Draft baseline and monitoring methodology AM0XXX

"Energy efficiency in data centres through dynamic power management"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

This baseline and monitoring methodology is based on elements from the following proposed new methodology:

- NM0350 "Improving Energy Efficiency in Data Centers through Dynamic Power Management" prepared by Carbonomics, LLC and Power Assure, Inc.

This methodology also refers to the latest approved versions of the following tools:

- "Tool to calculate the emission factor for an electricity system";
- "Combined tool to identify the baseline scenario and demonstrate additionality".

For more information regarding the proposed new methodology and the tools, as well as their consideration by the CDM Executive Board, please refer to <http://cdm.unfccc.int/methodologies/PAmethodologies/index.html>.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable".

Definitions

For the purpose of this methodology, the following definitions apply:

Data Centre physically houses various equipment, such as computers, servers (e.g., web servers, application servers, database servers), switches, routers, data storage devices, load balancers, wire cages or closets, vaults, racks, and related equipment. Data centres store, manage, process, and exchange digital data and information.

Dynamic Power Management (DPM) is an energy management activity at data centres that optimises the load of servers and their electricity consumption by activating "turn off events" (TOE).

"Always On" model represents the situation in data centres in absence of DPM system, in which the servers are in on or idle mode 24 hours a day independent of demand, except during their maintenance or replacement or during complete power outages.

Server's operation mode could be one of the following:

- **On Mode** is a server's normal operational mode, in which it performs workload transactions.
- **Idle Mode** is an operational state in which a server's operating system and other software have completed loading and the server is capable of performing workload transactions, but no active workload transactions are requested or pending by the system.
- **Off Mode**, also called standby mode, is an operational state in which, under the instruction of DPM, a server is powered off and cannot perform workload transactions. Off mode does not refer to situations in which a server is completely switched off and cannot be turned back on by the DPM.

Turn-off Event (TOE) is the length of time each server is turned off as a result of the DPM. The TOE includes only the time the server is completely off. If it takes a period of time for a server to reach its completely "off" state after being switched off, or if time is required after a server is turned on to reach its idle or loaded state, these periods are NOT included in the TOE.

Existing server is a server that was operating within the project boundary for at least one year prior to the implementation of the project activity.

Replacement server is a server directly replacing an existing server, which is in turn no longer used in the data centre.

Server Capacity is a quantification of a server's ability to perform tasks required of it. The capacity of each existing and replacement server, measured in transactions per second, shall be determined according to one of the following standards: UL 2640, TPC or SPEC.

Server Load is a quantification for the actual work a server is doing, compared to the maximum work it is capable of doing. Load is measured by a server's operation system, and is the ratio between the server's actual usage and its maximal usage level, based on CPU cycles.

Applicability

This methodology applies to project activities that reduce power consumption in existing data centres through the implementation of DPM. The project activity only incorporates practices within the data centre concerning the management of server operation mode.

Installation of new equipment, such as new and more efficient servers or cooling systems, is allowed, but the reduction in electricity consumption due to the higher efficiency would not be eligible for emission reductions under this methodology, because these changes are commonplace within the industry. In addition, installation of such equipment would require adjustments to the baseline emissions, as described in the "Baseline emissions" section.

The methodology is applicable under the following conditions:

- Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal;
- The project activity must be implemented in data centres that, prior to the implementation of the project activity, have no DPM system, no systematic method to adjust the data centre's total server capacity to actual demand and no manual adjustment of server's operation mode to reduce electricity consumption. This shall be demonstrated *inter alia* through crosschecking that the load of each existing server for at least 6 consecutive months prior to DPM implementation, indicates "always on" operation, except during periods of maintenance and power outage;
- The TOE should be distributed among all servers within the project boundary, including existing/replacement servers, based only on operational and DPM considerations;
- In addition, the applicability conditions included in the tools referred to above apply.

Finally, this methodology is only applicable if under the most plausible baseline scenario the servers in the data centre continue in the current "Always On" model.

II. BASELINE METHODOLOGY PROCEDURE

Project boundary

(1) The **spatial extent** of the project boundary encompasses the physical property of the data centre itself, as well as the extent of the power grid, if the project is grid-connected;

(2) The greenhouse gases included in or excluded from the project boundary are shown in **Table 1**.

