CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Trigeneration at Mobile Telephone Networks (MTN), 14th Avenue Commercial Site South Africa
Version: 04
Date: 01/31/2012

A.2. Description of the small-scale project activity:

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Mobile Telephone Networks (henceforth referred to as 'MTN') is multinational telecommunications group, with operations in 21 countries across Africa and the Middle East. MTN's head office is located in Johannesburg, South Africa. This head office is situated on a site which consists of a number of commercial buildings. These buildings include:

- Two office blocks (referred to as 'Phase 1' and 'Phase 2'),
- A data centre,
- A test switch, and
- A service yard.

The head office has an existing heating and cooling system, and is supplied with electricity from South Africa's national grid. This project activity will be implemented at MTN's head office.

Purpose of the project activity

The purpose of this project activity is to reduce the greenhouse gas emissions at MTN's commercial site, through the installation of an on-site, energy efficient, 2.136 MW trigeneration plant. This plant will see the simultaneous production of electricity, cooling, and heating from a single fuel source - methane-rich natural gas which is sourced from the Egoli gas pipeline. The outputs from the trigeneration plant will be used to meet part of the commercial site's energy requirements.

Measures undertaken to reduce greenhouse gas emissions

The trigeneration plant will displace grid electricity. MTN's commercial site currently purchases its electricity from Eskom, South Africa's national electricity provider. The South African grid is predominantly coal-fired (coal accounts for more than 92% of the fuel used in South Africa's electricity generation[1]) and therefore, heavily carbon-intensive. The reduction in electricity consumption from the grid will result in a reduction of greenhouse gas emissions, as well as some of the negative impacts of coal mining. These negative impacts include: the utilisation of scarce water resources; SO_2 emissions; and the impacts associated with the disposal of coal ash.

Contribution of the project activity to sustainable development

The project makes positive contributions to sustainable development. The South African Designated National Authority (DNA) evaluates sustainability in three categories: economic, environmental, and social. The contribution of the project towards sustainable development is discussed below in terms of these three categories:

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[1] Department of Water and Environmental Affairs. (2010). *National Climate Change Response Draft Green Paper, pg 13, para..3.* Retrieved from South Africa Government Online: http://www.environment.gov.za

Economic

There will be a transfer of technology from a developed country to a developing country. The internal combustion engines that are used to generate the electricity are sourced from GE Jenbacher in Austria (Annex-1 country) and will be imported to South Africa. There will be a transfer of knowledge as personnel responsible for the operation and maintenance of the engines will receive the necessary training.
South Africa's economic policy is defined in the document 'The New Growth Path', which is a broad framework that sets out a vision and identifies key areas where jobs can be created in the country[2]. One of the key challenges identified in this document is a lack of skills which constraints economic growth[3]. Increasing the skill level of MTN employees (through training on this project activity) will increase the capability of South Africa's workforce, thereby promoting South Africa's economic growth.
The project will also contribute to foreign reserve earnings for South Africa via the carbon credit sales revenue.

Environmental

This project supports South Africa's emission mitigation actions. According to a letter sent to the United Nations Framework Convention on Climate Change (UNFCCC) on 29/01/2010, South Africa committed to "taking nationally appropriate mitigation actions to enable a 34% deviation below the 'Business as Usual' emissions growth trajectory by 2020 and a 42% deviation below the 'Business as Usual' emissions growth trajectory by 2025". This project will see a reduction of greenhouse gas emissions in South Africa.

Social

South Africa's national electricity provider, Eskom, carried out planned electricity supply interruptions at the beginning of 2008. These interruptions were caused by the demand for electricity exceeding the supply of electricity. During the interruptions, grid electricity was not accessible. Therefore, the electricity saved as a result of the project will alleviate pressure from the national grid. The alleviation of pressure from the national grid will reduce the probability of electricity supply interruptions and make the electricity available for development of other industries.

The historically low cost of electricity in South Africa means that carbon intensive electricity is cheaper than any other source of power. This has made it difficult for energy efficiency projects to compete with coal based power[4]. This project activity will provide MTN with a framework on which to overcome this barrier.

A.3. Project participants:

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[2] South African Government Information. (2011, July 21). *The New Growth Path*. Retrieved February 15, 2012, from Economy: http://www.info.gov.za/aboutsa/economy.htm#growthpath

[3] The South African Government. (2011). *The New Growth Path: The Framework*, page 5 paragraph 4.

[4] Department of Water and Environmental Affairs. (2010). *National Climate Change Response Draft Green Paper, pg 13, para. 5*. Retrieved from South Africa Government Online: http://www.environment.gov.za

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of South Africa (host)	MTN South Africa	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party (ies):

>>
Republic of South Africa

A.4.1.2. Region/State/Province etc.:

>>
Gauteng Province

A.4.1.3. City/Town/Community etc:

>>
Johannesburg

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

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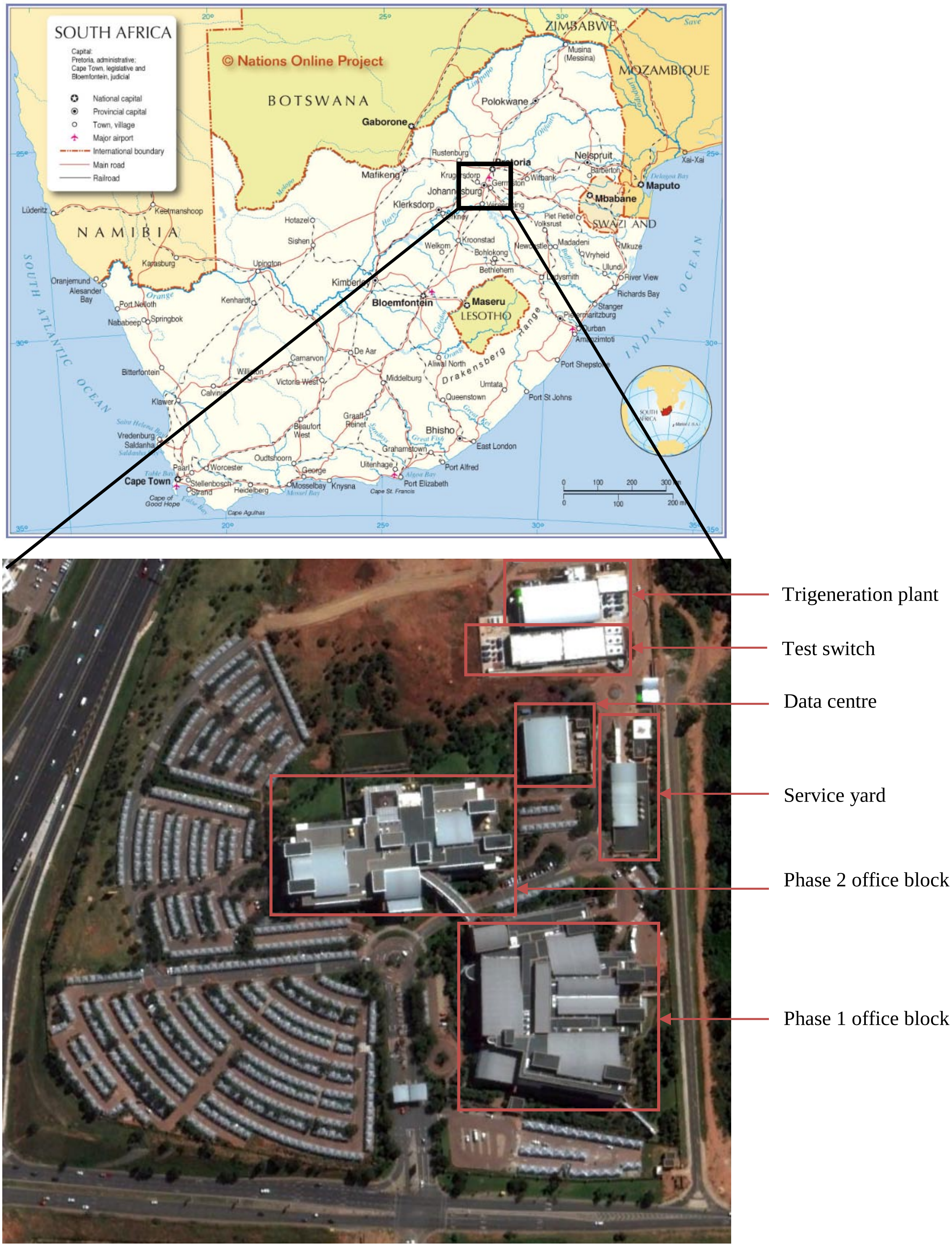
The street address of MTN's head office is: 216 14th Avenue, Fairland, Johannesburg. The GPS coordinates for each of the commercial buildings at the head office is shown in the table below, together with the distance of each building from the trigeneration plant:

Commercial building	*GPS coordinates*		*Distance from the trigeneration plant (m)*
	Latitude	Longitude	
Phase 1 office block	26° 9'2.42"S	27°55'55.60"E	246
Phase 2 office block	26° 8'59.04"S	27°55'51.38"E	189
Data centre	26° 8'56.75"S	27°55'55.25"E	72
Test switch	26° 8'53.53"S	27°55'55.67"E	34
Trigeneration plant	26° 8'54.47"S	27°55'55.67"E	-
Service yard	26° 8'57.83"S	27°55'57.15"E	112

The location of the project site (including the commercial buildings on the site) is shown in the figures below.


