49.5 MW WIND POWER PROJECT BY MASTER WIND ENERGY LIMITED IN PAKISTAN

Document Prepared by Emergent Ventures International Pte. Ltd.

Project Title	*49.5 MW Wind Power Project by Master Wind Energy Limited in Pakistan*
Version	*1.2*
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

M/s. Master Wind Energy Limited (hereafter referred to as the "MWEL") has set up a 52.8 MW grid-connected wind energy project in Jhampir, Thatta, in Pakistan. The Project comprises the installation of 33 wind turbines of 1.6 MW each.

The project has been commissioned and achieved start of commercial operation on 14th October 2016 and is under operation since.

The current verification covers the monitoring period from **14-October-2016 to 31-October-2021**. The project achieved GHG emission reductions equal to **417,782 tCO2e** during the period.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 01 - Energy industries (renewable / non-renewable sources)

Project Type: I-Renewable Energy Projects

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	M/s. Master Wind Energy Limited
Contact person	Rumman A. Dar
Title	CEO
Address	82-C/1, Gulberg III, Lahore, Pakistan
Telephone	-
Email	rumman.dar@masterwind.com.pk

1.4 Other Entities Involved in the Project

Organization name	Emergent Ventures International Pte. Ltd.
Role in the Project	Project Consultant

Contact person	Atul Sanghal
Title	Business Head
Address	10 Anson Road, #29-03 A, International Plaza, Singapore - 079903
Telephone	+91-97173 96309
Email	contact@emergent-ventures.com

1.5 Project Start Date

14-October-2016

1.6 Project Crediting Period

Crediting Period Start Date: 14-October-2016

Crediting Period End Date: 13-October-2026

Total number of years of the crediting period: 10 years

1.7 Project Location

The project is located at Jhimpir, District Thatta, Sindh, Pakistan. Geo-coordinates of individual WTGs are provided below:

Turbine No.	Easting 'E' (M)	Northing 'N' (M)
T-01	397799	2776086
T-02	397862	2775205
T-03	398056	2775078
T-04	398269	2774934
T-05	398447	2774799
T-06	398653	2774657
T-07	398860	2774521
T-08	399074	2774379
T-09	399280	2774243
T-10	399487	2774101
T-11	399679	2773965

T-12	399879	2773823
T-13	400028	2773713
T-14	400292	2773517
T-15	400499	2773395
T-16	400691	2773267
T-17	400891	2773132
T-18	401090	2773004
T-19	398261	2776990
T-20	398468	2776222
T-21	398661	2776094
T-22	398844	2775984
T-23	399008	2775852
T-24	399188	2775745
T-25	399363	2775611
T-26	399532	2775477
T-27	399707	2775346
T-28	399890	2775228
T-29	399522	2777939
T-30	399102	2778188
T-31	399224	2777334
T-32	398738	2776787
T-33	400087	2775076

The above mentioned geo-coordinates are provided in UTM system. The applicable grid zone[1] is 42 R.

The project location has been highlighted on the map of Pakistan.

[1] http://www.dmap.co.uk/utmworld.htm


PAKISTAN
CHINA
TURKMENISTAN
AFGHANISTAN
IRAN
INDIA
Chitral
Malam Jabba
Mongora
Takht Bhai
Mardan
Peshawar
Faisal Mosque
ISLAMABAD
Taxila
Rawalpindi
Rohtas Fort
Jhelum
Bannu
Mianwali
Rani Mahal
Sialkot
Takht-e-Sulaiman
3,487 m
Tank
Thal
Desert
Gujranwala
Lahore
Lahore Fort
Badshahi Mosque
Faisalabad
Khybar Pass
Zhob
Koh-i-Takatu
3,472 m
Harappa
Quetta
Zarghun Ghar
3,578 m
Bolan Pass
Multan
Dera Ghazi Khan
Rukn-e-Alam
Bahawalpur
Cholistan Desert
Nushki
Nok Kundi
Kharan
Khanpur
Jacobabad
Rahimyar Khan
Siahan Range
Larkana
Sukkur
Panjgur
Moen Jo Daro
Turbat
Bela
Nawabshah
Kirthar NP
Makran Coast Range
Makran Coast
Mirpur Khas
Gwadar
Hingol NP
Hyderabad
Jiwani
Pasni
Chaukhandi Tombs
Mohatta Palace
Karachi
Tatta
Arabian Sea
LEGEND
Country Boundary
Major Road
River
Major Town
Other Town
Country Capital
Airport
Point of Interest
National Park
Mt. Peak
Mt. Pass
Seaport
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Taung
Ādam
Khandu
Liāri
Budhāpur
B A L U C H I S T A N
K Ī R T H A R - K E T T E
Matiāri
Nāsirpur
PAKISTAN
Sonmiāni
Kāthor
Hyderabad
Kotri
Thāno Ahmad Khān
Sari Sing
Nāka Khārari
Qila
Sonmiāni Bay
Goth Gohrām
Gadāp
S I N D
Kālu Khuhar
Tando Muhammad K
Jerruck
Khudāi
Mātli
Hab Chauki
Malir Cantonment
Īsa
Karāchi Lines
Drigh Road
Goth Lashkari
Manora
Karachi
Karachi-Hafen
Thatta
Khorewāh
Mīrpur Batoro
Sujāwal
Arabisches Meer
Project Site
Mīrpur Sakro
Jāti
Indus