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from power consumption	CO_2	Yes	Primary gas involved in generation of electricity
		CH_4	No	Excluded for simplification. Negligible emissions
		N_2O	No	Excluded for simplification. Negligible emissions
Project Activity	Emissions from power consumption	CO_2	Yes	Primary gas involved in generation of electricity
		CH_4	No	Excluded for simplification. Negligible emissions
		N_2O	No	Excluded for simplification. Negligible emissions

Identification of the baseline scenario and demonstration of additionality

Project participants shall determine the most plausible baseline scenario and demonstrate additionality using the latest version of the "Combined tool to identify the baseline scenario and demonstrate additionality".

In applying Step 1 of the tool, realistic and credible alternative scenarios could include:

- Implementing a DPM project without CDM;
- Implementing a DPM project without CDM in the future;
- Using technology(ies) other than DPM to manage server load in the data centre;
- Adjusting server load manually, by turning off a subset of servers at a certain time (night-time) or during a specific season;
- Continuing the current "Always On" model;

This methodology is only applicable in case the most plausible baseline scenario identified is "Continuing the current "Always On" model".

The following guidance is provided on the various steps of the tool.

First-of-its-Kind Analysis: If first-of-its-kind analysis is performed, all data centres with comparable capacity in the relevant geographic region, regardless of their application, have to be considered.

Barrier Analysis: According to the "Guidelines for objective demonstration and assessment of barriers", barriers that can be mitigated by additional financial means and can be quantified and represented as costs, should not be identified as a barrier for implementation of project while conducting the barrier analysis, but rather should be considered in the framework of investment analysis. Under the step of barrier analysis, such barriers (if any) should be identified and the risk of confronting those barriers should be converted in monetary value, such as the premium claimed by insurance to cover such risk. The value of such cash outflow shall be used in the investment analysis for the purpose of demonstration of additionality. If such barriers are evaluated, project participants shall provide credible evidence of

- Their plan to approach an insurance company, in absence of CDM, to cover the risks caused by implementation of DPM ;
- The estimate of the monetary losses due to risk posed by the barrier; and
- The insurance premium claimed by the insurance company to cover these losses.

Investment Analysis: The electricity savings earned through energy savings shall be taken into account in the investment analysis. Since "the continuation of the current situation, not requiring any investment or expenses to maintain the current situation" scenario, as depicted in the latest version of "Combined tool to identify the baseline scenario and demonstrate additionality" is among the alternative scenarios, the guidance provided in the tool for investment analysis of this scenario may be followed.

Common Practice Analysis: Under common practice analysis, the project participants shall survey other data centres in the applicable geographic region to check whether the "Always On" model without the use of DPM is the one used by data centres historically and currently.

Baseline emissions

Baseline emissions (BE_y) include both emissions from electricity consumption of the servers and emissions from electricity consumption for cooling:

$$BE_y = EC_{BL,y} \times EF_{EL,y} \times \left(1 + \frac{1}{COP}\right) \quad \textbf{(1)}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2/yr)
$EC_{BL,y}$	=	Electricity consumed in year y if the servers operated in idle mode (MWh/yr)
$EF_{EL,y}$	=	Emission factor for electricity consumed in year y (tCO_2/MWh)
COP	=	A conservative Coefficient of Performance (COP) of the chillers. For vapour-compression chillers, COP is set to 6, otherwise 1/COP is set to 0

The power consumption of each server is multiplied by their respective aggregated TOE hours in year y to determine the electricity consumption that would have occurred in absence of a DPM system, assuming all the servers would operate in idle mode.

$$EC_{BL,y} = DF_y \times \frac{\sum_i (PR_{idle,i,y} \times OH_{off,i,y})}{1000} \quad \textbf{(2)}$$

Where:

$EC_{BL,y}$	=	Electricity consumed in year y if the servers operated in idle mode (MWh/yr)
$PR_{idle,i,y}$	=	Power requirement to operate existing/replacement server i in idle mode (kW)
$OH_{off,i,y}$	=	Total length of turn off events for existing/replacement server i in year y. This figure excludes times when the server is down for maintenance, replacement or power outage (hours/yr)
DF_y	=	Discount factor in year y (ratio)

Determination and adjustment of $PR_{idle,i,y}$

Servers in data centres could frequently be in idle mode or close to idle mode. In the project activity, the servers would be turned off when not needed, thus saving energy.

