricity: (Quality check & assurance is as per Article 7 of PPA signed between Bhoruka Power Corporation Limited (BPCL) & Karnataka Power Transmission Corporation Limited (KPTCL.). Both Main Meter and Check Meters (export & import) installed by BPCL are of 0.2% accuracy class. Each meter is jointly inspected and sealed on behalf of the parties.

Both Main and Check meters are tested and certified at least once every year against an accepted laboratory standard meter in accordance with electricity standards. The meters are deemed to be working satisfactorily if the errors are within specifications for meters of 0.2% accuracy class.
Results of the latest calibration tests carried out for the two sites are as below:

SITE: SHAHAPUR D-9

| Date of calibration | 19.12.2009 |
|---|---|
| % error noticed in Main meter | - 0.045 |

| | |
|---|---|
| % error noticed in Check meter | + 0.044 |

SITE: Mandagere

| Test conducted on 25.07.2009 | Line 1 | Line 2 |
|---|---|---|
| % error noticed in Main meter | +0.014 | +0.018 |
| % error noticed in Check meter | +0.024 | +0.021 |

As per the billing period, the Month wise data on electricity generation, auxiliary power consumption, electricity exported to grid, electricity imported from grid and diesel consumptions are presented in the tables given below:

**Table – 3.1: Details of Electricity exported to grid, Electricity imported from grid, Net electricity displaced and diesel consumption by Shahapur-D9 Project.**

