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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

>>SA Calcium Carbide Furnace Waste Gas to Electricity CDM Project
PDD Version: 04
PDD Completed on 03/07/2012

Version History
Document version History

PDD version 01, submitted 7 March 2011	Version submitted for Global Stakeholder Process
PDD version 02, submitted 23 August 2011	Revised version during validation
PDD version 03, submitted 26 March 2012	Revised version during validation
PDD version 04, submitted 3 July 2012	Revised version during validation

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

Purpose of the Project activity

SA Calcium Carbide (SACC) (Pty) Ltd in Newcastle, South Africa is to develop an electricity generation project utilizing furnace waste gas that has been flared since the construction of the industrial facility. Because of the high CO concentration, the waste gas produced in the closed submerged electric arc furnace has to be flared (combusted) for safety reasons before it goes out to atmosphere.

The electricity generated on site will displace a net of 43,371
MWh per year of the electricity imported from the South African national grid if all four gensets are running at design rated capacity and if sufficient gas is produced in the furnace so that the gensets can run at design capacity for 7,157 hours a year.

Construction of the project activity starts on 1 March 2012. Commissioning of the gensets will occur by 1 October 2012.

Starting date of the project activity is 11 August 2011 when the deposit is made toward purchasing the equipment[1].

A fixed crediting period of 10 years is selected.

Scenario prior to the implementation of the project activity

SACC produces calcium carbide (CaC_2), a basic raw material for acetylene gas production. Calcium carbide is a chemical compound with the chemical formula of CaC_2. It is mainly used industrially in the production of acetylene and desulphurization of steel. Calcium carbide is produced industrially in an electric arc furnace from a mixture of lime and a carbon source (metallurgical coke or anthracite) which are processed at between 2200 to 2300°C in a closed submerged arc furnace. The CaC_2 production

[1] Tax invoice provided to DOE

method has generally not changed since its invention in 1888. SACC produced an average of 66,001 tons of calcium carbide per year from 2008 to 2010 and has a capacity capability to produce up to between 90,000 – 100,000 tons per year. SACC are the only producer of calcium carbide on the African continent. During the past 3 years, SACC has produced less CaC_2 than the production facility is designed to produce due to strained market conditions.

The SACC submerged electric arc closed furnace generates waste gas that is currently flared prior to release into the atmosphere as part of the business-as-usual calcium carbide production process. This gas typically contains between 25 to 30% hydrogen (H_2) and between 55 to 65% carbon monoxide (CO) by volume, which is to be utilised as a gas fuel source for the project activity. The CO concentration in the waste gas makes the waste gas explosive and it cannot be vented to atmosphere directly without being combusted first.

In the absence of the project, waste off-gas from the furnace would continue to be flared (via a scrubber and flare system) prior to release to the atmosphere. At no time is furnace gas vented to the atmosphere unburnt. The gas produced is burnt inside the furnace, during the first part of the warm up schedule or at the flare tip, cleaned (i.e. after having gone through the scrubber) or uncleaned during a period of upset operations.

It is a safety hazard to allow unburnt carbon monoxide gas to go to atmosphere and SA Calcium Carbide has safety equipment installed to prevent this from happening. This procedure is according to the original operating procedures. In other words whenever the furnace is running the gas is burnt directly to atmosphere (if the scrubbing plant is not operating) or burnt at the flare tip after being cleaned. It is never vented to atmosphere unburnt as this is a safety hazard. The South African National Ambient Air Quality regulations specifies the ambient CO concentration of CO emissions (Annex 19). The concentration of CO gas emitted by SACC is too high to be vented to atmosphere uncombusted.

Proposed project activity

Installed electrical generation capacity is to be a maximum of 7,896MW. The project is to generate an estimated net (after parasitic load) of 43,371
MWh electrical power per year which will be fed directly back to the SACC furnace thereby reducing SACC's electrical power demand from the local municipal grid. SACC will utilize the power produced from their new generator to displace some of the electricity being purchased from the municipality. The electricity generated by SACC will displace grid electricity imported by SACC from the national utility.

With the project, the proposed power plant installation will replace grid electricity reducing carbon dioxide emissions to the atmosphere. There is a significant capital cost expenditure requirement for the development of the project.

Economic Development

The project activity has a robust economic dimension addressing the following in terms of national economic development:

- The project will contribute to national economic development by bringing foreign exchange into the country through the sale of carbon credits.
- The project will generate employment both during construction (estimated 150 temporary positions) and operation (estimated up to 10 permanent positions, i.e. 1 x Superintendent, 1 x Electrical Technician, 4 x Operators, 2 x Maintenance). The majority of these positions will be filled from the local community of Newcastle and surrounding districts.

Social

- The project's contribution to social development is centred on sustainable job creation and the reduction of emissions to the atmosphere, thus resulting in a cleaner and safer environment in the immediate vicinity of the project.
- The project will result in the creation of skilled professional-level jobs, technician-level jobs and semi-skilled/unskilled jobs. The project's contribution to employment and the associated multiplier effect of these jobs is difficult to monitor, but could be ascertained by an annual profitability review for the overall project. (This would be based on the assumption that the number and sustainability is directly correlated to the ongoing profitability and success of the project).
- Because there are no similar technology installations in the area, the local people will require education and training in the operation and maintenance of the plant. This will enhance information sharing and skills transfer from foreign parties to the local community.
- Skills transfer will be offered in terms of the technologies employed, as well as in the complexities of registering a CDM Project and subsequent trading in the carbon market are expected to take place.

Environment

- The project activity will take place on an existing established industrial site, on previously utilised available open land within the greater plant operation covered by the existing plant permit.
- On a national scale the project will have a positive impact on air quality as carbon dioxide (CO_2) emissions will be mitigated.
- On a wider scale, the project will also contribute towards the sustainable recovery, reuse and recycling of waste gas by major industry and the combating of climate change.
- It is hoped that this project will assist in streamlining the development of other alternative energies, emissions-reductions and sustainability projects, and benefit the environment by placing these projects firmly on the country's agenda for the future.
- Disposal of scrubber waste:

  SACC currently has a wet scrubbing plant installed that cleans the furnace gas produced. The water containing the scrubbed dust is sent to a settler where the solids are concentrated up and the clean water is reused in the wet scrubber. The thickened slurry is pumped to a slurry tank owned by Karbochem where this stream is mixed with a stream of fly ash from boilers owned by Karbochem. Karbochem pump the combined slurries to a settling dam which is owned, operated and permitted by Karbochem.