To ensure a reliable result, the power consumption of each existing server shall be measured when there is no load on the server, and registered as $PR_{idle,i,y}$. The measurements should take place under standard operating conditions of the data centre.

If there is a change in inventory (for example, when old servers are replaced with new, higher capacity servers), or a piece of equipment is reconfigured (for example, adding or removing memory or disks to a server) the baseline emissions shall be adjusted. In such situations, the baseline idle power requirement of existing/replacement server *i* ($PR_{idle,i,y}$) is adjusted by measuring the new power requirements of the new server in the idle mode and applying the lower of the idle power requirements before and after the reconfiguration/replacement.

Determination of DF_y

The potential length of time the servers could be in off mode prior to the implementation of DPM limits the baseline emissions derived from the actual length of time servers are in off mode during the project. The discount factor ensures that emission reductions from the electricity saving under the following situations are not eligible under this methodology: (1) shifting transaction workload to new servers or other data centres, and (2) replacement of servers with higher capacity servers, which might increase the amount of hours a server can be in off mode.

In addition, the discount factor also accounts for the possible adoption of the DPM technology by the project data centre in the baseline, considering the fast developments expected in the information technology sector.

$$DF_y = \min\left(\frac{OH_{BL,idle,\max}}{OH_{PJ,idle,\max,y}},1\right)\times\left(1-MS_y\right) \tag{3}$$

Where:

DF_y	=	Discount factor in year *y* (ratio)
$OH_{BL,idle,max}$	=	Total equivalent length of time an average server could be fully idle in the year prior to the implementation of DPM (hours/yr)
$OH_{PJ,idle,max,y}$	=	Total equivalent length of time an average server could be fully idle or in off mode in year *y* (hours/yr)
MS_y	=	Market share of DPM technology (ratio)

$$OH_{PJ,idle,\max,y} = \frac{\sum_i\left[(1-L_{i,y})\times OH_{i,y}\times C_{i,y}\right]}{\sum_i C_{i,y}} \tag{4}$$

Where:

$OH_{PJ,idle,max,y}$	=	Total equivalent length of time an average server could be fully idle or in off mode in year *y* (hours/yr)
$C_{i,y}$	=	Nominal capacity of server *i* in year *y* (transactions/second)
$L_{i,y}$	=	Load of server *i* in year *y* (ratio)
$OH_{i,y}$	=	Total length of time server *i* operated, in any mode, in year *y*. This figure excludes times when the server is, independently of the project, down for maintenance, replacement or power outage (hours/yr)

$$OH_{BL,idle,\max} = \frac{\sum_i \left[(1 - L_{i,0}) \times OH_{i,0} \times C_{i,0}\right]}{\sum_i C_{i,0}} \qquad \textbf{(5)}$$

Where:

$OH_{BL,idle,max}$	=	Total equivalent length of time an average server could be fully idle in the year prior to the implementation of DPM (hours/yr)
$C_{i,0}$	=	Nominal capacity of server *i* in the year prior to DPM implementation (transactions/second)
$L_{i,0}$	=	Load of server *i* in the year prior to DPM implementation (ratio)
$OH_{i,0}$	=	Total length of time server *i* operated, in any mode, in the year prior to DPM implementation. This figure will exclude times when the server was down for maintenance, replacement or power outage (hours/yr)

For clarification:

- $1\text{-}L_{i,0}$ and $1\text{-}L_{i,y}$ indicates how much of the capacity of server *i* is untapped;
- $OH_{i,y}$, $OH_{i,0}$, $L_{i,y}$ and $L_{i,0}$ are the operation hours and load of server *i* in any operation mode, excluding times when the server is, independently of the project, down for maintenance, replacement or power outage;
- Multiplication by $C_{i,y}$ and $C_{i,0}$ serves to calculate a capacity weighed operational hours, and dividing by the sum of capacities results in the value for a theoretical average server.

Determination of the Emission factor for electricity consumption

If the data centres are supplied electricity by the grid, the emissions factor of the grid can be determined using the latest approved version of the “Tool to calculate the emission factor for an electricity system”.

