Revision in Monitoring Plan

Version :	01
Date of Revision:	31/05/2010
Project Title:	125 MW Wind Power Project in Karnataka, India
UNFCCC Reference Number:	0315

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

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Name of the Monitoring Methodology:

"Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources"

Reference is taken from the available UNFCCC document available for approved consolidated baseline methodology ACM0002, Version 04, 28th November 2005

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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Since the project is a grid connected renewable energy project, emission reduction quantity totally depends on the units wheeled to the grid. The methodology covers the monitoring of units wheeled along with the other parameters affecting the power export and CO_2 emissions. Hence, this is the most suitable monitoring methodology applicable for the project.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

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Not Applicable – as the project is a zero emission grid connected electricity generation from a renewable source

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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Not Applicable

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	Data type	Data Variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1. EG_y	Electricity supplied to the grid by the project activity	KPTCL and BESCOM records	MWh	Calculated	Hourly measurement and monthly recording	100%	Electronic	Crediting Period plus two years	This parameter is calculated based on measured values. (Refer section D.2.1.4)

2. $E_{EXP,y}$	Gross electricity export from the project activity	KPTCL and BESCOM records	MWh	Directly Measured	Hourly measurement and monthly recording	100%	Electronic	Crediting Period plus two years	
3. $E_{IMP,y}$	Electricity import by the project activity	KPTCL and BESCOM records	MWh	Directly Measured	Hourly measurement and monthly recording	100%	Electronic	Crediting Period plus two years	
4. $E_{TL,y}$	Transmission losses	KPTCL and BESCOM records	MWh	Calculated	Hourly measurement and monthly recording	100%	Electronic	Crediting Period plus two years	This parameter is calculated based on measured values. (Refer section D.2.1.4)
5. EF_y	CO_2 emission factor of the grid	KPTCL/CEA	tCO_2/ MWh	Calculated	Once at the beginning of the crediting period	This parameter is fixed ex-ante and will not be	Electronic	Crediting Period plus two years	Calculated as weighted sum of OM and BM emission

						not be monitored.			factors as per Step 3 of ACM0002
6. $EF_{OM,,y}$	CO_2 operating margin emission factor of the grid	KPTCL/CEA	t CO_2/ MWh	Calculated	Once at the beginning of the crediting period	This parameter is fixed ex-ante and will not be monitored.	Electronic	Crediting Period plus two years	Calculated as Step 1 of ACM0002
7. $EF_{BM,y}$	CO_2 build margin emission factor of the grid	KPTCL/CEA	t CO_2/ MWh	Calculated	Once at the beginning of the crediting period	This parameter is fixed ex-ante and will not be monitored.	Electronic	Crediting Period plus two years	Calculated as Step 2 of ACM0002
8. $F_{i,j,y}$	Amount of fossil fuel i, consumed by each power source/ plant in year y	KPTCL/CEA	tons	Calculated	Once at the beginning of the crediting period	This parameter is fixed ex-ante and will not be	Electronic	Crediting Period plus two years	Calculated based on the Total power generation, Average Net Calorific

						monitored.			Value of the Fuel used and the Designed Station Heat Rate data of power plants of KPTCL grid
9. $COEF_{i,j,y}$	CO_2 emission factor of each fuel type i,	IPCC/local	t CO_2 / ton of fuel	Standard /Calculated	Once at the beginning of the crediting period	This parameter is fixed ex-ante and will not be monitored.	Electronic	Crediting Period plus two years	Calculated based on the IPCC default value of the Emission Factor, Net Calorific Value and Oxidation Factor of the Fuel used by the power plants of

									KPTCL grid
10. $GEN_{j,y}$	Electricity delivered to the grid by power source j in year y	KPTCL/CEA	MWh/ annum	Measured	Once at the beginning of the crediting period	This parameter is fixed ex-ante and will not be monitored.	Electronic	Crediting Period plus two years	Obtained from authentic and latest local statistics.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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Calculation of net electricity supplied to the grid by the project activity

In accordance with the Power Purchase Agreements (PPAs), payments against electricity supplied to the grid by the project activity are made for the delivered energy (gross electricity exported less transmission losses), less 115% of the electricity imported. Although taking 15% over and above measured import values is merely an accounting provision implemented by KPTCL/BESCOM, it is considered in the calculation of the parameter EG_y on a conservative basis.