1.8 Title and Reference of Methodology

Methodology: ACM0002: Grid-connected electricity generation from renewable sources - Version 17.0

http://cdm.unfccc.int/methodologies/PAmethodologies/approved

Title and reference of tools applied to the project activity:

- Tool for the demonstration and assessment of additionality, version 7.0.0

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

- Tool to calculate the emission factor for an electricity system, version 5.0

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf

- Tool-Additionality of first-of-its kind project activities" version 03.0

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-23-v1.pdf

- Tool24: Methodological Tool: Common practice, version 03.1

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf

1.9 Participation under other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs. The project is registered only in VCS program. The Project is not rejected by other GHG programs.

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits: The project is not included in an emissions trading program or any other mechanism and that net GHG emission reductions generated during this monitoring period have not been used for compliance under any other programs.

Other Forms of Environmental Credit: The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period.

1.11 Sustainable Development

The Project contributions for sustainable development of the Host Country are:

Social Wellbeing: The project activity has led to the built up of road and local infrastructure development.

Economic wellbeing: Direct employment generation happened during the construction and operational phases of the project activity. The power generated from the project contributes to overall power availability in the region which can help to improve the economic performance of other businesses connected to the grid.

Environmental wellbeing: The project activity produces power from wind which is clean source of energy and does not involve any GHGs emission.

Technological wellbeing: The project activity uses the environmental safe and sound technologies for wind power generation in the Country. By adopting foreign manufactured wind turbines, the project activity promoted important transfer of technical know-how to Pakistan, and acted as a pioneer in promoting the spread of this technology to other wind power projects.

2 SAFEGUARDS

2.1 No Net Harm

There is no negative environmental and socio-economic impact due to the project activity.

2.2 Local Stakeholder Consultation

Local stakeholders' consultation meeting was conducted as part of the initial environmental assessment to get the comments and suggestions of the local stakeholders on the project activity. The information was validated at the time of registration of project.

Further, project proponent carries out a number of welfare programs around project site for community on an ongoing basis such as school for children of local community, providing for potable water, providing for wash rooms and toilets, ration supplies and medical camps etc. Project owner is committed to keep engaging with the local communities on a regular basis. Project owner keeps identifying needs of the community through their CSR activities in the area and provide for resources for the implementation and running for the programs.

A mechanism has been set up at the site to receive complaints from the local community. No complaints were received during the monitoring period.

2.3 AFOLU-Specific Safeguards

This is not AFOLU project hence this section is not required.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project has been commissioned and achieved start of commercial operation on 14th October 2016 and is under operation since. The project remained operational through the period. However, project experienced outages as detailed out below:

Month	Down Time (Min.)	Month	Down Time (Min.)
October, 16	726	July, 19	605
November, 16	3,626	September, 19	78
December, 16	127	December, 19	62
January, 17		February, 20	

	1,400		1,129
February, 17	530	June, 20	191
March, 17	3,017	August, 20	97
April, 17	3,567	October, 20	376
May, 17	1,890	December, 20	255
July, 17	167	January, 21	2,396
August, 17	1,786	February, 21	290
October, 17	844	March, 21	31
January, 18	2,723	April, 21	145
February, 18	727	June, 21	1,053
March, 18	22	August, 21	121
May, 18	302	September, 21	122
June, 18	107	November, 21	585
July, 18	429		
August, 18	859		
September, 18	2,419		
October, 18	3,620		
November, 18	1,357		
December, 18	190		
January, 19	627		
April, 19	321		
May, 19	52		
June, 19	67		

3.2 Deviations

2.3.1 Methodology Deviations

There is no methodology deviation during the current monitoring period.