  On this dam the solids settle out and the clean water overflows into run off ponds. The clean water is pumped from the run off ponds at a rate of approximately 25m^3/hr back to the scrubbing system at the SACC furnace to replace the water that had been sent to the dam with the dust. Some fresh water is added to the system to make up for evaporation losses.

As part of the project it is planned to install a second scrubber which will make use of the same waste water and solids handling facilities. Only one scrubber will run at any one time and as a result there will be no increase in the amount of waste produced.

Technology Transfer and Transfer of skills

- There are very few existing projects using the envisaged technology in South Africa and the project will provide an opportunity for technological and knowledge transfer.
- As one of the first CDM projects of this nature involving the utilisation of a furnace waste off-gas, which is classified a 'special gas' by the gas engine manufacturing industry since it contains carbon monoxide (CO) and Hydrogen (H_2), this project will mark a *trend-setter* to other potential projects in South Africa.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Host Party South Africa	Private Entity SA Calcium Carbide (Pty) Ltd.	No

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

i. The proposed project involves the installation of waste gas-fired gensets in-line with the post-scrubber gas flows from the existing SACC furnace. These gensets are purpose built for special gas fuels such as the mixture of CO and H_2 produced by the SACC furnace. It is anticipated that the four engines will be GE-Jenbacher engines. These gensets have a guaranteed power capacity (rated capacity) of 1.515kWe[2] each.

ii. Most of the available waste gas from the furnace, will be diverted into the gen-sets. There will always be a small flow of gas that must be flared for safety reasons and so that the process can be kept under control and if the gas scrubbing plant trips the gas will automatically ignite.

iii. To improve the efficiency of a sustained supply of gas to the new gen-sets, a second scrubber plant is to be installed. The newly proposed second scrubber plant will incorporate a moistener, a wet scrubber system and an in-line disintegrator. This arrangement will allow for any one of the two scrubbers to be placed off-line for cleaning and servicing.

iv. It is proposed that exhaust gas heat from the engines may be fed to the existing kiln for the drying

[2] Annex 8: Technical Description provided by Jenbacher

of the carbon source material replacing the existing combined usage of furnace CO gas and LPG fuel. No emission reductions will be claimed for this part of the project.

v. When the gas production from the furnace is greater than the amount of gas required by the gen-sets or when the engine gen-sets are off for any reason i.e. maintenance and the furnace is running, gas will continue to be flared for safety reasons.

vi. The gen-sets are to deliver 11kV electrical power complete with synchronization and control equipment.

vii. Only the waste gas will be used as fuel and no other fuel will be used to augment supply to the gen-sets.

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

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A.4.1.1. Host Party(ies):

>>South Africa

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

>>Kwa-Zulu Natal

A.4.1.3. City/Town/Community etc:

>>Newcastle

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

>>The project is to be implemented on an existing industrial site of the SA Calcium Carbide Furnace installation. The SA Calcium Carbide site is located within the existing Karbochem Industrial Area in Newcastle.

The co-ordinates for the site currently under consideration for the project are:
27º 46‟ 48.91‟‟ South and 29º 58‟ 27.27‟‟ East.

