

199.70 MW WIND PROJECT IN MAHARASHTRA BY BWDPL



Document Prepared By - **EKI Energy Services Limited**

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The main purpose of this project activity is to generate clean form of electricity through renewable wind energy source. Bothe Windfarm Development Pvt. Ltd. is the promoter of the proposed project activity. The Project activity envisages implementation of 40 WTGs of individual capacity 2 MW each, and 57 WTGs of individual capacity 2.1 MW each, in the state of Maharashtra. The technology employed is of Suzlon Energy Limited (2.1 MW) and Vestas (2 MW). The total project capacity is 199.7 MW.

The Project activity is a new facility (Greenfield) and it plans to utilize wind energy to generate electricity and supply it to distribution licensees which is a part of the NEWNE (Northern, Eastern, Western and North-Eastern) grid of India.

Start date for this project is 17th May 2013. This is the day on which the first WTG was commissioned under the Project activity.

The Project activity is supplying 492,918.68 MWh of energy to the NEWNE Grid of India during the current monitoring period. This result in emission reductions of 481,581 tCO_{2e} by its operation during the current monitoring period.

Connectivity of WTG's adjoining to its feeders is provided in Appendix 1 below.

1.2 Sectoral Scope and Project Type

As per the categorization by UNFCCC, the project activity falls under: "Grid-connected electricity generation from renewable sources" Sectoral Scope 1.

Methodology applied is ACM 0002 of version 16.0¹

Project type is renewable (wind).

The project is not a grouped project activity.

1.3 Project Proponent

The project proponent details are as follows:

Organization name	Bothe Windfarm Development Pvt. Ltd.
Contact person	Mr. Himir Shah
Title	Sr. Manager - Corporate Finance

¹ <https://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83>

Address	102, 'El Tara Building', Orchard Avenue, Hiranandani, Powai, Mumbai - 400 076
Telephone	+91-22-25701567
Email	himir.shah@continuumenergy.in

1.4 Other Entities Involved in the Project

Not applicable

1.5 Project Start Date

The project start date for this project is 17th May 2013. This is the day on which the first WTG was commissioned under the Project activity.

1.6 Project Crediting Period

The Project has begun generating GHG emission reductions from 17th May 2013. Hence, crediting period for VCS begins on 17th May 2013 and ends on 16th May 2023 i.e. 10 years crediting period which can be renewed for maximum 2 times.

Under the current verification cycle the emission reduction was considered for the crediting period 17/05/2013 to 01/04/2016.

1.7 Project Location

The project activity is located in 9 villages namely, Khokade, Bothe, Ransingwadi, Shripalwan, Ugalyachiwadi, Khandyachiwadi, Garudachiwadi, Katalgewadi, and Shirawali, in Satara district in the state of Maharashtra.

S No.	WTG ID	Village Name	Commissioning Date	Easting	Northing	Turbine Type
1	I - 48	Khokade	21-06-13	432715	1970045	Vestas V100 - 2.0 MW
2	I - 64	Khokade	21-06-13	432816	1969730	Vestas V100 - 2.0 MW
3	I - 1	Khokade	27-05-13	433203	1970143	Vestas V100 - 2.0 MW
4	I - 66	Khokade	20-09-13	433311	1969611	Vestas V100 - 2.0 MW
5	I - 7	Khokade	17-05-13	433073	1969188	Vestas V100 - 2.0 MW
6	I - 23	Khokade	18-06-13	433292	1968940	Vestas V100 - 2.0 MW
7	I - 25	Khokade	21-06-13	433388	1968741	Vestas V100 - 2.0 MW
8	I - 29	Khokade	21-06-13	433497	1968475	Vestas V100 - 2.0 MW
9	I - 68	Khokade	21-06-13	433145	1968359	Vestas V100 - 2.0 MW
10	I - 2	Khokade	27-05-13	432698	1969429	Vestas V100 - 2.0 MW