SOUTH AFRICA
© Nations Online Project
BOTSWANA
NAMIBIA
ZIMBABWE
MOZAMBIQUE
LESOTHO
SWAZILAND
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
Trigeneration plant
Test switch
Data centre
Service yard
Phase 2 office block
Phase 1 office block

MTN's head office site in Johannesburg, South Africa

A.4.2. Type and category (ies) and technology/measure of the small-scale project activity:

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The project is applying for registration under AMS II.K.: 'Installation of co-generation or tri-generation systems supplying energy to commercial buildings', Version 01, Sectoral Scope 03, EB 54. This methodology was developed specifically for this project. The type of technology to be implemented at MTN's commercial site is described below.

MTN is installing an onsite, energy efficient, 2.136 MW trigeneration plant. Trigeneration is the simultaneous production of electricity, heat, and cooling from a single fuel source. The fuel used in this project activity is methane-rich natural gas.

Natural gas

The natural gas used at the trigeneration plant is sourced from the Egoli gas pipeline. The Egoli gas pipeline originates in the off-shore gas fields in Temane, Mozambique, where it then piped over 860 km to the Gauteng province[5]. This is illustrated in Figure 3 below.

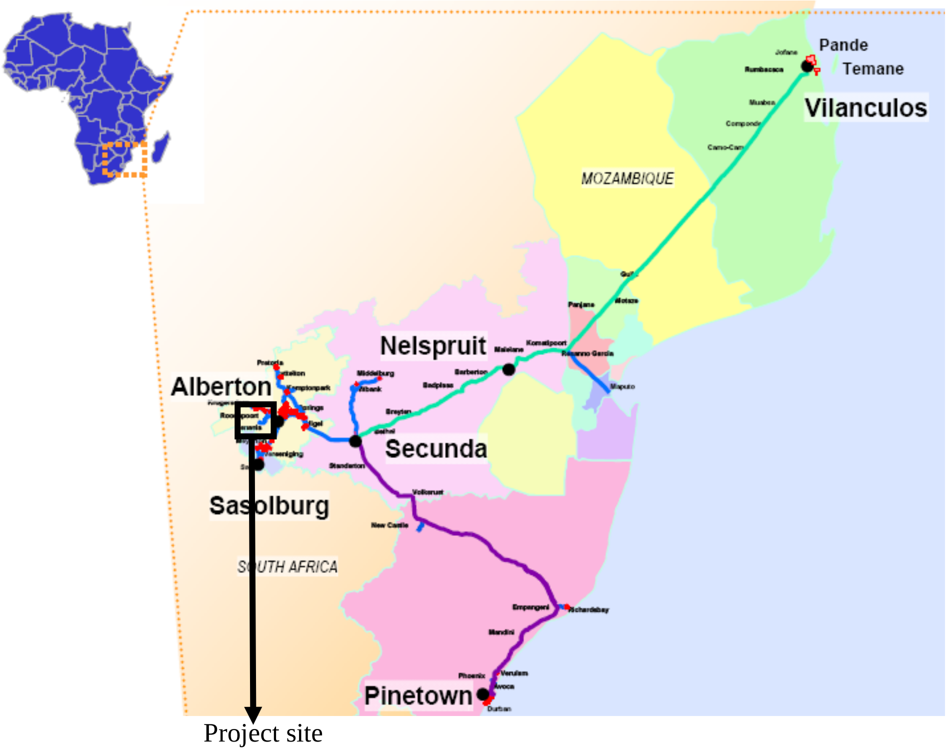

Figure 1: The Egoli gas pipeline[5]

The combustion of natural gas (used in the generation of electricity) emits lower levels of NO_x, CO_2, and particulate emissions, than coal, which is primarily used for South Africa's electricity production. The

[5] Retrieved from http://www.joburg-archive.co.za/2009/pdfs/economic_development/egoli_gas.pdf

combustion of natural gas also emits negligible amounts of SO_2 and mercury[6]. For this reason, the project makes a contribution to global greenhouse gas emission reduction.

Power generation

The electricity at the trigeneration plant will be generated by two internal combustion engines. The internal combustion engines are spark ignition engines operating on the same principles as normal petrol engines. These engines have electrical outputs of 1.068 MW.

The engines are sourced from GE Jenbacher in Austria, an annex-1 country. Therefore, there will be a technology transfer from an industrial country in Europe to a developing country in Africa. These internal combustion engines have been used in six other registered CDM projects in South Africa. These projects are:

– PetroSA Biogas to Energy Project (project 0446)
– Durban Landfill Gas-to-Electricity Project – Mariannhill and La Mercy (project 0545)
– Kanhym Farm manure to energy project (project 1665)
– Durban Landfill-Gas Bisaser Road (project 1921)
– Alton Landfill Gas to Energy Project (project 2549)
– Ekurhuleni Landfill Gas Recovery Project – South Africa (project 3677)

However, these projects are all biogas projects and therefore differ fundamentally from the MTN project. This project aims to be the first CDM project to implement trigeneration technology at a commercial site, as the project participant wrote the methodology used in this project activity (AMS II.K.).

Cooling

The waste heat from the engines will be used to generate cooling at the trigeneration plant. The waste heat will be passed through three absorption chillers (which make use of a thermal-chemical process) to generate chilled water. The absorption chillers use lithium bromide, a refrigerant with no global warming potential (GWP). Therefore, the project activity complies with applicability criterion 9 in methodology AMS II.K.

Provided that the internal combustion engines are operational (and that there is a cooling demand), chilled water will be produced, independent of power supply and unaffected by load shedding. The cooling output of the absorption chillers are given below.

Absorption chiller 1 cooling output	550 kW
Absorption chiller 2 cooling output	550 kW
Absorption chiller 3 cooling output	450 kW

The chilled water is supplied to the air-handing units that supply the cooled air for the electronic equipment housed in the new building – the test switch centre on the ground floor and the data centre on the first floor.

[6] NaturalGas.org. (2010). *Natural Gas and the Environment.* Retrieved from http://www.naturalgas.org/environment/naturalgas.asp

Heating

A 100kW heat exchanger will be used to generate heating at the trigeneration plant. The cooling and heating at the trigeneration plant will be automatically controlled to provide the required supply-water temperature conditions during summer or winter.

A block flow diagram of the trigeneration plant is illustrated in Figure 4 below.

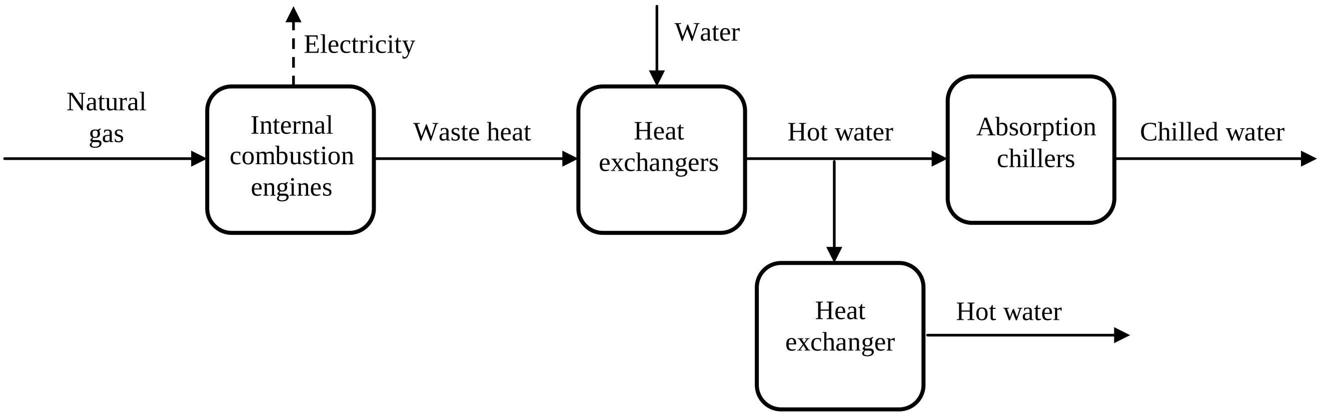

Figure 2: Block flow diagram of the trigeneration plant

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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Years	**Estimation of annual emission reductions in tonnes of CO_2e**
2012	15,284
2013	15,284
2014	15,284
2015	15,284
2016	15,284
2017	15,284
2018	15,284
2019	15,284
2020	15,284
2021	15,284
Total estimated reductions (tonnes of CO_2e)	152,840
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	15,284

A.4.4. Public funding of the small-scale project activity:

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No public funding will be used in the development or in the implementation of this project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to the 'Guidelines on assessment of debundling for SSC project activities' (Version 03) EB 54 Annex 13, a proposed small scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(a) With the same project participants;
(b) In the same project category and technology/measure;
(c) Registered within the previous two years;
(d) Whose boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The size of this project falls well under the limits of a small-scale project activity. This is the first CDM project for MTN and, as such, MTN has not registered a similar project activity within a 1 km radius of its commercial site within the previous two years. Therefore, as per Appendix C of the 'Simplified modalities and procedures for small-scale CDM project activities[7]', this project activity is not a debundled component of a large-scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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The approved baseline and monitoring methodology is AMS II.K.: 'Installation of co-generation or tri-generation systems supplying energy to commercial buildings', Version 01, Sectoral Scope: 03, EB 54.