For the cases where electricity for the operation of the data centre is fully or partly provided by an on-site fossil fuel fired captive power plant, the lower value between the grid emission factor and the emission factor of the captive power plant should be used as a conservative simplification.

$$EF_{EL,y} = MIN(EF_{grid,y}; EF_{EL,captive,y}) \qquad \textbf{(6)}$$

Where:

$EF_{EL,y}$	=	Emission factor for electricity consumed in year *y* (tCO_2/MWh)
$EF_{grid,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)
$EF_{EL,captive,y}$	=	Emission factor for electricity generation in the captive power plant in year *y* (tCO_2/MWh)

The emission factor of the captive power plant ($EF_{EL,captive,y}$) may be determined by one of the following options:

- In case of diesel generators: use the default emission factor from AM0103 for an isolated grid using mainly liquid or solid fossil fuels and no combined cycle power plant(0.8 tCO2/MWh);
- Calculate $EF_{EL,captive,y}$ as follows:

$$EF_{EL,captive,y} = \frac{\sum_n FC_{n,y} \cdot NCV_{n,y} \cdot EF_{FF,n,y}}{EG_y \cdot 1000} \qquad \textbf{(7)}$$

Where:

$EF_{EL,captive,y}$	=	Emission factor for electricity generation by the captive power plant in year *y* (tCO_2/MWh)
$EF_{FF,n,y}$	=	Emission factor of fossil fuel type n used in captive power plants in year *y* (tCO_2/TJ)
$FC_{n,y}$	=	Quantity of fuel type n consumed in captive power plants in year y (Mass or volume unit/yr)
$NCV_{n,y}$	=	Average net calorific value of fuel type n fired in captive power plants n in year y (GJ/mass or volume unit)
EG_y	=	Net electricity generated and utilised by captive power plants in year y (MWh/yr)

Project emissions

Project emissions include the emissions from the electricity consumption during the aggregated TOE hours of each existing and replacement server from the data centre after the project is implemented. It can be calculated as follows:

$$PE_y = EC_{off,y} \times EF_{EL,y} \times (1 + \frac{1}{COP}) \quad \textbf{(8)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2/yr)
$EC_{off,y}$	=	Actual electricity consumption, when the servers are in off mode in year y (MWh/yr)
$EF_{EL,y}$	=	Emission factor for electricity consumed in year *y* (tCO_2/MWh)
COP	=	A conservative Coefficient of Performance of the chillers. For vapour-compression chillers, COP is set to 6, otherwise 1/COP it is set to 0

$$EC_{off,y} = \frac{\sum_i (PR_{off,i,y} \times OH_{off,i,y})}{1000} \quad \textbf{(9)}$$

Where:

$EC_{off,y}$	=	Actual electricity consumption, when the servers are in off mode in year y (MWh/yr)
$PR_{off,i,y}$	=	Power requirement for server *i* to run when in the off mode (kW)
$OH_{off,i,y}$	=	Total length of turn off events for server *i* in year *y*. This figure excludes times when the server is, independently of the project, down for maintenance, replacement or power outage (hours/yr)

Determination and adjustment to $PR_{off,i,y}$

The value of $PR_{off,i,y}$ should be determined and updated in a similar manner as the update of $PR_{idle,i,y}$ as described above, for each existing and replacement server while in off mode.

Leakage

There is no anticipated leakage from this type of project activity.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(10)}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
PE_y	=	Project emissions in year *y* (t CO_2/yr)

Data and parameters not monitored

In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / Parameter:	$OH_{i,0}$
Data unit:	Hours
Description:	Total length of time server *i* is operational in any mode, in the year prior to DPM implementation. This figure will exclude times when the server was down for maintenance, replacement or power outage
Source of data:	Data Centre
Measurement procedures (if any):	Data from at least 6 months operation should be evaluated, and the parameter value should be extrapolated to one year operation
Any comment:	-

Data / Parameter:	$C_{i,0}$
Data unit:	transactions/second
Description:	Nominal capacity of server *i* in the year prior to DPM implementation
Source of data:	Data Centre
Measurement procedures (if any):	-
Any comment:	The capacity shall be determined according to one of the following standards: UL 2640, TPC or SPEC