11	I - 21	Khokade	18-06-13	433898	1968102	Vestas V100 - 2.0 MW
12	I - 27	Khokade	21-06-13	433987	1967849	Vestas V100 - 2.0 MW
13	I - 3	Khokade	27-05-13	433976	1968556	Vestas V100 - 2.0 MW
14	I - 39	Khokade	21-08-13	433489	1969269	Vestas V100 - 2.0 MW
15	I - 49	Khokade	09-10-13	433922	1969250	Vestas V100 - 2.0 MW
16	I - 30	Khokade	10-10-13	434504	1969161	Vestas V100 - 2.0 MW
17	I - 15	Bothe	10-10-13	433794	1964844	Vestas V100 - 2.0 MW
18	I - 47	Bothe	09-10-13	435661	1967519	Vestas V100 - 2.0 MW
19	I - 59	Bothe	24-01-14	435304	1966889	Vestas V100 - 2.0 MW
20	I - 52	Bothe	20-02-14	433629	1965759	Vestas V100 - 2.0 MW
21	I - 8	Bothe	11-09-13	433264	1966630	Vestas V100 - 2.0 MW
22	I - 35	Bothe	11-09-13	435970	1964202	Vestas V100 - 2.0 MW
23	I - 37	Bothe	24-01-14	435510	1963836	Vestas V100 - 2.0 MW
24	I - 5	Bothe	15-06-13	433407	1966182	Vestas V100 - 2.0 MW
25	I - 56	Bothe	11-09-13	434341	1966878	Vestas V100 - 2.0 MW
26	I - 41	Bothe	11-09-13	434513	1967378	Vestas V100 - 2.0 MW
27	I - 63	Bothe	11-09-13	435018	1967306	Vestas V100 - 2.0 MW
28	I - 6	Bothe	11-09-13	435393	1965677	Vestas V100 - 2.0 MW
29	I - 60	Bothe	09-10-13	435495	1967133	Vestas V100 - 2.0 MW
30	I - 4	Bothe	15-06-13	435579	1966475	Vestas V100 - 2.0 MW
31	I - 42	Bothe	11-09-13	435133	1964729	Vestas V100 - 2.0 MW
32	I - 40	Bothe	24-01-14	435431	1964130	Vestas V100 - 2.0 MW
33	I - 43	Bothe	11-09-13	434906	1963444	Vestas V100 - 2.0 MW
34	I - 45	Bothe	11-09-13	435538	1963390	Vestas V100 - 2.0 MW
35	I - 33	Bothe	31-01-14	432975	1966213	Vestas V100 - 2.0 MW
36	I - 71	Bothe	24-01-14	434722	1966997	Vestas V100 - 2.0 MW
37	I - 72	Bothe	24-01-14	434947	1965611	Vestas V100 - 2.0 MW
38	I - 73	Bothe	31-01-14	433888	1966254	Vestas V100 - 2.0 MW
39	I - 75	Bothe	31-01-14	434436	1964724	Vestas V100 - 2.0 MW
40	I - 76	Bothe	24-01-14	435844	1964579	Vestas V100 - 2.0 MW
41	I - 22	Bothe	29-03-14	432941	1966570	Suzlon S97 - 2.1 MW
42	I - 57	Bothe	26-03-14	433278	1965448	Suzlon S97 - 2.1 MW
43	I - 16	Bothe	26-03-14	433126	1964908	Suzlon S97 - 2.1 MW
44	I - 24	Bothe	26-03-14	433947	1965241	Suzlon S97 - 2.1 MW
45	I - 34	Bothe	31-03-14	435075	1966583	Suzlon S97 - 2.1 MW
46	I - 26	Bothe	07-09-13	434809	1964382	Suzlon S97 - 2.1 MW
47	I - 77	Bothe	24-01-14	435082	1963199	Suzlon S97 - 2.1 MW
48	I - 81	Bothe	26-03-14	434952	1966183	Suzlon S97 - 2.1 MW
49	I - 82	Bothe	26-03-14	435841	1963715	Suzlon S97 - 2.1 MW
50	I - 18	Ransingwadi	30-03-14	435175	1962459	Suzlon S97 - 2.1 MW
51	SP40	Shripalwan	11-12-14	437702	1972737	Suzlon S97 - 2.1 MW

52	SP05	Shripalwan	11-12-14	437652	1971805	Suzlon S97 - 2.1 MW
53	SP06	Shripalwan	11-12-14	437635	1972144	Suzlon S97 - 2.1 MW
54	SP07	Shripalwan	11-12-14	437525	1972413	Suzlon S97 - 2.1 MW
55	SP08	Shripalwan	11-12-14	437221	1972545	Suzlon S97 - 2.1 MW
56	SP09	Shripalwan	11-12-14	438792	1972391	Suzlon S97 - 2.1 MW
57	SP10	Shripalwan	11-12-14	438573	1972616	Suzlon S97 - 2.1 MW
58	SP12	Shripalwan	25-12-14	439547	1972523	Suzlon S97 - 2.1 MW
59	SP13	Shripalwan	25-12-14	439328	1972768	Suzlon S97 - 2.1 MW
60	SP17	Shripalwan	25-12-14	439689	1973423	Suzlon S97 - 2.1 MW
61	SP19	Ugalyachiwadi	16-12-14	441226	1970762	Suzlon S97 - 2.1 MW
62	SP20	Ugalyachiwadi	16-12-14	441217	1971075	Suzlon S97 - 2.1 MW
63	SP21	Ugalyachiwadi	30-12-14	441113	1971358	Suzlon S97 - 2.1 MW
64	SP22	Khandyachiwadi	30-12-14	441487	1971736	Suzlon S97 - 2.1 MW
65	SP26	Khandyachiwadi	30-12-14	442326	1971555	Suzlon S97 - 2.1 MW
66	SP27	Khandyachiwadi	16-12-14	441879	1971908	Suzlon S97 - 2.1 MW
67	SP29	Khandyachiwadi	16-12-14	444070	1969891	Suzlon S97 - 2.1 MW
68	SP30	Khandyachiwadi	16-12-14	444028	1970223	Suzlon S97 - 2.1 MW
69	SP31	Khandyachiwadi	16-12-14	444072	1970498	Suzlon S97 - 2.1 MW
70	SP32	Khandyachiwadi	16-12-14	443768	1970738	Suzlon S97 - 2.1 MW
71	SP33	Khandyachiwadi	16-12-14	443821	1971105	Suzlon S97 - 2.1 MW
72	SP34	Khandyachiwadi	30-12-14	443637	1971320	Suzlon S97 - 2.1 MW
73	SP35	Khandyachiwadi	30-12-14	443207	1971303	Suzlon S97 - 2.1 MW
74	SP36	Khandyachiwadi	30-12-14	443201	1971719	Suzlon S97 - 2.1 MW
75	SP37	Khandyachiwadi	30-12-14	444567	1970614	Suzlon S97 - 2.1 MW
76	SP38	Khandyachiwadi	30-12-14	444335	1970801	Suzlon S97 - 2.1 MW
77	SP39	Khandyachiwadi	30-12-14	445038	1971267	Suzlon S97 - 2.1 MW
78	SP41	Garudachiwadi	16-12-14	441422	1972960	Suzlon S97 - 2.1 MW
79	SP24	Garudachiwadi	16-12-14	440601	1972323	Suzlon S97 - 2.1 MW
80	SP28	Garudachiwadi	30-12-14	441239	1972441	Suzlon S97 - 2.1 MW
81	I - 13	Ransingwadi	22-08-14	434217	1961171	Suzlon S97 - 2.1 MW
82	I - 19	Katalgewadi	01-10-14	434737	1961237	Suzlon S97 - 2.1 MW
83	I - 31	Katalgewadi	01-10-14	435289	1961773	Suzlon S97 - 2.1 MW
84	I - 38	Katalgewadi	03-11-14	435475	1961574	Suzlon S97 - 2.1 MW
85	I - 53	Katalgewadi	22-08-14	436157	1961880	Suzlon S97 - 2.1 MW
86	I - 69	Katalgewadi	03-11-14	434557	1960987	Suzlon S97 - 2.1 MW
87	I - 28	Shirawali	03-11-14	435370	1962109	Suzlon S97 - 2.1 MW
88	I - 46	Shirawali	22-08-14	435648	1962339	Suzlon S97 - 2.1 MW
89	I - 61	Shirawali	22-08-14	435954	1962087	Suzlon S97 - 2.1 MW
90	I - 51	Katalgewadi	03-11-14	436663	1962098	Suzlon S97 - 2.1 MW
91	I - 80	Shirawali	16-11-14	438325	1962057	Suzlon S97 - 2.1 MW
92	I - 78	Shirawali	27-11-14	437099	1961893	Suzlon S97 - 2.1 MW