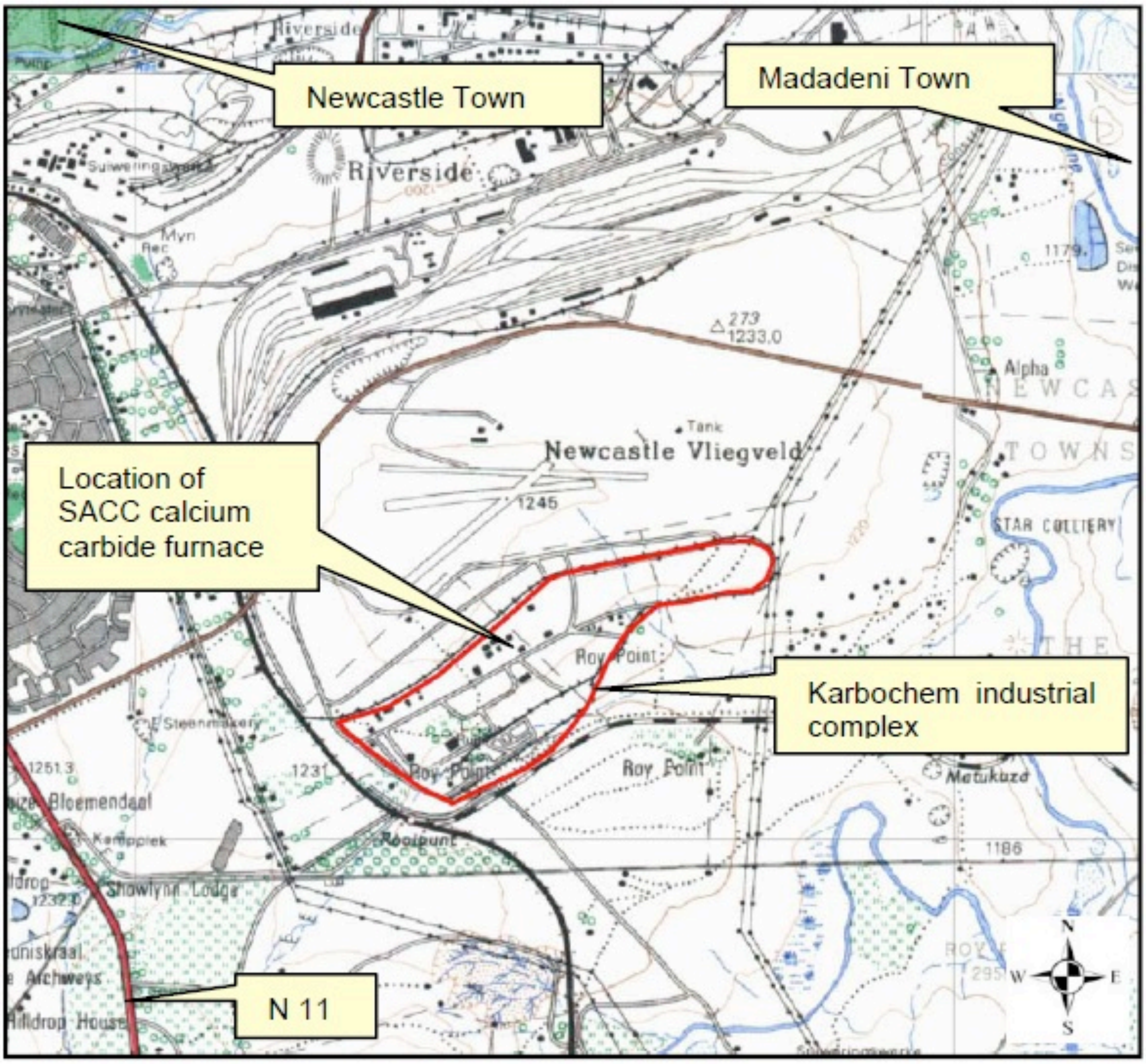


Figure 1: Location of proposed project activity

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

>>Type and category

According to Appendix B of the UNFCCC's published simplified procedures for small scale activities, this project falls into the following type and category:

Type III: Other project activities

Category Q: "Waste Gas Recovery Projects"

Sectoral Scope 04: Manufacturing industries

A summary of the process parameters as foreseen for the project:

Waste Off-Gas Volume required: Depending on the gas quality, between 5,580 to 6,560Nm^3/h of gas will be required by the gen-sets to generate approximately 43,371 MWh per year.

- Waste Gas Composition: 55 to 65%(CO), 2%(CO_2), 25 to 30%(H_2), <0.1%(O2), ±5%(N_2), <1%(CH_4)
- Technology Selection: Internal combustion engines (Jenbachers)
- Engine Gen-Set efficiency: ±37.1% (Jenbacher specification – Annex 8)
- Proposed Configuration: Output potential: 4 x 1.515,kWe Gen-sets (Reference: Annex 8_Technical Description provided by Jenbacher)
- Power Plant Capacity: 6.06MW when sufficient waste gas is available and all four gensets are operating at capacity, based on the supplier information.

Net Annual Electricity Potential: Approximately 43,371

- MWh, estimated based on gas produced and production hours, taking into account capacity and parasitic load of the power plant.
- Parasitic load of the power plant and gas cleaning equipment: 306kW (Source: Annex 31 gives the information for one genset and auxiliaries and Annex 22 gives the parasitic load for the scrubber)

Technology selection

Table 1: Design parameters for the preferred technology (Source: Annex 8: Updated Jenbacher specification sheet)

Manufacturer	**Units**	**GE Jenbacher**
Engine type		JGS 620 GS-S.L Converter gas: engine version E58
Working principle		4-stroke
Configuration		V 60°
No. of cylinders		20
Bore	Mm	190
Stroke	Mm	220
Piston displacement	Lit	124.75
Electrical output	kW el.	1.515
Spec. fuel consumption of engine	kWh/kWh	2.62
Electrical efficiency	%	37.1

i. The monitoring equipment and their location in the system is described in Section B.7.2.
After parasitic load has been accounted for 43,371
ii. MWh per year will be displaced from the national grid.
In the baseline scenario, the 43,371

iii. MWh would be delivered by the national grid.

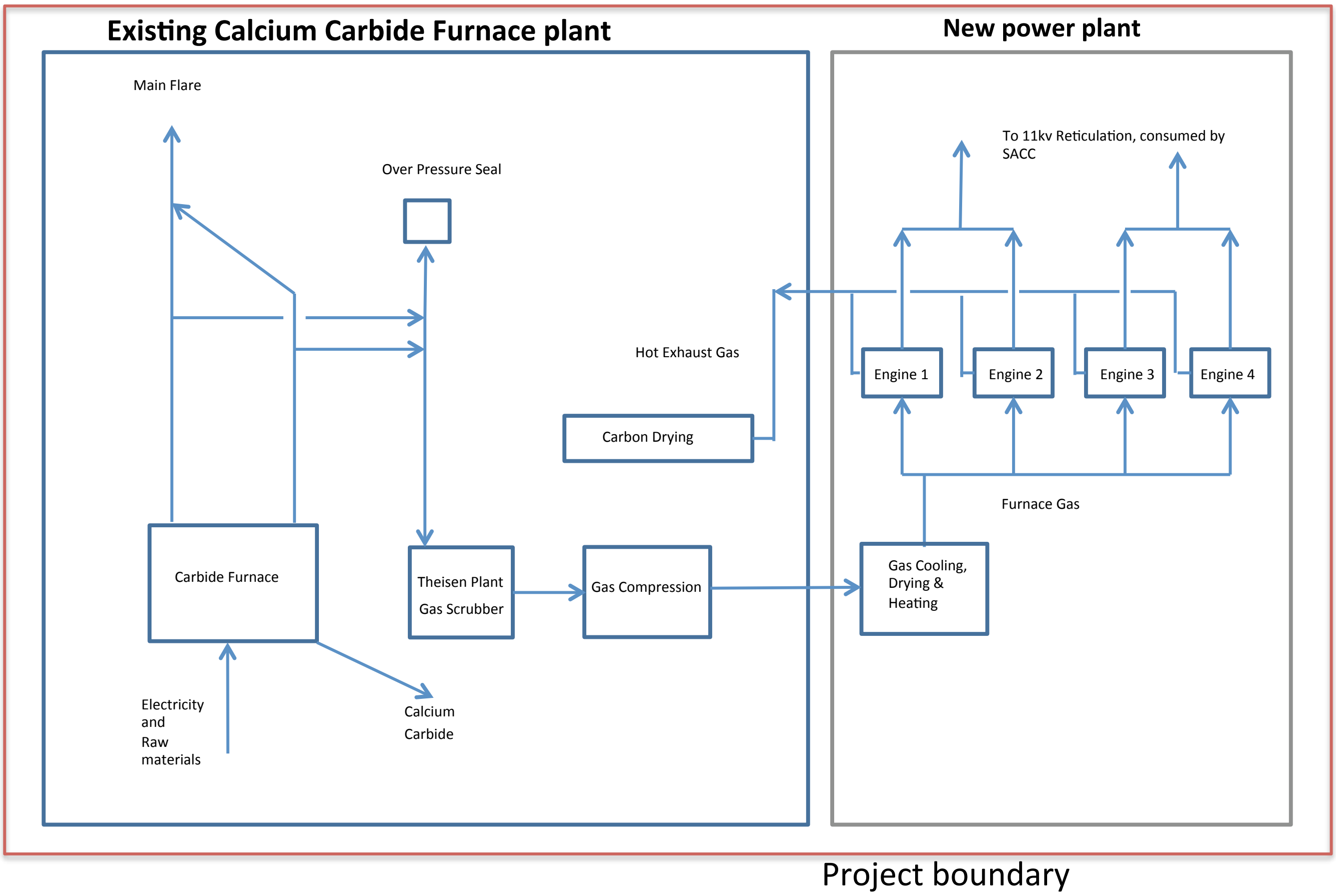
Figure 2: Example of Proposed GE-J 6-Series Type 620 Engine Gen-set Installed Within Powerhouse