| S.No. | Monitored Period | Electricity Exported to Grid | Electricity Imported from Grid | Net Electricity Displaced | | Diesel consu-mption |
|---|---|---|---|---|---|---|
| | | kWh | kWh | kWh | MWh | Lit |
| 1 | 01.04.06 to 01.05.06 | 288380 | 1040 | 287340 | 287.34 | 2 |
| 2 | 01.05.06 to 01.06.06 | 0 | 2930 | -2930 | -2.93 | 13 |
| 3 | 01.06.06 to 01.07.06 | 0 | 3140 | -3140 | -3.14 | 41 |
| 4 | 01.07.06 to 01.08.06 | 184860 | 1740 | 183120 | 183.12 | 26 |
| 5 | 01.08.06 to 01.09.06 | 443870 | 580 | 443290 | 443.29 | 4 |
| 6 | 01.09.06 to 01.10.06 | 382440 | 370 | 382070 | 382.07 | 5 |
| 7 | 01.10.06 to 01.11.06 | 473980 | 0 | 473980 | 473.98 | 3 |
| 8 | 01.11.06 to 01.12.06 | 403620 | 0 | 403620 | 403.62 | 3 |
| 9 | 01.12..06 to 01.01.07 | 481240 | 320 | 480920 | 480.92 | 10 |
| **Sub-total** | | **2658390** | **10120** | **2648270** | **2648.27** | **105** |
| | | | | | | |
| 10 | 01.01.07 to 01.02.07 | 523640 | 10 | 523630 | 523.63 | 3 |
| 11 | 01.02.07 to 01.03.07 | 479550 | 180 | 479370 | 479.37 | 4 |
| 12 | 01.03.07 to 01.04.07 | 450740 | 10 | 450730 | 450.73 | 3 |
| 13 | 01.04.07 to 01.05.07 | 199610 | 1740 | 197870 | 197.87 | 5 |
| 14 | 01.05.07 to 01.06.07 | 0 | 3390 | -3390 | -3.39 | 8 |
| 15 | 01.06.07 to 01.07.07 | 10 | 2570 | -2560 | -2.56 | 19 |
| 16 | 01.07.07 to 01.08.07 | 30000 | 2300 | 27700 | 27.70 | 12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | 01.08.07 to 01.09.07 | 420260 | 220 | 420040 | 420.04 | 4 |
| 18 | 01.09.07 to 01.10.07 | 193520 | 700 | 192820 | 192.82 | 26 |
| 19 | 01.10.07 to 01.11.07 | 489000 | 180 | 488820 | 488.82 | 3 |
| 20 | 01.11.07 to 01.12.07 | 562160 | 10 | 562150 | 562.15 | 3 |
| 21 | 01.12.07 to 01.01.08 | 377130 | 660 | 376470 | 376.47 | 2 |
| **Sub-total** | | **3725620** | **11970** | **3713650** | **3713.65** | **88** |
| | | | | | | |
| 22 | 01.01.08 to 01.02.08 | 351730 | 970 | 350760 | 350.76 | 4 |
| 23 | 01.02.08 to 01.03.08 | 304770 | 1130 | 303640 | 303.64 | 2 |
| 24 | 01.03.08 to 01.04.08 | 213740 | 1620 | 212120 | 212.12 | 3 |
| 25 | 01.04.08 to 01.05.08 | 217970 | 1170 | 216800 | 216.80 | 8 |
| 26 | 01.05.08 to 01.06.08 | 0 | 3730 | -3730 | -3.73 | 7 |
| 27 | 01.06.08 to 01.07.08 | 0 | 3130 | -3130 | -3.13 | 7 |
| 28 | 01.07.08 to 01.08.08 | 18960 | 3060 | 15900 | 15.90 | 64 |
| 29 | 01.08.08 to 01.09.08 | 489920 | 0 | 489920 | 489.92 | 3 |
| 30 | 01.09.08 to 01.10.08 | 331210 | 490 | 330720 | 330.72 | 7 |
| 31 | 01.10.08 to 01.11.08 | 443960 | 110 | 443850 | 443.85 | 2 |
| 32 | 01.11.08 to 01.12.08 | 385980 | 190 | 385790 | 385.79 | 3 |
| 33 | 01.12.08 to 20.12.08 | 170290 | 580 | 169710 | 169.71 | 12 |
| 34 | 20.12.08 to 01.01.09 | 157200 | 230 | 156970 | 156.97 | 0 |
| **Sub-total** | | **3085730** | **16410** | **3069320** | **3069.32** | **120** |
| | | | | | | |
| 34 | 01.01.09 to 01.02.09 | 403280 | 530 | 402750 | 402.75 | 2 |
| 35 | 01.02.09 to 01.03.09 | 295430 | 830 | 294600 | 294.60 | 2 |
| 36 | 01.03.09 to 01.04.09 | 167550 | 1875 | 165675 | 165.68 | 7 |
| 37 | 01.04.09 to 01.05.09 | 64050 | 2100 | 61950 | 61.95 | 1 |
| 38 | 01.05.09 to 01.06.09 | 0 | 2550 | -2550 | -2.55 | 8 |
| 39 | 01.06.09 to 01.07.09 | 0 | 2175 | -2175 | -2.18 | 6 |
| 40 | 01.07.09 to 01.08.09 | 5475 | 2475 | 3000 | 3.00 | 1 |
| 41 | 01.08.09 to 01.09.09 | 430800 | 450 | 430350 | 430.35 | 3 |
| 42 | 01.09.09 to 01.10.09 | 278850 | 525 | 278325 | 278.33 | 4 |
| 43 | 01.10.09 to 01.11.09 | 252675 | 1125 | 251550 | 251.55 | 5 |
| 44 | 01.11.09 to 01.12.09 | 314850 | 450 | 314400 | 314.40 | 7 |
| 45 | 01.12.09 to 31.12.09 | 347925 | 300 | 347625 | 347.63 | 2 |
| **Sub-total** | | **2560885** | **15385** | **2545500** | **2545.50** | **45** |

| | | | | | |
|---|---|---|---|---|---|
| **Grand -Total** | **12030625** | **53885** | **11976740** | **11976.74** | **357** |

**Table – 3.2: Details of Electricity exported to grid, Electricity imported from grid, net electricity displaced and diesel consumption by Mandagere Project**