93	I - 79	Shirawali	16-11-14	437872	1961810	Suzlon S97 - 2.1 MW
94	I - 83	Shirawali	16-11-14	437163	1962752	Suzlon S97 - 2.1 MW
95	I - 17	Shirawali	27-11-14	437427	1961851	Suzlon S97 - 2.1 MW
96	I - 84	Khandyachiwadi	30-12-14	444824	1971013	Suzlon S97 - 2.1 MW
97	SP25	Garudachiwadi	30-12-14	440644	1972737	Suzlon S97 - 2.1 MW

1.8 Title and Reference of Methodology

The methodology applied for the project is ACM0002 of version 16.0 titled “Grid-connected electricity generation from renewable sources²”

ACM0002 draws upon the following tools which have been used in the PDD:

- Tool to calculate the emission factor for an electricity system (Version 04)³
- Tool for demonstration and assessment of additionality (Version 7.0.0)⁴

1.9 Other Programs

The Project does not intend to participate in any other GHG mechanism which includes GHG allowance trading. It does not generate any other form of GHG-related environmental credit apart from GHG emission reductions or removals claimed under the VCS Program.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The implementation of the project has been started on 17-May-2013 and completed on 30-December-2014.

Wind power technology details – The technology employed, converts wind energy to electrical energy. In wind power generation, energy of wind is converted into mechanical energy and subsequently into electrical energy. The project activity is the installation of an environmentally safe and sound technology since there are no GHG emissions associated with the electricity generation.

The technical specifications of the WTGs have been provided as below. There is no transfer of technology involved in the project activity. The project activity consists of WTGs of Following Machines:-

Key Technical Particulars of Vestas V-100 2.0 MW WTG

² <https://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83>

³ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v4.0.pdf>

⁴ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-01-v7.0.0.pdf>

Particulars	Specifications
Make	Vestas
Model	V-100
Rated Capacity	2000 kW
Rotor Diameter	100 m
Hub height	95 m
Type of Tower	Tubular
Number of Blades	3
Geared/Gearless	Geared
Gear Box	One planetary stage and two helical stages
Cut-in Wind speed	3 m/s
Rated Wind speed	12 m/s
Cut-out Wind speed	20 m/s
Wind Class	IEC S (IEC IIIA average wind and IEC IIIA extreme wind)

Key Technical Particulars of Suzlon S- 97 90 2.1 MW WTG

Particulars	Specifications
Make	Suzlon
Model	S-97
Rotor diameter	97 m
Hub height	90 m
Estimated service life	20 years
Rated power	2.1 MW
Rated wind speed	11 m/s (without turbulence intensity according to GL guideline)
Cut in wind speed	3.0 m/s (30-second average)
Cut out wind speed	20 m/s (10-minute average)
Controller type	Programmable Logic Controller with SUZLON CONTROL SYSTEM software

No any events has occurred during the current monitoring period that may impact the GHG emission reductions or removals and monitoring.

2.2 Deviations

2.2.1 Methodology Deviations

The project activity has been implemented as described in the VCS-PD and there was no methodological deviation applied during the monitoring plan.

2.2.2 Project Description Deviations

No project description deviation is applied during the monitoring period.

2.3 Grouped Project

Not applicable as the project is non-grouped.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO ₂ /MWh
Description	Operating Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014 ⁵
Value applied:	0.9862 (NEWNE Grid)
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 04.0.0" as 3-year generation weighted average using data for the years 2011-2012, 2012-2013 & 2013-2014. The data are obtained from "CO ₂ Baseline Database for Indian Power Sector" version 10.0, published by the Central Electricity Authority, Ministry of Power, and Government of India.
Purpose of the data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO ₂ /MWh
Description	Built Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014 ⁶
Value applied:	0.9495 (NEWNE Grid)
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 04.0.0" as 3-year generation weighted average using data for the years 2011-2012, 2012-2013 & 2013-2014. The data are obtained from "CO ₂ Baseline Database for Indian Power Sector" version 10.0, published by the Central Electricity Authority, Ministry of Power, and Government of India.
Purpose of the data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ /MWh
Description	Combined Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014 ⁷
Value applied:	0.9770 (NEWNE Grid)
Justification of choice of data or description of measurement methods	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where:

⁵ http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf

⁶ http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf

⁷ http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf

and procedures applied	$EF_{grid,BM,y}$ = Build margin CO ₂ emission factor in year y (tCO ₂ /MWh) $EF_{grid,OM,y}$ = Operating margin CO ₂ emission factor in year y (tCO ₂ /MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM} = Weighting of build margin emissions factor (%) = 25%
Purpose of the data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

3.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project to the grid in year y
Source of data	Monthly electricity share certificates
Description of measurement methods and procedures to be applied	The value of net electricity generation supplied to the grid as per Monthly electricity share certificates forms the basis for calculation of the emission reductions; which can be cross checked from the invoice raised to DISCOM. Net electricity supplied to grid will be calculated as the difference of the measured values of “export” and “import” of electricity through the dedicated SEB energy meter (electronic trivector bidirectional main meter & check meter which measures both export & import concurrently) installed at the delivery point (i.e. the connected substation). Net electricity generated and supplied by the project to the grid = Electricity Export to the grid - Electricity Import from the grid Monthly meter readings are taken from the main and check meter installed at the substation and certified by the representatives of SEB Officials and the representatives of the project proponent. For apportioning procedure refer section 3.3 of the monitoring report.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and at least monthly recording
Value monitored:	492,918.68
Monitoring equipment	Monitoring: Tri vector meter will be used Data type: Measured Type of meter: Static type meter (Main & Check). Both are Bidirectional meters. Class of meter: 0.2s.

QA/QC procedures to be applied	• The energy meter reading are taken on monthly basis • Energy meters will be calibrated annually and faulty meters will be duly replaced immediately. • All the energy meters are under the control of state utility and calibration/testing of energy meters is also under the jurisdiction of state utility. • The Net electricity exported to the grid will be cross checked against the invoice raised by the PP towards the DISCOM
Purpose of the data	Calculation of Baseline emissions
Calculation method	-
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years.

3.3 Monitoring Plan

The monitoring methodology specified in the methodology requires that the project-monitoring plan to consist of monitoring of quantity of net electricity supplied to the grid in the year y. In order to monitor the mitigation of GHG due to the project activity, the total energy exported needs to be measured. The net energy supplied to grid by the project activity multiplied by emission factor for regional grid, would form the baseline for the project activity.

Since the baseline emission factor is based on an ex-ante determination, monitoring of this parameter is not required. The sole parameter for monitoring is the net electricity exported to the grid.

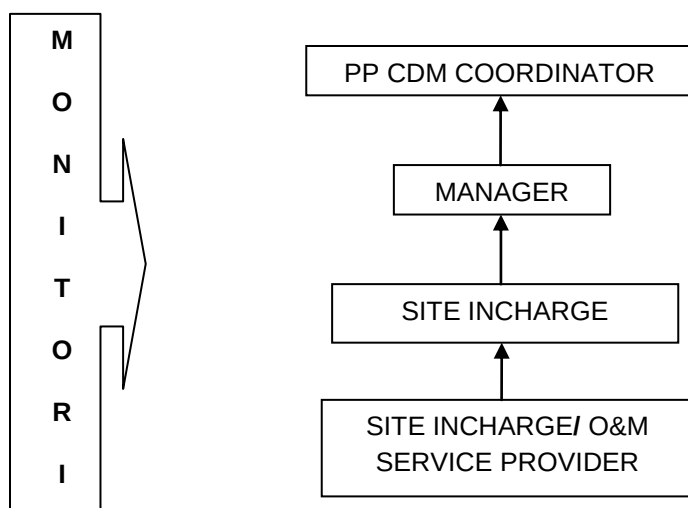
Aim of monitoring:

The monitoring procedure will set guidelines for the project investor to monitor the parameters regularly and to ensure quality and accuracy in monitoring. It elaborates on the functions of the monitoring team and procedures to be followed in monitoring of the CDM parameters.

The monitoring shall include all the equipment's that contribute towards reduction in GHG emissions. Since the project activity focuses mainly on the generation of renewable power, it is important to monitor all the equipment involved in the metering of all the necessary instruments.

The project investor has a well-defined management structure for monitoring the project activity.

Organizational Structure for monitoring



Organizational Structure for monitoring:

Designation	Responsibilities
PP CDM COORDINATOR	Overall project monitoring including collecting and aggregating JMRs/Invoices for all WTG investors
MANAGER	Holds complete control over monitoring aspects pertaining to the project
SITE INCHARGE	• Recording • Verification • Storage of Data
SITE INCHARGE/ O&M SERVICE PROVIDER	• Operation and Maintenance • Storage of data • Data Recording

In case of NEWNE grid, multiple WTGs would be connected to the feeder, one of which would be part of the project activity and rest of which would not be part of the project activity (WTGs owned by other entities). The import and export of electricity is continuously monitored by the export/import meter and the data is recorded on a monthly basis jointly by the proponent and the electricity board. The meter is located at the delivery point of wind power in the grid. This accounts for the import of electricity that is used by the Project proponent. Hence the net electricity generated is calculated from the joint meter reading and recorded /archived in paper/electronic.

SEB/O&M Contractor follows an apportioning procedure to account for electricity generation from individual WTGs based on data from individual WTG controllers.

Following the joint meter readings, apportioning of net electricity supplied to grid by each WTG is done by the SEB/O&M Contractor based on the individual meter readings recorded from the controller panel meter of each WTG and based on the meter reading recorded from the meters situated at the connected substations.

Based on the monthly export and import data as per main/check meters and the WTG controller readings, SEB provides a break-up of the electricity exported and imported for each WTG.