The waste gas passes through a scrubbing system (existing scrubber with a newly installed moistener, a wet gas scrubber plant system and an in-line disintegrator). The clean gas will then enter the engine gen-sets. The four engines will be GE-Jenbacher engines.

The electricity generated will be utilized for captive purpose. The project activity is a completely waste gas based energy recovery system (i.e. 100% of gas energy input), without the option of co-firing of fossil fuel.

The diagram below illustrates the proposed process flow.

Figure 3: Diagrammatic presentation of project activity with the existing plant



Waste off-gas from the calcium carbide furnace, which is classified as a 'special gas' owed to its composition of Carbon Monoxide (CO) and Hydrogen (H_2) will be fed via pipeline to an electrical generation 'powerhouse' installation. This powerhouse will contain the four gen-sets of output potential (max): 4 x 1,515kWe[3] = 6.06MW (excluding parasitic load) combined electrical power output capacity. The gen-sets deliver power at 11kV and are accompanied by the required control equipment for the overall installation.

Forecasted operating hours per year for the power plant

The forecasted operating hours of 7,157 per year were determined in the Technical Feasibility Study conducted by an independent engineering company (Annex 24). The parameters taken into account were the furnace availability based on historical information, the design availability of the gensets.

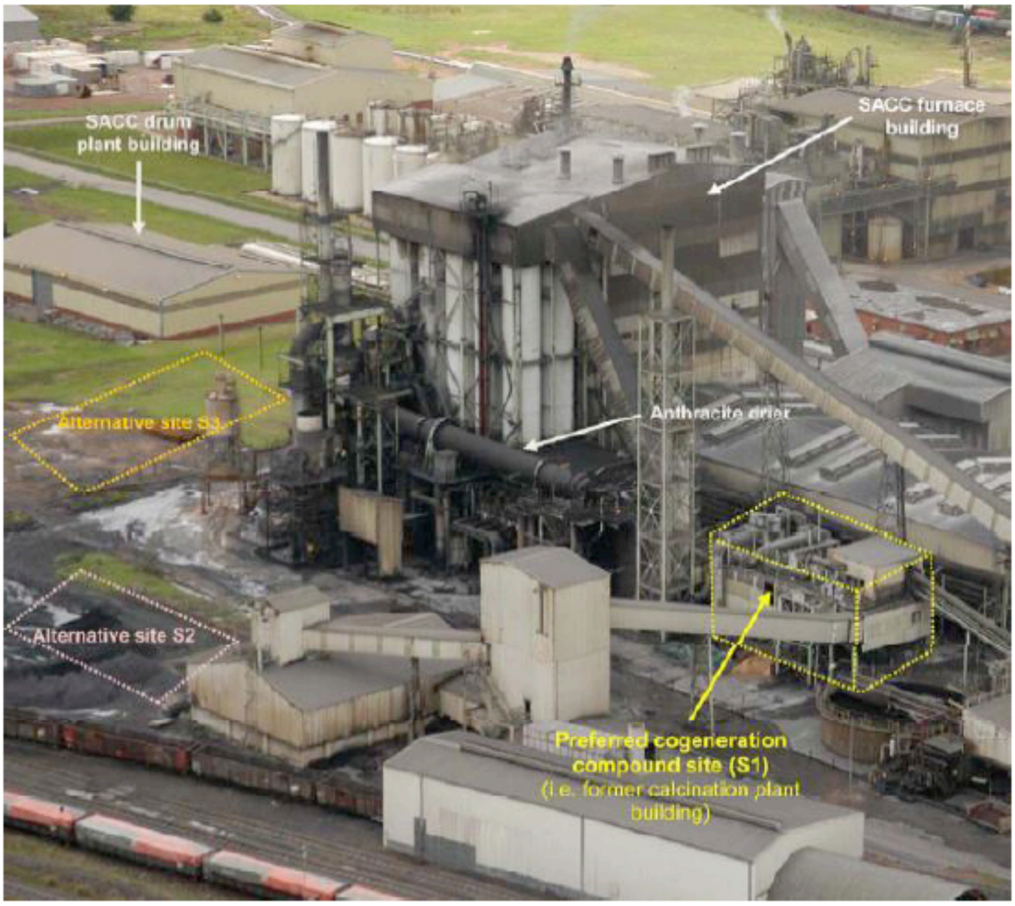
[3] Annex 8: Technical Description Unit JGS 620 GS-S.L Converter Gas Version E58; GE-J

There are no known installations in the world using this technology on a Calcium Carbide furnace off-gas for electricity generation. There are, however, three similar installations located in Spain (an Annex 1 country) that adopt this technology with similar gas compositions. It is therefore a first project of its kind in the Calcium Carbine industry in the developing countries.

Location of the proposed project activity

Figure 4 below shows the possible locations for the new power plant as investigated in the Environmental Impact Assessment.

Figure 4: Proposed locations for the waste gas power plant (Source: EIA document)



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

>>A fixed crediting period is applied to this project.

Table 2: Estimated amount of emission reductions for the crediting period

Years	Annual estimation of emissions reductions in tonnes of CO_2 e
1	40,686
2	40,686
3	40,686
4	40,686
5	40,686
6	40,686
7	40,686
8	40,686
9	40,686
10	40,686
Total estimated reductions (tonnes CO_2 e)	**406,860** tonnes CO_2e
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**40,686**

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

>>There is no public funding related to Annex 1 Countries in the Project Activity.