The following methodological tools are used:
- 'Tool to determine the remaining lifetime of equipment', Version 01.
- 'Tool to calculate the emission factor for an electricity system', Version 02.2.1, as referred to by AMS-I.D Version 17. Paragraph 12 of AMS-I.D states that 'the emission factor can be calculated in a transparent and conservative manner using a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures described in the "Tool to calculate the emission factor for an electricity system"'.
- 'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion', Version 02.
- 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption', Version 01.

[7] http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf#page=43

B.2 Justification of the choice of the project category:

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The project activity complies with the applicability criteria as set out in the selected methodology. This is justified in the table below.

Item	AMS II.K.	Project activity at MTN
1	*This methodology applies to the installation of fossil fuel based co-generation or tri-generation facilities that simultaneously produce electricity and cooling (e.g., chilled water) and/or heating (e.g., steam or hot water) for supplying such energy to commercial, non-industrial, buildings.*	This project involves the installation of a new trigeneration plant at MTN’s commercial site. This plant will simultaneously produce electricity, cooling, and heating, which will meet part of the demand at the commercial site.
2	*The methodology is applicable to installation of new co-generation or tri-generation systems that replace or supplement either: the operation of (a) existing systems that supply electricity (grid or on-site generation) and cooling (e.g., chillers) and/or heating systems (e.g., boilers) or (b) electricity and cooling and/or heating systems that would have been built and utilized.*	The new trigeneration plant will be installed at MTN’s commercial site to supplement the operation of existing systems that supply electricity, cooling and heating.
3	*The methodology does not apply to the replacement of existing co-generation or tri-generation systems.*	The project activity involves the installation of a new trigeneration plant, and not the replacement of an existing trigeneration system.
4	*If it is identified that the baseline situation is the continued use of existing system then the existing system must have been in operation for at least the immediately prior three years, to the start date of the project activity, in order to ensure that adequate baseline performance data are available.*	The existing district heating and cooling system has been in operation for more than three years.
5	*This methodology only applies to commercial, non-industrial applications. Projects that comprise energy efficiency measures implemented through integration of a number of utility provisions (for example, integrating power, steam/heat and cooling systems) of an industrial facility cannot apply this methodology.*	MTN is a mobile operator, whose operation affects commerce (where commerce is transactions (sales and purchases) having the objective of supplying commodities (goods and services)). Hence, MTN is classified as a commercial, non-industrial facility, and therefore complies with this applicability criterion. This project activity does not involve the integration of a number of utility provisions.

6	*For the purpose of this methodology, natural gas is defined as a gas which consists primarily of methane and which is generated from (i) natural gas fields (non-associated gas), (ii) associated gas found in oil fields. It may be blended up to 1% on a volume basis with gas from other sources, such as, inter alia, biogas generated in biodigesters, gas from coal mines, gas which is gasified from solid fossil fuels, etc.*	The internal combustion engines will operate on natural gas from the Egoli gas pipeline. This gas is generated in natural gas fields in Mozambique, which is then piped more than 900 km to the project site.
7	*Any chilled water/cooling, steam/hot water/heat and electricity produced by the co-generation or tri-generation system must be used on-site (within the project boundary) to meet all or part of the energy demand. Existing chillers, boilers, electrical heaters, electricity generating units, etc. may remain in operation after the implementation of the project activity to either (a) supply the balance of the demand not met by the co-generation or tri-generation systems if the cogeneration or tri-generation system has insufficient capacity to supply the total energy demand and/or (b) provide backup to the co-generation or tri-generation facilities. However, emission reductions can only be claimed for the cooling, heat and electricity produced by the new co-generation or tri-generation system.*	The chilled water supplied by the trigeneration plant will be used on-site to meet part of the MTN's demand. Electrical vapour compression chillers will still remain in operation after the implementation of the project activity. The hot water generated by the trigeneration plant will be used to meet part of MTN's hot water demand. Electrical heaters will still remain in operation after the implementation of the project activity to supply the balance of the demand.
8	*The energy savings caused by a single project activity may not exceed the equivalent of 60 GWh per year. A maximum saving of 60 GWh is equivalent to maximum savings of 60 GWhe of electricity consumption or maximum savings of 180 GWhth of fuel consumption, i.e., for calculation of maximum savings allowable per year, 1 GWHe equals 3 GWHth.*	The project activity results in energy savings of approximately 30 GWh per year.
9	*This project activity can include installation of cooling equipment which use refrigerants only if such refrigerants have no global warming potential (GWP) and no ozone depleting potential (ODP) and if such installation is not mandated by laws or regulations.*	The project activity makes use of lithium bromide in the absorption chillers. Lithium bromide does not have a global warming potential (GWP).

10	*In case the produced electricity, cooling and/or heat are delivered to a facility that is not owned or under the control of the project owner, a contract between the project owner and consumer of the energy must be in force, during the crediting period, specifying that only the facility generating the energy can claim CERs from the emissions displaced by the subject project.*	The electricity, cooling and heat are consumed on-site.

The project meets all of the applicability criteria in AMS II.K, as demonstrated in the table above. Furthermore, the annual energy savings of the trigeneration plant will not exceed 60 GWh (or an appropriate equivalent) in any year of the crediting period.

B.3. Description of the project boundary:

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According to methodology AMS II.K., the project boundary “encompasses the physical site of the facility where the co-generation or tri-generation system is being implemented and the facility or facilities consuming the energy generated by the project activity”.

The project boundary is illustrated in Figure 5 below.

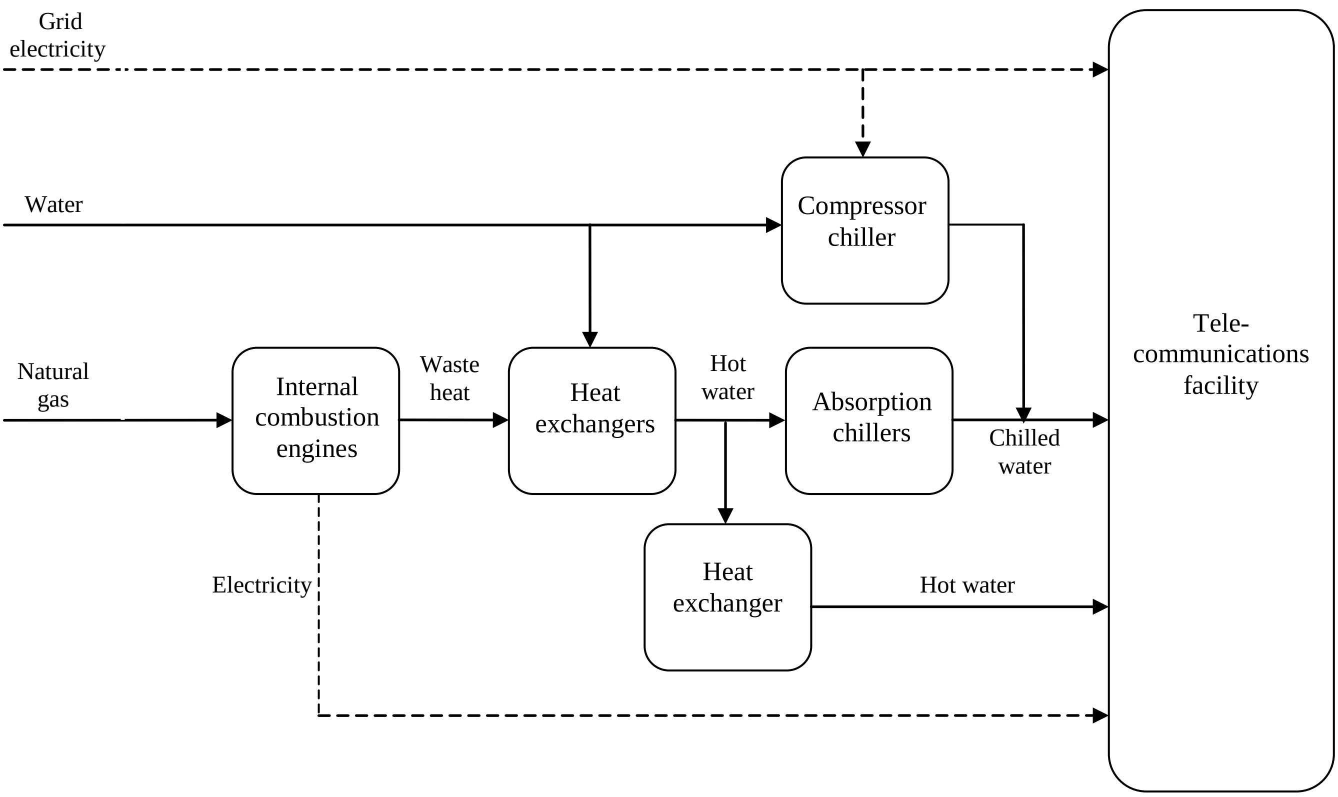

Figure 3: Project boundary

B.4. Description of baseline and its development:

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Methodology AMS II.K Version 01 requires that the project participant choose between two baseline options. Option 13 (a) is appropriate as the project involves the supplementing of an existing system – the project consists of a new trigeneration system that supplements grid electricity, and existing heating and cooling systems.

The project participant is then required to select the appropriate baseline scenario from further two options. Option 13 (a) (i) is applicable to this project activity as the total annual consumption of energy (electricity, cooling, and heating) at MTN's commercial site does not increase by more than the 20% (during the crediting period) from the established baseline values.

For this reason, the baseline scenario is the continuation of the operation of the existing systems:

- Electricity is sourced from the national grid;
- Heating is sourced from conventional electric heaters; and
- Cooling is sourced from conventional electric vapour compression chillers.

Therefore, the baseline emissions are established from existing systems (using data from the three years prior to the project start date).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to paragraph 28 of the 'Simplified modalities and procedures for small-scale CDM project activities', a simplified baseline and monitoring methodology may be used for a small-scale CDM project activity if the project participants are able to demonstrate that the project activity would otherwise not be implemented due to the existence of one or more of the barriers. The attachment A to Appendix B corresponds to the list of barriers that project participants shall use in order to demonstrate that a small-scale project activity would not have occurred otherwise (i.e. is additional).This will be demonstrated below.

Investment barrier

The cost of the project activity is significantly higher than the continuation of the current situation (which is importing electricity from the grid, and sourcing the building's heating and cooling requirements from conventional electric heaters and chillers). Although it is associated with higher emissions, importing electricity from the national grid is a viable alternative.

The capital expenditure of this project activity is approximately R56 million.

Technological barrier

Importing electricity from the national grid (the business as usual practice) is the least technologically advanced option with little risk as the electricity generation is spread over nine entities in the Southern African Power Pool. The distribution of natural gas, however, is only through SASOL.

Barrier due to prevailing practice

Commercial buildings in South Africa typically use electricity to meet all of their energy requirements. In South Africa it is extremely unusual for commercial facilities to install onsite trigeneration systems.

Other barriers

A telecommunications business such as MTN does not typically have the capacity to implement, operate and maintain electricity generating equipment.

Notice of prior consideration

The project start date is 24/11/2008. Notice of prior consideration (in terms of EB 49 Annex 12) was given to the EB on 30/04/2009, which is within 6 months from the project activity start date.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The emission reductions were calculated in accordance with AMS II.K.: 'Installation of co-generation or tri-generation systems supplying energy to commercial buildings', Version 01, Sectoral Scope 03, EB 54.

Baseline Emissions

The baseline emissions, BE_y, are calculated using equation (1) of the applied methodology:

$$BE_y = BE_{grid,y} + BE_{capt,y} + BE_{BC,y} + BE_{BH,y} \qquad \text{(AMS II.K. equation 1)}$$

Where:

BE_y	Baseline emissions in year *y* (tCO_2e/year)
$BE_{grid,y}$	Baseline emissions associated with grid electricity displaced by the project in year *y* (tCO_2e/year)
$BE_{capt,y}$	Baseline emissions associated with the electricity produced by a captive power plant in year *y* (tCO_2e/year)
$BE_{BC,y}$	Baseline emissions associated with the cooling (e.g., chilled water) produced in year *y* (tCO_2e/year)
$BE_{BH,y}$	Baseline emissions associated with the heat (e.g., steam or hot water) produced in year *y* (tCO_2e/year)

The project activity does not displace electricity that would have been obtained from a captive power plant. Hence, $BE_{capt,y} = 0$.

The baseline electricity related emissions are calculated as follows:

Since the project activity displaces electricity that was previously obtained from the grid or would have been obtained from the grid, the baseline emissions include the CO_2 emissions of the power plants connected to the grid. The baseline emissions associated with grid electricity for the project, $BE_{grid,y}$, are calculated using equation (2) of the applied methodology:

$BE_{grid,y} = E_{grid,y} \times EF_{grid,y}$ (AMS II.K. equation 2)

Where:

$BE_{grid,y}$	Baseline emissions for the grid electricity displaced by the project in year *y* (tCO_2e/year)
$E_{grid,y}$	Amount of grid electricity displaced by the project in year *y* (MWh/year)
$EF_{grid,y}$	Emission factor of the grid (calculated with methodology AMS-I.D) (tCO_2e/MWh)

The baseline emissions associated with the grid electricity consumed to produce chilled water within the project boundary are calculated using equation (5) of the applied methodology:

$BE_{BC,y} = EF_{ELEC,y} \times \sum_i \frac{C_{P,i,j}}{COP_{c,i}}$ (AMS II.K. equation 5)

Where:

$BE_{BC,y}$	Baseline emissions for chilled water produced in the project activity in year *y* (tCO_2e/year)
$EF_{ELEC,y}$	Electricity emission factor of the grid, calculated in accordance with methodology AMS-I-D (tCO_2e/MWh). The calculations for the emission factor of the grid are provided in Annex 3.
$COP_{c,i}$	The Coefficient of Performance of the baseline scenario chiller(s) *i* (MWh_{th}/MW_{he}). Since the baseline scenario is existing chillers, the COP is based on existing chiller performance from the last three years, immediately preceding the start of the project activity. Since multiple chillers exist, average performance data will be used in a conservative manner with consideration of the historic output and power consumption of each chiller.
$C_{P,i,j}$	Cooling output of baseline scenario chiller(s) *i* in year *y* (MWh_{th}/year)

The cooling output of each baseline scenario chiller *i* is calculated using measured values of the total chilled water mass flow rate and of the differential temperature of incoming and outgoing chilled water, as per equation (6) of the applied methodology:

$C_{P,i,j} = \frac{\sum_{h=1}^{8,760} m_{C,i,h} \times C_{pw,C} \times \Delta T_{C,i,h}}{3600}$ (AMS II.K. equation 6)

Where:

$C_{P,i,j}$	Cooling output if the baseline chiller(s) *i* in year *y* ($MWht_h$/year)
$m_{C,i,h}$	The chilled water mass flow rate for chiller(s) *i* produced by project in hour *h* of year *y* (tonnes/hour)
$C_{pw,C}$	The specific heat capacity of water (MJ/tonnes°C) (4.2 MJ/t°C)
$\Delta T_{C,i,h}$	Differential temperature of inlet and outlet chilled water for chiller(s) *i* in hour *h* of year *y* of incoming and outgoing water from project (°C)

Since the project activity uses electricity in its water heating system, the baseline emissions are determined using the electricity emission factor and hourly measurements of the total water mass flow-rate and differential temperature of incoming and outgoing water, per equation (7) of the applied methodology. This equation is based on the assumption that the efficiency of electric water heating systems is 100%.

$$BE_{BH,y} = EF_{ELEC,y} \times \sum_{h=1}^{8.760} \frac{m_h \times C_{pw} \times \Delta T_h}{3600}$$ (AMS II.K. equation 7)

Where:

$BE_{BH,y}$	Baseline emissions for hot water produced in the project activity in year *y* (tCO_2e/year)
$EF_{ELEC,y}$	Electricity emission factor of the grid (calculated in accordance with methodology AMS-I-D) (tCO_2e/MWh). The calculations for the emission factor of the grid are provided in Annex 3.
m_h	The water mass flow rate from heater(s) during hour *h* in year *y* (tonnes/hour)
C_{pw}	The specific heat capacity of water (MJ/tonnes °C) (4.2 MJ/t °C)
ΔT_h	Differential temperature of inlet and outlet hot water for heater(s) during hour *h* (°C)

Project Emissions

The project emissions are calculated as per the applied methodology:

$$PE_y = PE_{FC,j,y} + PE_{EC,y} + PE_{LR,y}$$

Where:

PE_y	Emissions in year *y* (tCO_2e/year) in project activity
$PE_{FC,j,y}$	Emissions from the consumption of fossil fuels in the project activity in year *y* (tCO_2e/year)
$PE_{EC,y}$	Emissions from the consumption of electricity in the project activity in year *y* (tCO_2e/year)
$PE_{LR,y}$	Emissions associated with the leakage of refrigerant with a GWP in the project activity in year y (tCO_2e/year)

The chillers used in the project activity do not make use of a refrigerant with a GWP. Hence, $PE_{LR,y} = 0$

Fossil Fuel Consumption:

The only fossil fuel used in the project activity is natural gas. The emissions associated with the consumption of natural gas are calculated in accordance with the 'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion', Version 02, EB 41, Annex 11.