A monthly joint meter reading of the energy meters is taken by MSEDCL officials and O&M contractors (representatives of the project investor). Apportioning of net electricity generation from each WTG connected to NEWNE grid is then determined as follows:

1.	Apportioning Ratio	=	Generation at WTG Controller
			Total Generation of All WTG Controller for the feeder
2.	Electricity Import from WTG by the grid (EG_{import})	=	Import from Main/Check Meter * Apportioning Ratio
3.	Electricity Export to the WTGs by the grid (EG_{export})	=	Export from Main/Check Meter * Apportioning Ratio
4.	Net electricity generated by WTG	=	Electricity Import from WTG by the grid – Electricity Export to the WTGs by the grid

Above steps for calculation of EG_{import} and EG_{export} are carried out by MSEDCL Officials & energy break-up sheet is issued by the MSEDCL Officials. Based on the break-up sheets Project investor raises invoice to DISCOM which forms the cross-check for the net electricity generated. The Project investor has no role in the entire procedure of apportioning

Emergency Preparedness and Uncertainty Procedure:

In case Main meter or check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the check meter will be used. In case both the main and check meter are found to be outside the acceptable limits of accuracy or faulty or not functioning properly, both the meters shall be calibrated immediately and the error percentage found in the main meter during its calibration shall be applied to its metered energy data for the entire period since its last calibration to obtain the corrected value of net electricity exported to the grid.

Data Recording and Archiving:

O&M operator will keep complete and accurate records of operating log at the Power Plant. The data will be archived electronically as well as in log books at the power plant and will be kept for two years after the end of the crediting period or the last issuance of VERs for this project activity, whichever occurs later.

In case the dates of a particular monitoring period do not match with the dates of the billing cycle, the net electricity exported to the grid would be calculated from:

- Apportioning the net electricity exported to grid, as recorded in the consolidated Share Certificate / JMR Report / Credit Notes certified by the respective state discom, based on the number of days in the monitoring period and the number of days for which Share Certificate / JMR Report / Credit Notes was prepared.

The calculated value after apportioning would be used for calculation of emission reductions during that period.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The baseline emissions are calculated using the following formula:

$$\text{Baseline Emissions (BE}_y\text{)} = \text{EG}_{PJ,y} \times \text{EF}_{\text{Grid,CM},y}$$

Where:

BE_y = Baseline emissions in year y (tCO₂/yr)

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

$\text{EF}_{\text{grid,CM},y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system, ver. 02.2.1” (tCO₂/MWh)

As per the VCS PD, the baseline emissions factor ($\text{EF}_{\text{Grid,CM},y}$) is 0.9770 tCO₂/MWh

The net electricity exported to the grid and baseline emissions are given below:

Period	Net Electricity generation (MWh)	Baseline emissions factor (tCO ₂ /MWh)	Baseline emissions (ER _y)
17-05-2013 to 31-12-2013	68,835.44	0.9770	67,252.23
01-01-2014 to 31-12-2014	235,525.87	0.9770	230,108.77
01-01-2015 to 31-12-2015	131,718.83	0.9770	128,689.29
01-01-2016 to 01-04-2016*	56,838.54	0.9770	55,531.25
Total	492,918.68	-	4,81,581⁸

*Calculation details are provided in excel worksheets

4.2 Project Emissions

As per the para 35 of methodology ACM0002 (Version 16.0), “For most renewable power generation project activities, $\text{PE}_y = 0$.”

4.3 Leakage

As per para 60 of the methodology ACM0002 (Version 16.0) does not consider any leakage emissions.

4.4 Net GHG Emission Reductions and Removals

The emission reductions are calculated as per the equation:

⁸ Round down values

$$ER = BE - PE - LE$$

ER – Emission Reduction (tCO_{2e})

BE - Baseline Emissions (tCO_{2e})

PE – Project Emissions (tCO_{2e})

LE - Leakage Emissions (tCO_{2e}).

$$ER = BE - PE - LE = 481,581 - 0 - 0 = 481,581 \text{ tCO}_{2e}$$

Year	Baseline emissions or removals (tCO _{2e})	Project emissions or removals (tCO _{2e})	Leakage emissions (tCO _{2e})	Net GHG emission reductions or removals (tCO _{2e})
Year 2013	67,252.23	0	0	67,252.23
Year 2014	230,108.77	0	0	230,108.77
Year 2015	128,689.29	0	0	128,689.29
Year 2016	55,531.25	0	0	55,531.25
Total	481,581	0	0	481,581 ⁹

⁹ Round down values

APPENDIX 1: <CALIBRATION, FEEDER AND BREAKDOWN DETAILS OF WIND MILLS>

Calibration Details of the WTGs installed in the project activity is provided below:

Details	Calibration details of the_meters at Feeder No. 1	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	15687851	5269326
Date of calibration	17/05/2013	17/05/2013
Due Date of calibration	16/05/2016 ¹⁰	16/05/2016
Calibration delay	No delay	No delay

Details	Calibration details of the_meters at Feeder No. 2	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	15687861	15687859
Date of calibration	22/08/2014	22/08/2014
Due Date of calibration	21/08/2017 ¹¹	21/08/2017
Calibration delay	No delay	No delay

Details	Calibration details of the_meters at Feeder No. 3	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	05269324	05269316

¹⁰ As per registered PD calibration frequency is once in three years.

¹¹ As per registered PD calibration frequency is once in three years.

Date of calibration	15/06/2013	15/06/2013
Due Date of calibration	14/06/2016 ¹²	14/06/2016
Calibration delay	No delay	No delay

Details	Calibration details of the_meters at Feeder No. 4	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	05269327	15687848
Date of calibration	15/06/2013	15/06/2013
Due Date of calibration	14/06/2016 ¹³	14/06/2016
Calibration delay	No delay	No delay

Details	Calibration details of the_meters at Feeder No. 5	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	16351048	16351049
Date of calibration	30/03/2014	30/03/2014
Due Date of calibration	29/03/2017 ¹⁴	29/03/2017
Calibration delay	No delay	No delay

¹² As per registered PD calibration frequency is once in three years.