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

The following table summarises the requirements as specified in Annex 13, EB54, Guidelines on assessment of de-bundling for SSC project activities, (Version 03) of the simplified modalities and procedures for small-scale CDM project activities of the simplified modalities and procedures for small-scale CDM project activities.

Table 3: Summary of the simplified modalities for small scale projects

Appendix C, paragraph 2 requirements	The proposed project
Consider whether another small-scale CDM project activity with the same project participants have been registered.	The project participant (SACC) has not registered another small-scale project activity.
Consider whether another small-scale CDM project activity in the same project category and technology/measure has been registered by the project participant.	The proposed project activity is a small-scale project activity implemented using III.Q. There is no project activity at SACC in the same project category with or using the same technology.
Whether the project participant has registered a small-scale CDM project activity within the previous 2 years.	There was no registered or application for registration small scale CDM project activity in the past two years within 1km of the project

Whether there is another registered small-scale CDM project activity whose project boundary is within 1km of the project boundary of the proposed small-scale activity at the closest point.	boundary related to the proposed project.

SECTION B. Application of a baseline and monitoring methodology

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

Approved methodology AMS-III.Q for small scale project with title "Waste Energy Recovery (gas/heat/pressure) Projects", Version 04, Sectoral Scope: 01 and 04.

This methodology also refers to the following:

- Tool to calculate the emission factor for an electricity system, Version 02.2.1
- Tool for the demonstration and assessment of additionality, Version 6
- Approved consolidated baseline and monitoring methodology ACM0012, Version 04.0.0

Reference: for more information please visit the website of UNFCCC.

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

AMS-III.Q (Version 04) is applicable to the proposed project due to the following reasons:

Table 4: Applicability assessment

Methodology applicability criteria	Project Activity in accordance with the applicability criteria
1. The category is for project activities that utilize waste gas and/or waste heat at existing facilities as an energy source for: (a) Cogeneration; or (b) Generation of electricity; or (c) Direct use as process heat; or (d) For generation of heat in elemental process (e.g., steam, hot water, hot oil, hot air); (e) For generation of mechanical energy.	The project activity is the generation of electricity from waste gas at an existing facility that has been in operation since 1984.
2. The category is also applicable to project activities that use waste pressure to generate electricity at existing facilities.	Not applicable – the project does not involve utilization of waste pressure.
3. The recovery of waste gas/heat/pressure should be a new initiative (no waste	The recovery of waste gas is a new initiative at SACC. No was gas was recovered from the furnace

Methodology applicability criteria	Project Activity in accordance with the applicability criteria
gas/heat/pressure was recovered from the project activity source prior to the implementation of the project activity).	for the generation of electricity before implementation of the project activity.
4. In case the project activity is an incremental gain, the difference between the technology used before project activity implementation and the project technology should be clearly shown. It should be demonstrated why there are barriers for the project activity that did not prevent the implementation of the technology used before the project activity implementation.	The proposed project is a totally new project for SACC.
4. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	The emission reduction due to this project activity is less than 60 ktCO_2 equivalents annually, which is detailed in Part B.6. The electricity generation is limited by the design capacity of the gensets. The potential net electricity generation has been determined based on the rated design output of the Jenbacher engines and the forecasted operating hours per year taking into account the parasitic load of the power plant and gas cleaning equipment. Even if all four gensets operate 100% during the year, i.e. 8,760 hours at full capacity assuming sufficient waste gas is available, the amount of electricity generated is 50,404MWh (taking into account parasitic load). (Refer to the CER calculations sheet, cell C41) 1.515kW x 4(gensets) x 8,760(hours)/1000 – 306kW x 4 x 8,760(hours)/1000 = 50,404MWh This maximum electricity generation is a theoretical maximum and will not be achieved in the project activity, as it assumes that all four gensets are operated at full capacity for every hour in the year. The grid emission factor is determined ex-ante and therefore will not increase during the crediting period of the project activity. The emission reductions based on the theoretical maximum rated capacity of the gensets operating 8,760 hours per year are determined as 49,799 tons CO_2 per year – this is the

Methodology applicability criteria	Project Activity in accordance with the applicability criteria
	maximum CERs that could possible be delivered, based on ideal circumstances which will not be achieved in reality. Refer to the CER calculation sheet, cell C42. Therefore, the CERs will not exceed 60kt CO2 equivalent per year.
5(a). The energy produced with the recovered waste gas/heat or waste pressure should be measurable	The electricity produced by the gensets installed in the project activity will be measured using an electricity meter. The gas volume and CV of the waste gas sent to the gen-sets will also be measured.
5(b). Energy generated in the project activity may be used within the industrial facility or exported to other industrial facilities (included in the project boundary)	The electricity produced by the project activity will be used by SACC for own consumption.
5(c). Electricity generated in the project activity may be exported to the grid or used for captive purposes. However, the methodology is not applicable to projects where the waste gas/heat/pressure recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) where heat (energy) generated on-site is not utilizable for any other purposes on-site except to generate power. Such project activities shall consider AMS-III.AL “Conversion from single cycle to combined cycle power generation”. Projects recovering waste energy from such power plants for the purpose of generation of heat only can apply this methodology	The electricity produced by the project activity will be used for own consumption. The project is not the implementation of a waste energy recovery unit within a single-cycle power plant.
5(d). For a project activity which recovers waste gas/heat/pressure for power generation from multiple sources (e.g. kiln and single-cycle power plant), this methodology can be used in combination with AMS-III.AL provided that: (i) Within the project activity it is possible to distinguish two distinct waste energy sources such that: • Waste energy source-I (e.g. kiln) belongs to such waste heat	The project activity is the recovery of waste gas from one source only, the CaC_2 furnace. Therefore, AMS-III.AL will not be applied and the requirements listed in 5(d) do not apply to the project activity.

Methodology applicability criteria	Project Activity in accordance with the applicability criteria
sources which are eligible under AMS-III.Q; • Waste energy source-II (e.g. single-cycle power unit) belongs to such waste heat sources which are eligible under AMS-III.AL; (ii) It is possible, for each waste energy source, to determine the baseline according to the specific methodology referred to; (iii) It is possible to objectively allocate the electricity produced in the project activity to each waste energy source, by means of one of the following methods: • Through separate measurements of the electricity produced by utilizing waste energy from each waste energy source; or • Through separate measurements of the energy content of the waste energy carrying medium (WECM)[4] streams used for electricity production; or • Through separate measurements of the energy content of the waste energy streams that are associated with each waste energy source and used for electricity production or for the WECM generation in a common waste heat recovery system (e.g. if steam is generated by waste heat from a kiln and waste heat from an internal combustion engine in a common waste heat recovery boiler);	
5(e)The emission reductions are claimed by the generator of energy using waste energy;	The emission reductions are claimed by the producer of the waste energy, i.e. SACC. The criteria is met by the project activity.