$EG_y = E_{EXP,y} – E_{TL,y} – 115\%*E_{IMP,y}$

Where

EG_y = net quantity of electricity supplied to the grid by the project activity during the year y in MWh

$E_{EXP,y}$ = gross electricity export from the project activity during the year y in MWh

$E_{IMP,y}$ = electricity import by the project activity during the year y in MWh

$E_{TL,y}$ = quantity of transmission losses between the project activity and the receiving substation in year y

Transmission loss percentage is computed by KPTCL in accordance with equations specified in the PPAs and official KPTCL/BESCOM circulars as follows:

$$Z = \left\{ \frac{(X_1 + X_2 + X_3 + X_4 + ...) - Y}{(X_1 + X_2 + X_3 + X_4 + ...)} \right\} \times 100$$

Where

Z = percentage of transmission losses

$(X_1+X_2+X_3+X_4+…)$ = sum of electricity export from energy meters connected to the receiving substation

Y = electricity export from bulk energy meter installed at the receiving substation

For each metering point, transmission losses are computed each month as the product of the electricity export from the metering point (eg: X_1) and the transmission loss percentage (Z).

Calculation of electricity baseline emission factor:

An electricity baseline emission factor ($EF_{,y}$) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source and made publicly available.

STEP 1. Calculate the Operating Margin emission factor(s)

Out of four methods mentioned in the ACM0002, Simple OM approach has been chosen for calculations since in the Southern Regional grid mix, the low-cost/must run resources constitutes less than 50% of total grid generation. Simple OM factor is calculated as under.

$EF_{OM,simple,y}$ is calculated as the average of the most recent three years (2001-2002, 2002-2003 & 2003-2004) .

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \, x \, COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

where

$COEF_{i,j\,y}$ - Is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as given below and

$GEN_{j,y}$ - Is the electricity (MWh) delivered to the grid by source j

$_{i,j,y}$ - Is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y , calculated as given below

j - Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid

The Fuel Consumption $F_{i,j,y}$ is obtained directly from Annual General Review reports published by the Central Electricity Authority.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

where

NCV_i - Is the net calorific value (energy content) per mass or volume unit of a fuel i

$EF_{CO2,i}$ - Is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ - Is the oxidation factor of the fuel

STEP 2: Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of the Southern Regional grid, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \, x \, COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ - Are analogous to the variables described for the simple OM method above for plants m.

The Build Margin emission factor $EF_{BM,y}$ is calculated ex ante based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently, since it comprises of larger annual power generation. (Refer Annex 3)

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of the Southern Regional grid mix.

STEP 3: Calculate the electricity baseline emission factor $EF_{electricity,y}$ as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = W_{OM} \otimes EF_{OM,y} \oplus W_{BM} \otimes EF_{BM,y}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,Simple,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

Calculation of Baseline Emissions

$$BE_y = EF_y \; x \; EG_y$$

where

BE_y - Are the baseline emissions due to displacement of electricity during the year y in tons of CO_2

EG_y - Is the net quantity of electricity supplied to the grid by the project activity during the year y in MWh

EF_y - Is the CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

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D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

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This section is not applicable as there are no project emissions from the project activity.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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This section is not applicable as there are no leakage emissions as a result of the project activity.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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Formula used for estimation of the total net emission reductions due to the MSPL project activity during a given year *y* is as under.

$$ER_y = BE_y - PE_y - L_y$$

where

ER_y - Are the emissions reductions of the project activity during the year y in tons of CO_2

BE_y - Are the baseline emissions due to displacement of electricity during the year y in tons of CO_2