| S.No. | Monitored Period | Electricity Exported to Grid | Electricity Imported from Grid | Net Electricity Displaced | | Diesel consu-mption |
|---|---|---|---|---|---|---|
| | | kWh | kWh | kWh | MWh | Ltrs |
| 1 | 01.04.06 to 01.05.06 | 136400 | 5000 | 131400 | 131.40 | 94 |
| 2 | 01.05.06 to 01.06.06 | 66000 | 13300 | 52700 | 52.70 | 34 |
| 3 | 01.06.06 to 01.07.06 | 0 | 11100 | -11100 | -11.10 | 133 |
| 4 | 01.07.06 to 01.08.06 | 622400 | 2100 | 620300 | 620.30 | 75 |
| 5 | 01.08.06 to 01.09.06 | 1222900 | 400 | 1222500 | 1222.50 | 16 |
| 6 | 01.09.06 to 01.10.06 | 935300 | 500 | 934800 | 934.80 | 45 |
| 7 | 01.10.06 to 01.11.06 | 811000 | 100 | 810900 | 810.90 | 24 |
| 8 | 01.11.06 to 01.12.06 | 988500 | 200 | 988300 | 988.30 | 73 |
| 9 | 01.12.06 to 01.01.07 | 702600 | 600 | 702000 | 702.00 | 160 |
| **Sub-total** | | **5485100** | **33300** | **5451800** | **5451.80** | **654** |
| | | | | | | |
| 10 | 01.01.07 to 01.02.07 | 208600 | 3700 | 204900 | 204.90 | 34 |
| 11 | 01.02.07 to 01.03.07 | 25000 | 6100 | 18900 | 18.90 | 27 |
| 12 | 01.03.07 to 01.04.07 | 0 | 30000 | -30000 | -30.00 | 29 |
| 13 | 01.04.07 to 01.05.07 | 175500 | 12500 | 163000 | 163.00 | 44 |
| 14 | 01.05.07 to 01.06.07 | 241700 | 15100 | 226600 | 226.60 | 43 |
| 15 | 01.06.07 to 01.07.07 | 18100 | 10100 | 8000 | 8.00 | 81 |
| 16 | 01.07.07 to 01.08.07 | 1132500 | 500 | 1132000 | 1132.00 | 23 |
| 17 | 01.08.07 to 01.09.07 | 992400 | 1100 | 991300 | 991.30 | 20 |
| 18 | 01.09.07 to 01.10.07 | 1489900 | 200 | 1489700 | 1489.70 | 29 |
| 19 | 01.10.07 to 01.11.07 | 1325200 | 200 | 1325000 | 1325.00 | 24 |
| 20 | 01.11.07 to 01.12.07 | 1292900 | 200 | 1292700 | 1292.70 | 17 |
| 21 | 01.12.07 to 01.01.08 | 1149700 | 200 | 1149500 | 1149.50 | 26 |
| **Sub-total** | | **8051500** | **79900** | **7971600** | **7971.60** | **397** |
| | | | | | | |
| 22 | 01.01.08 to 01.02.08 | 295200 | 2600 | 292600 | 292.60 | 44 |
| 23 | 01.02.08 to 01.03.08 | 367800 | 1900 | 365900 | 365.90 | 20 |
| 24 | 01.03.08 to 01.04.08 | 659000 | 800 | 658200 | 658.20 | 29 |
| 25 | 01.04.08 to 01.05.08 | 542300 | 1200 | 541100 | 541.10 | 17 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 26 | 01.05.08 to 01.06.08 | 89500 | 4000 | 85500 | 85.50 | 17 |
| 27 | 01.06.08 to 01.07.08 | 0 | 4200 | -4200 | -4.20 | 56 |
| 28 | 01.07.08 to 01.08.08 | 135500 | 4300 | 131200 | 131.20 | 50 |
| 29 | 01.08.08 to 01.09.08 | 1308800 | 400 | 1308400 | 1308.40 | 22 |
| 30 | 01.09.08 to 01.10.08 | 1366500 | 200 | 1366300 | 1366.30 | 27 |
| 31 | 01.10.08 to 01.11.08 | 1430800 | 0 | 1430800 | 1430.80 | 22 |
| 32 | 01.11.08 to 01.12.08 | 868500 | 1200 | 867300 | 867.30 | 25 |
| 33 | 01.12.08 to 01.01.09 | 977100 | 100 | 977000 | 977.00 | 29 |
| **Sub-total** | | **8041000** | **20900** | **8020100** | **8020.10** | **358** |
| | | | | | | |
| 34 | 01.01.09 to 01.02.09 | 398600 | 1300 | 397300 | 397.30 | 23 |
| 35 | 01.02.09 to 01.03.09 | 32100 | 5000 | 27100 | 27.10 | 23 |
| 36 | 01.03.09 to 01.04.09 | 0 | 5000 | -5000 | -5.00 | 26 |
| 37 | 01.04.09 to 01.05.09 | 40500 | 5000 | 35500 | 35.50 | 24 |
| 38 | 01.05.09 to 01.06.09 | 40200 | 4100 | 36100 | 36.10 | 33 |
| 39 | 01.06.09 to 01.07.09 | 4000 | 3400 | 600 | 0.60 | 52 |
| 40 | 01.07.09 to 01.08.09 | 697700 | 1800 | 695900 | 695.90 | 39 |
| 41 | 01.08.09 to 01.09.09 | 1426700 | 300 | 1426400 | 1426.40 | 26 |
| 42 | 01.09.09 to 01.10.09 | 1416500 | 200 | 1416300 | 1416.30 | 30 |
| 43 | 01.10.09 to 01.11.09 | 1541700 | 100 | 1541600 | 1541.60 | 25 |
| 44 | 01.11.09 to 01.12.09 | 1293500 | 100 | 1293400 | 1293.40 | 32 |
| 45 | 01.12.09 to 31.12.09 | 1385500 | 100 | 1385400 | 1385.40 | 33 |
| **Sub-total** | | **8277000** | **26400** | **8250600** | **8250.60** | **364** |
| | | | | | | |
| **Grand Total** | | **29854600** | **160500** | **29694100** | **29694.10** | **1773** |