[4] It is the medium carrying the waste energy in the form of heat, chemical energy or pressure. Examples of WECM include gas, air, steam, etc.

Methodology applicability criteria	**Project Activity in accordance with the applicability criteria**
5(f). In cases where the energy is exported to other facilities (included in the project boundary), the following are required: (i) All historical information from the recipient plants; (ii) An official agreement exists between the owners of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reductions would not be claimed by the recipient plant(s) for using a zero-emission energy source;	This criteria is not applicable, because electricity will not be exported to other facilities.
5(g). For those facilities and recipients included in the project boundary, that prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods: (i) The remaining lifetime of equipments currently being used; and (ii) Crediting period.	The facility does not generate any of its energy on site. Therefore this applicability criteria does not apply.
5(h). The waste gas utilized in the project activity would have been flared or released into the atmosphere in the absence of the project activity. This shall be proven by one of the following options: (i) By **direct measurements** of energy content and amount of the waste gas for at least three years prior to the start of the project activity. (ii) **Energy balance** of relevant sections of the plant to prove that the waste gas was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance shall demonstrate that the waste gas was not used and also provide conservative estimations of the energy content and amount of waste released. **(iii) Energy bills** (electricity, fossil fuel) to demonstrate that all the energy required for	Prior to the implementation of the project activity the waste gas generated by SACC was flared to atmosphere. This statement is supported by the following list of evidence: 1. The electricity bills demonstrate that all the energy needed for the process is imported from the national grid and none is generated on site. The electricity bills were audited by an independent energy expert in South Africa and it was confirmed that all the electricity needed for the process has been imported from the national grid prior the implementation of the project activity. (Refer to Annex 9 for a copy of the audit report and confirmation statement.) 2. Records of flare operational time for 2008 to 2010 from process information provided by SACC. This is provided in Annex 28. The CO gas has to be flared for safety reasons and cannot be vented to atmosphere under normal operating

Methodology applicability criteria	Project Activity in accordance with the applicability criteria
the process (e.g., based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g., balance sheets, profit and loss statement) that no energy was generated by waste gas and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities. **(iv)** Process plant manufacturer's original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas produced for rated plant capacity per unit of product produced.	conditions. Operational procedures that describe the flare operation are provided in Annex 26. 3. There is no equipment installed at the facility to recover waste energy prior to the project activity. This is confirmed at the validation site visit.
6. For the purpose of this category waste energy is defined as: a by-product gas/heat/pressure from machines and industrial processes having potential to provide usable energy, for which it can be demonstrated that it was wasted. For example gas flared or released into the atmosphere, the heat or pressure not recovered (therefore wasted). Gases that have intrinsic value in a spot market as energy carrier or chemical (e.g., natural gas, hydrogen, liquefied petroleum gas, or their substitutes) are not eligible under this category.	Waste energy is a by-product gas from the furnace (industrial process) that was flared historically. The gas does not have a value in the spot market. Although the waste gas produced by SACC contains hydrogen, the quality of the waste gas produced is too low and it cannot be used or sold as hydrogen rich gas. The gas is contaminated and has a low hydrogen content and low calorific value. It has to be processed, cleaned and compressed before it could be compared to a hydrogen rich gas that is traded on the spot market.

B.3. Description of the project boundary:

According to the methodology III.Q the boundary is defined as:

The physical, geographical site of the facility where the waste gas/heat/ pressure is produced and transformed into useful energy delineates the project boundary.

The geographical extent of the project boundary shall include the following:

(a) The industrial facility where waste energy is generated, including the part of the industrial facility where the waste gas was utilized for generation of captive electricity prior to implementation of the project activity;

The industrial facility where waste energy is generated is SACC, therefore the SACC industrial facility is included in the boundary.

(b) The facility where steam/process heat in the element process/electricity/mechanical energy is generated (generator steam/ process heat/electricity/mechanical energy). Equipment providing auxiliary heat to the waste energy recovery process shall be included within the project boundary; and

The electricity is generated by gen-sets at the SACC industrial facility. The gen-sets and auxiliary equipment is included in the boundary.

(c) The facility(ies) where steam/process heat in the element process/electricity/ mechanical energy is used (the recipient plant(s)) and/or grid where electricity is exported, if applicable.

The electricity produced by the project activity will be used for own consumption.

In terms of electricity supply, the project boundary extends to the power sources supplying the national grid.

The greenhouse gases included in or excluded from the project boundary are shown in Table 5.

Source		Gas	Included?	Justification / Explanation
Baseline	National Grid	CO_2	Yes	Major source of emissions.
		CH_4	No	Minor source of emissions
		N_2O	No	Minor source of emissions
Project activity	Electricity Consumption (New equipment installed will be using electricity)	CO_2	Yes	Major source of emissions
		CH_4	No	Minor source of emissions
		N_2O	No	Minor source of emissions

Table 5: Greenhouse emissions included or excluded

B.4. Description of baseline and its development:

Baseline definition as per AMS-III.Q

In case of the SACC project, all the electricity to be generated by the project will be used for own consumption and will displace electricity imported from the grid, which is in line with the scenario described in paragraph 8a), page 4/14 of AMS IIIQ version 04.

The electricity is obtained from the grid. Therefore, the baseline of the project is defined as the electricity from the national grid, and the waste gas utilized by the project activity was flared and released to atmosphere. The baseline scenario for the SACC project activity is therefore the scenario as represented by the historical scenario.

The baseline emissions are calculated according to AMS-III.Q as described in paragraph 8 of the methodology (page 4/14), Equation 1.

Determination of f_{cap}

f_{cap} is estimated according to the corresponding section of ACM0012 version 4.0.0, Method-3, as required by AMS-III.Q.