Data / Parameter:	$L_{i,0}$
Data unit:	Ratio
Description:	Load of server *i* in the year prior to DPM implementation
Source of data:	Data Centre
Measurement procedures (if any):	The server load as measured by the server's operation system, derived from the ratio between the server's actual usage and its maximal usage level, based on CPU cycles. Only time in which a server is operational shall be considered. Data from at least 6 months operation should be evaluated
Any comment:	-

III. MONITORING METHODOLOGY

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

Data and parameters monitored

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2/MWh
Description:	Grid emission factor in year *y*
Source of data:	Project Participants
Measurement procedures (if any):	As per latest approved version of Tool to calculate the emission factor for an electricity system
Monitoring frequency:	As per latest approved version of Tool to calculate the emission factor for an electricity system
QA/QC procedures:	As per latest approved version of Tool to calculate the emission factor for an electricity system
Any comment:	-

<table>
<tr><td>Data / Parameter:</td><td>$EF_{FF,n,y}$</td></tr>
<tr><td>Data unit:</td><td>tCO_2/TJ</td></tr>
<tr><td>Description:</td><td>Emission factor of fossil fuel type n used in captive power plants in year y</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source.</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>If a) is not available
These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>d) IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a), b) and c) are not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For a) and b): Measurements should be undertaken in line with national or international standards</td></tr>
</table>

Monitoring frequency:	For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$OH_{off,i,y}$
Data unit:	hours/yr
Description:	Total length of turn off events for server *i* in year *y*. This figure excludes times when the server is down for maintenance, replacement or power outage
Source of data:	Data centre
Measurement procedures (if any):	Hours during which servers are turned off (TOE) will be automatically monitored and entered into the DPM system database. The monitoring equipment installed under the CDM project activity should be able to continuously monitor all TOEs and measure the length of time the server is completely off. The duration of each server *i* being off, and the TOE triggering this, shall be recorded in a database
Monitoring frequency:	Continuous
QA/QC procedures:	The TOE should be distributed among all servers within the project boundary, including existing/replacement servers, based only on operational and DPM considerations. This will be achieved through, *inter alia*, comparing the operation profile of the various servers. If a server's operation profile varies from the expected average profile, and this cannot be justified by operational considerations, the value of $OH_{off,i,y}$ for the specific server shall be 0
Any comment:	-

Data / Parameter:	$OH_{i,y}$
Data unit:	hours/yr
Description:	Total length of time server *i* is operational in any mode, in year *y* This figure excludes times when the server is, independently of the project, down for maintenance, replacement or power outage
Source of data:	Data Centre
Measurement procedures (if any):	Hours during which servers are operational, regardless of the operation mode, will be automatically monitored and entered into the DPM system database. The monitoring equipment installed under the CDM project activity should be able to measure the length of time the server is operational
Monitoring frequency:	Continuous
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PR_{idle,i,y}$
Data unit:	kW
Description:	Power requirement to operate server *i* in idle mode
Source of data:	Data centre

Measurement procedures (if any):	Power meters will be used to evaluate the power consumed by each server in idle mode, which will then be entered into a database
Monitoring frequency:	The $PR_{idle,i}$ of servers may change throughout the crediting period if new units are added to replace older units. The parameter will be measured once a server is replaced or modified. Any changes will be included in an updated database for a verifier to review each year
QA/QC procedures:	The validating DOE shall select one or more random rooms or racks of servers in the data centre to confirm these baseline measurements with actual measurements
Any comment:	-

Data / Parameter:	$PR_{off,i,y}$
Data unit:	kW
Description:	Power requirement for server *i* to run when in the off mode
Source of data:	Data centre
Measurement procedures (if any):	Power meters will be used to evaluate the power consumed by each server in off mode, which will then be entered into a database
Monitoring frequency:	The $PR_{off,i}$ of servers may change throughout the crediting period if new units are added to replace older units. The parameter will be measured once a server is replaced or modified. Any changes will be included in an updated database for the verifying DOE to review each year
QA/QC procedures:	The validating DOE shall select one or more random rooms or racks of servers in the data centre to confirm these baseline measurements with actual measurements
Any comment:	-