Considering that there are 1370 days in the monitoring period under consideration (from 1.4.2006 to 31.12.2009), the details of PLF achieved for the two facilities are as below:

| Project | Power exported to grid (MWh) | PLF achieved | PLF as per PD |
|---|---|---|---|
| Shahapur D-9 | 12030.625 | 36.56% | 49.2% |
| Mandagere | 29854.6 | 25.9% | 51.53% |

## 10. GHG Calculations

The following formula is adopted for calculating emission reductions generated by the project activity:

$ER_y = BE_y - PE_y - L_y$

Where $ER_y$ = Emission reductions in a given year
$BE_y$ = Baseline emissions in a given year
$PE_y$ = Project emissions in a given year
$L_y$ = Leakage in a given year

**Baseline Emissions**

The baseline emissions are calculated as follows:

$$BE_y = EG_y \cdot EF_y$$

Where $EG_y$ = Net electricity export to grid in a given year (MWh)
$EF_y$ is = Emission factor for a given year ($tCO_2/MWh$)

**Project emissions (PEy) for using Diesel:**

$PE_{diesel,y} = (F_{d,y} \times Density \times NCV \times EF_{CO2} \times OXID)/10\text{^}6$

Where $F_{d,y}$ = 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)
$EF_{CO2}$ = $CO_2$ 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)

**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.

## 11. Net Emission Reductions

The emission reductions for the chosen monitored period i.e. from 1st April t 2006 to 31st December 2009 as given below:

**Table – 4.1 : Net Emission Reductions – Month wise for Shahapur-D9 Project for reported period**

| S. No. | Monitored Period | Net Electricity Displaced | Diesel consu-mption | Baseline Emission Factor | Baseline Emissions | Project Emissions | Net Emission Reductions |
|---|---|---|---|---|---|---|---|
| | | MWh | Ltrs | $tCO_2$/ MWh | $tCO_2e$ | $tCO_2e$ | $tCO_2e$ |
| 1 | 01.04.06 to 01.05.06 | 287.34 | 2 | 0.8545 | 245.5 | 0.01 | 245.5 |
| 2 | 01.05.06 to 01.06.06 | -2.93 | 13 | 0.8545 | -2.5 | 0.03 | -2.5 |
| 3 | 01.06.06 to 01.07.06 | -3.14 | 41 | 0.8545 | -2.7 | 0.11 | -2.8 |
| 4 | 01.07.06 to 01.08.06 | 183.12 | 26 | 0.8545 | 156.5 | 0.07 | 156.4 |
| 5 | 01.08.06 to 01.09.06 | 443.29 | 4 | 0.8545 | 378.8 | 0.01 | 378.8 |
| 6 | 01.09.06 to 01.10.06 | 382.07 | 5 | 0.8545 | 326.5 | 0.01 | 326.5 |
| 7 | 01.10.06 to 01.11.06 | 473.98 | 3 | 0.8545 | 405.0 | 0.01 | 405.0 |
| 8 | 01.11.06 to 01.12.06 | 403.62 | 3 | 0.8545 | 344.9 | 0.01 | 344.9 |
| 9 | 01.12..06 to 01.01.07 | 480.92 | 10 | 0.8545 | 410.9 | 0.02 | 410.9 |
| **Sub-total** | | **2648.27** | **105** | | **2262.9** | **0.27** | **2262.7** |
| | | | | | **2262** | **1** | **2261** |
| 10 | 01.01.07 to 01.02.07 | 523.63 | 3 | 0.8545 | 447.4 | 0.01 | 447.4 |
| 11 | 01.02.07 to 01.03.07 | 479.37 | 4 | 0.8545 | 409.6 | 0.01 | 409.6 |
| 12 | 01.03.07 to 01.04.07 | 450.73 | 3 | 0.8545 | 385.1 | 0.01 | 385.1 |
| 13 | 01.04.07 to 01.05.07 | 197.87 | 5 | 0.8545 | 169.1 | 0.01 | 169.1 |
| 14 | 01.05.07 to 01.06.07 | -3.39 | 8 | 0.8545 | -2.9 | 0.02 | -2.9 |
| 15 | 01.06.07 to 01.07.07 | -2.56 | 19 | 0.8545 | -2.2 | 0.05 | -2.2 |
| 16 | 01.07.07 to 01.08.07 | 27.70 | 12 | 0.8545 | 23.7 | 0.03 | 23.6 |
| 17 | 01.08.07 to 01.09.07 | 420.04 | 4 | 0.8545 | 358.9 | 0.01 | 358.9 |
| 18 | 01.09.07 to 01.10.07 | 192.82 | 26 | 0.8545 | 164.8 | 0.07 | 164.7 |
| 19 | 01.10.07 to 01.11.07 | 488.82 | 3 | 0.8545 | 417.7 | 0.01 | 417.7 |
| 20 | 01.11.07 to 01.12.07 | 562.15 | 3 | 0.8545 | 480.4 | 0.01 | 480.4 |
| 21 | 01.12.07 to 01.01.08 | 376.47 | 2 | 0.8545 | 321.7 | 0.01 | 321.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sub-total** | | **3713.65** | **88** | | **3173.3** | **0.2** | **3173.1** |
| | | | | | **3173** | **1** | **3172** |
