



**Programme of activities design document form
(Version 08.1)**

BASIC INFORMATION	
Title of the PoA	Replacement of Higher Carbon Fuels by Natural Gas in the Industrial and Power Sector in Nigeria
Version number of the PoA-DD	Version 1.0
Completion date of the PoA-DD	08/03/2019
Coordinating/managing entity	Greenville Oil & Gas Company Limited, Nigeria
Host Parties	Federal Republic of Nigeria
Applied methodologies and standardized baselines	AMS-III.B, version 18.0: 'Switching fossil fuels' AMS-III.AN, version 2.0: 'Fossil fuel switch in existing manufacturing industries'
Sectoral scopes linked to the applied methodologies	Sectoral Scope 1: Energy industries (renewable / non-renewable sources) and Sectoral Scope 4: Manufacturing industries

PART I. Programme of activities (PoA)

SECTION A. Description of PoA

A.1. Purpose and general description of PoA

The proposed PoA aims at reducing the use of highly intensive carbon fossil fuel with a lower carbon fossil fuel for use in electricity generation and industrial heating purposes in Nigeria.

The project will further encourage the use of cleaner energy sources and improve energy supply in the country by helping to ensure a more sustainable supply of natural gas through the use of gas in locations not accessible to the gas pipeline or with erratic gas supply.

Overall objectives are reduction of greenhouse gases, sustainable use of natural gas as well as improved health conditions due to improved air quality within the facilities and communities where the fuel switch is to take place.

Framework for the implementation of the proposed PoA

Greenville Oil & Gas Company Limited, Nigeria, will act as the Coordinating Management Entity (CME) of this PoA and will coordinate the efforts of potential CPA implementers to expand the use of gas in Nigeria.

The PoA will support the use of natural gas use for energy (electricity and heat) production in existing and new facilities in Nigeria and this will cover the use of thermal energy conversion technologies as stated in A.3. It seeks to include the use of natural gas for use in supply of energy to facility where in the baseline the facility would have been supplied from a higher fossil fuel such as diesel or fuel oil.

All CPAs within the PoA will consist of use of natural gas for supply of the energy need (electricity or heat) and will also use any one methodology. The individual CPAs will either use the AMS-III.B version 18.0 or AMS-III.AN version 02.

Separate generic CPA is prepared for each methodology in line with paragraph 76 and 77 of the Project Standard for programmes of activities.

The PoA will have the following types of generic CPA DD namely;

Type 1: Small Scale CPA with AMS-III.B for natural gas fuel switch project

Type 2: Small Scale CPA with AMS-III.AN for fuel switch in existing manufacturing industries

Confirmation that the PoA is a voluntary action by the coordinating/managing entity

This PoA is a voluntary action by the coordinating/managing entity (CME), Greenville Oil & Gas Company Limited, Nigeria.

PoA contributes to sustainable development

The PoA will contribute to sustainable development in the following areas:

- Burning natural gas in place of fuel oils results in a reduction of GHG emissions.
- Improving the economic situation through better access to lower-carbon energy supplies that will support small and medium scale industries and thus creation of more jobs.

- Improving health conditions (especially in the facilities themselves) as a result of use of cleaner energy and air quality considering the reduction in NOx and SOx which are associated with some highly carbon intensive fossil fuels currently used in the country.
- It will also provide technology benefits due to the retrofitting of existing technologies and other installations at the facilities undergoing the switch, which would lead to an increase in overall operation efficiency under the PoA.

A.2. Physical/geographical boundary of PoA

All CPAs associated with this PoA will be implemented within the geographical boundary of the Federal Republic of Nigeria.

Latitude: 10° 00' N

Longitude: 8° 00' E

Source: https://www.mapsofworld.com/lat_long/nigeria-lat-long.html

Figure 1: Map showing the geographical boundary as the Federal Republic of Nigeria



A.3. Technologies/measures

The technologies/measures employed under the PoA covers the use of natural gas for electricity generation and heat production in thermal energy equipment technologies such as gas generator, gas turbines, boilers, kiln etc.

AMS-III.B (Version 18.0)

As provided in the methodology,

“This methodology comprises fossil fuel switching in industrial, residential, commercial, institutional, or electricity generation applications (e.g. fuel switch from fuel oil to natural gas in an existing captive electricity generation or replacement of a fuel oil boiler by a natural gas boiler).”

Under the small-scale methodology AMS-III.B Version 18.0, the technology/measure employed covers the use of gas generators for electricity generation application in residential, industrial and commercial facilities where in the baseline the same would have been provided using higher fossil fuel like fuel oil and diesel. CPAs under the PoA will comprise small size gas generators (1-15 MW).

Facilities employing the fuel switch could either retrofit or change the mechanism of the combustion process in the power generating engines. This process involves basically a change in the compression ratio of the engine. Typically, in diesel engine, compression ratio is between (14 – 18: 1)¹ whereas gas engines usually work within the range of (8 – 10:1)². This may involve modifying or replacement of the pistons needs to suit this requirement and allow proper air-fuel mixing. Other changes will include the spark plugs, valves, catalytic converters, improvement in thermal and engine management systems to ensure that higher efficiency is attained.

AMS-III.AN (Version 02)

“The methodology comprises fossil fuel switching in existing manufacturing industries where baseline fossil fuel (fuel oil or diesel, coal) and project energy source (Natural gas) are consumed in thermal energy conversion equipment (e.g. furnaces, kilns, dryers) used to manufacture products (e.g. steels, ceramics, aluminium).”

Technology involve in AMS-III.AN will cover the use of natural gas in thermal energy conversion equipment such as boilers, kilns, furnace etc. in existing manufacturing industry where such need would have been provided at the baseline with the use of higher fossil fuel such as coal, fuel oil and diesel which would have resulted in higher GHGs emission due to the emissions intensity of coal/fuel oil and diesel compared to natural gas.

The application of technology could include retrofitting, conversion or replacement of nozzle and timer of fuel supplied into heating chamber of the industrial heating systems. In the application of the two methodologies, a change/modification in technology used in application of fuel into the combustion system of the engine is expected. The change in technology could imply outright replacement of the engine, replacement of components or retrofitting of existing engine in the system.

All the technologies to be employed under the PoA will adhere to the requirements of the applicable methodology.

¹ <https://pdfs.semanticscholar.org/39c5/ac10e62925f1cfd20282dd02f8cb3ac56594.pdf>

² http://resources.kohler.com/power/kohler/industrial/pdf/GasGeneratorSetPerformance_WhitePaper.pdf

A.4. Coordinating/managing entity

The CME is Greenville Oil & Gas Company Limited, Nigeria. Greenville Oil & Gas Company Limited, Nigeria. It will have a written agreement with project developers who submit CPAs as part of the PoA. Greenville Oil & Gas Company Limited may work with consultants in the office of the CME to manage the PoA.

A.5. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Federal Republic of Nigeria (host party)	Greenville Oil & Gas Company Limited, Nigeria	No

A.6. Public funding of PoA

Greenville Oil & Gas Company Limited, Nigeria declares that there is no public funding for the proposed PoA.

SECTION B. Management system

To ensure that the PoA is properly managed and coordinated, the CME will provide administrative support to all stakeholders of the PoA. According to the CDM project standard for programme of activities (version 02.0), paragraph 36 which states:

The coordinating/managing entity shall establish and implement, and provide a description of, the operational and management system for the implementation of the proposed CDM PoA, including the following:

- a. *A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;*
- b. *Records of arrangements for training and capacity development for personnel;*
- c. *A procedure for technical review of inclusion of CPAs;*
- d. *A procedure to avoid double counting (e.g. to avoid the case of including a new CPA that has already been registered either as a CDM project activity or included as a CPA in another registered CDM PoA);*
- e. *Records and documentation control process for each CPA under the PoA;*
- f. *Measures for continuous improvements of the PoA management system;*

Greenville Oil & Gas Company Limited, as the CME, will develop and implement a robust management system based on the above criteria.

Roles and Responsibilities

As the coordinating/managing entity, Greenville Oil & Gas Company Limited, Nigeria will be responsible for the overall management of the PoA, collation of all relevant data and preparation of monitoring reports for verification purposes and providing the interface with the DOE and UNFCCC EB.

Each developer in Nigeria with a project that is believed to fit the eligibility requirements of this PoA can submit a written request including a draft CPA to the CME. The CME will screen and review the request and if appropriate shall inform the project developer accordingly on the steps to be followed and how it can be included in the PoA. This will depend on the conformity to the terms of

the PoA and successful completion of the final CPA. Upon completion of the final CPA, it will be reviewed by the CME, and if it meets the PoA requirements, a contract agreement will be reached between the CME and the project developer of the CPA for its inclusion in the PoA.

Given the requirements involved and to deliver each CPA in the most effective manner, the CME may choose to have agreements with partner organisations and/or hire contractors to provide technical advice or services to the PoA subject to agreed terms and conditions.

Greenville Oil & Gas Company Limited as the CME will implement a detailed management system to ensure all CPA Implementers under the PoA implement, operate, and monitor their respective CPAs in an effective and verifiable manner. The roles and responsibilities of the CME and CPA will cover the following aspects as shown in the table below:

Roles and Responsibilities of the CME	Roles and Responsibilities of the CPA
Approval of CPAs	Complete and submit CPA DD form to the CME
Overall data collection and collation of the various CPAs	Collection and quality control of data
Quality control, monitoring and avoidance of double counting	Training and Capacity building of its staff
Submit monitoring report to the DOE	Submit monitoring report to the CME
Assign CERs to the CPAs	Calculation of CERs based on the methodology

PoA involves small-scale activities with limited CERs, thus CME will act to eliminate unnecessary monitoring costs so that CDM registration and CER issuance contributes to the projects' implementation and operation.

Records of Training and Capacity Development

The CPA developer shall include as part of its monitoring plan proper staff training and provide, as needed, to the CME all records of training and capacity development. The records of all these trainings shall be kept in the office of the CME.

Procedure for technical review of inclusion of CPAs

The CPA shall send a letter of intent of project participation and a standard Project Idea Note (PIN) to the CME. The CME will therefore review the request letter and the CPA against the eligibility criteria. These criteria will be reviewed carefully and if the project qualifies based on the set criteria as stated in section B.2, the CME will sign agreement with the participating entity and issue a unique ID for the project. The CME shall review the prepared CPA-DD and submit to the DOE for further review and when approved, the CPA gets registered and posted on the UNFCCC website.

Procedure to avoid of double counting

All project activities shall be identified by their specific GPS coordinates and CME will grant CPA implementers an ID number. As the project activities require significant fixed infrastructure, the CME can readily verify the projects using the coordinates to trace their locations.

Records and documentation control process for each CPA under the PoA

The CPA implementers shall maintain all relevant monitoring data, which will be compiled in an electronic workbook, and will be supported by all field notes/records (where applicable) and details of all instrument/equipment calibrations (including dates and copies of calibration certificates where available), as per the approved monitoring procedures. The required data shall be provided to the CME in agreed standard format made available by the CME to provide a central point for data management and archiving of all records applicable to the PoA.

Measures for continuous improvements of the PoA management system

The CME will review the performance of the CPAs submitting monitoring reports at the end of each monitoring period, and if shortcomings are identified, improvements will be put in place.

Quality control of monitoring

Each CPA shall put in place a comprehensive monitoring plan and system of electronic data management prior to the commencement of the first crediting period that will follow a template that allows the information to be collated and reviewed by the CME. Both the CPA and the CME data monitoring system will be accessible to the verifying Designated Operational Entity (DOE). Any CPA that does not maintain proper monitoring and reporting shall be excluded from the PoA for the affected monitoring period. A manual will be developed to highlight roles and responsibilities for each CPA.

SECTION C. Demonstration of additionality of PoA

The CDM project standard for programme of activities (version 02.0) and the “Methodological tool on the demonstration of additionality on small scale project activities (version 12)” states that project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers;

- (a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
- (b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
- (c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- (d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

As per the provision of the *Methodological tool on the demonstration of additionality on small scale project activities version 12.0*, the project activity would not have occurred as a result of barrier due to prevailing practise. The conditions relevant to the application of barrier due to prevailing practise provides that *any* of the following practise below would have led to implementation of technology with higher emissions:

- *prevailing practice or,*
- *existing regulatory or*
- *policy requirements*

The most relevant barrier from the options above is the barrier due to prevailing practise. It is imperative to note that most small and medium scale industries³ in Nigeria rely on the use of diesel or LPFO as feedstock for meeting their energy (electricity/heat) needs which has been the situation over the past years largely due to the limited growth in access to gas infrastructure in the country.