2.3.2 Project Description Deviations

There is no project description deviation during the current monitoring period.

3.3 Grouped Projects

The project is not a grouped project activity.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OMy}$
Data unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor for grid in the year y
Source of data	Pakistan Energy Yearbook published by Ministry of Petroleum & Natural Resources
Value applied	0.7732
Justification of choice of data or description of measurement methods and procedures applied	Calculated ex ante as per "Tool to calculate the emission factor for an electricity system, ver. 05.0" as 3-year generation-weighted average of latest three years, 2012-13, 2013-14 and 2014-15, data obtained from Pakistan Energy Yearbook published by Ministry of Petroleum & Natural Resources, Hydrocarbon Development Institute of Pakistan.
Purpose of Data	Calculation of baseline emissions
Comments	Computed once during VCS-PD finalization (ex-ante) and will remain same throughout the crediting period.

Data / Parameter	$EF_{grid,BMy}$
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor for grid in the year y
Source of data	*Pakistan Energy Yearbook published by Ministry of Petroleum & Natural Resources*
Value applied	0.4575
Justification of choice of data or description of measurement methods	Calculated ex ante as per "Tool to calculate the emission factor for an electricity system, ver. 05.0" based on the most recent year 2014-15 data available from Pakistan Energy Yearbook published by Ministry of Petroleum & Natural Resources,

and procedures applied	Hydrocarbon Development Institute of Pakistan.
Purpose of Data	Calculation of baseline emissions
Comments	Computed once during VCS-PD finalization (ex-ante) and will remain same throughout the crediting period.

Data / Parameter	$EF_{grid,CMy}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid in the year y
Source of data	Calculated weighted average combined margin using equation – $EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$ The default values for w_{OM} and w_{BM} are taken as applicable to wind power generation project activities as $w_{OM} = 0.75$ and $w_{BM} = 0.25$.
Value applied	0.6943
Justification of choice of data or description of measurement methods and procedures applied	Calculated ex ante as per "Tool to calculate the emission factor for an electricity system, ver. 05.0" as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$
Purpose of Data	Calculation of baseline emissions
Comments	Computed once during VCS-PD finalization (ex-ante) and will remain same throughout the crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{export,y}$
Data unit	MWh
Description	Electricity exported to the grid by the project activity in year y
Source of data	Joint monthly meter reading report
Description of measurement methods and procedures to be applied	Energy meters installed at Jhampir 132 kV line measures the export and import of electricity on continuous basis. Meter readings are taken and verified, once in a month, jointly by the representatives of NTDC and the representative of MWEL. Meter readings taken from both feeders are added to arrive at electricity exported to the grid by the project activity in year y.
Frequency of monitoring/recording	Measured continuously, recorded monthly, Value Applied is the measured quantity in one year

Value monitored	603,783.118
Monitoring equipment	Energy Meter
QA/QC procedures to be applied	The data is cross-checked with the invoices raised in case sale of the electricity and electricity bills in case of captive use. As per NEPRA grid code, meters are calibrated atleast once in two years to verify meter accuracy. The metering system has an accuracy class of 0.2 or better and is located within the substation. Under the provisions of EPA, as part of metering system of wind farm, two independent energy meters have been installed at Jhampir in the substation (i) Metering System and (ii) Back-up Metering System. These meters are of identical type and accuracy class. The Metering System and the Back-Up Metering System is jointly sealed by NTDC and MWEL. Metering system is used for billing purposes. In case the Metering System has a failure, the Back-Up Metering System is used for the same purpose.
Purpose of the data	Calculation of baseline emissions
Calculation method	$EG_{export,y} = EG_{export,y,\ Jhampir}$ $EG_{export,y,\ Jhampir}$= Electricity exported to the grid measured at Jhampir 132 kV line
Comments	The data will be archived in electronic and physical form for the crediting period + 2 years

Data / Parameter	$EG_{import,y}$
Data unit	MWh
Description	Electricity imported from the grid by the project activity in year y
Source of data	Joint monthly meter reading report
Description of measurement methods and procedures to be applied	Energy meters installed at Jhampir 132 kV line measures the export and import of electricity on continuous basis. Meter readings are taken and verified, once in a month, jointly by the representatives of NTDC and the representative of MWEL. Meter readings taken from both feeders are added to arrive at electricity imported from the grid by the project activity in year y.
Frequency of monitoring/recording	Measured continuously, read monthly, Value Applied is the measured quantity in one year
Value monitored	2,051.671
Monitoring equipment	Energy Meter