¹³ As per registered PD calibration frequency is once in three years.

¹⁴ As per registered PD calibration frequency is once in three years.

Details	Calibration details of the_meters at Feeder No. 6	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	16351050	16351051
Date of calibration	21/06/2013	21/06/2013
Due Date of calibration	20/06/2016 ¹⁵	20/06/2016
Calibration delay	No delay	No delay

Details	Calibration details of the_meters at Feeder No. 7	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	16351052	16351053
Date of calibration	26/12/2014	26/12/2014
Due Date of calibration	25/12/2017 ¹⁶	25/12/2017
Calibration delay	No delay	No delay

Details	Calibration details of the_meters at Feeder No.8	
Type of meter	Main Meter	Check Meter
Accuracy class	0.2 s	0.2 s
Meter Make	Elster	Elster
Meter Sr. No.	16351054	16351055
Date of calibration	11/12/2014	11/12/2014
Due Date of calibration	10/12/2017 ¹⁷	10/12/2017

¹⁵ As per registered PD calibration frequency is once in three years.

¹⁶ As per registered PD calibration frequency is once in three years.

¹⁷ As per registered PD calibration frequency is once in three years.

Calibration delay	No delay	No delay
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Calibration of meter and feeder connectivity details:-

Feeder	WTG ID														
FID 1	I-1	I-2	I-3	I-7	I-21	I-23	I-25	I-29	I30	I-39	I-48	I49	I-64	I66	
FID 2	I13	I46	I53	I61	I19	I31	I28	I38	I51	I69	I80	I83	I79	I17	I78
FID 3	I-5	I06	I08	I33	I52	I72	I73	I24	I57	I22					
FID 4	I-4	I41	I47	I56	I59	I60	I63	I71	I81	I34					
FID 5	I15	I35	I37	I40	I42	I43	I45	I75	I76	I26	I77	I16	I82	I18	
FID 6	I-27	I-68	SP19	SP20	SP24	SP27	SP41	SP21	SP22	SP25	SP26	SP28			
FID 7	SP29	SP30	SP31	SP32	SP33	I84	SP34	SP35	SP36	SP37	SP38	SP39			
FID 8	SP05	SP06	SP07	SP08	SP09	SP10	SP40	SP12	SP13	SP17					

Breakdown details

State	Maharashtra			Monthly Performance Report					Date:17/03/2013-01/04/2016		
WTG No.	Generation		Lack Of Wind	Down Time					Machine Avail ability (%)	Capaci ty Factor (%)	Grid Avai abilit y (%)
	KWh	Hrs		Machine		Grid		Total			
				Fault	Shutdow n	Fault	Shutdown				
Site: BOTHE MAHARASHTRA			Bothe Windfarm Development Pvt. Ltd.							Total WEC : 97	
I - 48	3,721,959	20822:00	1909:12:00	102:55:00	102:04:00	216:01:00	214:47:00	2649:43:00	99.12	19.9	97.72
I - 64	3,695,241	20896:00	1831:04:00	112:54:00	94:29:00	214:15:00	214:22:00	2571:48:00	99.11	19.76	97.73
I - 1	3,891,549	20771:00	1939:38:00	131:44:00	93:41:00	212:57:00	215:39:00	2698:23:00	99.04	20.81	97.73
I - 66	3,822,707	20831:00	1903:38:00	110:54:00	96:23:00	214:15:00	211:31:00	2641:25:00	99.11	20.44	97.75
I - 7	3,421,419	20537:00	1845:18:00	469:44:00	93:51:00	214:20:00	214:47:00	2942:44:00	97.59	18.3	97.73
I - 23	3,612,330	20850:00	1829:57:00	142:30:00	125:26:00	213:04:00	214:47:00	2630:28:00	98.85	19.32	97.74
I - 25	3,689,787	20970:00	1861:39:00	54:10:00	88:32:00	170:25:00	219:15:00	2498:45:00	99.39	19.73	97.9
I - 29	3,716,312	20838:00	1939:26:00	112:51:00	90:38:00	166:00:00	219:15:00	2632:54:00	99.13	19.87	97.92
I - 68	3,723,671	20925:00	1860:29:00	84:40:00	104:13:00	168:12:00	217:20:00	2539:38:00	99.19	19.91	97.92
I - 2	3,942,221	21080:00	1794:56:00	15:29	79:04:00	169:40:00	219:15:00	2383:08:00	99.6	21.08	97.9
I - 21	4,026,084	21048:00	1717:46:00	103:27:00	102:54:00	168:52:00	219:15:00	2416:58:00	99.12	21.53	97.91
I - 27	3,806,484	20945:00	1886:41:00	63:36:00	77:02:00	194:52:00	197:40:00	2524:35:00	99.4	20.35	97.89
I - 3	3,952,678	21028:00	1661:46:00	172:10:00	87:57:00	207:27:00	207:09:00	2438:47:00	98.89	21.14	97.8
I - 39	4,078,569	20830:00	1969:25:00	79:57:00	88:45:00	170:10:00	219:15:00	2629:50:00	99.28	21.81	97.91
I - 49	3,947,340	20958:00	1866:25:00	65:11:00	78:28:00	169:26:00	219:15:00	2501:03:00	99.39	21.11	97.91
I - 30	3,917,222	21121:00	1683:52:00	52:01:00	80:00:00	211:59:00	213:23:00	2343:33:00	99.44	20.95	97.76
I - 15	3,919,444	21033:00	1692:16:00	138:47:00	83:57:00	208:39:00	214:47:00	2440:44:00	99.05	20.96	97.77
I - 47	4,107,825	21156:00	1683:20:00	41:51:00	94:50:00	169:43:00	219:15:00	2311:17:00	99.42	21.97	97.91