³ Operational overview of captive power in Nigeria. <http://www.financialnigeria.com/operational-overview-of-captive-power-in-nigeria-blog-168.html>

The abundant natural gas supplies in the country are located in the Niger Delta region and gas infrastructure is limited to the major cities in the coastal areas; resulting in very large parts of the country without gas supplies. In addition, even in areas with gas infrastructure, gas supplies to end-users is mostly erratic due to security and grid supply issues ⁴ and as such necessitated the predominant use of LPFO/diesel as primary fuel source for meeting both power and heating needs in these commercial cities where the industries are located. This results in small and medium scale industries having to rely on highly carbon intensive fossil fuel such as diesel and LPFO to meet both power and heating needs in their respective industries leading to even higher GHG emissions in the country. This is the prevailing practise in the country.

The use of natural gas especially in locations far from either the state or private sector gas grid constitute a major challenge for implementation by project developers that requires reliable energy for their operation. This is due to unavailability of gas infrastructure and high cost of implementation of these projects. as the project activities will also require purchase of equipment for deployment of natural gas to locations where these projects would be implemented. Hence, this makes the use of diesel/fuel oil, the most convenient option, considering the established chain of distribution for ordering and delivery of diesel fuel in Nigeria⁵. The concept of using gas via a virtual pipeline to supply facilities that are not accessible to gas infrastructure is the principal objective of this PoA and is the first in the country to use the virtual gas pipeline concept to supply on a widespread basis. ⁶.

Since all individual CPAs to be included under this PoA will utilize gas as the energy feedstock and will be supplied via Greenville's virtual pipeline, the demonstration of additionality as per prevailing practice barrier shall be valid for all CPAs.

CDM registration serves as an incentive for the implementation of switch from the current use of LPFO/ diesel to natural gas, which provide a clearly provides a lesser carbon intensive option than the LPFO/diesel utilised in most industries in country. The prevailing practice barrier is real and substantial reason to encourage developers of such projects. It also serves to satisfy the additionality requirement for all CPAs under this PoA.

SECTION D. Start date and duration of PoA

D.1. Start date of PoA

The start date of the PoA chosen is the date of notification of the intention to seek CDM status by the coordinating/managing entity to the DNA(s) of the host Party (ies) and the secretariat. This date is 21/11/2016.

D.2. Duration of PoA

28 years and 0 months

⁴ <https://www.sunnewsonline.com/investment-opportunities-in-lpfo/>

⁵ Climate Technology Centre and Network. <https://www.ctc-n.org/resources/captive-power-nigeria-comprehensive-guide-project-development>

⁶ <http://www.nnpcgroup.com/PublicRelations/NNPCinthenews/tabid/92/articleType/ArticleView/articleId/1086/NNPC-Launches-Virtual-Gas-Pipeline-System.aspx>

SECTION E. Environmental impacts**E.1. Level at which environmental impacts analysis is undertaken**

Environmental impact analysis will be done at the CPA level and will be undertaken based on the requirement by the Nigerian Government and its agencies. The review and approval of such environmental analysis is the responsibility of the government agency involved.

In carrying out the impact assessment, Environmental Regulatory Agencies exist at various levels in Nigeria and these agencies have a common objective of protecting and preserving the environment and human health. This is in accordance with the EIA Act No. 86 of 1992, which mandates that public or private sector of the economy shall not undertake or embark or authorize projects or activities without prior consideration, at the early stage, of their environmental effects. The social impacts of the project activity are also considered and analysed. It should however be noted that small scale project activity such as those expected in this PoA might only require environmental auditing and not full EIA.

It should be noted that the gas supply will be covered by the EIA for the facility and will not require a separate EIA.

E.2. Analysis of environmental impacts

Not applicable.

E.3. Environmental impact assessment

Not applicable

SECTION F. Local stakeholder consultation**F.1. Level at which local stakeholder consultation is undertaken**

The project activities under this PoA will be at specific physical locations. It is therefore proper that the local stakeholder consultation process, if required by the country regulation, will be undertaken by the individual CPA as that is where the affected stakeholders are located.

It should be noted that the gas supply provision is a small component of the overall facility, and stakeholder consultation will generally be that as required in the overall facility EIA.

F.2. Modalities for local stakeholder consultation

Not applicable

F.3. Summary of comments received

Not applicable. This will be recorded at the Individual CPA level if so required.

F.4. Consideration of comments received

Not applicable. All comments received at individual CPA level will be considered as per the required regulations in the country.

SECTION G. Approval and authorization

The host government through the Designated National Authority (DNA) has been informed and a letter of approval for the PoA as well as letter of authorization for the CME has been requested from the Nigerian Office of the Designated National Authority.

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

Fuel Switch in Existing and Greenfield Power Generating Facility

H.2. Reference number of generic CPA

Generic CPA Type 1

H.3. Purpose and general description of generic CPA

The purpose of the Type 1 CPAs is to promote the use of natural gas for use in electricity generation in existing and new facility in Nigeria, whose supply of gas comes from virtual pipelines (such as Greenville's). This Type 1 CPA shall involve project developers replacing or installing small capacity power generators in any location in Nigeria which includes switching from a higher carbon intensive fossil fuel such as burning fuel oil or diesel oil to use of natural gas. The installed gas generator with use of natural gas for electricity generation in facilities under the type 1 CPA will contribute to reducing GHG emissions that would have occurred with the use of the baseline fuel.

Type 1 CPAs may include retrofit or replacement of existing installations, green field facilities or project activities involving capacity additions. Also, the CPAs may include one or more element processes within a facility provided that the demonstration of de-bundling requirements is satisfied (see discussion on the eligibility criteria section below). It should be noted that multiple fossil fuel switching in an element process is however not covered under this PoA. Each element process must switch from burning only one type of fossil fuel (fuel oil/diesel) to burning natural gas.

Typically, CPA facility owners will have power plant generator(s) which utilized or would have utilized a higher carbon intensive fossil fuel and are interested in using natural gas for their operations for captive purposes in their operations (commercial, industrial or residential estates).

In accordance with the CDM project standard for programmes of activities (version 02) and as per the AMS III.B Version 18.0, the small-scale project type applicable to the CPA is Type III, that is amount of emission reduction is limited to less than or equal to 60,000 tCO₂e annually.

H.4. Technologies/measures

Under the type 1 CPA, the project activity will target the use of natural gas for electricity generation for residential, industrial and commercial application where higher fossil fuels would have been used for their operations.

The technology/measure to be applied by each type 1 CPA will conform to the AMS-III.B (Version 18) and will involve;

- Use of natural gas in a retrofit or newly installed gas generators for captive generation
- Use of natural gas in greenfield facilities or in project activities involving capacity additions of electricity generators for captive generation

Further description of technologies/measures to be employed by each specific Type 1 CPA will be provided in the specific CPA document, including all technical specifications as required by the applied methodology.

The expected installed capacity of the Type 1 CPA will be within the range of 15MW.

In the baseline, equivalent electricity needs would have been met by the use of diesel/fuel oil fired generators which would have led to increase in GHG emissions.

SECTION I. Application of selected methodologies and standardized baselines

I.1. Reference to methodologies and standardized baselines

All CPAs registered under this PoA reference the following methodologies, tools and Guidelines;

- *AMS-III.B. Switching Fossil Fuels Version 18.0*⁷
- *Tool 09: Tool to determine baseline efficiency of thermal and electricity systems Version 02.0*⁸
- *Tool to determine the remaining lifetime of equipment Version 01*⁹
- *ACM0009: Consolidated baseline and monitoring methodology for fuel switch from coal or petroleum fuel to natural gas Version 05.0*¹⁰.

I.2. Applicability of methodologies and standardized baselines

The applicability criteria for registering under this PoA using AMS-III.B (Version 18) methodology are listed in the table below. The compliance requirements that must be met by each CPA and/or each CPA Facility are as listed.

The applicability criteria for AMS III B is discussed below;

⁷ <http://cdm.unfccc.int/methodologies/DB/1T8IU3YG99FQOYHN12FM3T0QZFFPBX>

⁸ <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-09-v2.0.pdf>

⁹ <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-10-v1.pdf>

¹⁰ http://cdm.unfccc.int/filestorage/H/0/F/H0FKRV2QCIBE5YZJGA4WTDUPX6O87L/EB81_repan10_ACM000_9_ver05%200_clean.pdf?t=Z0l8cGp4anFlfDDKHwHVASrZn8pqCWFPzL2

Table 1: Applicability criteria for AMS-III.B

NO.	Applicability	Justification by CPA
1.	This methodology comprises fossil fuel switching in industrial, residential, commercial, and institutional or electricity generation applications (e.g., fuel switch from fuel oil to natural gas in an existing captive electricity generation or replacement of a fuel oil boiler by a natural gas boiler)	The proposed CPA includes fuel switch from higher carbon intensive fossil fuel (diesel, LPFO etc) to natural gas for electricity generation for industrial application
2.	Fuel switch may be in a single element process or may include several element processes within the facility. Multiple fossil fuel switching in an element process however is not covered under this methodology. In other words, only element processes utilizing a single fuel in the baseline as well as in the project scenario are eligible, dual or multiple fuel utilization by an element process is not covered	Proposed CPA will include elemental process that utilizes a single fuel for baseline as well as the project scenario. Multiple fossil fuel switching in an element process will not be included.
3.	This methodology is applicable for: (a) Retrofit or replacement of existing installations; (b) Greenfield facilities or project activities involving capacity additions	The proposed CPA will include either that of a retrofit/replacement of existing installations or a greenfield facility/capacity addition.
4.	Fuel switching may also result in energy efficiency improvements. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this methodology. If fuel switching is part of a project activity focussed primarily on energy efficiency, the project activity falls under a Type-II methodology	Not applicable as the proposed CPA will not include energy efficiency.
5.	The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the latest approved version of the "Tool to determine the remaining lifetime of equipment". If the remaining lifetime of the affected systems increases due to the project activity, the crediting period shall be limited to the estimated remaining lifetime, (i.e., the time when the affected systems would have been replaced in the absence of the project activity).	The proposed CPA will meet the requirement concerning the demonstration of the remaining lifetime of replaced equipment as specified in the latest tool, " <i>tool to determine the remaining lifetime of equipment</i> ".
6.	The following types of fuels as listed under the 2006 IPCC Guidelines for greenhouse gas inventories (volume 2, chapter 1, table 1.1) are eligible under this methodology: (a) Liquid fuel (crude oil and petroleum products); (b) Solid fuel (coal and coal products); (c) Gas (natural gas).	The proposed CPA will include fuel types as specified in the 2006 IPCC guidelines for greenhouse gas inventories
7.	This methodology excludes the use of derived gases (from coal and coal products).	The propose CPA will not include the use of derived gases. Hence this criterion is not applicable to the project activity