QA/QC procedures to be applied	The data is cross-checked with the invoices raised in case sale of the electricity and electricity bills in case of captive use. As per NEPRA grid code, meters are calibrated atleast once in two years to verify meter accuracy. The metering system has an accuracy class of 0.2 or better and is located within the substation. Under the provisions of EPA, as part of metering system of wind farm, two independent energy meters have been installed at Jhampir in the substation (i) Metering System and (ii) Back-up Metering System. These meters are of identical type and accuracy class. The Metering System and the Back-Up Metering System is jointly sealed by NTDC and MWEL. Metering system is used for billing purposes. In case the Metering System has a failure, the Back-Up Metering System is used for the same purpose.
Purpose of the data	Calculation of baseline emissions
Calculation method	$EG_{import,y} = EG_{import,y,\ Jhampir}$ $EG_{import,y,\ Jhampir}$= Electricity imported from the grid measured at Jhampir 132 kV line
Comments	The data will be archived in electronic and physical form for the crediting period + 2 years

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y
Source of data	Joint monthly meter reading report
Description of measurement methods and procedures to be applied	Energy meter installed at Jhampir 132 kV line measures the export and import of electricity on continuous basis. Meter readings are taken and verified, once in a month, jointly by the representatives of NTDC and the representative of MWEL. The net electricity supplied to the grid is calculated by subtracting the import of the electricity from the export of the electricity.
Frequency of monitoring/recording	Measured continuously, recorded monthly, Value Applied is the measured quantity in one year
Value monitored	601,731.447
Monitoring equipment	Energy Meter
QA/QC procedures to be	The data is cross-checked with the invoices raised in case sale of

applied	the electricity and electricity bills in case of captive use. As per NEPRA grid code, meters shall be calibrated atleast once in two years to verify meter accuracy. The metering system has an accuracy class of 0.2 or better and is located within the substation. Under the provisions of EPA, as part of metering system of wind farm, two independent energy meters have been installed at Jhampir in the substation (i) Metering System and (ii) Back-up Metering System. These meters are of identical type and accuracy class. The Metering System and the Back-Up Metering System is jointly sealed by NTDC and MWEL. Metering system is used for billing purposes. In case the Metering System has a failure, the Back-Up Metering System is used for the same purpose.
Purpose of the data	Calculation of baseline emissions
Calculation method	Net electricity fed to the grid is calculated as $EG_{BL,y} = EG_{export,y}-EG_{import,y}$
Comments	The data will be archived in electronic and physical form for the crediting period + 2 years

4.3 Monitoring Plan

Monitoring of emission reductions is carried as per the applied methodology in the project activity i.e. ACM0002, version 17.0, which requires monitoring of the following relevant parameters:

- $EF_{grid,CM,y}$: Combined margin CO_2 emission factor for the grid in the year y
- $EG_{PJ,y}$: Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y

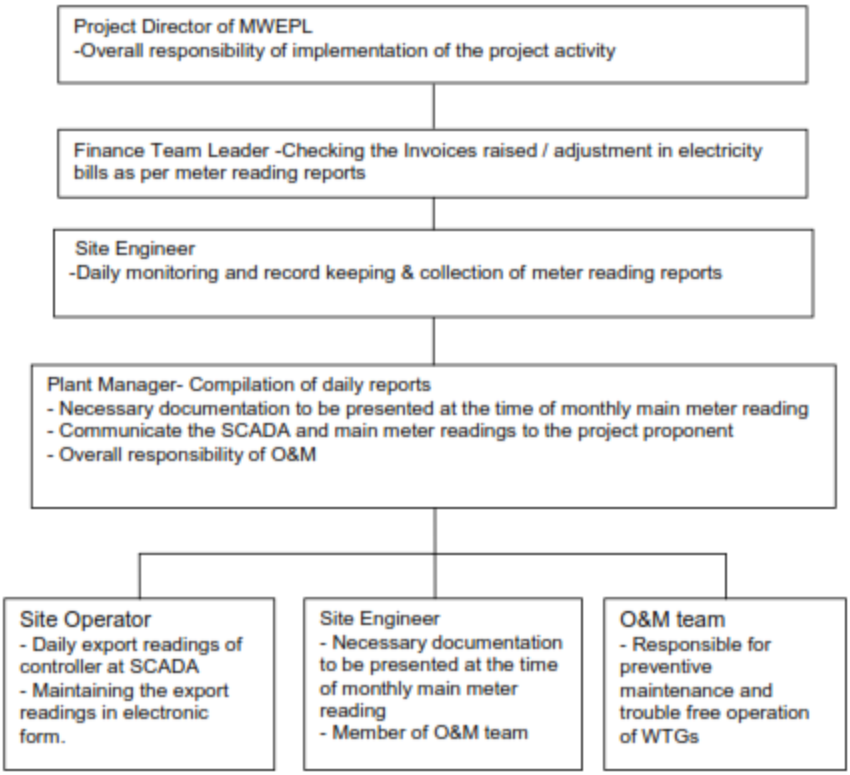
The personnel appointed by the project owner are in charge of the monitoring plan.