I - 59	3,581,630	20683:00	2087:01:00	84:37:00	105:41:00	166:15:00	219:15:00	2765:07:00	99.19	19.15	97.93
I - 52	3,546,450	20592:00	2086:42:00	134:05:00	107:27:00	164:35:00	219:15:00	2817:53:00	98.97	18.96	97.94
I - 8	3,970,962	20944:00	1872:50:00	76:32:00	85:15:00	169:40:00	219:15:00	2525:50:00	99.31	21.23	97.91
I - 35	4,156,800	21005:00	1813:10:00	62:38:00	89:36:00	169:40:00	219:15:00	2456:37:00	99.35	22.23	97.91
I - 37	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 5	3,666,551	20649:00	1852:35:00	373:00:00	115:14:00	158:53:00	214:42:00	2816:42:00	97.91	19.61	97.98
I - 56	4,170,663	20847:00	1919:02:00	85:21:00	91:26:00	170:01:00	219:15:00	2587:23:00	99.24	22.3	97.91
I - 41	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
I - 63	3,697,889	20997:00	1827:18:00	36:24:00	46:45:00	202:42:00	197:02:00	2530:51:00	99.64	19.77	97.87
I - 6	3,539,324	20956:00	1770:38:00	91:58:00	84:36:00	200:45:00	204:40:00	2573:17:00	99.24	18.93	97.84
I - 60	3,949,699	21169:00	1676:08:00	16:55	61:49:00	201:20:00	204:40:00	2381:32:00	99.66	21.12	97.84
I - 4	3,683,118	20890:00	1882:29:00	25:15:00	69:33:00	217:01:00	203:02:00	2618:00:00	99.59	19.7	97.78
I - 42	3,899,060	21138:00	1670:32:00	24:34:00	46:45:00	200:53:00	204:40:00	2368:04:00	99.69	20.85	97.84
I - 40	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 43	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 45	3,666,551	20649:00	1852:35:00	373:00:00	115:14:00	158:53:00	214:42:00	2816:42:00	97.91	19.61	97.98
I - 33	3,899,060	21138:00	1670:32:00	24:34:00	46:45:00	200:53:00	204:40:00	2368:04:00	99.69	20.85	97.84
I - 71	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 72	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 73	3,723,671	20925:00	1860:29:00	84:40:00	104:13:00	168:12:00	217:20:00	2539:38:00	99.19	19.91	97.92
I - 75	3,942,221	21080:00	1794:56:00	15:29	79:04:00	169:40:00	219:15:00	2383:08:00	99.6	21.08	97.9
I - 76	3,723,671	20925:00	1860:29:00	84:40:00	104:13:00	168:12:00	217:20:00	2539:38:00	99.19	19.91	97.92
I - 22	3,942,221	21080:00	1794:56:00	15:29	79:04:00	169:40:00	219:15:00	2383:08:00	99.6	21.08	97.9
I - 57	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 16	3,666,551	20649:00	1852:35:00	373:00:00	115:14:00	158:53:00	214:42:00	2816:42:00	97.91	19.61	97.98
I - 24	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
I - 34	3,697,889	20997:00	1827:18:00	36:24:00	46:45:00	202:42:00	197:02:00	2530:51:00	99.64	19.77	97.87
I - 26	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
I - 77	4,272,167	20960:00	1801:49:00	113:51:00	96:57:00	169:40:00	219:15:00	2503:50:00	99.1	22.85	97.91
I - 81	3,723,671	20925:00	1860:29:00	84:40:00	104:13:00	168:12:00	217:20:00	2539:38:00	99.19	19.91	97.92
I - 82	3,942,221	21080:00	1794:56:00	15:29	79:04:00	169:40:00	219:15:00	2383:08:00	99.6	21.08	97.9