| 22 | 01.01.08 to 01.02.08 | 350.76 | 4 | 0.8545 | 299.7 | 0.01 | 299.7 |
| 23 | 01.02.08 to 01.03.08 | 303.64 | 2 | 0.8545 | 259.5 | 0.01 | 259.5 |
| 24 | 01.03.08 to 01.04.08 | 212.12 | 3 | 0.8545 | 181.3 | 0.01 | 181.3 |
| 25 | 01.04.08 to 01.05.08 | 216.80 | 8 | 0.8545 | 185.3 | 0.02 | 185.2 |
| 26 | 01.05.08 to 01.06.08 | -3.73 | 7 | 0.8545 | -3.2 | 0.02 | -3.2 |
| 27 | 01.06.08 to 01.07.08 | -3.13 | 7 | 0.8545 | -2.7 | 0.02 | -2.7 |
| 28 | 01.07.08 to 01.08.08 | 15.90 | 64 | 0.8545 | 13.6 | 0.17 | 13.4 |
| 29 | 01.08.08 to 01.09.08 | 489.92 | 3 | 0.8545 | 418.6 | 0.01 | 418.6 |
| 30 | 01.09.08 to 01.10.08 | 330.72 | 7 | 0.8545 | 282.6 | 0.02 | 282.6 |
| 31 | 01.10.08 to 01.11.08 | 443.85 | 2 | 0.8545 | 379.3 | 0.01 | 379.3 |
| 32 | 01.11.08 to 01.12.08 | 385.79 | 3 | 0.8545 | 329.7 | 0.01 | 329.7 |
| 33 | 01.12.08 to 20.12.08 | 169.71 | 12 | 0.8545 | 145.0 | 0.03 | 145.0 |
| 34 | 20.12.08 to 01.01.09 | 156.97 | 0 | 0.8545 | 134.1 | 0.00 | 134.1 |
| **Sub-total** | | **3069.32** | **120** | | **2622.7** | **0.31** | **2622.4** |
| | | | | | **2622** | **1** | **2621** |
| 34 | 01.01.09 to 01.02.09 | 402.75 | 2 | 0.8545 | 344.1 | 0.01 | 344.1 |
| 35 | 01.02.09 to 01.03.09 | 294.60 | 2 | 0.8545 | 251.7 | 0.01 | 251.7 |
| 36 | 01.03.09 to 01.04.09 | 165.68 | 7 | 0.8545 | 141.6 | 0.02 | 141.6 |
| 37 | 01.04.09 to 01.05.09 | 61.95 | 1 | 0.8545 | 52.9 | 0.00 | 52.9 |
| 38 | 01.05.09 to 01.06.09 | -2.55 | 8 | 0.8545 | -2.2 | 0.02 | -2.2 |
| 39 | 01.06.09 to 01.07.09 | -2.18 | 6 | 0.8545 | -1.9 | 0.02 | -1.9 |
| 40 | 01.07.09 to 01.08.09 | 3.00 | 1 | 0.8545 | 2.6 | 0.00 | 2.6 |
| 41 | 01.08.09 to 01.09.09 | 430.35 | 3 | 0.8545 | 367.7 | 0.01 | 367.7 |
| 42 | 01.09.09 to 01.10.09 | 278.33 | 4 | 0.8545 | 237.8 | 0.01 | 237.8 |
| 43 | 01.10.09 to 01.11.09 | 251.55 | 5 | 0.8545 | 214.9 | 0.01 | 214.9 |
| 44 | 01.11.09 to 01.12.09 | 314.40 | 7 | 0.8545 | 268.7 | 0.02 | 268.6 |
| 45 | 01.12.09 to 31.12.09 | 347.63 | 2 | 0.8545 | 297.0 | 0.01 | 297.0 |
| **Sub-total** | | **2545.50** | **45** | | **2175.1** | **0.12** | **2175.0** |
| | | | | | **2175** | **1** | **2174** |
| **Grand -Total** | | **11976.74** | **357** | | **10234.1** | **0.93** | **10233.2** |
| | | **Considered** | | | **10232** | **4** | **10228** |