8.	<p>This methodology is not applicable to project activities that propose switch from fossil fuel use in the baseline to renewable biomass, biofuel or renewable energy in the project scenario. A relevant Type I methodology shall be used for such project activities that generate renewable energy displacing fossil fuel use. This methodology is also not applicable to project activities involving the use of waste energy (e.g., waste gases from H₂SO₄ facilities etc.); these project activities might be eligible under “AMS-III.Q: Waste energy recovery (gas/heat/pressure) projects”.</p>	<p>The propose CPA will be limited to fossil fuel switch only. Hence this criterion is not applicable to the project activity</p>
9.	<p>The methodology is limited to fuel switching measures which require capital investments. Examples of capital investment include creating infrastructure required to use project fuel or retrofitting existing installations.</p>	<p>The proposed CPA will be limited to fuel switching measures that require capital investment.</p>
10.	<p>The facility may involve grid connected element processes. However, under this methodology project activities that export electricity to a regional and/or national grid (hereinafter mentioned as grid) may:</p> <p>(a) Not claim emission reductions for the grid component; or</p> <p>(b) Claim emission reductions for the grid component, provided they have operational history of three years and the installed capacity of the project element process supplying electricity to the grid is up to or equal to 15 MW. Greenfield and capacity-addition are not covered under this category.</p>	<p>The proposed CPA will not involve facility that export electricity to the grid, hence this criterion is not applicable</p>
11.	<p>This methodology does not cover emission reductions on account of shift from use of grid electricity (e.g. shift from a carbon intensive grid to a low carbon intensive fossil fuel). In such a case, other applicable methodologies such as “AMS-III.AG: Switching from high carbon intensive grid electricity to low carbon intensive fossil fuel” might be explored.</p>	<p>The proposed CPA will cover emission reduction based on fuel switch only. Hence this criterion is not applicable to the project activity</p>
12.	<p>This methodology is applicable to project activities where it is possible to directly measure and record the energy use/output (e.g. heat, steam and electricity) and consumption (e.g. fossil fuel) within the project boundary. In case of project activities that meet the criteria under paragraph 43 (<i>estimated annual emission reduction of each element processes are equal or less than 600tCO₂e per year</i>), this methodology is applicable only where it is possible to directly measure and record at least the energy consumption in the element process (e.g. fossil fuel input)</p>	<p>The energy use/output and energy consumption for the proposed CPA will be directly measured and recorded.</p>
13.	<p>Heat, steam or electricity produced under the project activity shall be for on-site captive use</p>	<p>Electricity generated for the proposed CPA will be for on-site captive use and may include export to other facility within</p>

	and/or export to other facilities and/or a grid included in the project boundary. In case of electricity generation plants, the generated electricity may also be supplied to users via mini/isolated grid(s) system exclusively supplied by fossil fuel units.	the project boundary, hence this criterion is applicable. Electricity exported to the grid will not be considered in the CPA, hence the criterion is not applicable.
14.	In case energy produced by the project activity is delivered to another facility, or facilities, within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered specifying that only the facility generating the energy can claim emission reductions from the energy displacement	The energy produced based on the proposed CPA will be used in the facility within the project boundary. Should the energy produced by the proposed CPA be delivered to another facility, a contract will be made to ensure that emission can only be claimed by the generating facility.
15.	Regulations do not constrain the facility from using the energy sources cited in paragraph 7 above, before or after the fuel switch. Regulations do not require the use of low carbon energy source (e.g. natural gas or any other fuel) in the element processes	The proposed CPA is not bound by regulation as regards the listed energy sources.
16.	The project activity does not result to integrated process change. The purpose is to exclude measures that affect other characteristics of the process besides switch of energy sources e.g. operational conditions, type of raw material processed, use of non-energy additives, change in type or quality of products manufactured etc.	As the proposed CPA is limited to fuel switch and as such will not result to integrated process change, this criterion is not applicable.
17.	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO ₂ equivalent annually	The measures in the proposed CPA is limited to activity that result to emission reduction less or equal to 60ktCO ₂ e annually

If a CPA complies with the applicability criteria in the table above, therefore, it's inclusion under the PoA using AMS-III.B version 18 is justified.

Qualification as Type III

As per paragraph 18 of the AMS III.B version 18.0, the amount of emission reduction for each CPA will be limited to less than or equal to 60,000 tCO₂e annually. Hence, the proposed CPA qualifies as a Type III project activity, as it covers activities not included under Type I or Type II listed in paragraph 126 of the project standard for programme of activities version 02.0.

I.3. Application of multiple methodologies

The CPA applied only a single methodology AMS-III.B version 18.0

I.4. Project boundary, sources and greenhouse gases (GHGs)

The project boundary and GHG sources are summarised and discussed below:

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from combustion of fossil fuels used by the power plant (generators) at the baseline.	CO ₂	Yes	Main emission source in the baseline scenario
		CH ₄	No	Minor source. Neglected for simplicity
		N ₂ O	No	Minor source. Neglected for simplicity
Project activity	Emissions from combustion of natural gas used by power plants (generators) at the project activity.	CO ₂	Yes	Main emission source in the project scenario
		CH ₄	No	Minor source. Neglected for simplicity
		N ₂ O	No	Minor source. Neglected for simplicity

As per the methodology, “the project boundary comprises the physical, geographical site where the switching of energy source takes place. It includes all installations, processes or equipment affected by the switching. In case where energy produced by the project activity is delivered to another facility, the boundary also extends to the residential, industrial or commercial facilities consuming energy generated by the system”. For a typical CPA, the project boundary therefore includes the physical, geographical site where the fuel switch takes place and in situation where the electricity produced by the project activity is delivered to another facility, the boundary extends to the facility(ies) consuming the electricity.

Gases included in the project boundary for the baseline are carbon dioxide emission from the use of higher fossil fuel for electricity generation. Project emissions are carbon dioxide emissions due to the actual consumption of natural gas for electricity generation at the project case.

Figure 2: Flow diagram for baseline scenario, showing project boundary (dashed line) and emissions sources

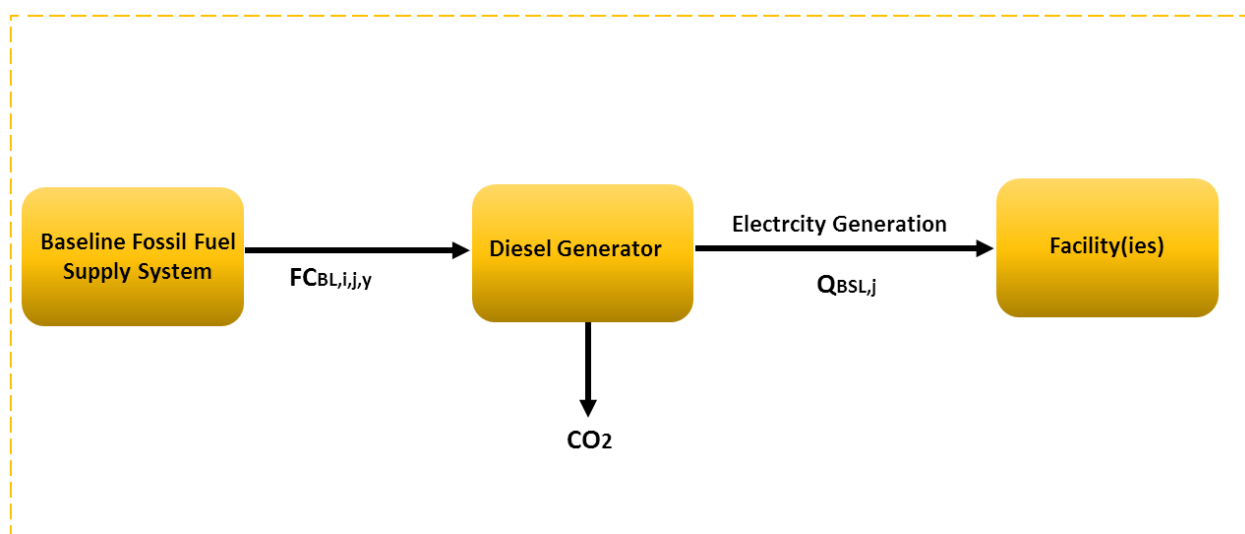
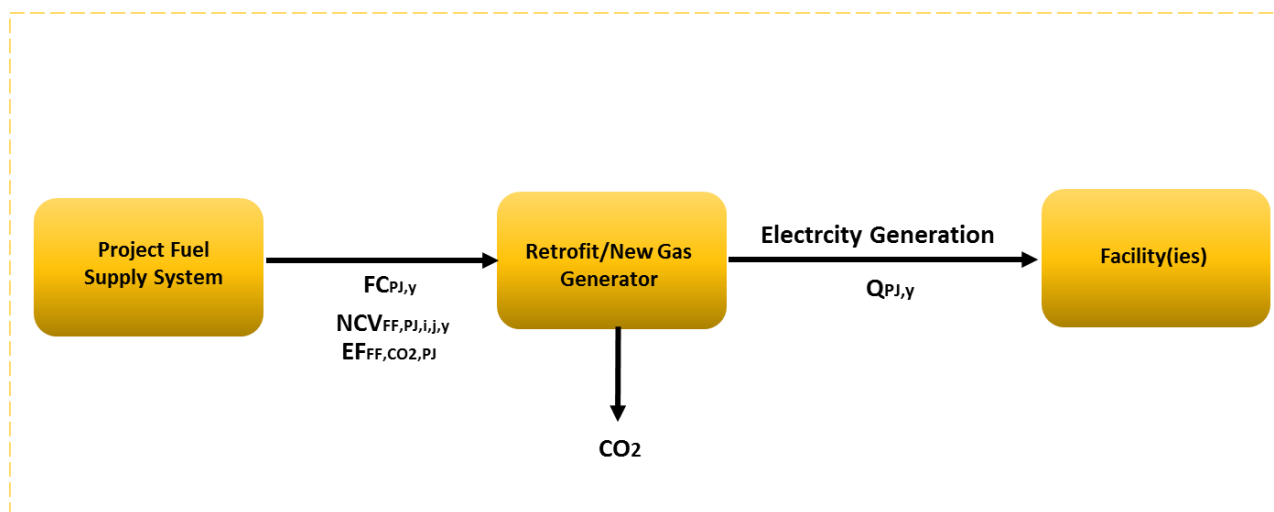


Figure 3: Flow diagram for project scenario, showing project boundary (dashed line) and emissions sources



1.5. Establishment and description of baseline scenario

Under the methodology, as per section 5.2, the baseline is determined as per the type of facility where the fuel switch would occur. Based on the provision of the methodology, the propose CPA will consider the following type of facilities defined as “existing facility and greenfield facility which in the baseline would have employed the use of a higher fossil fuel prior the project activity for electricity generation due to lack of grid electricity and availability of baseline fuel. In Nigeria, supply of natural gas is not readily available for use by many facilities either due to limited/erratic supply or unavailability of the gas infrastructure to industries where the fuel is needed as a result necessitate the use of the baseline fuel¹¹. Hence, for all CPAs under this PoA, the most likely baseline scenario that would have occurred in absence of the PoA is the continuation of the use of a higher carbon intensive fossil fuel (fuel oil or diesel). In most cases in the country, diesel is mainly used in electricity generation in industrial and commercial facility¹². In a few instances fuel oil is used. While this is the most likely scenario for all the CPAs, the baseline scenario for each CPA would be identified in line with the baseline and monitoring methodology.

In the CPA boundary, there are neither national and/or sectoral policies or regulations that give comparative advantages to more emissions-intensive technologies or fuels, nor national and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies implemented before the adoption of the Kyoto Protocol (December 1997) or since the adoption of the CDM M&P (November 2001).

¹¹ https://www.uschamber.com/sites/default/files/documents/files/022572_intl_pipeline_to_power_opt.pdf

¹² https://www.springer.com/cda/content/document/cda_downloadaddocument/9789811009730-c2.pdf?SGWID=0-0-45-1566477-p179949807

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

As per the methodology, the emission reduction from each CPA will be calculated using the following step below;

Equations to be used in calculating emission reductions

Step 1: Baseline emissions

Baseline emissions for CPA implemented in existing facilities that generate electricity for on-site captive use and/or export to other captive facilities including supply to captive users via mini/isolated grid(s) system is be determined as follows:

$$BE_y = EF_{BSL} \times Q_{PJ,y} \quad \text{Equation 1}$$

Where:

BE_y	=	Baseline emissions in year y (t CO ₂ e)
EF_{BSL}	=	Emission factor for the baseline scenario (t CO ₂ /MWh)
$Q_{PJ,y}$	=	Net energy output in the project activity in year y (MWh)

The net energy output in the project activity ($Q_{PJ,y}$) is limited to the installed capacity in the baseline scenario. In cases of Greenfield project with increased capacity, it shall demonstrate that the project or the added capacity has the same baseline scenario.

For existing facilities, the emission factor in the baseline scenario (EF_{BSL}) is the coefficient for the fossil fuel used in the baseline expressed as emissions per unit of energy output.

$$EF_{BSL} = \sum_i (FC_{BL,i,j,y} \times NCV_j \times EF_{CO_2,j}) \div Q_{BSL,j} \quad \text{Equation 2}$$

Where:

EF_{BSL}	=	Emission factor for the baseline scenario (t CO ₂ /MWh)
$FC_{i,j,BL,y}$	=	Amount of fuel j consumed by the element process i during the year y operating at the baseline scenario (mass or volume unit)
NCV_j	=	Net calorific value of the fuel type j (kJ/ mass or volume unit)
$EF_{CO_2,j}$	=	CO ₂ emission factor of the fuel type j (t CO ₂ /kJ)
$Q_{BSL,j}$	=	Net energy generated in the element process j in the baseline scenario during the corresponding period of time for which the total fuel consumption was taken (MWh)

For existing and greenfield/capacity expansion project activities the baseline emissions are estimated as the CO₂ emissions from the combustion of the baseline fossil fuel that would in the absence of project activity be used ($FC_{BL,i,j,y}$) in element processes as per the below:

$$BE_y = \sum_i FC_{BL,i,j,y} \times NCV_j \times EF_{CO_2,j}$$

Equation 3

$FC_{BL,i,j,y}$ is calculated based on the actual monitored quantity of project fossil fuel in the element process ($FC_{PJ,i,j,y}$) and the relation of the energy efficiencies and the net calorific values between the project scenario and the baseline scenario.

$$FC_{BL,i,j,y} = FC_{PJ,i,j,y} \times \frac{NCV_{FF,PJ,i,j,y} \times \epsilon_{project,i,y}}{NCV_j \times \epsilon_{baseline,i}}$$

Equation 4

Where:

- $NCV_{FF,PJ,i,j,y}$ = Net calorific value of the fossil fuel j used in the element process i in the project activity in year y (TJ/mass or volume unit)
- $FC_{PJ,i,j,y}$ = Amount of fuel j consumed in the element process i in project activity during year y (mass or volume unit)
- $\epsilon_{project,i,y}$ = Energy efficiency of the element process i if fired with project fuel
- $\epsilon_{baseline,i}$ = Energy efficiency of the element process i if fired with baseline fuel

The value to be applied for the baseline efficiency will be determine at each individual CPA in line with the provision in paragraph 41 and 42 of the AMS III.B Version 18.0.