PE_y - Are the project emissions associated with MSPL

L_y - Are the emissions sources as leakage

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

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Data	*Uncertainty level of data*	*Explain QA/QC procedures planned for these data, or why such procedures are not necessary*
1. EG_y - Electricity supplied to the grid by the project activity	*Low*	*Electricity meters are properly maintained and annual calibration is carried out.*
2. $E_{EXP,y}$ - Gross electricity export from the project activity	*Low*	*Electricity meters are properly maintained and annual calibration is carried out. Values in JMR Statements are compared with values in Proforma Invoices.*
3. $E_{IMP,y}$ - Electricity import by the project activity	*Low*	*Electricity meters are properly maintained and annual calibration is carried out. Values in JMR Statements are compared with values in Proforma Invoices.*
4. $E_{TL,y}$ - Transmission losses	*Low*	*Values in JMR Statements are compared with values in Proforma Invoices.*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

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As emission reductions from the project are determined by the number of units exported to the grid, it is mandatory to have a monitoring system in place and ensure that the project activity produces and exports the rated power at the stipulated norms. The sole objective of having a monitoring system is to have a constant watch on the emission reductions.

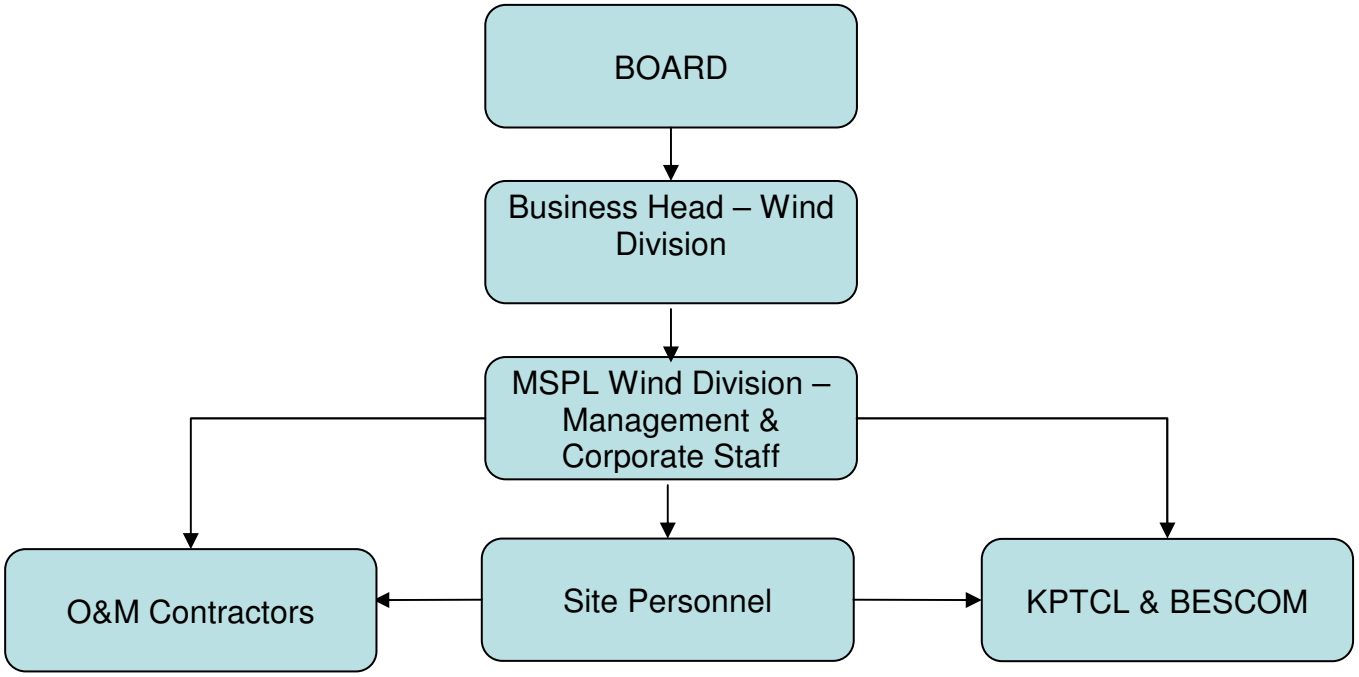
It is worthwhile to note here that there are two major stakeholders outside of MSPL Limited with considerable direct influence on the monitoring and performance of the wind projects.