Baseline

According to ACM0012 version 4.0.0, the section under "Baseline emissions, 1.1 No recovery on the WECM stream(s) in the absence of CDM project activity" the following procedure will be applied as described in: (a) Baseline emissions from electricity ($BE_{Elec,y}$) generation, "Case 1: Waste energy is used to generate electricity".

Energy baseline for the project activity
In summary: In the absence of the project activity, the waste gas would continue to be flared and the electricity would have been generated by grid-connected power plants.

Emission Baseline for the project activity
The incremental electricity produced by the gen-set is used to displace grid electricity, accordingly, the grid emission coefficient determined in accordance with provisions of "Tool to calculate the emission factor for an electricity system" is considered for baseline emission.

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

The following list of events demonstrates that SACC considered CDM as part of the project development from an early phase.

Table 6: Table indicating the timeline of project and consideration of the CDM

Event	Time	Supporting document
Contract GreenEng (Pty) Ltd to, inter alia, assess the CDM potential of the project	08 February 2010	Annex H – Agreement with GreenEng (Pty) Ltd
The decision to proceed with a CDM project was made by SACC on19th February 2010.	19 February 2010	Annex 21 – Meeting minutes where it is decided to continue with the project and appoint an EIA consultant
EIA commenced for the project where the project was clearly named a 'CDM Project' from the onset	10 June 2010	Annex 20 – Appointment letter of the EIA Consultant
PIN submitted to the DNA in South Africa	13 October 2010	Annex B Confirmation e-mail from the South African DNA that confirms receipt of the PIN
Contract CDM Africa Climate Solutions to develop CDM documentation	October 2010	
Letter of No Objection received from the	4 November 2010	Annex C – Letter of no objection

DNA in South Africa		received from the South African DNA
EIA Record of Decision received	16 February 2011	Annex 18 - EIA Approval received from the South African Department of Environment
Validation initiated – global stakeholder comment period starts	11 March 2011	PDD made available on the UNFCCC website.

Additionality Assessment

There are no national or sectoral policies that mandate waste gas recovery in South Africa for South African Carbide operations.

As per Attachment A to Appendix B of the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, will be considered as additional if the project activity would not have occurred any way due to at least one of following barriers.
(a) Investment barrier: a financially more viable alternative to the project activity would 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.

The risks faced by the project activity are demonstrated through following barriers:

1. Technological barrier
2. Barrier due to prevailing practice

1. Technological Barriers:

As per Attachment A to Appendix 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*".

1.1. Low risk alternative – Easy access to the Municipal/National Grid (i.e. import from the grid):

The SA Calcium Carbide (SACC) furnace is currently connected to the local municipal grid of Newcastle (which is distributed from the National Grid) for the supply of up to 50MW electrical power. The National grid is predominately supplied by coal-fired electricity generation. The on-going use of this electricity presents the easiest technology option to SACC for the sustained production of Calcium Carbide. The use of gas-fired electrical gen-sets, using the 'special gas' (termed 'special gas' owed to the composition of the gas being some 60% carbon monoxide [CO] and some 30% hydrogen [H_2]) does not offer easy access to electrical power. Considering the current practice and the pre-project scenario of

SACC, import of electricity from the local grid would be the low risk alternative to the proposed project activity. This is further explained in the points below.

1.2. Low market share of the new technology adopted for the project activity:

I. Engines application risk - Quality of flue gas

The fuel gas quality requirement for a gas-fired spark ignition (reciprocating) engine is stringent. According to General Electric-Jenbacher (GE-J) who are arguably the only supplier internationally of gas engine generators for such a 'special gas' application stipulate in their technical instruction No. 1000-0300 'Fuel Gas Quality' that specific to dust levels, the maximum dust grade size allowable in the fuel gas is 3µm and 50mg/10kWh – which relates to a level of some 5.4mg per Nm^3 (average) of the furnace flue gas-flow. There are in addition several other fuel gas quality determinand limitations demanded by the engine manufacturers such as inlet temperature; relative humidity; sulphic compounds; halide compounds; silicon; ammonia and oil. SACC are required to optimally operate and maintain their wet scrubber system (supplied by Theisen) to ensure upon the sustained supply of clean flue gas to the engine gen-sets. Furthermore, at greater capital and slightly greater operational cost to SACC, they will be required to operate a second gas scrubber plant to increase scrubber on-line time efficiency to the engines – since a current permit scrubber on-time allowance condition of 90% is insufficient for the required electrical power by SACC for the furnace. Indeed, it is required by SACC that when the furnace is operational, so must be the engine gen-sets.

Dust level in the flue gas fuel to the engines has been a significant concern to all similar gas projects. A similar project was recently terminated in South Africa and 3No. new GE-J 620 engines had to be auctioned/sold owed to complications with flue gas quality. The recent (July; 2011) sale advert stated: '*During the preparations for the Project certain market conditions have changed and based on concerns around sustainable Gas supply, RBM board of Directors decided to terminate the Project in May 2011.*[5]' Also similar in risk is the quality of landfill gas where in Durban, South Africa, the 7No. GE-J 320 units and 1No GE-J 316 unit have experienced problems with inlet gas quality and specific (and costly) operational and maintenance measures must be taken to ensure the electrical generation power output is sustained (registered CDM project 1921).

II. *Special gas* nature of flue gas (CO and H_2)

The SACC submerged electric arc furnace generates waste gas as part of the business-as-usual Calcium Carbide manufacturing process and currently burns the off gas in accordance to the atmospheric permit. The low cost alternative would be to carry on with business as usual as SACC does not violate any current regulation / legislation. This gas contains some 60% carbon monoxide (CO) and 30% hydrogen (H_2) by volume which is to be utilised as a gas fuel source for electrical generation internal combustion engines. Owed to the *special gas* nature of the engine fuel gas, there are very view projects throughout the world applying such technology. The table below offers the only projects where GE-Jenbacher engines are generating electricity using similar fuel gases. SACC are the sole producer of Calcium Carbide in Africa. Moreover, SACC are in a higher risk situation with this technology decision as they are to pioneer *the only gas-to-electricity generation project in the world* where furnace waste gas is to be utilised for a Calcium Carbide manufacturing process.