Step 2: Project emissions

The project emissions are calculated by multiplying the actual quantity of natural gas consumed by the emission factor and calorific value of natural gas.

$$PE_y = \sum_i FC_{PJ,i,j,y} \times NCV_{FF,PJ,i,j,y} \times EF_{FF,CO_2,PJ}$$

Equation 5

Where:

- PE_y = Project emissions in year y (t CO₂e)
- $FC_{PJ,i,j,y}$ = Amount of fuel j consumed in the element process i in project activity during year y (mass or volume unit)
- $NCV_{FF,PJ,i,j,y}$ = Net calorific value of the fossil fuel j used in the element process i in project activity in year y (TJ/mass or volume unit)
- $EF_{FF,CO_2,PJ}$ = CO₂ emission factor of project fuel combusted in the project activity (t CO₂/TJ)

Step 3: Leakage emissions

In accordance with AMS.III. B version 18, projects under a programme of activities, shall consider “leakage emissions resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside the project boundary, based on the guidance provided in the leakage section of “ACM0009: Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas”. Where it is estimated that leakage emissions in the baseline situation are higher than leakage emissions in the project situation, leakage emissions will be set to zero.” Therefore, leakage emissions shall be calculated according to ACM0009 (Version 05.0), which further states that leakage emissions in year y ($LE_{US,y} = LE_y$) shall be determined using the latest version of the methodological tool “Upstream leakage emissions associated with fossil fuel use”.

Leakage upstream emissions are calculated as follows:

$$LE_{US,y} = EF_{US,x,default} \times (FC_{PJ,x,y} - FC_{BL,x,y}) \quad \text{Equation 6}$$

Where:

- $LE_{US,y}$ = Leakage upstream emissions in year y (t CO₂e/yr)
- $FC_{PJ,x,y}$ = Quantity of fossil fuel type x used in the project situation in year y (TJ/yr)
- $FC_{BL,x,y}$ = Quantity of fossil fuel type x used in the baseline situation in year y (TJ/yr)
- $EF_{US,x,default}$ = Default emission factor for upstream emissions associated with consumption of fossil fuel type x (t CO₂e/TJ)
- x = Fossil fuel types used in the project and/or baseline situation and for which upstream emissions should be determined

Emission reductions:

The emission reduction achieved by the project activity will be calculated as the difference between the baseline emissions and the sum of project emissions and leakage as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation 7}$$

I.6.2. Data and parameters fixed ex ante

Data / Parameter:	<i>NCV_{diesel}</i>
Data unit:	TJ/Gg
Description:	Net calorific value for diesel
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value(s) applied:	41.4
Choice of data or Measurement methods and procedures:	IPCC default values
Purpose of data	Baseline Emissions Calculation
Additional comment:	None

Data / Parameter:	<i>EF_{CO2,diesel}</i>
Data unit:	KgCO ₂ /TJ
Description:	CO ₂ emission factor for diesel
Source of data:	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.
Value(s) applied:	72.6 X 10 ³
Choice of data or Measurement methods and procedures:	IPCC default values
Purpose of data	Baseline Emissions Calculation
Additional comment:	None

Data / Parameter:	<i>EF_{US,LNG,default}</i>
Data unit:	tCO _{2e} /TJ
Description:	Default emission factor for upstream emissions associated with consumption of natural gas
Source of data:	Table 3 on default emission factors for upstream emissions from the methodological tool for upstream leakage emissions associated with fossil fuel use version 02
Value(s) applied:	16.2
Choice of data or Measurement methods and procedures:	As stated in the methodological tool on upstream leakage emissions associated with fossil fuel use version 02.
Purpose of data	Leakage Emissions Calculation
Additional comment:	None

Data / Parameter:	$EF_{US,diesel,default}$
Data unit:	tCO _{2e} /TJ
Description:	Default emission factor for upstream emissions associated with consumption of diesel
Source of data:	Table 3 on default emission factors for upstream emissions from the methodological tool for upstream leakage emissions associated with fossil fuel use version 02.
Value(s) applied:	16.7
Choice of data or Measurement methods and procedures:	As stated in the methodological tool on upstream leakage emissions associated with fossil fuel use.
Purpose of data	Leakage Emissions Calculation
Additional comment:	None

I.6.3. Modalities for ex ante calculation of emission reductions

Emission reductions for technologies/measures under AMS-III.B version 18.0 for a Type 1 CPA are calculated with reference to the equation listed in section 6.1. The equations and calculations for baseline emissions, project emissions, and leakage below will be applied to each Type 1 CPA under the PoA for each year of the crediting period. The sample calculation applies the equations to be used with sample values.

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation 8}$$

Baseline emissions

For a greenfield facility, it is assumed that in the absence of the project activity a 1.4MW diesel generator would have been used to generate electricity for captive use in the facility. The baseline emission for the CPA implemented is determined as shown below:

$$BE_y = \sum_i FC_{BL,i,j,y} \times NCV_j \times EF_{CO_2,j} \quad \text{Equation 9}$$

Where:

$FC_{BL,i,j,y}$ is calculated based on the actual monitored quantity of project fossil fuel in the element process ($FC_{PJ,i,j,y}$) and the relation of the energy efficiencies and the net calorific values between the project scenario and the baseline scenario.

$$FC_{BL,i,j,y} = FC_{PJ,i,j,y} \times \frac{NCV_{FF,PJ,i,j,y} \times \varepsilon_{project,i,y}}{NCV_j \times \varepsilon_{baseline,i}} \quad \text{Equation 10}$$

Where:

$NCV_{FF,PJ,i,j,y}$ = Net calorific value of the fossil fuel j used in the element process i in the project activity in year y (TJ/mass or volume unit)

- $FC_{PJ,i,j,y}$ = Amount of fuel j consumed in the element process i in project activity during year y (mass or volume unit)
- $\epsilon_{project,i,y}$ = Energy efficiency of the element process i if fired with project fuel
- $\epsilon_{baseline,i}$ = Energy efficiency of the element process i if fired with baseline fuel

$$FC_{BL,i,j,y} = 7,154,730 \times \frac{0.0353 \times 0.9}{34.36 \times 1} = 6611.3m^3$$

Parameters	Sample Values Applied	Reference
$FC_{i,j,BL,y}$ (m ³)	6611.3	Calculated based on the equation 10
NCV_j (TJ/m ³)	34.36	IPCC Lower limit default value converted to appropriate unit
$EF_{CO_2,j}$ (tCO ₂ /TJ)	0.0726	IPCC lower limit default value
$\epsilon_{project,i,y}$	90%	As per GE gas generator engine
$\epsilon_{baseline,i}$	100%	As per default value of Option A in AMS-III.B

$$BE_y = 6611.3 \times 34.362 \times 0.0726 = 16493.05 \text{ tCO}_{2e}$$

Project emissions

As the facility (power generator) uses natural gas as replacement for diesel, the project emissions are estimated by multiplying the quantity of natural gas consumed by the emission factor and calorific value of the natural gas.

$$PE_y = \sum_i FC_{PJ,i,j,y} \times NCV_{FF,PJ,i,j,y} \times EF_{FF,CO_2,PJ}$$

Equation 11

Where:

- PE_y = Project emissions in year y (t CO₂e)
- $NCV_{FF,PJ,i,j,y}$ = Net calorific value of the fossil fuel j used in the element process i in project activity in year y (TJ/mass or volume unit)
- $EF_{FF,CO_2,PJ}$ = CO₂ emission factor of project fuel combusted in the project activity (t CO₂/TJ)
- $FC_{PJ,i,j,y}$ = Amount of fuel j consumed in the element process i in project activity during year y (mass or volume unit)

Parameters	Sample Values Applied	Reference
$FC_{PJ,i,j,y}$ (m ³)	7,154,730	Gas consumption of GE gas engine at full load
$NCV_{FF,PJ,i,j,y}$ (TJ/m ³)	0.0353	IPCC default value upper limit converted to appropriate unit
$EF_{FF,CO_2,PJ}$ (tCO ₂ e/TJ)	0.0583	IPCC default value upper limits

$$PE_y = 7,154,730 \times 0.0353 \times 0.0583 = 14,716.02 \text{ tCO}_{2e}$$

Leakage emissions

As the project activity shall be operated using re-gasified natural gas that is from LNG and considering that it is a PoA, the guidance in AMS.III. B version (18) which requires projects under a programme of activities to consider “leakage emissions resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside the project boundary, based on the guidance provided in the leakage section of “ACM0009: Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas” is applied.

Therefore, leakage emissions is calculated according to ACM0009 (Version 05.0), which states that leakage emissions in year y ($LE_{US,y} = LE_y$) using the latest version of the methodological tool “Upstream leakage emissions associated with fossil fuel use”.

Leakage upstream emissions are calculated as follows:

$$LE_{US,y} = EF_{US,x,default} \times (FC_{PJ,x,y} - FC_{BL,x,y}) \quad \text{Equation 12}$$

Where:

- $LE_{US,y}$ = Leakage upstream emissions in year y (t CO_{2e}/yr)
- $FC_{PJ,x,y}$ = Quantity of fossil fuel type x used in the project situation in year y (TJ/yr)
- $FC_{BL,x,y}$ = Quantity of fossil fuel type x used in the baseline situation in year y (TJ/yr)
- $EF_{US,x,default}$ = Default emission factor for upstream emissions associated with consumption of fossil fuel type x (t CO_{2e}/TJ)
- x = Fossil fuel types used in the project and/or baseline situation and for which upstream emissions should be determined

For the purpose of the sample calculation leakage, it is assumed that the estimated leakage emissions at the baseline situation is higher than leakage emissions in the project situation, therefore leakage emissions is set to be zero.”

Emission reductions:

The emission reduction achieved by the project activity is therefore calculated as the difference between the baseline emissions and the sum of project emissions and leakage emissions (which is set zero) as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation 13}$$

$$ER_y = 16493.05 - 14,716.02 - 0 = 1,777tCO_{2e}$$

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

Data / Parameter:	$FC_{NG,y}$
Data unit:	m ³
Description:	Quantity of NG consumed in the element process during the year y (unit of volume or mass)
Source of data:	Measured by onsite flow meter.
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	Volume Meter
Monitoring frequency:	Continuously
QA/QC procedures:	The recorded values will be cross-checked the NG supplier receipts
Purpose of data	Project Emissions Calculation
Additional comment:	None

Data / Parameter:	$\epsilon_{project,i,y}$
Data unit:	J/J
Description:	Energy efficiency (output/input) of the element process if fired with the NG
Source of data:	Calculated
Value(s) applied	Not applicable.
Measurement methods and procedures:	<p>The efficiency should be determined by undertaking measurements at the element process firing the relevant fuels. All measurements should be conducted at a representative load factor (or operation mode), based on national or international standards. Where a representative load factor (or operation mode) cannot be determined, measurements should be conducted for different load factors (or operation modes) and be weighted by the time these load factors (or operation modes) are typically operated.</p> <p>For project activities with estimated annual emission reductions of each of the element processes equal to or less than 3000 t CO₂e per year the efficiencies may be determined using sampling in accordance with the standard "Sampling and surveys for CDM project activities and programme of activities". Estimates at upper limit of the uncertainty at 95 per cent confidence interval should be used</p>
Monitoring frequency:	Monthly or fixed for the crediting period only if option D of the methodology is applied
QA/QC procedures:	Not applicable
Purpose of data	Baseline Emissions Calculation
Additional comment:	None

Data / Parameter:	Installed capacity
Data unit:	MW
Description:	Installed capacity of the project power plant
Source of data:	Project site (Plant nameplate)
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	Manufacturers specification
Monitoring frequency:	Not applicable
QA/QC procedures:	Not applicable
Purpose of data	Baseline Emissions Calculation
Additional comment:	None