1) Karnataka Power Transmission Corporation Limited (KPTCL) and the relevant Energy Supply Company (ESCOM)

2) Contracted entities responsible for Operation and Maintenance of WEGs

The monitoring of electricity generation data, and the operation and maintenance of the WEGs must be carried out through close coordination with the above-mentioned entities.

MSPL Limited has formulated a CDM Team to ensure proper and continuous monitoring of the performance of turbines and generation of power. The CDM Team is headed by the Board of MSPL and the structure is as follows.



Functions of the CDM Team:

The Wind Division reports to the Business Head of the Wind Division who reports directly to the Board of MSPL Limited. The Management and Corporate Staff of the MSPL Wind Division are responsible for coordinating with Site Personnel as well as the O&M contractors and the power off-takers (KPTCL & BESCOM). Site personnel are located at individual sites and are responsible for collection and transfer of monitored data from respective sites to the corporate office. The CDM team has the following overall functions:

- Collection of monitoring data for power generation by the project activity
- Maintenance of records and backup of relevant data for verification
- Coordination with KPTCL for maintenance and calibration of monitoring equipment

- Coordination with O&M contractors to ensure continuous functioning of WEGs

Functions of KPTCL & BESCOM:

In presence of MSPL representatives, KPTCL staff note the meter readings every month and generate a record for the power supplied to the grid. KPTCL issues Joint Meter Reading Statements every month. Based on the monthly Joint Meter Reading Statements, Pro Forma Invoices are generated, on which basis BESCOM issues payments against electricity supplied to grid. The energy meters used are sealed and can not be accessed by the project promoters independently of KPTCL officials. KPTCL officials are responsible for attending to any malfunctioning of the energy meters and associated equipment. KPTCL officials are also responsible for carrying out calibration of the energy meters.

Functions of O&M Contractors:

The O & M contractor operates and maintains the project activity through a full fledged trained service organization stationed at the site. The Service set up consists of site in-charge, service engineers, machine operators and security personnel. The number of personnel depends on the size of the site. The service engineers at site have been professionally trained. The service set up at site is equipped with motor cycles and other utility vehicles for immediate access to the machines. Essential spares are stocked at site stores apart from the other stocks kept at Central storage location. The service organization carries out the following activities:

Shall perform the following services in relation to the Equipment in accordance with

→ The O & M Manuals, the safety management plans and procedures and as per the manufacturers recommendations, where applicable or

→ In accordance with accepted industry practices

- Services involving Labour only:

➢ Routine Maintenance Services involving labour work

Routine Maintenance Labour Work involves making available suitable manpower for operation and maintenance of the equipment and covers periodic preventive maintenance, cleaning and upkeep of the equipment including -

→ Tower Torquing
→ Blade Cleaning
→ Nacelle Torquing and Cleaning
→ Transformer Oil Filtration
→ Control Panel & LT Panel Maintenance
→ Site and Transformer Yard Maintenance

➢ Security Services

This service includes watch and ward and security of the wind farm and the equipment.

➢ Management Services

a) Data logging in for power generation, grid availability, machine availability.
b) Preparation and submission of monthly performance report in agreed format.
c) Taking monthly meter reading jointly with UTILITY, of power generated at Customer's Wind Farm and supplied to UTILITY Grid from the meter/s maintained by UTILITY for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

➢ Technical Services

→ Visual inspection of the WTGs and all parts thereof.

→ Technical Assistance including checking of various technical, safety and operational parameters of the Equipment, trouble shooting and relevant technical services.

- Crane Services for attending Breakdown Repairs
  a. This involves providing Crane whenever required for attending Breakdown repairs.