The project emissions from the consumption of natural gas are calculated with equation 1 from the Tool; where the emissions are based on the quantity of fuel combusted and the CO_2 emission coefficient of the fuel; as follows:

$$PE_{FC,j,y} = FC_{j,y} \times COEF_{i,y}$$ (Fossil fuel tool equation 1)

Where:

$PE_{FC,j,y}$	Project emissions from the consumption of fossil fuels in year *y* (tCO_2e/yr)
$FC_{j,y}$	Quantity of fuel consumed by the project activity in year *y* (m^3/yr)
$COEF_{i,y}$	CO_2 emission coefficient of natural gas in year *y* (tCO_2e/ m^3)

The CO_2 emission coefficient of natural gas is calculated using Option B from the Tool, where the coefficient, $COEF_{i,y}$, is based on net calorific value and the CO_2 emission factor of natural gas; as follows:

$$COEF_{i,y} = NCV_{NG,y} \times EF_{CO_2,NG,y}$$ (Fossil fuel tool option B)

Where:

$COEF_{i,y}$	CO_2 emission coefficient of natural gas in year *y* (tCO_2e/tonne)
$NCV_{NG,y}$	Net calorific value of natural gas in year *y* (GJ/tonne)
$EF_{CO_2,NG,y}$	Emission factor of natural gas in year *y* (tCO_2e/GJ)

Electricity Consumption:

The electricity consumption of the project, including any electricity used to run auxiliary equipment, is calculated using the 'Tool to calculate baseline, project and/or leakage emissions from electricity consumption', Version 01, EB 39, Annex 7. Scenario A of the Tool applies because electricity is purchased from the grid only.

A generic approach is taken. The project emissions from the consumption of electricity by trigeneration plant is calculated based on the quantity of electricity consumed and an emission factor for electricity generation (taking into account transmission losses). This is calculated using equation (1).

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times \left(1 + TDL_{j,y}\right)$$ (Electricity consumption tool equation 1)

Where:

$PE_{EC,y}$	Project emissions from electricity consumption in year y (tCO_2/yr)
$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{EL,j,y}$	Emission factor for electricity generation for source *j* in year *y* (tCO_2/MWh)
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*

Option A1 is selected. The combined margin emission factor of the project electricity system is calculated using version 02.2.1 of the 'Tool to calculate the emission factor for an electricity system'. These calculations are provided in Annex 3. Therefore:

$$EF_{EL,j,y} = EF_{grid,CM,y}$$

Leakage Emissions

According to AMS II.K., "leakage is to be considered if the displaced energy generating equipment is transferred from another activity or the existing equipment is transferred to another activity". There is no displaced equipment as a result of the project activity, and therefore, no leakage associated with the project activity.

Emission Reductions

The emission reductions are calculated as the difference between the baseline emissions and the project and leakage emissions, as represented below:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	Emission reductions in year *y* (tCO_2/year)
BE_y	Baseline emissions in year *y* (tCO_2/year)
PE_y	Project emissions in year *y* (tCO_2/year)
LE_y	Leakage emissions in year *y* (tCO_2/year)

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2e/MWh
Description:	Emission factor of the grid
Source of data used:	This parameter is calculated in accordance with the methodology AMS-I.D.
Value applied:	1.021
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to paragraph 12 of AMS-I.D version 17, the emission factor can be calculated in a transparent and conservative manner using a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' (version 02.2.1). As per applied tool, this value will be calculated ex-ante. The calculations for the tool are provided in Annex 3.
Any comment:	

Data / Parameter:	$EF_{ELEC,y}$
Data unit:	tCO_2e/MWh
Description:	Emission factor of the grid
Source of data used:	This parameter is calculated in accordance with the methodology AMS-I.D..
Value applied:	1.021
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to paragraph 12 of AMS-I.D version 17, the emission factor can be calculated in a transparent and conservative manner using a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' (version 02.2.1). As per applied tool, this value will be calculated ex-ante. The calculations for the tool are provided in Annex 3..
Any comment:	

Data / Parameter:	$COP_{c,i}$
Data unit:	MWh_{th}/MW_{he}
Description:	The Coefficient of Performance of the baseline scenario chiller(s) *i*
Source of data used:	Existing chiller performance from the last three years, immediately preceding

	the start of the project activity.
Value applied:	2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since multiple chillers exist, average performance data is used in a conservative manner with consideration of the historic output and power consumption of each chiller.
Any comment:	

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for the project electricity system in year *y*
Source of data used:	This parameter is calculated in accordance with the 'Tool to calculate the emission factor for an electricity system', Version 02.2.1
Value applied:	1.021
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per applied tool, this value will be calculated ex-ante. The calculations for the tool are provided in Annex 3.
Any comment:	

Data / Parameter:	$TDL_{j,y}$
Data unit:	Fraction
Description:	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
Source of data used:	Eskom's Annual Report
Value applied:	0.067
Justification of the choice of data or description of measurement methods and procedures actually applied :	Eskom measures the losses on their system every year and publishes them in the annual report.
Any comment:	N/A

B.6.3 Ex-ante calculation of emission reductions:

>>

The baseline emissions, BE_y, are calculated using equation (1) of the applied methodology:

$$BE_y = BE_{grid,y} + BE_{capt,y} + BE_{BC,y} + BE_{BH,y}$$ (AMS II.K. equation 1)

Year	BE_y	$BE_{grid,y}$	$BE_{capt,y}$	$BE_{BC,y}$	$BE_{BH,y}$
	tCO_2e/y	tCO_2e/y	tCO_2e/y	tCO_2e/y	tCO_2e/y

2012	27,059	19,167	0	6,990	902
2013	27,059	19,167	0	6,990	902
2014	27,059	19,167	0	6,990	902
2015	27,059	19,167	0	6,990	902
2016	27,059	19,167	0	6,990	902
2017	27,059	19,167	0	6,990	902
2018	27,059	19,167	0	6,990	902
2019	27,059	19,167	0	6,990	902
2020	27,059	19,167	0	6,990	902
2021	27,059	19,167	0	6,990	902

The baseline emissions associated with grid electricity for the project, $BE_{grid,y}$, are calculated using equation (2) of the applied methodology:

$$BE_{grid,y} = E_{grid,y} \times EF_{grid,y}$$ (AMS II.K. equation 2)

Year	$BE_{grid,y}$	$E_{grid,y}$	$EF_{grid,y}$
	tCO_2e/y	MWh/y	tCO_2e/MWh
2012	19,167	18,430	1.04
2013	19,167	18,430	1.04
2014	19,167	18,430	1.04
2015	19,167	18,430	1.04
2016	19,167	18,430	1.04
2017	19,167	18,430	1.04
2018	19,167	18,430	1.04
2019	19,167	18,430	1.04
2020	19,167	18,430	1.04
2021	19,167	18,430	1.04

The baseline emissions associated with the electricity consumed to produce chilled water within the project boundary are calculated using equation (5) of the applied methodology:

$$BE_{BC,y} = EF_{ELEC,y} \times \sum_i \frac{C_{P,i,j}}{COP_{c,i}}$$ (AMS II.K. equation 5)

Year	$BE_{BC,y}$	$EF_{ELEC,y}$	$C_{P,i,j}$	$COP_{c,i}$
	tCO_2e/y	tCO_2e/MWh	MWh_{th}/yr	MWh_{th}/MW_{he}
2012	6,990	1.04	13,442	2
2013	6,990	1.04	13,442	2
2014	6,990	1.04	13,442	2
2015	6,990	1.04	13,442	2
2016	6,990	1.04	13,442	2

2017	6,990	1.04	13,442	2
2018	6,990	1.04	13,442	2
2019	6,990	1.04	13,442	2
2020	6,990	1.04	13,442	2
2021	6,990	1.04	13,442	2

The baseline emissions associated with the electricity consumed to produce hot water within the project boundary are calculated using equation (7) of the applied methodology:

$$BE_{BH,y} = EF_{ELEC,y} \times \sum_{h=1}^{8.760} \frac{m_h \times C_{pw} \times \Delta T_h}{3600}$$ (AMS II.K. equation 7)