I - 18	3,723,671	20925:00	1860:29:00	84:40:00	104:13:00	168:12:00	217:20:00	2539:38:00	99.19	19.91	97.92
SP40	3,942,221	21080:00	1794:56:00	15:29	79:04:00	169:40:00	219:15:00	2383:08:00	99.6	21.08	97.9
SP05	3,917,222	21121:00	1683:52:00	52:01:00	80:00:00	211:59:00	213:23:00	2343:33:00	99.44	20.95	97.76
SP06	3,919,444	21033:00	1692:16:00	138:47:00	83:57:00	208:39:00	214:47:00	2440:44:00	99.05	20.96	97.77
SP07	4,107,825	21156:00	1683:20:00	41:51:00	94:50:00	169:43:00	219:15:00	2311:17:00	99.42	21.97	97.91
SP08	3,581,630	20683:00	2087:01:00	84:37:00	105:41:00	166:15:00	219:15:00	2765:07:00	99.19	19.15	97.93
SP09	3,546,450	20592:00	2086:42:00	134:05:00	107:27:00	164:35:00	219:15:00	2817:53:00	98.97	18.96	97.94
SP10	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
SP12	3,697,889	20997:00	1827:18:00	36:24:00	46:45:00	202:42:00	197:02:00	2530:51:00	99.64	19.77	97.87
SP13	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
SP17	3,697,889	20997:00	1827:18:00	36:24:00	46:45:00	202:42:00	197:02:00	2530:51:00	99.64	19.77	97.87
SP19	3,721,959	20822:00	1909:12:00	102:55:00	102:04:00	216:01:00	214:47:00	2649:43:00	99.12	19.9	97.72
SP20	3,695,241	20896:00	1831:04:00	112:54:00	94:29:00	214:15:00	214:22:00	2571:48:00	99.11	19.76	97.73
SP21	3,891,549	20771:00	1939:38:00	131:44:00	93:41:00	212:57:00	215:39:00	2698:23:00	99.04	20.81	97.73
SP22	3,822,707	20831:00	1903:38:00	110:54:00	96:23:00	214:15:00	211:31:00	2641:25:00	99.11	20.44	97.75
SP26	3,421,419	20537:00	1845:18:00	469:44:00	93:51:00	214:20:00	214:47:00	2942:44:00	97.59	18.3	97.73
SP27	3,612,330	20850:00	1829:57:00	142:30:00	125:26:00	213:04:00	214:47:00	2630:28:00	98.85	19.32	97.74
SP29	3,721,959	20822:00	1909:12:00	102:55:00	102:04:00	216:01:00	214:47:00	2649:43:00	99.12	19.9	97.72
SP30	3,695,241	20896:00	1831:04:00	112:54:00	94:29:00	214:15:00	214:22:00	2571:48:00	99.11	19.76	97.73
SP31	3,970,962	20944:00	1872:50:00	76:32:00	85:15:00	169:40:00	219:15:00	2525:50:00	99.31	21.23	97.91
SP32	3,917,222	21121:00	1683:52:00	52:01:00	80:00:00	211:59:00	213:23:00	2343:33:00	99.44	20.95	97.76
SP33	3,919,444	21033:00	1692:16:00	138:47:00	83:57:00	208:39:00	214:47:00	2440:44:00	99.05	20.96	97.77
SP34	4,107,825	21156:00	1683:20:00	41:51:00	94:50:00	169:43:00	219:15:00	2311:17:00	99.42	21.97	97.91
SP35	3,581,630	20683:00	2087:01:00	84:37:00	105:41:00	166:15:00	219:15:00	2765:07:00	99.19	19.15	97.93
SP36	3,546,450	20592:00	2086:42:00	134:05:00	107:27:00	164:35:00	219:15:00	2817:53:00	98.97	18.96	97.94
SP37	3,970,962	20944:00	1872:50:00	76:32:00	85:15:00	169:40:00	219:15:00	2525:50:00	99.31	21.23	97.91
SP38	3,917,222	21121:00	1683:52:00	52:01:00	80:00:00	211:59:00	213:23:00	2343:33:00	99.44	20.95	97.76
SP39	3,721,959	20822:00	1909:12:00	102:55:00	102:04:00	216:01:00	214:47:00	2649:43:00	99.12	19.9	97.72
SP41	3,695,241	20896:00	1831:04:00	112:54:00	94:29:00	214:15:00	214:22:00	2571:48:00	99.11	19.76	97.73
SP24	3,891,549	20771:00	1939:38:00	131:44:00	93:41:00	212:57:00	215:39:00	2698:23:00	99.04	20.81	97.73
SP28	3,822,707	20831:00	1903:38:00	110:54:00	96:23:00	214:15:00	211:31:00	2641:25:00	99.11	20.44	97.75

I - 13	3,421,419	20537:00	1845:18:00	469:44:00	93:51:00	214:20:00	214:47:00	2942:44:00	97.59	18.3	97.73
I - 19	3,612,330	20850:00	1829:57:00	142:30:00	125:26:00	213:04:00	214:47:00	2630:28:00	98.85	19.32	97.74
I - 31	3,721,959	20822:00	1909:12:00	102:55:00	102:04:00	216:01:00	214:47:00	2649:43:00	99.12	19.9	97.72
I - 38	3,695,241	20896:00	1831:04:00	112:54:00	94:29:00	214:15:00	214:22:00	2571:48:00	99.11	19.76	97.73
I - 53	3,891,549	20771:00	1939:38:00	131:44:00	93:41:00	212:57:00	215:39:00	2698:23:00	99.04	20.81	97.73
I - 69	3,822,707	20831:00	1903:38:00	110:54:00	96:23:00	214:15:00	211:31:00	2641:25:00	99.11	20.44	97.75
I - 28	3,421,419	20537:00	1845:18:00	469:44:00	93:51:00	214:20:00	214:47:00	2942:44:00	97.59	18.3	97.73
I - 46	3,917,222	21121:00	1683:52:00	52:01:00	80:00:00	211:59:00	213:23:00	2343:33:00	99.44	20.95	97.76
I - 61	3,919,444	21033:00	1692:16:00	138:47:00	83:57:00	208:39:00	214:47:00	2440:44:00	99.05	20.96	97.77
I - 51	4,107,825	21156:00	1683:20:00	41:51:00	94:50:00	169:43:00	219:15:00	2311:17:00	99.42	21.97	97.91
I - 80	3,581,630	20683:00	2087:01:00	84:37:00	105:41:00	166:15:00	219:15:00	2765:07:00	99.19	19.15	97.93
I - 78	3,546,450	20592:00	2086:42:00	134:05:00	107:27:00	164:35:00	219:15:00	2817:53:00	98.97	18.96	97.94
I - 79	3,970,962	20944:00	1872:50:00	76:32:00	85:15:00	169:40:00	219:15:00	2525:50:00	99.31	21.23	97.91
I - 83	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
I - 17	3,697,889	20997:00	1827:18:00	36:24:00	46:45:00	202:42:00	197:02:00	2530:51:00	99.64	19.77	97.87
I - 84	3,938,852	20671:00	1784:24:00	407:44:00	113:10:00	169:35:00	217:00:00	2794:11:00	97.77	21.06	97.92
SP25	3,697,889	20997:00	1827:18:00	36:24:00	46:45:00	202:42:00	197:02:00	2530:51:00	99.64	19.77	97.87