Data / Parameter:	<i>$Q_{NG,electrical,y}$</i>
Data unit:	MWh
Description:	Net energy output in the project activity in year y
Source of data:	On-site measurement
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	Energy meter
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	This will be checked by calculations or Cross check measurement results with invoices if sold to third party.
Purpose of data	Baseline Emissions Calculation
Additional comment:	None

Data / Parameter:	<i>$Q_{NG,thermal,y}$</i>
Data unit:	TJ
Description:	Net quantity of thermal energy supplied by the project activity during the year y
Source of data:	Project plant records
Value(s) applied	Not applicable
Measurement methods and procedures:	<p>Steam or hot fluid and/or gases generated by the heat generation equipment and the sum of the enthalpies of the feed-fluid and/or gases blow-down and if applicable any condensate returns. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.</p> <p>In case of equipment that produces hot water/oil this is expressed as the difference in the enthalpy between the hot water/oil supplied to and returned by the plant.</p> <p>In case of equipment that produces hot gases or combustion gases, this is expressed as the difference in the enthalpy between the hot gas produced and all streams supplied to the plant. The enthalpy of all relevant streams shall be determined based on the monitored mass flow, temperature, pressure, density and specific heat of the gas.</p> <p>In case the project activity is exporting heat to other facilities, the metering shall be carried out at the recipient's end</p>
Monitoring frequency:	Continuous monitoring aggregated annually

QA/QC procedures:	Measurement results shall be cross checked with records if Sold/purchased thermal energy (e.g. invoices/receipts) to third party. Otherwise this will be checked by calculations
Purpose of data	Not applicable
Additional comment:	Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO ₂ /MWh
Description:	Emission factor of the electricity grid to which the project plant is connected
Source of data:	Calculated
Value(s) applied	Not applicable
Measurement methods and procedures:	Calculated as per the procedure in AMS-I.D
Monitoring frequency:	Annually
QA/QC procedures:	Not applicable
Purpose of data	Baseline Emissions Calculation
Additional comment:	This is not expected to be used by CPAs as the scale of the project does not allow connection to the national grid as per national electricity policy.

Data / Parameter:	$NCV_{y,NG}$
Data unit:	GJ/m ³
Description:	Average net calorific value of NG combusted in element process during the year <i>y</i>
Source of data:	Either option a) Gas supplier to d) IPCC default values options as per methodology
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	To be determined at each CPA level
Monitoring frequency:	To be determined at each CPA level
QA/QC procedures:	To be determined at each CPA level
Purpose of data	Baseline and Project Emissions Calculation
Additional comment:	None

Data / Parameter:	$EF_{CO_2,y,NG}$
Data unit:	t CO ₂ /GJ
Description:	CO ₂ emission factor of NG combusted in element process in the year <i>y</i>
Source of data:	a) Gas supplier or d) IPCC default values options as per methodology
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	To be determined at each CPA level
Monitoring frequency:	To be determined at each CPA level
QA/QC procedures:	To be determined at each CPA level
Purpose of data	Baseline Emissions Calculation
Additional comment:	None

I.7.2. Sampling plan

Not applicable

I.7.3. Other elements of monitoring plan

In the proposed PoA, the option (ii) is chosen, i.e. the CME opts for a verification method that does not use sampling but verifies each small-scale CPA.

For each small-scale CPA; a monitoring plan, Quality assurance and Quality control measures will be prepared and described in the CPA-DD. The operating manual will outline the procedures for monitoring and recording of parameters as described in the Section B.7.1 above.

The project proponent of CPA will be responsible for:

- Monitoring, recording and storing of their project data,
- Reporting of their project data to the CME,
- Arranging the maintenance and calibration of the monitoring equipment, as will be described in the monitoring plan of the CPA.
- Ensuring all data sources or other official sources for the emergency situations when the measurement equipment fails shall be specified in the CPA-DD.

The Project proponent will prepare a detailed operating manual of the equipment. An organizational structure to manage the collection, processing and storage of data will be used to manage the monitoring of the project activity.

SECTION J. Crediting period type and duration

The CPA has a renewable crediting period.

The length of the crediting period is 7 years and 0 month and renewable twice (maximum total length of 21 years 0 months)

SECTION K. Eligibility criteria for inclusion of CPAs**Table 2: Eligibility Criteria**

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	Geographical Boundary	Each CPA will be located within the physical/geographical boundary of the PoA.	Geographic reference showing the activity is within the physical/geographical boundary of the PoA
2	Double Counting	Each CPA will utilize unique identifiers, such as GPS coordinates for every technology/measure under the CPA.	A description of the unique identifier will be provided by the CPA
3	Exclusiveness of CPA	The CPA shall not be previously: 1. Registered as a CDM project activity 2. Included as a CPA in any other registered PoA, or deregistered as a CPA of a PoA	Confirmed by the CME
4	Technology/Measures	The CPA specifies the level and type of service provided by the technology/measure as well as its performance, which are in line with the technology outlined in PoA-DD. Specifications of technology/measure shall include the type, capacity, and other key features of the design of the systems	Technical details of will be provided in the specific CPA
5	Start Date	Each CPA will prove that the start date of the CPA is on or after the start date of the PoA. The start date of the CPA is the date on which construction, implementation, or real action concerning the CPA, as shown through a contract detailing real action or an invoice for equipment.	The start date of activity as shown through a purchase order, service agreement, or other type of contract.
6	Applicability of the methodologies	Each CPA will apply the CDM baseline and monitoring methodology AMS-III.B version 18.0, and adhere to all applicability conditions and other requirements of the methodology	CPA DD, applying CDM methodologies AMS-III.B version 18.0
7	Additionality	CPA shall demonstrate its additionality to be eligible for inclusion under the PoA in line with the Methodological tool on the demonstration of additionality of small-scale project activities (version 12).	CPA-DD

8	EIA & Stakeholders Consultation	Evidence of EIA been carried out, Local Stakeholder consultation minutes and list of attendees must be presented as evidence (if applicable).	CPA. Section E based on the EIA report (if applicable).
9	Funding	CPA will affirm that funding from Annex I Parties, if any, does not result in a diversion of official development assistance	Letter stating the disclosure of public funding or other funding options will be provided.
10	Target Group	The target group of each CPA shall be residential, industrial and commercial facility that switch from higher fossil fuel to use of natural gas for electricity generation.	CPA-DD, Section A.1
11	Sampling	Not applicable as per section I.7.2 above	Not applicable
12	Small Scale Threshold	The CPAs shall adhere to the Small scale threshold (less or equal to 15MW) and result in emission reductions equivalent to or less than 60 ktCO ₂ e emissions reductions.	CPA-DD. The result in the CPA emission Reductions calculation less than or equal to 60k tCO ₂ e per annum.
13	Debundling	The project developer will provide a written statement attesting that the CPA is not a debundled component of a large-scale project activity, including a map of any nearby project activity. The CME will compare this to other activities under the PoA.	CPA-DD

PART III. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

Fossil Fuel Switch in Existing Manufacturing Industries

H.2. Reference number of generic CPA

Generic CPA Type 2

H.3. Purpose and general description of generic CPA

As per the methodology, CPAs can be implemented based on fuel switch project activities that involve switching from a fossil fuel to;

- A lower carbon content fossil fuel; or
- A lower carbon intensive electric grid energy source in existing manufacturing industries.

The purpose of the type 2 CPA shall be the replacement of higher carbon intensive fossil fuel (fuel oil/diesel) in industrial project activity that are implemented in Nigeria to a lesser carbon intensive fossil fuel (natural gas) of lower GHG emissions.

The technology employed will be the use of natural gas in the thermal energy conversion equipment such as furnace, kiln, dryers etc to produce products which would have in the absence of the project activity used a higher carbon intensive fossil fuel.

In accordance with the CDM project standard for programme of activities version 01 and as per the AMS III.AN version 02, the small-scale project type applicable to the CPA is Type III, that is amount of emission reduction is limited to less than or equal to 60,000 tCO₂e annually

H.4. Technologies/measures

The CPA seeks to target low heat requirement Industries to switch from the use of fuel oil or diesel which are the commonly used fuel to natural gas. The proposed CPA showcases the longer-term economic and environmental benefits of the switch. This will result in the reduction of GHGs because the emissions intensity of fuel oil and diesel are higher than that of natural gas.

From the provisions of the applicable methodology:

-AMS-III.AN (Version 02):

“The methodology comprises fossil fuel switching in existing manufacturing industries (e.g. fuel switch from fuel oil or diesel to natural gas in a heating process that involves use of e.g. furnaces, kilns, dryers.”

The Type 2 CPA Technology will involve the use of natural gas in thermal energy conversion equipment such as boilers, kilns, furnace etc in existing manufacturing industry to produce products¹³ where such need would have been provided at the baseline with the use of higher fossil fuel such as coal, fuel oil and diesel in the baseline which would resulted in higher GHGs emission.

The project may involve the reconstruction the thermal energy conversion equipment for the fossil fuel switch to natural gas. The technology involved is dependent on the type of equipment employed by the CPA Type 2. However, this may include retrofitting, conversion or replacement of nozzle and timer of fuel supplied into the heating chamber of the industrial heating system. Each CPA Type 2 will provide a summary of the technology to be employed or implemented in line with the AMS III.AN methodology.

SECTION I. Application of selected methodologies and standardized baselines

I.1. Reference to methodologies and standardized baselines

All CPAs registered under this PoA reference the following methodologies, tool and guideline;

- *AMS-III.AN. Fossil fuel switch in existing manufacturing industries Version 02*
- *Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion¹⁴*
- *ACM0009: Consolidated baseline and monitoring methodology for fuel switch from coal or petroleum fuel to natural gas Version 05.0¹⁵*

I.2. Applicability of methodologies and standardized baselines

The applicability criteria for registering under this PoA using AMS-III.AN (Version 02) methodology are listed in the table below. The compliance requirements that must be met by each CPA and/or each CPA facility are as listed. The applicability criteria for AMS III. AN is discussed below;

Table 3: Applicability criteria for AMS III. AN

No.	Applicability	Justification by CPA
1.	<p>The methodology is applicable to project activities that involve switching from a fossil fuel to either:</p> <p>(a) A lower carbon content fossil fuel; or (b) A lower carbon intensive electric grid energy source in existing manufacturing industries.</p> <p>Applicable projects may also result in improved energy efficiency. However, this methodology does not provide any emissions reduction credits for energy efficiency improvement.</p>	<p>The proposed CPA will include activities that involves switching from a fossil fuel to a lower carbon content fossil fuel.</p>
2.	<p>The methodology is applicable if the following requirements are met:</p>	

¹³ The fuel switch in manufacture of bricks is not covered by the methodology. The project proponents shall explore applying AMS-III.Z.