Year	$BE_{BH,y}$	$EF_{ELEC,y}$	$\Sigma m_h.C_{pw}.\Delta T_h/3600$
	tCO_2e/y	tCO_2e/MWh	MWh/y
2012	902	1.04	867
2013	902	1.04	867
2014	902	1.04	867
2015	902	1.04	867
2016	902	1.04	867
2017	902	1.04	867
2018	902	1.04	867
2019	902	1.04	867
2020	902	1.04	867
2021	902	1.04	867

The project emissions are calculated as per methodology AMS II.K:

$$PE_y = PE_{FC,j,y} + PE_{EC,y} + PE_{LR,y}$$

Year	PE_y	$PE_{FC,j,y}$	$PE_{EC,y}$	$PE_{LR,y}$
	tCO_2e/y	tCO_2e/y	tCO_2e/y	tCO_2e/y
2012	11,775	9,260	2,516	0
2013	11,775	9,260	2,516	0
2014	11,775	9,260	2,516	0
2015	11,775	9,260	2,516	0
2016	11,775	9,260	2,516	0
2017	11,775	9,260	2,516	0
2018	11,775	9,260	2,516	0
2019	11,775	9,260	2,516	0
2020	11,775	9,260	2,516	0
2021	11,775	9,260	2,516	0

The project emissions from the consumption of natural gas are calculated using equation 1 of the tool:

$$PE_{FC,j,y} = FC_{j,y} \times COEF_{i,y}$$ (Tool equation 1)

Year	$PE_{FC,j,y}$	$FC_{j,y}$	$COEF_{i,y}$
	tCO_2e/y	m^3/y	tCO_2e/m^3
2012	9,260	5,157,993	0.00180
2013	9,260	5,157,993	0.00180
2014	9,260	5,157,993	0.00180
2015	9,260	5,157,993	0.00180
2016	9,260	5,157,993	0.00180
2017	9,260	5,157,993	0.00180
2018	9,260	5,157,993	0.00180
2019	9,260	5,157,993	0.00180
2020	9,260	5,157,993	0.00180
2021	9,260	5,157,993	0.00180

The CO_2 emission factor of natural gas is calculated using option B of the tool:

$$COEF_{i,y} = NCV_{NG,y} \times EF_{CO_2,NG,y}$$ (Tool option B)

Year	$COEF_{i,y}$	$NCV_{CO2,y}$	$EF_{CO2,NG,y}$
	tCO_2e/m^3	MJ/m^3	tCO_2e/MJ
2012	0.00180	32	0.0000561
2013	0.00180	32	0.0000561
2014	0.00180	32	0.0000561
2015	0.00180	32	0.0000561
2016	0.00180	32	0.0000561
2017	0.00180	32	0.0000561
2018	0.00180	32	0.0000561
2019	0.00180	32	0.0000561
2020	0.00180	32	0.0000561
2021	0.00180	32	0.0000561

The electricity consumption of the project is calculated using equation (1) of the tool:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times \left(1 + TDL_{j,y}\right)$$ (Tool equation 1)

Year	$PE_{EC,y}$	$EC_{PJ,j,y}$	$EF_{EL,j,y}$	$TDL_{j,y}$
	tCO_2e/y	MWh/y	tCO_2e/MWh	-
2012	2,516	2,419	1.04	0
2013	2,516	2,419	1.04	0
2014	2,516	2,419	1.04	0
2015	2,516	2,419	1.04	0
2016	2,516	2,419	1.04	0
2017	2,516	2,419	1.04	0
2018	2,516	2,419	1.04	0
2019	2,516	2,419	1.04	0
2020	2,516	2,419	1.04	0
2021	2,516	2,419	1.04	0

The emission reductions of the project are calculated using the equation below:

$$ER_y = BE_y - PE_y - LE_y$$

Year	ER_y	BE_y	PE_y	LE_y
	tCO_2e/y	tCO_2e/y	tCO_2e/y	tCO_2e/y
2012	15,284	27,059	11,775	0
2013	15,284	27,059	11,775	0
2014	15,284	27,059	11,775	0
2015	15,284	27,059	11,775	0
2016	15,284	27,059	11,775	0
2017	15,284	27,059	11,775	0
2018	15,284	27,059	11,775	0
2019	15,284	27,059	11,775	0
2020	15,284	27,059	11,775	0
2021	15,284	27,059	11,775	0

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Year	**Estimation of project activity emissions (tCO_2e)**	**Estimation of baseline emissions (tCO_2e)**	**Estimation of leakage (tCO_2e)**	**Estimation of overall emission reductions (tCO_2e)**
2012	11,775	27,059	0	15,284
2013	11,775	27,059	0	15,284
2014	11,775	27,059	0	15,284
2015	11,775	27,059	0	15,284
2016	11,775	27,059	0	15,284
2017	11,775	27,059	0	15,284
2018	11,775	27,059	0	15,284
2019	11,775	27,059	0	15,284
2020	11,775	27,059	0	15,284
2021	11,775	27,059	0	15,284
Total (tonnes of CO_2e)	117,752	270,592	0	152,840

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$E_{grid,y}$
Data unit:	MWh
Description:	Amount of grid electricity displaced by the project in year *y*
Source of data to be used:	Measured at project site

Value of data	18,430
Description of measurement methods and procedures to be applied:	The amount of grid electricity displaced by the project activity will be monitored continuously using a four-quadrant energy meter with a 0.2 accuracy class. The readings from this meter will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format.

Data / Parameter:	$C_{P,i,j}$
Data unit:	MWh_{th}/year
Description:	Cooling output of baseline scenario chillers in year *y*
Source of data to be used:	Measured at project site
Value of data	13,422
Description of measurement methods and procedures to be applied:	The cooling output of the baseline scenario chillers will be monitored continuously using energy meters. The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	$m_{C,i,h}$
Data unit:	tonnes/hour
Description:	The chilled water mass flow rate for chillers *i* produced by project in hour *h* of year *y*
Source of data to be used:	Measured at project site
Value of data	Not used for the purposes of estimating ex-ante emission reductions.
Description of measurement methods and procedures to be applied:	The chilled water mass flow rate will be monitored continuously using thermal energy meters with < 0.5% error in reading. The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	$\Delta T_{C,i,h}$
Data unit:	°C
Description:	Differential temperature of inlet and outlet chilled water for chillers *i* in hour *h* of year *y* of incoming and outgoing water from project

Source of data to be used:	Measured at project site
Value of data	Not used for the purposes of estimating ex-ante emission reductions.
Description of measurement methods and procedures to be applied:	Each chiller has a chilled water supply and return temperature sensor, which will be used to measure the incoming and outgoing chiller water continuously. The differential temperature will be calculated in the onsite Building Management System (BMS). The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	m_h
Data unit:	tonnes/hour
Description:	The water mass flow rate from heater(s) during hour *h* in year *y*
Source of data to be used:	Measured at project site
Value of data	Not used for the purposes of estimating ex-ante emission reductions.
Description of measurement methods and procedures to be applied:	The water mass flow rate from the heat exchanger will be monitored continuously using thermal energy meters with < 0.5% error in reading. The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	ΔT_h
Data unit:	°C
Description:	Differential temperature of inlet and outlet hot water for heater(s) during hour *h*
Source of data to be used:	Measured at project site
Value of data	Not used for the purposes of estimating ex-ante emission reductions.
Description of measurement methods and procedures to be applied:	The heat exchanger has a hot water supply and return temperature sensor, which will be used to measure the incoming and outgoing water continuously. The differential temperature will be calculated in the onsite Building Management System (BMS). The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting

	period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	$FC_{j,y}$
Data unit:	m^3/yr
Description:	Quantity of fuel consumed by the project activity in year *y*
Source of data to be used:	Measured at project site
Value of data	2012 – 2021: 5,157,993
Description of measurement methods and procedures to be applied:	The quantity of fuel consumed by the project activity will be monitored continuously using thermal mass flow meters. These meters measure the gas flow rate of the main supply line and have a maximum measured error of ±1.5% of reading. The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	$NCV_{NG,y}$
Data unit:	MJ/m^3
Description:	Net calorific value of natural gas in year *y*
Source of data to be used:	Manufacturer specifications
Value of data	32
Description of measurement methods and procedures to be applied:	The energy content of the natural gas used in the project activity, as specified by Egoli gas.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

Data / Parameter:	$EF_{CO_2,NG,y}$
Data unit:	tCO_2e/GJ
Description:	Emission factor of natural gas in year *y*
Source of data to be used:	IPCC guidelines
Value of data	0.0561
Description of measurement methods and procedures to be applied:	The IPCC default value for the emission factor of natural gas, according to the IPCC 2006 guidelines.

QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$EC_{PJ,j,y}$
Data unit:	MWh/yr
Description:	Quantity of electricity consumed by the project electricity consumption source *j* in year *y*
Source of data to be used:	Measured at project site
Value of data	2012 – 2021: 2,419
Description of measurement methods and procedures to be applied:	The quantity of electricity consumed by the project electricity consumption source will be monitored continuously using power meters of a 0.5S accuracy class. The readings from these meters will be aggregated monthly for use in the emission reduction report.
QA/QC procedures to be applied:	
Any comment:	The data will be kept for a minimum of two years after the end of crediting period or the last issuance of CERs, whichever occurs later. The data will be maintained in both soft copy and hard copy format

B.7.2 Description of the monitoring plan:

>>

The monitoring plan will ensure that the project emission reductions are accurately monitored, recorded and reported.

The following parameters will be monitored onsite during the crediting period:

1. The amount of grid electricity displaced by the project will be monitored using four-quadrant energy meters with a 0.2 accuracy class;

2. The chilled water mass flow rate (for the chillers) will be monitored using thermal energy meters with a < 0.5% error in reading;

3. The temperatures of inlet and outlet chilled water (for the chillers) will be monitored using immersion temperature sensors. The differential temperature will then be calculated in the onsite Building Management system (BMS).

4. The water mass flow rate from the heat exchanger will be monitored using thermal energy meters with a < 0.5% error in reading;

5. The temperatures of the inlet and outlet hot water (for the heat exchanger) will be monitored using immersion temperature sensors. The differential temperature will then be calculated in the onsite Building Management system (BMS).

6. The quantity of natural gas consumed by the project activity will be monitored by thermal mass flow meters, which measures the gas flow rate of the main supply line. The thermal mass flow meters have a maximum measured error of ±1.5% of reading.

7. The quantity of electricity consumed by the project activity will be monitored using power meters with a 0.5S accuracy class.

The process of data collection and storage is as follows:

1. The data is initially fed to the plant control system. Data can be kept in this control system for a maximum of 30 weeks.

2. Data is collected once a day from the plant control system and is logged directly into a database in the onsite Building Management System (BMS). The data in the BMS is available for a period of five years.

3. The data is also logged into the two onsite Management Information System (MIS) servers. The MIS integrates directly into the control system backbone, and will keep a database for at least five years.

4. All data will also be stored in a database in the historian. The data in the historian will be stored for a minimum period of two years after the end of the crediting period or the last issuance of CER's, whichever occurs later.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
Date of completion of application: 25/05/2011

Contact information for the entity responsible for the application of the baseline and monitoring information:
Promethium Carbon (Pty) Ltd
Coral House
20 Peter Place
Bryanston 2021
Johannesburg
Telephone: +27 11 706 8185

This entity is not a project participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
24/11/2008

C.1.2. Expected operational lifetime of the project activity:

>>
The lifetime of the GE Jenbacher engines exceeds the duration of the crediting period.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
This section is intentionally left blank.

C.2.1.2. Length of the first crediting period:

>>
This section is intentionally left blank.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/01/2013

C.2.2.2. Length:

>>
10 years 0 months.

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>
The environmental impacts of the project are considered minor, since it is being developed on an existing ‘commercial’ site. The project does not involve any activity that is listed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and, as such, does not require an environmental impact assessment or a basic assessment.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
The project activity mainly has a positive impact on the environment. It will reduce the electricity consumption from the South African national grid.

The reduction in electricity consumption from the national grid will result in a reduction of coal-based electricity and all the negative impacts associated with coal mining such as: the impact of the actual (coal) mining process, the utilisation of scarce water resources, SO_2 emissions and the impacts associated with the disposal of coal ash. Hence the project will reduce GHG emissions.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>
Employees, visitors, and the general public were invited to be local stakeholders for this project. The following stakeholder consultation was conducted:

MTN posted notices around the commercial site during the month of August 2009. These notices invited employees (and visitors to the commercial site) to comment on the proposed CDM project

MTN also posted a newspaper advertisement in the Daily Sun on 18/08/2009. The Daily Sun is South Africa's biggest daily newspaper, with over 500,000 sales in Gauteng (the provincial location of the project activity), and surrounding regions.

The newspaper advertisement provided some background information about the proposed trigeneration project. The advertisement also explained that it aimed to be a carbon credit project, which would offset some of the costs of the trigeneration plant and purchased gas. Any reader with comments or concerns about the proposed project was invited to contact an MTN employee during a 21 day advertising period, ending on the 8th of September 2009.

E.2. Summary of the comments received:

>>
Several verbal comments were received. Members of staff and the public were interested in finding out more about MTN's drive to green its environment and reduce its carbon footprint.

Eight telephonic enquiries were received. Seven of the respondents enquired whether MTN would be in a position to assist them with their employment at MTN head office. The response provided to these individuals was that MTN has a number of contracts with companies for the provision of such services, and unfortunately does not employ any extra staff for these purposes. One respondent enquired whether MTN was interested in making use of an entertainer to do a road show for the purposes of promoting MTN's green initiatives.

E.3. Report on how due account was taken of any comments received:

>>
Since no negative comments were received, there was no need to make adjustments on the design, construction, or operation of the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	MTN South Africa
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding will be used in the development or in the implementation of this project.

Annex 3

BASELINE INFORMATION

This Annex presents the calculations for the South African grid emission factor.

Step 1: Identify the Relevant Electricity Systems

This tool will serve project activities that prospect to displace grid electricity in South Africa.
The project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be displaced without significant transmission constraints.

Similarly, a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints, but transmission to the project electricity system has significant transmission constraints.

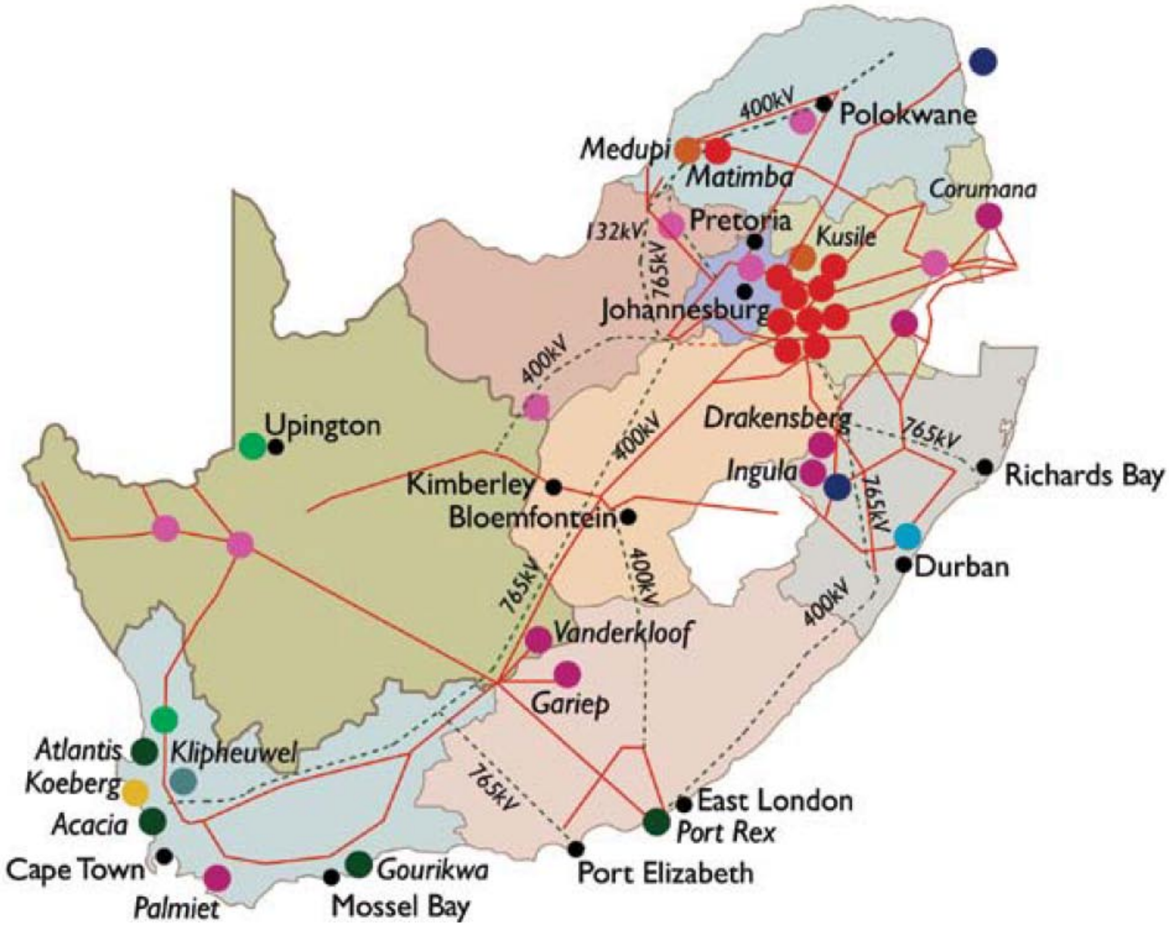
The DNA of South Africa has not published a delineation of the project electricity system and connected electricity systems. Also, the application of the criteria with regards to determining significant transmission constraints does not result in a clear grid boundary due to a lack of sufficient data. For these reasons the following was chosen for the reference system of this project:

- The project electricity system entails all the Eskom power plants in the South African electricity grid.
- Due to a lack of data available in the public domain (in order to evaluate significant transmission constraints), all other power stations (non-Eskom) and countries with power grids connected to South Africa, are treated as connected electricity systems, and emission factors for imports from these systems are conservatively assumed to be 0 tCO_2/MWh.