**Table – 4.2: Net Emission Reductions – Month wise for Mandagere Project for reported period**

| S. No. | Monitored Period | Net Electricity Displaced | Diesel consu-mption | Baseline Emission Factor | Base line Emissions | Project Emissions | Net Emission reductions |
|---|---|---|---|---|---|---|---|
| | | MWh | Ltrs | tCO2/ MWh | tCO2e | tCO2e | tCO2e |
| 1 | 01.04.06 to 01.05.06 | 131.40 | 94 | 0.8545 | 112.3 | 0.25 | 112.0 |
| 2 | 01.05.06 to 01.06.06 | 52.70 | 34 | 0.8545 | 45.0 | 0.09 | 44.9 |
| 3 | 01.06.06 to 01.07.06 | -11.10 | 133 | 0.8545 | -9.5 | 0.35 | -9.8 |
| 4 | 01.07.06 to 01.08.06 | 620.30 | 75 | 0.8545 | 530.0 | 0.20 | 529.9 |
| 5 | 01.08.06 to 01.09.06 | 1222.50 | 16 | 0.8545 | 1044.6 | 0.04 | 1044.6 |
| 6 | 01.09.06 to 01.10.06 | 934.80 | 45 | 0.8545 | 798.8 | 0.12 | 798.7 |
| 7 | 01.10.06 to 01.11.06 | 810.90 | 24 | 0.8545 | 692.9 | 0.06 | 692.9 |
| 8 | 01.11.06 to 01.12.06 | 988.30 | 73 | 0.8545 | 844.5 | 0.19 | 844.3 |
| 9 | 01.12.06 to 01.01.07 | 702.00 | 160 | 0.8545 | 599.9 | 0.42 | 599.4 |
| **Sub-total** | | **5451.80** | **654** | | **4658.6** | **1.71** | **4656.9** |
| | | | | | **4658** | **2** | **4656** |
| 10 | 01.01.07 to 01.02.07 | 204.90 | 34 | 0.8545 | 175.1 | 0.09 | 175.0 |
| 11 | 01.02.07 to 01.03.07 | 18.90 | 27 | 0.8545 | 16.2 | 0.07 | 16.1 |
| 12 | 01.03.07 to 01.04.07 | -30.00 | 29 | 0.8545 | -25.6 | 0.08 | -25.7 |
| 13 | 01.04.07 to 01.05.07 | 163.00 | 44 | 0.8545 | 139.3 | 0.11 | 139.2 |
| 14 | 01.05.07 to 01.06.07 | 226.60 | 43 | 0.8545 | 193.6 | 0.11 | 193.5 |
| 15 | 01.06.07 to 01.07.07 | 8.00 | 81 | 0.8545 | 6.8 | 0.21 | 6.6 |
| 16 | 01.07.07 to 01.08.07 | 1132.00 | 23 | 0.8545 | 967.3 | 0.06 | 967.2 |
| 17 | 01.08.07 to 01.09.07 | 991.30 | 20 | 0.8545 | 847.1 | 0.05 | 847.0 |
| 18 | 01.09.07 to 01.10.07 | 1489.70 | 29 | 0.8545 | 1272.9 | 0.08 | 1272.9 |
| 19 | 01.10.07 to 01.11.07 | 1325.00 | 24 | 0.8545 | 1132.2 | 0.06 | 1132.1 |
| 20 | 01.11.07 to 01.12.07 | 1292.70 | 17 | 0.8545 | 1104.6 | 0.04 | 1104.6 |
| 21 | 01.12.07 to 01.01.08 | 1149.50 | 26 | 0.8545 | 982.2 | 0.07 | 982.2 |
| **Sub-total** | | **7971.60** | **397** | | **6811.7** | **1.04** | **6810.7** |
| | | | | | **6811** | **2** | **6809** |
| 22 | 01.01.08 to 01.02.08 | 292.60 | 44 | 0.8545 | 250.0 | 0.11 | 249.9 |
| 23 | 01.02.08 to 01.03.08 | 365.90 | 20 | 0.8545 | 312.7 | 0.05 | 312.6 |
| 24 | 01.03.08 to 01.04.08 | 658.20 | 29 | 0.8545 | 562.4 | 0.08 | 562.4 |
| 25 | 01.04.08 to 01.05.08 | 541.10 | 17 | 0.8545 | 462.4 | 0.04 | 462.3 |
| 26 | 01.05.08 to 01.06.08 | 85.50 | 17 | 0.8545 | 73.1 | 0.04 | 73.0 |
| 27 | 01.06.08 to 01.07.08 | -4.20 | 56 | 0.8545 | -3.6 | 0.15 | -3.7 |
| 28 | 01.07.08 to 01.08.08 | 131.20 | 50 | 0.8545 | 112.1 | 0.13 | 112.0 |
| 29 | 01.08.08 to 01.09.08 | 1308.40 | 22 | 0.8545 | 1118.0 | 0.06 | 1118.0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 01.09.08 to 01.10.08 | 1366.30 | 27 | 0.8545 | 1167.5 | 0.07 | 1167.4 |
| 31 | 01.10.08 to 01.11.08 | 1430.80 | 22 | 0.8545 | 1222.6 | 0.06 | 1222.6 |
| 32 | 01.11.08 to 01.12.08 | 867.30 | 25 | 0.8545 | 741.1 | 0.06 | 741.0 |
| 33 | 01.12.08 to 01.01.09 | 977.00 | 29 | 0.8545 | 834.8 | 0.07 | 834.8 |
| **Sub-total** | | **8020.10** | **358** | | **6853.2** | **0.93** | **6852.2** |
| | | | | | **6853** | **1** | **6852** |
| 34 | 01.01.09 to 01.02.09 | 397.30 | 23 | 0.8545 | 339.5 | 0.06 | 339.4 |
| 35 | 01.02.09 to 01.03.09 | 27.10 | 23 | 0.8545 | 23.2 | 0.06 | 23.1 |
| 36 | 01.03.09 to 01.04.09 | -5.00 | 26 | 0.8545 | -4.3 | 0.07 | -4.3 |
| 37 | 01.04.09 to 01.05.09 | 35.50 | 24 | 0.8545 | 30.3 | 0.06 | 30.3 |
| 38 | 01.05.09 to 01.06.09 | 36.10 | 33 | 0.8545 | 30.8 | 0.09 | 30.8 |
| 39 | 01.06.09 to 01.07.09 | 0.60 | 52 | 0.8545 | 0.5 | 0.13 | 0.4 |
| 40 | 01.07.09 to 01.08.09 | 695.90 | 39 | 0.8545 | 594.6 | 0.10 | 594.5 |
| 41 | 01.08.09 to 01.09.09 | 1426.40 | 26 | 0.8545 | 1218.9 | 0.07 | 1218.8 |
| 42 | 01.09.09 to 01.10.09 | 1416.30 | 30 | 0.8545 | 1210.2 | 0.08 | 1210.1 |
| 43 | 01.10.09 to 01.11.09 | 1541.60 | 25 | 0.8545 | 1317.3 | 0.06 | 1317.2 |
| 44 | 01.11.09 to 01.12.09 | 1293.40 | 32 | 0.8545 | 1105.2 | 0.08 | 1105.1 |
| 45 | 01.12.09 to 31.12.09 | 1385.40 | 33 | 0.8545 | 1183.8 | 0.09 | 1183.7 |
| **Sub-total** | | **8250.60** | **364** | | **7050.1** | **0.95** | **7049.2** |
| | | | | | **7050** | **1** | **7049** |
| **Grand Total** | | **29694.10** | **1773** | **0.0** | **25373.6** | **4.63** | **25369.0** |
| | | | | | **25372** | **6** | **25366** |