¹⁴ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf>

¹⁵ <https://cdm.unfccc.int/methodologies/DB/CMUDDO0MI7G7SYSDFXA75EIITKEVA4P>

a.	The baseline fossil fuel and the project low carbon energy source are consumed in thermal energy conversion equipment (e.g. furnaces, kilns, dryers) that are used in the manufacture of products (e.g. steel, ceramics, cement, Aluminium). This is referred to as an element process in this methodology;	The proposed CPA includes fossil fuel consumed at the baseline and natural gas consumed at the project scenario in the thermal energy conversion equipment
b.	Fossil fuel switch may be implemented for multiple element processes within the industrial facility, where the project is implemented. However, switching multiple fossil fuels in (single) element process is not applicable under this methodology;	The proposed CPA will not include switching of multiple fossil fuels in a single element process
c.	The baseline is the continued use of existing system and where the system must have been in operation for at least the immediate prior three years to the start date of the project activity. This requirement is in order to ensure that adequate baseline performance data are available;	The established baseline for the proposed CPA will be the continued use of existing system with an evidence of at least three years prior to the start of the project activity
d.	Regulations do not require the use of project low carbon energy source (e.g. natural gas, electricity or any other fuel) or restrict the use of the baseline fuel;	Not applicable
e.	Each element process should have a distinct energy input (i.e. specific fuel or electricity) and distinct output (i.e. intermediate or finished product). The output of each element process shall be an output for which an appropriate international/national standard or industrial norm exists;	The proposed CPA will have a distinct energy input and distinct energy output.
f.	The product(s) produced in the industrial facility throughout the crediting period shall be equivalent to the product(s) produced in the baseline. For the purposes of this methodology, equivalent products are defined as products having the same use, the same general physical properties, and which function in a similar manner. In addition, products produced in the industrial facility throughout the crediting period shall provide the same level of service, or better, and be of the same level of quality, or better than the product(s) produced in the baseline. When national or international product standards apply to the product(s), product quality shall be as defined in such standards, otherwise the relevant industrial norms are to be followed;	The product in the proposed CPA shall be same as that produced in the baseline.

g.	The type of input materials used in the project shall be homogeneous and similar to the input material that was used in the baseline and any deviation during the crediting period of input material type, composition, or amount used per unit of product output shall be within the range of +/-10% of the baseline characteristics and values;	For the proposed CPA, the type of input material used in the project shall be similar to the input material at the baseline and any deviation during the crediting period shall be within +/-10 of the baseline characteristics
h.	For each element process, the ratio of energy input to product output in the project activity shall be equal to or less than the ratio of energy input to product output in the baseline.	For the proposed CPA, the ratio of energy input to product output will be monitored and ensure to be equal to or less than the ratio of energy input to product output in the baseline
3.	This methodology is not applicable to:	
a.	Project activities that propose switch from fossil fuel use in the baseline to renewable biomass, biofuel or other renewable energy;	Not applicable
b.	Switching from a carbon intensive electricity grid to a low carbon intensive grid for industrial processes;	Not applicable
c.	Situations in which, whether as a result of the project activity or not, there are changes during the project implementation or during the crediting period, either in the elemental process associated with the project activity or other downstream or upstream processes related to the project elemental processes. The purpose is to exclude complex project activities where the impact of the measures implemented (fossil fuel switch) by the project activity cannot be clearly distinguished from changes in energy use due to other variables not influenced by the project activity (signal to noise ratio);	Not applicable
d.	Project activities involving the use of waste gas or energy.	Not applicable
4.	In case the fuel switch project involves more than one element process, the historical data used for the baseline emission determination and the project activity monitoring will be based on the fuel use and output of each element process separately	The proposed CPA will involve fuel switch in a single element process. Should fuel switch be involved in more than one element process, the historical data used for the baseline determination and the project activity monitoring will be based on the fuel use and output of each element process separately.
5.	The requirements concerning demonstration of the remaining lifetime of any baseline equipment that is replaced equipment shall be as described in the general guidelines to SSC CDM methodologies. If the remaining lifetime of the element processes increases due to the project	The proposed CPA will meet the requirement concerning the demonstration of the remaining lifetime of replaced equipment as specified in the latest tool, "tool to determine the remaining lifetime of

	activity, the crediting period shall be limited to the estimated remaining lifetime of the baseline equipment, i.e. the time when the affected element processes would have been replaced in the absence of the project activity.	equipment”.
6.	It can be demonstrated that the difference between the specific energy consumption of the fuel handling and other auxiliary systems of the project system is less than, or equal to, or not significantly higher than the baseline facility. Specific energy consumption for fuel handling and other auxiliary systems (within the variation of 10% on annual basis, i.e. project auxiliary energy consumption per project output is no more than 110% of baseline auxiliary energy consumption per baseline output). Specific energy consumption is energy input of the auxiliary system per unit product output.	The proposed CPA will demonstrate that the difference between the specific energy consumption of the fuel is less than or within a variation of not more 10% of that of the baseline facility on an annual basis
7.	In cases where product output (e.g. hot/fused metal) cannot be measured, the input material used in the element process can be used as a proxy for determining baseline/project emissions.	The proposed CPA will show that in cases where output cannot be measured, the input material is used as proxy.
8.	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO ₂ equivalent annually.	The measures in the proposed CPA is limited to activity that result to emission reduction less or equal to 60ktCO ₂ e annually

I.3. Application of multiple methodologies

The CPA only applied a single methodology, AMS-III.AN version 02.0

I.4. Project boundary, sources and greenhouse gases (GHGs)

The project boundary and GHG sources are summarised and discussed below.

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from combustion of fossil fuels used by the power plant (generators) at the baseline.	CO ₂	Yes	Main emission source in the baseline scenario
		CH ₄	No	Minor source. Neglected for simplicity
		N ₂ O	No	Minor source. Neglected for simplicity
Project activity	Emissions from combustion of natural gas used by power plants (generators) at the project activity.	CO ₂	Yes	Main emission source in the project scenario
		CH ₄	No	Minor source. Neglected for simplicity
		N ₂ O	No	Minor source. Neglected for simplicity

As per the methodology, “the project boundary is the physical, geographical site where the switching of energy source takes place. It includes all installations, processes or equipment affected by the switching”. Hence, for a typical CPA, the project boundary therefore includes the physical, geographical site where the fuel switch takes place.

Gases included in the project boundary for the baseline are carbon dioxide emission from the use of higher fossil fuel in the thermal energy conversion equipment. Project emissions are carbon dioxide emissions due to the actual consumption of natural gas at the project case.

The project boundary is the physical, geographical site where the switching of energy source takes place. It includes all installations, processes or equipment affected by the switching.

Figure 4: flow diagram for baseline scenario, showing project boundary (dashed line) and emissions sources

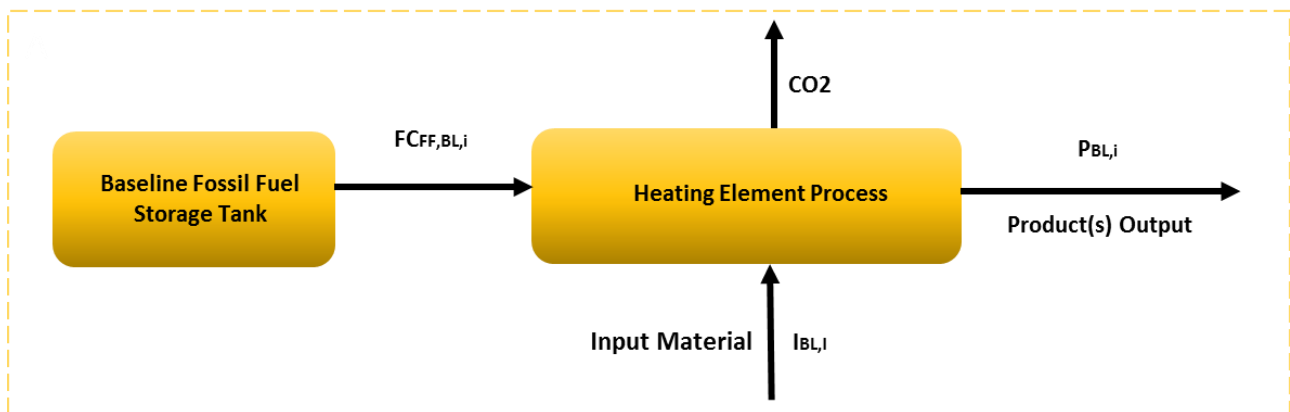
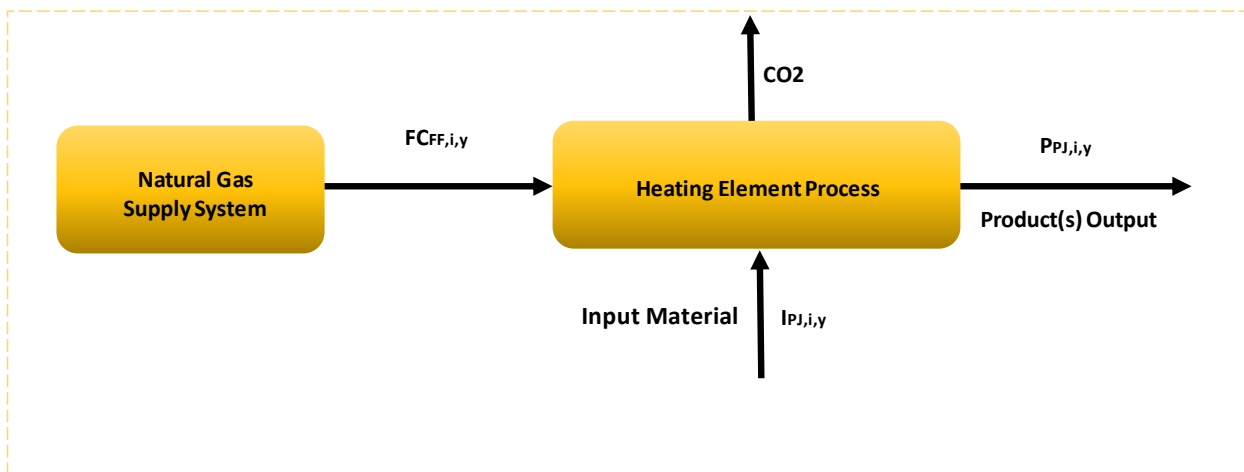


Figure 5: Flow diagram for project scenario, showing project boundary (dashed line) and emissions sources



1.5. Establishment and description of baseline scenario

In accordance with the AMS-III.AN, the baseline scenario is same as the scenario existing prior to the start of implementation of the project activity that is, the use of fuel oil/diesel in the thermal energy conversion equipment.

Therefore, for all type 2 CPA, the most likely baseline scenario that would occur in the absence of the PoA is the continued use of a higher carbon intensive fossil fuel; in most cases in the country, fuel oil/diesel are commonly used. While this is the most likely scenario for all the CPAs, the baseline scenario for each CPA would be identified in line with the provision of the methodology and the project standard.

In the CPA boundary, there are neither national and/or sectoral policies or regulations that give comparative advantages to more emissions-intensive technologies or fuels, nor national and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies implemented before the adoption of the Kyoto Protocol (December 1997) or since the adoption of the CDM M&P (November 2001).

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

In line with the AMS. III.AN methodology version 02, the emission reduction from each CPA will be calculated using the three basic steps below;

Step 1: Baseline emissions

The baseline emissions are the emissions related to the historical fossil fuel consumed and associated with the element processes affected by the project activity that would continue to occur in the absence of the project activity.

The baseline emissions are calculated using the equation below:

$$BE_y = \sum_i \{ SEF_{BL,i} * P_{PJ,i,y} \} \quad \text{Equation 14}$$

Where:

BE_y	The annual baseline emissions from fossil fuel displaced by the project activity in tCO ₂ e in year y (tCO ₂ e/year)
$SEF_{BL,i}$	Specific baseline emission factor for the element process i (tCO ₂ e/tonne)
$P_{PJ,i,y}$	The annual net production of the element process i in year y (tonnes)

The baseline fuel consumption of the CPA ($FC_{FF,BL,i}$), product output at baseline ($P_{BL,i}$) and/or input material at the baseline ($I_{BL,i}$) as relevant shall be available for the last three years prior to the start date of the project activity (or the start date of validation with due justification) for the purpose of baseline emissions calculation. For element processes with less than three years operational data, all historical data shall be available (a minimum of one-year data would be required).

The specific baseline emission factor ($SEF_{BL,i}$) shall be calculated as the minimum of the *ex-ante* ($SEF_{CO_2,BL,i(ex-ante)}$) and *ex post* ($SEF_{CO_2,BL,i(ex-post)}$) values determined as per the equations (16) and (17) below.

$$SEF_{BL,i} = \text{MIN} \{ SEF_{CO_2,BL,i(ex-ante)} ; SEF_{CO_2,BL,i(ex-post)} \}$$

Equation 15

The $SEF_{CO_2,BL,i(ex-ante)}$ and $SEF_{CO_2,BL,i(ex-post)}$ are calculated as follows:

$$SEF_{CO_2,BL,i(ex-ante)} = \frac{(FC_{FF,BL,i} * NCV_{FF,BL} * EF_{FF,CO_2,BL})}{P_{BL,i}}$$

Equation 16

$$SEF_{CO_2,BL,i(ex-post)} = \frac{(FC_{FF,PJ,i,y} * NCV_{FF,PJ} * EF_{FF,CO_2,BL})}{P_{PJ,i,y}}$$

Equation 17

Where:

$FC_{FF,BL,i}$	Baseline fossil fuel consumption in element process i (mass or volume units)
$NCV_{FF,BL}$	Net calorific value ¹⁶ for the baseline fossil fuel (MJ per unit mass or volume)
$EF_{FF,CO_2,BL}$	CO ₂ emission factor of the baseline fossil fuel
$P_{BL,i}$	Baseline production in element process i (tonnes)
$FC_{FF,PJ,i,y}$	Fossil fuel consumption in element process i during the year y (mass or volume units)
$NCV_{FF,PJ}$	Net calorific value for the fossil fuel during the year y (MJ/mass or volume)
$P_{PJ,i,y}$	Production during the year y in element process i (tonnes)

Note that where it can be demonstrated that the product output cannot be directly measured, the $P_{PJ,i,y}$ shall be substituted with input material $I_{PJ,i,y}$ and $P_{BL,i}$ shall be substituted with input material $I_{BL,i}$.