Data / Parameter:	TOE Criteria
Data unit:	-
Description:	Criteria list of turn-off-events and turn-on-events
Source of data:	DPM service provider
Measurement procedures (if any):	The TOE triggering criteria should be documented in the PDD and continuously monitored during the project operation. If TOE triggering criteria are modified during the crediting period, this has to be clearly reported to the verifying DOE and justified
Monitoring frequency:	Continuous
QA/QC procedures:	A demonstration of metering and monitoring capacity is required during verification to demonstrate how the data for a TOE is collected and logged into the database. The DOE should witness specific TOEs, their effect on the project servers, the power consumption before and during the specific TOEs and how they are recorded and aggregated into an overall database. To ensure that the reduced electricity consumption for which carbon credits are claimed ensue strictly from the implementation of DMP, the TOE triggering criteria and the list of TOEs occurring should be cross-checked with the records of servers' operational mode
Any comment:	-

Data / Parameter:	$C_{i,y}$
Data unit:	transactions/second
Description:	Nominal capacity of server *i* in year *y*
Source of data:	Data Centre
Measurement procedures (if any):	-
Monitoring frequency:	After each equipment modification, upgrade and/or replacement
QA/QC procedures:	-
Any comment:	The capacity shall be determined according to one of the following standards: UL 2640, TPC or SPEC

Data / Parameter:	$L_{i,y}$
Data unit:	Ratio
Description:	Load of server *i* in year *y*
Source of data:	Data Centre
Measurement procedures (if any):	The server load as measured by the server's operation system, derived from the ratio between the server's actual usage and its maximal usage level, based on CPU cycles, and monitored by the DPM For times in which the server operates in idle or off mode, the parameter value is 0
Monitoring frequency:	Continuous
QA/QC procedures:	The data centre's load should be distributed between all servers within the project boundary, including existing/replacement servers, based only on operational and DPM considerations. This will be achieved through, *inter alia*, comparing the operation profile of the various servers. If a server's operation profile varies from the expected average profile, and this cannot be justified by operational considerations, the value of $OH_{off,i,y}$ for the specific server shall be 0.
Any comment:	-

Data / Parameter:	$FC_{n,y}$
Data unit:	Mass or volume unit
Description:	Quantity of fuel type n consumed in captive power plants in year y
Source of data:	Data Centre
Measurement procedures (if any):	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions
Monitoring frequency:	Continuously

QA/QC procedures:	The consistency of metered fuel consumption quantities should be crosschecked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Any comment:	-

Data / Parameter:	$NCV_{n,y}$
Data unit:	GJ/mass or volume unit
Description:	Average net calorific value of fuel type n fired in captive power plants n in year y
Source of data:	The following data sources may be used if the relevant conditions apply:

Data source	Conditions for using the data source
a) Values provided by the fuel supplier in invoices	This is the preferred source.
b) Measurements by the project participants	If a) is not available
c) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)
d) IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If a), b) and c) are not available

Measurement procedures (if any):	For a) and b): Measurements should be undertaken in line with national or international standards.
Monitoring frequency:	For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	EG_y
Data unit:	MWh/yr
Description:	Net electricity generated and utilised by captive power plants in year y
Source of data:	Measurements by project participants
Measurement procedures (if any):	Electricity meters
Monitoring frequency:	Continuously
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	MS_y
Data unit:	Ratio
Description:	Market share of DPM technology
Source of data:	Independent publications or survey
Measurement procedures (if any):	Data centres within the host country and with a comparable capacity from 50% to 150% of the entire data centre where the project is implemented , shall be evaluated. The parameter shall be the fraction of data centres which have DPM implemented, excluding data centres implementing DPM as a CDM project activity If the market share is higher that 50%, the parameter value shall be set at 1
Monitoring frequency:	Parameter shall be set at 0 *ex ante* and updated twice: • At the start of the fourth crediting year; • At the start of the seventh crediting year
QA/QC procedures:	-
Any comment:	-

IV. REFERENCES AND ANY OTHER INFORMATION

Not applicable.

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History of the document

Version	**Date**	**Nature of revision(s)**
01.0.0	EB 67, Annex # 11 May 2012	To be considered at EB 67.
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