1. Monitoring objects

The main monitoring object is the electricity delivered to the grid.

2. Management structure

The personnel structure along with assigned responsibility is as follows:



3. Monitoring equipment and installation

The meters are installed at the interconnection point to the grid for monitoring the electricity delivered to the grid. The accuracy of the meters and the calibration is according to National standards.

4. Data collection

The project owner and the grid company are responsible for checking the meters. They ensure that the meters are sealed and without damages.

5. Meters maintenance and calibration

As per NEPRA grid code, meters are calibrated atleast once in two years to verify meter accuracy. The meters are sealed after calibration. Neither the project owner, MWEL nor the Power Purchaser, NTDC could unseal or change the meters in the absence of the other party.

If any component of the metering system is found to be outside acceptable limits of accuracy, or otherwise not functioning properly, it is repaired, recalibrated or replaced as per requirement.

6. QA/QC procedures:

The meters are jointly inspected and sealed and are not interfered with by either project owner, MWEL or Power Purchaser, NTDC without the presence of the other party.

7. Data archiving:

Data from monthly metering reports are archived in electronic and physical form for the entire crediting period plus two years.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emission calculation for the project activity is attributable to the CO_2 Emission that could have been produced by the fossil fuel based power plants in absence of the proposed project activity. Therefore the amount electricity supplied to the national grid is multiplied by the grid emission factor to calculate the baseline emissions reduced by the proposed project activity.

$$BE_y = EG_{PJ,,y} \times EF_{grid,CMy}$$

BE_y Baseline emissions in year y (tCO_2)

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y (MWh/yr); equal to $EG_{facility,y}$ - Quantity of net electricity generation supplied by the project to the grid in year y (MWh)

$EF_{grid,CM,y}$ Combined margin CO_2 emissions factor in year y (tCO_2/MWh)

So, for the current monitoring period:

$EG_{PJ,,y}$ (MWh)	$EF_{grid,CMy}$ (tCO2/MWh)	BE_y (tCO2)
601,731	0.6943	417,782

5.2 Project Emissions

As per para 36 of applicable methodology ACM0002 version 17, for all renewable energy power generation project activities, project emission can be neglected. Hence, PEy = 0 tCO2e

5.3 Leakage

As per section 5.6 of applicable methodology ACM0002 version 17, The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil

fuel use (e.g. extraction, processing, transport etc.) are neglected. Hence $LE_y = 0$

5.4 Net GHG Emission Reductions and Removals

The annual emission reductions (ER_y) are calculated as:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions in year *y* (t CO2e/yr)
BE_y Baseline emissions in year *y* (t CO2e/yr)
PE_y Project emissions in year *y* (t CO2e/yr)
LE_y Leakage emissions in year *y* (t CO2e/yr)

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)
2016 (14/10/2016-31/12/2016) – both days included	8,556	0	0	8,556
2017	84,899	0	0	84,899
2018	96,412	0	0	96,412
2019	81,341	0	0	81,341
2020	65,147	0	0	65,147
2021 (01/01/2021-31/10/2021) - both days included	81,427	0	0	81,427
Total	**417,782**	**0**	**0**	**417,782**

APPENDIX 1: ENERGY METER DETAILS

Energy Meter Details	Main Meter M1 (Old)*	Main Meter M1 (New)*	M1 Backup Meter
Serial No	66219224	66213696	66807446
Make	ISKRA	ISKRA	ISKRA
Accuracy Class	0.2	0.2	0.2
Calibration 1	04/09/2016	09/04/2018	04/09/2016
Calibration 2	NA	26/09/2019	26/09/2019

*Old meter 66219224 was replaced with new meter 66213696 on 09-April-2018.

Energy Meter Details	Main Meter M2	M2 Backup Meter
Serial No	66219223	66605338
Make	ISKRA	ISKRA
Accuracy Class	0.2	0.2
Calibration 1	04/09/2016	04/09/2016
Calibration 2	26/09/2019	26/09/2019

APPENDIX 2: METERING LAYOUT

This provides metering arrangement at project site.