Step 2: Project emissions

The project emissions due to consumption of fossil fuels and grid electricity can be calculated as follows:

$$PE_y = \sum_i \{ (FC_{FF,i,y} * NCV_{FF,PJ} * EF_{FF,CO_2,PJ}) + [EC_{elec,i,y} * (1 + TDy) * EF_{Elec,CO_2,y}] \}$$
 Equation 18

Where:

PE_y	Project emissions in the project activity in year y in tCO ₂ e
$FC_{FF,i,y}$	Amount of the fossil fuel consumed in element process i in the project activity in year y (mass or volume unit)

$EF_{FF,CO_2,PJ}$	CO ₂ emission factor for the fossil fuel (CO ₂ /MJ)
$EC_{elec,i,y}$	Quantity of grid electricity consumed by the project activity in element process <i>i</i> in year <i>y</i> (MWh)
TD_y	Average annual technical grid losses (transmission and distribution) during year <i>y</i> for the grid serving the facility (fraction)
$EF_{Elec,CO_2,y}$	Emission factor of grid electricity in year <i>y</i> calculated in accordance with the provisions in AMS-I. D (tCO ₂ /MWh)

Step 3: Leakage emissions

According to the AMS.III.AN methodology, ‘if the energy generating equipment is transferred from another activity, leakage is to be considered’. Also, the methodology states that ‘Leakage emissions resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary shall be considered, as per the guidance provided in the leakage section of ACM0009 “Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas”. In case leakage emissions in the baseline situation are higher than leakage emissions in the project situation, leakage emissions will be set to zero.’

Therefore, leakage emissions shall be calculated according to ACM0009 (Version 05.0), which further states that leakage emissions in year *y* ($LE_{US,y} = LE_y$) shall be determined using the latest version of the methodological tool “Upstream leakage emissions associated with fossil fuel use”.

Leakage upstream emissions are calculated as follows:

$$LE_{US,y} = EF_{US,x,default} \times (FC_{PJ,x,y} - FC_{BL,x,y}) \tag{Equation 19}$$

Where:

- $LE_{US,y}$ = Leakage upstream emissions in year *y* (t CO₂e/yr)
- $FC_{PJ,x,y}$ = Quantity of fossil fuel type *x* used in the project situation in year *y* (TJ/yr)
- $FC_{BL,x,y}$ = Quantity of fossil fuel type *x* used in the baseline situation in year *y* (TJ/yr)
- $EF_{US,x,default}$ = Default emission factor for upstream emissions associated with consumption of fossil fuel type *x* (t CO₂e/TJ)
- x* = Fossil fuel types used in the project and/or baseline situation and for which upstream emissions should be determined

I.6.2. Data and parameters fixed ex ante

Data / Parameter:	$P_{BL,FF}$
Data unit:	tonnes/year
Description:	Baseline production in element process (tonnes)
Source of data:	Production data logs at the project sites
Value(s) applied:	To be determined at each CPA level
Choice of data or Measurement methods and procedures:	3years historical data of weighed raw material using calibrated scale or other measuring equipment after production in the facility. However, where measured data record is less than 3 years a minimum of one-year data is required.
Purpose of data	Baseline Emissions Calculation
Additional comment:	When it can be demonstrated that the product output cannot be directly measured as per paragraph 7, the $P_{BL,FF}$ shall be substituted with input material $I_{BL,FF}$. This is clearly demonstrated in paragraph 13 of the AM III.AN version 2.

Data / Parameter:	$I_{BL,FF}$
Data unit:	tonnes/year
Description:	The net project raw material consumption in the element process
Source of data:	Production data logs at the project sites
Value(s) applied:	To be determined at each CPA level
Choice of data or Measurement methods and procedures:	3 years historical data of weighed raw material using calibrated scale or other measuring equipment before entering the processing facility (e.g. reheating furnace). However, where measured data record is less than 3 years a minimum of one-year data is required.
Purpose of data	Baseline Emissions Calculation
Additional comment:	This is applicable, when it can be demonstrated that the product output cannot be directly measured as per paragraph 7, the $P_{BL,FF}$ shall be substituted with input material $I_{BL,FF}$. This is clearly demonstrated in paragraph 13 of the AM III.AN version 2.

Data / Parameter:	$FC_{FF,BL}$
Data unit:	mass or volume units
Description:	Baseline fossil fuel (fuel oil) consumption in element process.
Source of data:	Records at the project sites
Value(s) applied:	To be determined at each CPA level
Choice of data or Measurement methods and procedures:	Historical data for the last three years prior to the start of the Project. However, where measured data record is less than 3 years a minimum of one-year data is required
Purpose of data	Baseline Emissions Calculations
Additional comment:	None

Data / Parameter:	<i>NCV_{FF,BL}</i>
Data unit:	MJ/Gg
Description:	Net calorific value for the baseline fossil fuel (LPFO)
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value(s) applied:	38.9X 10 ⁶
Choice of data or Measurement methods and procedures:	IPCC default values
Purpose of data	Baseline Emissions Calculations
Additional comment:	None

Data / Parameter:	<i>EF_{FF,CO2,BL}</i>
Data unit:	tCO ₂ /MJ
Description:	CO ₂ emission factor of the baseline fossil fuel (fuel oil)
Source of data:	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.
Value(s) applied:	75.5 X 10 ⁻⁶
Choice of data or Measurement methods and procedures:	IPCC default values
Purpose of data	Baseline Emissions Calculations
Additional comment:	None

Data / Parameter:	<i>EF_{US,diesel,default}</i>
Data unit:	tCO _{2e} /TJ
Description:	Default emission factor for upstream emissions associated with consumption of diesel
Source of data:	Table 3 on default emission factors for upstream emissions from the methodological tool for upstream leakage emissions associated with fossil fuel use version 02.
Value(s) applied:	16.7
Choice of data or Measurement methods and procedures:	As stated in the methodological tool on upstream leakage emissions associated with fossil fuel use.
Purpose of data	Leakage Emissions Calculation
Additional comment:	None

Data / Parameter:	$EF_{US,LNG,default}$
Data unit:	tCO _{2e} /TJ
Description:	Default emission factor for upstream emissions associated with consumption of natural gas
Source of data:	Table 3 on default emission factors for upstream emissions from the methodological tool for upstream leakage emissions associated with fossil fuel use version 02
Value(s) applied:	16.2
Choice of data or Measurement methods and procedures:	As stated in the methodological tool on upstream leakage emissions associated with fossil fuel use version 02.
Purpose of data	Leakage Emissions Calculation
Additional comment:	None

Data / Parameter:	$EF_{US,LPFO,default}$
Data unit:	tCO _{2e} /TJ
Description:	Default emission factor for upstream emissions associated with consumption of fuel oil
Source of data:	Table 3 on default emission factors for upstream emissions from the methodological tool for upstream leakage emissions associated with fossil fuel use version 02.
Value(s) applied:	16.2
Choice of data or Measurement methods and procedures:	As stated in the methodological tool on upstream leakage emissions associated with fossil fuel use.
Purpose of data	Leakage Emissions Calculation
Additional comment:	None

1.6.3. Modalities for ex ante calculation of emission reductions

Emission reduction for technology/measure under the AMS.III.AN version 02 for a Type 2 CPA are calculated with reference to the equations listed under section B.6.1. The equations and calculations for baseline emissions, project emissions, and leakage below will be applied to each Type 2 CPA under the PoA for each year of the crediting period. The sample calculation applies the equations to be used with sample values. The values applied below are hypothetical, actual values will be used at the CPA level.

Baseline emissions

Assuming a fossil fuel switch from an existing reheating furnace facility where LPFO is used at the baseline scenario and this is being switched to natural gas. The facility has been running for the past 10 years but the records of LPFO consumption for the last three years prior the implementation of the fuel switch is used in line with the methodology. The baseline fuel consumption of the CPA ($FC_{FF,BL,i}$), Input raw material at baseline ($P_{BL,i}$) for the three year data was used prior to the start date of the project activity for the purpose of baseline emissions calculation.

Parameters	Sample value applied	Reference
$FC_{FF,BL,i}$ (tonnes)	17,302	Hypothetical value
$NCV_{FF,BL}$ (MJ/m ³)	0.0407	IPCC Lower limit default value converted to appropriate unit
$EF_{FF,CO_2,BL}$ (tCO ₂ /TJ)	75.5*10 ⁻⁶	IPCC Lower limit default value I
$P_{BL,i}$ (tonnes)	292,100	Hypothetical value
$FC_{FF,PJ,i,y}$ (m ³)	16,062,234	Hypothetical value
$NCV_{FF,PJ}$ (MJ/m ³)	35.3	IPCC Lower limit default value converted to appropriate unit
$I_{PJ,i,y}$ (tonnes)	335,000	Hypothetical value

The baseline emissions are calculated using the equation below:

$$BE_y = \sum_i \{ SEF_{BL,i} * P_{PJ,i,y} \} \quad \text{Equation 20}$$

Where:

BE_y The annual baseline emissions from fossil fuel displaced by the project activity in tCO₂e in year y (tCO₂e/year)

$SEF_{BL,i}$ Specific baseline emission factor for the element process i (tCO₂e/tonne)

$P_{PJ,i,y}$ The annual net production of the element process i in year y (tonnes)

The specific baseline emission factor ($SEF_{BL,i}$) is calculated as the minimum of the *ex-ante* ($SEF_{CO_2,BL,i(ex-ante)}$) while *ex post* ($SEF_{CO_2,BL,i(ex-post)}$) is calculated as per the equations below.

$$SEF_{CO_2,BL,i(ex-ante)} = \frac{(FC_{FF,BL,i} * NCV_{FF,BL} * EF_{FF,CO_2,BL})}{P_{BL,i}} = \frac{(17,302 * 0.0407 * 0.0000755)}{292,100} = 0.174 \text{ tCO}_2\text{e/t}$$

$$SEF_{CO_2,BL,i(ex-post)} = \frac{(FC_{FF,PJ,i,y} * EF_{FF,CO_2,BL})}{P_{PJ,i,y}} = \frac{16,062,234 * 35.3 * 0.0000755}{335,000} = 0.128 \text{ tCO}_2\text{e/t}$$

The minimum of the two specific baseline emission factors is selected as per:

$$SEF_{BL,i} = \text{MIN} \{ SEF_{CO_2,BL,i(ex-ante)} ; SEF_{CO_2,BL,i(ex-post)} \} = \text{Min} \{ 0.128 \text{ tCO}_2\text{e/t} \}$$

Where:

$FC_{FF,BL,i}$ Baseline fossil fuel consumption in element process i (mass or volume units)

$NCV_{FF,BL}$	Net calorific value for the baseline fossil fuel (MJ per unit mass or volume)
$EF_{FF,CO2,BL}$	CO ₂ emission factor of the baseline fossil fuel
$P_{BL,i}$	Baseline production in element process i (tonnes)
$FC_{FF,PJ,i,y}$	Fossil fuel consumption in element process i during the year y (mass or volume units)
$NCV_{FF,PJ}$	Net calorific value for the fossil fuel during the year y (MJ/mass or volume)
$P_{PJ,i,y}$	Production during the year y in element process i (tonnes)

$$BE_y = 0.128 \times 335,000 = 42,784.01 \text{ tCO}_{2e}$$

Project emissions

During the project activity, the project emissions using natural gas is calculated as follows:

$$PE_y = \sum_i \left\{ \left(FC_{FF,i,y} * NCV_{FF,PJ} * EF_{FF,CO2,PJ} \right) + \left[EC_{elec,i,y} * (1 + TD_y) * EF_{Elec,CO2,y} \right] \right\}$$

Where:

PE_y	Project emissions in the project activity in year y in tCO _{2e}
$FC_{FF,i,y}$	Amount of the fossil fuel consumed in element process i in the project activity in year y (mass or volume unit)
$EF_{FF,CO2,PJ}$	CO ₂ emission factor for the fossil fuel (CO ₂ /MJ)
$EC_{elec,i,y}$	Quantity of grid electricity consumed by the project activity in element process i in year y (MWh)
TD_y	Average annual technical grid losses (transmission and distribution) during year y for the grid serving the facility (fraction)
$EF_{Elec,CO2,y}$	Emission factor of grid electricity in year y calculated in accordance with the provisions in AMS-I.D (tCO ₂ /MWh)

Note that the project activity is purely fossil fuel switch in the boiler, hence only project emissions related to the fossil consumption in the boiler has been considered.