All electricity generated by the Eskom power stations is taken into consideration when calculating the grid emission factor; exports are not subtracted.

All of the data for the Eskom power stations are obtained from the Eskom website, where they have a specific webpage dedicated to CDM grid emission factor related data (Eskom Holdings SOC Limited , 2011). This data includes commissioning dates, electricity generated, and fuel consumed.

Data for the imported electricity are obtained from the Eskom annual report, where "*Total purchased for the Eskom system (GWh)*" is shown in the "*Statistical overview*" table on pg. 324 of the report (Eskom Holdings SOC Limited, 2011).



Step 2: Chose Whether to Include Off-Grid Power Plants in the Project Electricity System

This step is optional according to the tool. The grid emission factor is calculated from only grid power plants (Option I). Off-grid power plants are not included in the calculations.

Step 3: Select a Method to Determine the Operating Margin (OM)

The OM is calculated using the simple OM method (Option a). The simple OM method can be used provided that the low-cost/must-run resources constitute less than 50% of the total grid generation in average of the five most recent years.

The average percentage of low-cost/must-run resources amounts to 0.00% of the total grid generation for this project electricity system. Therefore, Option (a) is applicable.

In terms of data vintages, the *ex ante* option were chosen to calculate the simple OM. In this option a 3 year generation-weighted average are used for the grid power plants. Using this option also means that the emission factor is determined only once at the validation stage, thus no monitoring and recalculation is required during the crediting period.

The data used in OM calculations are for the 3 year period of 1 April 2007 – 31 March 2010 (Eskom financial year runs from 1 April – 31 March). This is the latest available data.

Step 4: Calculate the Operating Margin Emission Factor According to the Selected Method

The simple OM emission factor ($EF_{grid,OMsimple,y}$) is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. Hence, the hydro and nuclear power plants are excluded from the calculation of the OM.

Option A is used for calculating the simple OM. The calculations in this option are based on the total net electricity generation and a CO_2 emission factor of each power plant.

Option A: Calculation based on average efficiency and electricity generation of each plant

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power plant and an emission factor of each power plant, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in the year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	All power units serving the grid in year y except low-cost/must-run power units
y	The relevant year as per data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$

The emission factor for each power plant (*m)* was determined as follows (Option A1):

$$EF_{grid,OMsimple,y} = \frac{\sum_{i} \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_{y}}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year *y*

y The relevant year as per data vintage chosen in Step 3.

Electricity imports are treated as one power plant, as per the tool guidance.

The constants used in calculations appear in the table below.

Constants used in calculations

Constants		
$NCV_{other\ bituminous\ coal}$	19.9	GJ/T
$NCV_{other\ kerosene}$	42.9	GJ/T
$EF_{CO2other\ bituminous\ coal}$	0.0895	tCO_2/GJ
$EF_{CO2,other\ kerosene}$	0.0708	tCO_2/GJ

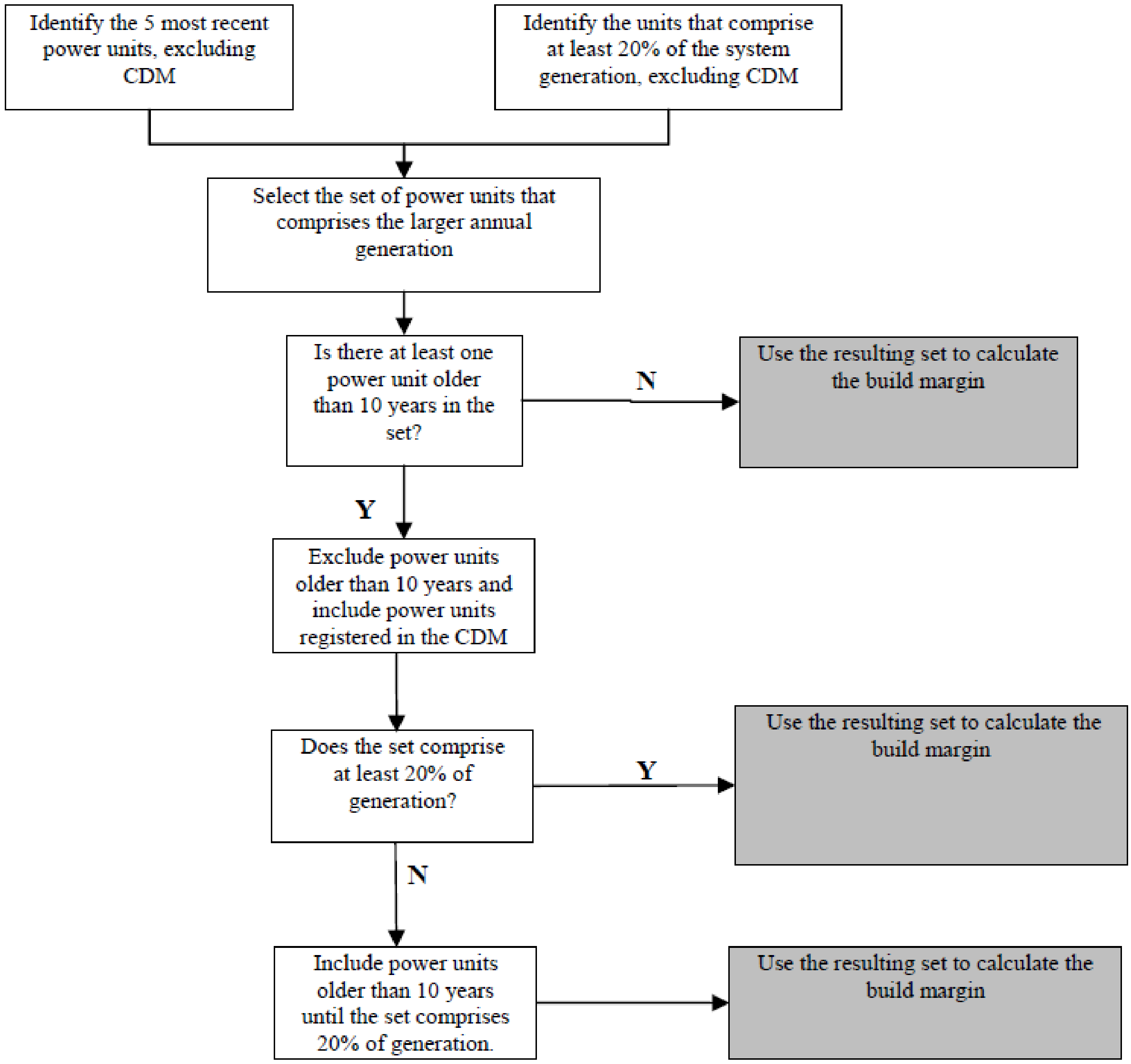
Using equation 6, the OM is calculated as **1.015** tCO_2e/ MWh.

Step 5: Calculate the Build Margin (BM) Emission Factor

In terms of vintage of data, one Option 1 was selected: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation.

The sample group of power units (*m)* used to calculate the build margin were determined as per the procedure delineated in the tool, consistent with the data vintages selected.

The following diagram summarizes the procedure of identifying the sample group:



The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/GJ)

m	Power units included in the build margin
y	Most recent historical year for which power generation data is available.

The CO_2 emission factor of each power unit m ($EL_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using Option A1 using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

If for a power unit *m* data on fuel consumption and electricity generation is available the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) fossil fuel type *i* in year y (GJ/mass or volume)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i	All fossil fuel types combusted in power plant/unit m in year y
y	The relevant year as per data vintage chosen in Step 3.

Using equation 13, the BM is calculated as **1.019** tCO_2e/ MWh.

Step 6: Calculate the Combined Margin (CM) Emission Factor

The combined margin factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$	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 (%)
w_{BM}	Weighting of build margin emissions factor (%)

The emission factors for the operating margin, the build margin, and the final combined margin appear in the table below.

CM emission factor

$EF_{grid,OM,y}$	1.015
$EF_{grid,BM,y}$	1.019
w_{OM}	0.5
w_{BM}	0.5
$EF_{grid,CM,y}$	**1.017**

Annex 4

MONITORING INFORMATION