- Maintenance & Repair Work involving Labour & Material

- I - Maintenance Work involving labour and materials

This involves labour as well as use of materials and consumables such as lubricants and oils, minor/ low value electrical and mechanical parts, etc. for preventive maintenance and upkeep of the Equipment including –

→ HT Line and Electrical Maintenance
→ Greasing of Rotor Bearings, Gear Box and Generator
→ Topping up of Gear Box, Hydraulic and Transformer Oil

- II - Breakdown Repair Work involving labour and materials

The Breakdown repair Work involve labour and use of components, spares and consumables in the event of any breakdown or suspected breakdown due to operational reasons in the Equipment or any part thereof. The breakdown shall be attended as soon as practically possible to put the Equipment back into operation. The breakdown repairs will cover cost of labour, spares/ materials and other works, which includes,

a) Spares repairs/replacement
b) Major breakdown as mentioned below -
   b. Repairs/replacement of Generator and Motors
   c. Repairs/replacement of Gear Box
   d. Repairs/replacement of Transformers
   e. Repairs/replacement of VCB

f. Repairs/replacement of Blades

g. Repairs/replacement of Controller and Control Panel

h. Repairs/replacement of Tower structure

c) Total replacement of oil in Gear Boxes and Transformers

d) Painting of Equipment

D.5 Name of person/entity determining the monitoring methodology:

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M/s. MSPL Limited

Annex 4

MONITORING PLAN

As emission reductions from the project are determined by the number of units supplied to the grid, it is mandatory to have a monitoring system in place and ensure that the project activity produces and exports the rated power at the stipulated norms. The sole objective of having a monitoring system is to have a constant watch on the emission reductions.

The electricity exported and imported from the project activity is noted monthly during joint meter readings of energy meters, for which KPTCL officials as well as representatives of the project promoters are present. Joint Meter Reading (JMR) statements, also referred to as Form B, are prepared based on the readings and signed by both parties. The JMR Statements also report transmission losses, calculated by KPTCL as per the methodology specified in the PPA and official notifications/circulars. In accordance with PPAs, the project promoters are billed for electricity exported, less 115% of electricity imported, less transmission losses.

QA/QC Procedures:

The monitoring team shall cross-check all values reported in the JMR statements with the values reported in Pro Forma Invoices (statements on bill payment towards power purchased by BESCOM) and in the case of any discrepancy the most conservative values shall be applied for calculation of emission reductions.

The main and check energy meters installed for monitoring of the project activity are electronic trivector energy meters of 0.2% accuracy class. Each meter is jointly inspected and sealed on behalf of MSPL and KPTCL, in the presence of its authorised representatives. All main and check meters are tested for accuracy annually by KPTCL with reference to portable standard meters which are of a minimum accuracy class of 0.1%. As the instruments are calibrated and marked at regular intervals, the accuracy of measurement can be assured at all times.

Data Management and Data Archiving:

Copies of JMR Statements and Pro Forma Invoices (statements on bill payment towards power purchased by BESCOM) will be retained by the monitoring team for the entire monitoring period. Monthly generation reports will also be produced by monitoring team and copies of the same will be maintained. All documents will be archived electronically for the entire crediting period plus two years.

Project Performance Reviews:

Site personnel are responsible for carrying out internal audits to review the project performance. Performance against the following functions of the CDM Team will be audited internally:

- Collection of monitoring data for power generation by the project activity
- Maintenance of records and backup of relevant data for verification
- Coordination with KPTCL for maintenance and calibration of monitoring equipment
- Coordination with O&M contractors to ensure continuous functioning of WEGs

Procedures for Data Adjustments/Uncertainties

KPTCL and BESCOM consider main meter readings for billing (generation of Pro Forma Invoices and payments to project promoters) by default if main meters are working within the specified accuracy class. However if the main meter malfunctions and the check meter is working within its accuracy class, check meter readings rather than main meter readings are considered for billing.

For determination of emission reductions, if the main meters are working within their accuracy class, the main meter readings would be considered in accordance with values reported in JMR Statements and Pro Forma Invoices. In the event that KPTCL reports a malfunctioning of a particular main meter and adopts the respective check meter readings for billing, check meter readings would be considered for emission reduction calculations in accordance with the parameters reported in the respective JMR Statements and Pro Forma Invoices.

In the rare event that both the main meter and respective check meter malfunction, the percentage of error reported by KPTCL officials (if applicable) would be noted by the monitoring team and adjustments to emission reductions would be made on a conservative basis.