## Table - 5: Summary of Net Emission Reductions for the Reported Period

| Description | Unit | Shahapur-D9 Project | | | | | Mandagere Project | | | | | Total for Grouped Activity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Year 2006 ( Apr 06- Dec 06) | Year 2007 | Year 2008 | Year 2009 | Total | Year 2006 ( Apr 06-Dec 06) | Year 2007 | Year 2008 | Year 2009 | Total | |
| **Electricity Export to Grid** | kWh | 2658390 | 3725620 | 3085730 | 2560885 | **12030625** | 5485100 | 8051500 | 8041000 | 8277000 | **29854600** | **41885225** |
| **Electricity Import from Grid** | kWh | 10120 | 11970 | 16410 | 15385 | **53885** | 33300 | 79900 | 20900 | 26400 | **160500** | **214385** |
| **Net Electricity Displaced** | MWh | 2648.27 | 3713.65 | 3069.32 | 2545.5 | **11977** | 5451.8 | 7971.6 | 8020.1 | 8250.6 | **29694** | **41671** |
| **Diesel Consumption** | Lts | 105 | 88 | 120 | 45 | **357** | 654 | 397 | 358 | 364 | **1773** | **2129** |
| **Baseline Emission Factor** | $tCO_2$ /MWh | 0.8545 | 0.8545 | 0.8545 | 0.8545 | | 0.8545 | 0.8545 | 0.8545 | 0.8545 | | |
| **Baseline Emissions** | t $CO_2e$ | 2262 | 3173 | 2622 | 2175 | **10232** | 4658 | 6811 | 6853 | 7050 | **25372** | **35604** |
| **Project Emissions** | t $CO_2e$ | 1 | 1 | 1 | 1 | **4** | 2 | 2 | 1 | 1 | **6** | **10** |
| **Net Emission Reductions** | **t $CO_2e$** | **2261** | **3172** | **2621** | **2174** | **10228** | **4656** | **6809** | **6852** | **7049** | **25366** | **35594** |

**CONSOLIDATED YEARWISE EMISSION REDUCTION DETAILS ARE AS BELOW**

| PERIOD | Baseline emissions | Project emissions | Nett emission reductions |
|---|---|---|---|
| 01.04.2006 to 31.12.2006 | 6920 | 3 | 6917 |
| 01.01.2007 to 31.12.2007 | 9984 | 3 | 9981 |
| 01.01.2008 to 31.12.2008 | 9475 | 2 | 9473 |
| 01.01.2009 to 31.12.2009 | 9225 | 2 | 9223 |
| **TOTAL** | **35604** | **10** | **35594** |

*The details of calculation of emission reductions are presented as Excel spread sheets.*

## 12. Measures to ensure the results/uncertainty analysis

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 daily at project site and the same is being verified by the respective officials.

## 13. Details of Monitoring team and Responsibilities

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.

| | | | | |
|---|---|---|---|---|
| Name of facility | Shahapur D-9 | | | |
| Dates on which IA was conducted | 21.08.2006 | 01.03.2007 & 05.10.2007 | 07.03.2008 & 14.11.2008 | 10.03.2009 & 29.09.2009 |
| Name of facility | Mandagere | | | |

| | | | | |
|---|---|---|---|---|
| Dates on which IA was conducted | 11.08.2006 & 29.11.2006 | 06.03.2007 & 09.10.2007 | 17.03.2008 & 07.11.2008 | 12.03.2009 & 24.09.2009 |

**Summary of the audit findings are as below:**

1. **Shahapur-D9 Project**

**Between 21.08.2006 & 29.09.2009, 7 internal audits have been conducted at Shahapur-D9 project. During the course of audits 16 opportunities for improvements, 16 positive observations and 7 non conformance were recorded. Action plan for opportunity for improvements was implemented. Root cause analysis and corrective action were taken for non conformance.**

2. **Mandagere project:**

**Between 11.8.2006 & 24.09.2009, 8 internal audits have been conducted at Mandagere project. During the course of audits 19 opportunities for improvements, 14 positive observations and 4 non conformance were recorded. Action plan for opportunity for improvements was implemented. Root cause analysis and corrective action were taken for non conformance.**

**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 when ever 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.

**Enclosure I:**

**Contact information of participants in the project activity**

| | |
|---|---|
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| Represented by | |
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| Last Name: | S. |
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