Parameters	Sample Value Applied	Reference
$FC_{FF,i,y}$ (m ³)	16,062,234	Hypothetical value
$NCV_{FF,PJ}$ (MJ/m ³)	35.3	IPCC default value upper limits equivalent unit
$EF_{FF,CO2,PJ}$ (tCO _{2e} /MJ)	$58.3 * 10^{-6}$	IPCC default value upper value

$$PE_y = 16,062,234 \times 35.3 \times 0.0000583 = 33,037.19 \text{ tCO}_{2e}$$

Leakage emissions

The project activity operates using re-gasified natural gas from LNG. Considering the rule that applies to a PoA as stated in AMS.III. AN version 02 which requires projects under a programme of activities to consider “*leakage emissions resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside the project boundary, based on the guidance provided in the leakage section of “ACM0009: Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas”*” is applied.

Leakage emissions is calculated according to ACM0009 (Version 05.0), which states that leakage emissions in year y ($LE_{US,y} = LE_y$) using the latest version of the methodological tool “*Upstream leakage emissions associated with fossil fuel use*”.

Leakage upstream emissions are calculated as follows:

$$LE_{US,y} = EF_{US,x,default} \times (FC_{PJ,x,y} - FC_{BL,x,y})$$

Where:

$LE_{US,y}$ = Leakage upstream emissions in year y (t CO₂e/yr)

$FC_{PJ,x,y}$ = Quantity of fossil fuel type x used in the project situation in year y (TJ/yr)

$FC_{BL,x,y}$ = Quantity of fossil fuel type x used in the baseline situation in year y (TJ/yr)

$EF_{US,x,default}$ = Default emission factor for upstream emissions associated with consumption of fossil fuel type x (tCO₂e/TJ)

x = Fossil fuel types used in the project and/or baseline situation and for which upstream emissions should be determined

For the purpose of the sample calculation, it is assumed that the estimated leakage emissions indicate that the leakage emission at the baseline situation to be higher than leakage emissions in the project situation, therefore leakage emissions is set to be zero.

Emission reductions:

The emission reduction achieved by the project activity is therefore calculated as the difference between the baseline emissions and the sum of project emissions and leakage emissions (which is set zero) as follows:

$$ER_y = BE_y - PE_y - LE_y$$

$$ER_y = 42,784.01 - 33,037.19 - 0 = 9,746 \text{ tCO}_2\text{e}$$

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

Data / Parameter:	$P_{PJ,i,y}$
Data unit:	tonnes/year
Description:	The annual net project production of the element process in year y
Source of data:	Measured data
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	Measurements are undertaken using calibrated meters.
Monitoring frequency:	To be determined at each CPA level as per the established industrial practice
QA/QC procedures:	Measurement results shall be cross-checked with records for sold production (e.g. invoices/receipts), inventory records and by performing mass-balance
Purpose of data	Baseline Emissions Calculation
Additional comment:	When it can be demonstrated that the product output cannot be directly measured as per paragraph 7, the $P_{PJ,FF}$ shall be substituted with input material $I_{BL,FF}$. This is clearly demonstrated in paragraph 13 of the AM III.AN version 2.

Data / Parameter:	$I_{PJ,i,y}$
Data unit:	tonnes/year
Description:	The annual net project raw material consumption in the element process in year y
Source of data:	Measured data
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	Raw material shall be weighed using calibrated scales or other measuring equipment before entering the processing facility.
Monitoring frequency:	To be determined at each CPA level as per the established industrial practice
QA/QC procedures:	Measurement results shall be cross-checked with records for purchased raw materials (e.g. invoices/receipts), inventory records and by performing a mass balance
Purpose of data	Baseline Emission. Applicable when product output cannot be measured
Additional comment:	This is applicable, when it can be demonstrated that the product output cannot be directly measured as per paragraph 7, the $P_{PJ,i,y}$ shall be substituted with input material $I_{PJ,i,y}$. This is clearly demonstrated in paragraph 13 of the AM III.AN version 2.

Data / Parameter:	$EF_{NG,CO_2,PJ}$
Data unit:	tCO _{2e} /MJ
Description:	CO ₂ emission factor for the fossil fuel
Source of data:	Option a) Gas supplier to d) IPCC default values from the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 02"
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	To be determined at each CPA level
Monitoring frequency:	To be determined at each CPA level
QA/QC procedures:	To be determined at each CPA level
Purpose of data	Project Emissions Calculations
Additional comment:	None

Data / Parameter:	$EF_{ELEC,CO_2,y}$
Data unit:	tCO _{2e} /kWh
Description:	CO ₂ emission factor of the grid electricity in year y
Source of data:	Calculated
Value(s) applied	Not applicable
Measurement methods and procedures:	Calculated as per the provisions of AMS-I.D
Monitoring frequency:	Annually
QA/QC procedures:	To be determine at CPA level
Purpose of data	Project Emissions Calculation
Additional comment:	None

Data / Parameter:	$FC_{NG,y}$
Data unit:	Mass or volume unit per year
Description:	Quantity of fossil fuel combusted in element process during the year y
Source of data:	On-site measurements
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	Mass or volume meter
Monitoring frequency:	Continuously
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes
Purpose of data	Project Emissions Calculation
Additional comment:	None

Data / Parameter:	$EC_{elec,y}$
Data unit:	MWh/y
Description:	Quantity of grid electricity consumed in year y
Source of data:	Energy meter
Value(s) applied	Not applicable
Measurement methods and procedures:	Measurements are undertaken using calibrated energy meters
Monitoring frequency:	Continuous monitoring integrated hourly and at least monthly recording
QA/QC procedures:	To be determine at CPA level
Purpose of data	Project Emissions Calculation
Additional comment:	None

Data / Parameter:	$NCV_{NG,y}$
Data unit:	MJ/mass or volume unit
Description:	Net calorific value of fossil fuel
Source of data:	Either option a) Gas supplier to d) IPCC default values from the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 02"
Value(s) applied	To be determined at each CPA level
Measurement methods and procedures:	To be determined at each CPA level
Monitoring frequency:	To be determined at each CPA level
QA/QC procedures:	To be determined at each CPA level
Purpose of data	Project Emissions Calculation
Additional comment:	None

Data / Parameter:	TD_y
Data unit:	fraction
Description:	Average annual technical grid losses (transmission and distribution) during year y for the grid
Source of data:	Calculated
Value(s) applied	Not applicable
Measurement methods and procedures:	Calculated value in accordance with the procedures described in the most recent version of AMSII. J
Monitoring frequency:	Annual
QA/QC procedures:	To be determine at each CPA level
Purpose of data	Project Emissions Calculation
Additional comment:	None

I.7.2. Sampling plan

Not applicable

I.7.3. Other elements of monitoring plan

In the proposed PoA, the option (ii) is chosen, i.e. the CME opts for a verification method that does not use sampling but verifies each small-scale CPA.

For each small-scale CPA; a monitoring plan, Quality assurance and Quality control measures will be prepared and described in the CPA-DD. The operating manual will outline the procedures for monitoring and recording of parameters as described in the Section B.7.1 above.

The project proponent of CPA will be responsible for:

- Monitoring, recording and storing of their project data,
- Reporting of their project data to the CME,
- Arranging the maintenance and calibration of the monitoring equipment, as will be described in the monitoring plan of the CPA.
- Ensuring all data sources or other official sources for the emergency situations when the measurement equipment fails shall be specified in the CPA-DD.

The Project proponent will prepare a detailed operating manual of the equipment. An organizational structure to manage the collection, processing and storage of data will be used to manage the monitoring of the project activity.

SECTION J. Crediting period type and duration

The CPA has a renewable crediting period.

The length of the crediting period is 7 years and 0 month and renewable twice (maximum total length of 21 years 0 months)

SECTION K. Eligibility criteria for inclusion of CPAs

Table 4: Eligibility Criteria

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	Geographical Boundary	Each CPA will be located within the physical/geographical boundary of the PoA.	Geographic reference showing the activity is within the physical/geographical boundary of the PoA

2	Double Counting	Each CPA will utilize unique identifiers, such as GPS coordinates for every technology/measure under the CPA.	A description of the unique identifier will be provided by the CPA
3	Exclusiveness of CPA	The CPA shall not be previously: 1. Registered as a CDM project activity 2. Included as a CPA in any other registered PoA, or deregistered as a CPA of a PoA	Confirmed by the CME
4	Technology/Measures	The CPA specifies the level and type of service provided by the technology/measure as well as its performance, which are in line with the technology outlined in PoA-DD. Specifications of technology/measure shall include the type, capacity, and other key features of the design of the systems	Technical details of will be provided in the specific CPA
5	Start Date	Each CPA will prove that the start date of the CPA is on or after the start date of the PoA. The start date of the CPA is the date on which construction, implementation, or real action concerning the CPA, as shown through a contract detailing real action or an invoice for equipment.	The start date of activity as shown through a purchase order, service agreement, or other type of contract
6	Applicability of the methodologies	Each CPA will apply the CDM baseline and monitoring methodology AMS-III.AN Version 2.0, and adhere to all applicability conditions and other requirements of the methodology	CPA DD, applying CDM methodologies AMS-III.AN Version 2.0
7	Additionality	CPA shall demonstrate its additionality to be eligible for inclusion under the PoA in line with the Methodological tool on the demonstration of additionality of small-scale project activities (version 12).	CPA-DD
8	EIA & Stakeholders Consultation	Evidence of EIA been carried out, Local Stakeholder consultation minutes and list of attendees must be presented as evidence (if applicable)	CPA. Section E based on the EIA report (if applicable)
9	Funding	CPA will affirm that funding from Annex I Parties, if any, does not result in a diversion of official development assistance	Letter stating the disclosure of public funding or other funding options will be provided.

10	Target Group	The target group of each CPA shall be manufacturing facility that switch from higher fossil fuel to use of natural gas for thermal application.	CPA-DD, Section A.1
11	Sampling	Not applicable as per section I.7.2 above	Not applicable
12	Small Scale Threshold	The CPAs shall adhere to the small scale threshold result in emission reductions equivalent to or less than 60 ktCO ₂ e emissions reductions.	CPA-DD. The result in the CPA emission reductions calculation less than or equal to 60k tCO ₂ e per annum.
13	Debundling	The project developer will provide a written statement attesting that the CPA is not a debundled component of a large-scale project activity, including a map of any nearby project activity. The CME will compare this to other activities under the PoA.	CPA

Appendix 1. Contact information of coordinating/managing entity and project participants

Coordinating/managing entity and/or project participants	<input checked="" type="checkbox"/> Coordinating/managing entity <input type="checkbox"/> Project participant
Organization name	Greenville Oil & Gas Company Limited
Country	Nigeria
Address	45B T.Y Danjuma Street, Asokoro
Telephone	+ (234) 0 708 416 1916
Fax	--
E-mail	ritu.sahajwalla@greengaslng.com
Website	www.greenvillelng.com
Contact person	Ritu Sahjwalla

Appendix 2. Affirmation regarding public funding

Not applicable as the PoA does not involve public funding.

Appendix 3. Applicability of methodologies and standardized baselines

Please refer section of PoA-DD

Appendix 4. Further background information on ex ante calculation of emission reductions

Please refer section of generic CPA

Appendix 5. Further background information on monitoring plan

Please refer section of generic CPA

Appendix 6. Summary report of comments received from local stakeholders

Not applicable

Appendix 7. Summary of post-registration changes

Not applicable

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
08.1	28 June 2017	Revision to: <ul style="list-style-type: none"> • Remove a duplicated instruction; • Make editorial improvement.
08.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Improve consistency with the “CDM project standard for programmes of activities” and with the PDD and CPA-DD forms; • Make editorial improvement.
07.0	25 May 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN) (version 01.0); • Incorporate the “Programme design document form for small-scale CDM programmes of activities” (CDM-SSC-PoA-DD-FORM); • Make editorial improvement.
06.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
05.0	9 March 2015	Revision to: <ul style="list-style-type: none"> • Include provisions related to choice of start date of PoA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Add exception for generic CPA where technology is under positive lists; • Make editorial improvement.
04.1	5 August 2014	Editorial revision to correct the document information table.
04.0	25 June 2014	Revision to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the Guideline: Completing the programme design document form for CDM programme of activities (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the PoA in B.4 and Appendix 1; • Add general instructions on post-registration changes in paragraphs 2 and 3 of general instructions and Appendix 6; • Change the reference number from F-CDM-PoA-DD to CDM-PoA-DD-FORM; • Make editorial improvement.

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	3 December 2012	EB 70 Revision to reflect changes to the <i>Guideline: Completing the programme design document form for CDM programmes of activities</i> (EB 70, Annex 6).
02.0	13 March 2012	EB 66 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, annex 12).
01.0	27 July 2007	EB 33, Annex 41 Initial publication.

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