[5] Annex 10, Rio Tinto EOI

Plant	***Country***	***Commissioned***	***Gen-sets***	***No.***	***Electrical Capacity***	***Gas Type***
Profusa	Spain	1994	GE-Jenbacher 316	12	6,528kW	Coke Gas
SAMA	Spain	2001	GE-Jenbacher 620	2	3,940kW	Coke Gas
Aceralia	Spain	2003	GE-Jenbacher 620	12	18,700kW	LD Gas
IFM	South Africa	2010	GE-Jenbacher 620	10	15,000kW	Smelter Gas
SACC	South Africa	2012	GE-Jenbacher 620	4	7,600kW	Furnace Gas

Source: GE-Jenbacher and GreenEng; 2010

During the technical assessment, detailed gas analyses were carried out and the preferred process and engine type selected. Gas testing undertaken (by Levego; 2006, 2010) has offered test results giving the typical and characteristic gas properties as shown in the table below. Assessment of the gas properties in terms of possible use as fuel in an internal combustion engine was carried out using Technical Instruction No. 1000-0302 from GE Jenbacher. The assessment indicates that use of the gas as fuel in a suitably-designed internal combustion engine is feasible.

“Small” (less than 75MW) power generation installations in South Africa are limited. For installations where more than around 2MW are to be generated, it is likely that multiple internal combustion engines will be required, whereas individual steam cycle and gas turbines become more economical with size up to 300MW. A factor in selection is that small steam cycle and gas turbines are generally assessed as having a capital cost that is around 25% to 45% higher than an internal combustion engine. However, operation and maintenance expenditure is typically greater for reciprocating engines in comparison to turbines. Turbines, and particularly steam cycle turbines, may be more tolerant of impurities in the fuel gas and the possibility of utilisation of the steam may offer an additional benefit. Efficiency of engines is in the 37% range while that for turbines varies dependent on type and size. The smaller turbines may have low efficiencies staring from 25% for micro turbines to up to 40% for large turbines with good heat recovery systems. Overall the technology selection by SACC offers distinct application risks requiring a high level of engineering intervention and operational maintenance demands to offer a sustained supply of electricity generation.

SACC Furnace Gas Composition

Furnace Load	**40MW**			
Furnace gas flow	±7200Nm^3/h (dry based) approximately 187Nm^3/furnace MW			
Gas properties	**Gas**	**Proportion (%)**	**Calorific Value***	**Energy**
	CO	60,4 average	11.79MJ/Nm^3	26 607MJ
	CO_2	±1,3	0	
	H_2	30,2 average	10,02MJ/Nm^3	45 194MJ
	H_2O	0		
	O_2	<0,1		
	N_2	±5	0	
	Total	**100**		**71 801MJ**
Fuel gas LHV	**2,67**	**kWh/Nm^3**		19.9MWh
Efficiency-engine	37%	Energy available for use		**7.4MWh**
Other factors	**Dust content** at ex. flare inlet dry (SGS)		3 -9mg/Nm^3	5,4mg/Nm^3 avg
	Relative gas moisture		100%	26 607
	Temperature at blower outlet		50°C	45 194

III. Impact of SACC generation operation on Calcium Carbide manufacturing

Limitations of raw materials flexibility in future

The electrical generation engines selected are *project-specific* to the current quality of the flue gas from the submerged arc furnace. The engine type selected is termed an 'E58' by GE-J with engine components (piston heads, etc) appropriate to SACC's furnace gas with a gas composition band of CO (22 – 66%) and H_2 (26 – 48%). SACC would from hereon not be in a position to change or alter the raw materials fed into the furnace without close pre-consideration of the gas quality that would result. This presents a business flexibility risk to SACC.

Not core business

SACC manufactures and supplies calcium carbide (CaC_2) which is the basic raw material for acetylene gas production and desulphurization of steel. The company is part of the Andina Group which is located in Buenos Aires, Argentina and is the only producer of calcium carbide on the African continent. Calcium carbide is produced in a closed submerged arc furnace from a mixture of lime and a carbon source such as coke or anthracite which is processed at between 2200 to 2300°C. The CaC_2 production method has generally not changed since its invention in 1888. The generation of electricity is not a core business of SACC and historically they have consumed *easy-access* power from the Newcastle municipal grid.

Impact due to quality of flue gas:

Due to the composition of the raw materials used by SACC for the calcium carbide manufacturing process, the gas comprises high levels of carbon monoxide (some 60%) and hydrogen (some 30%) as well as levels of ammonia and sulphur. Moreover, the flue gas exiting the furnace contains high dust levels requiring removal by a wet gas scrubbing system. The implementation of the electricity generation project results in the following impacts:

- Raw materials used in the production of calcium carbide should not be changed without close prior consideration of the resultant flue gas quality;
- A second scrubber system is required to increase the efficiency of supply of clean *scrubbed* gas to the proposed engines requiring slightly increased operation and maintenance costs and operational responsibility;
- The conditioning of the fuel gas must be closely managed and monitored to sustain quality requirements such as relative humidity (RH), pressure, temperature, dust, condensate, etc.

Impact of requirement for specialist skills for operating equipment

SACC will be required to operate the electrical generation engines as well as all of the associated gas conditioning equipment for the supply of ‘clean’ fuel gas to the engines. Whilst this is not core-business, SACC are to employ and train new staff for the specialist skills required for the operating and maintaining of the new electrical generation engines and equipment. This requirement will incur significant additional operational costs to SACC annually. Furthermore, SACC will bear significant risk for the correct operation and maintenance of the engine gen-sets and associated gas conditioning equipment.

Impact of high operational and maintenance costs and catastrophic failure

SACC are to enter into a Contract Service Agreement (CSA) with the suppliers GE-Jenbacher. However, such a CSA excludes operating requirements and also requires SACC to carry out several general maintenance and servicing tasks. Moreover, the cost of a CSA is significant to SACC against their current annual operational expenditure – expenditure required for the supply of furnace gas derived electricity to their furnace.

The regular maintenance of the electrical generation engines is essential to enhancing engine life. However, this does not preclude the risk of a catastrophic failure of any engine at any one time. The calcium carbide production process within the furnace is not a *steady-state* process and rapid pressure surges, as such can occur. Whilst SACC are to engineer a dedicated furnace pressure relief system for the project to optimise gas flow, damage to the entire gas train remains a risk. Moreover, the demand for regular maintenance of the fuel gas supply equipment at relatively high cost is essential in ensuring catastrophic failure of the engines never can occur.

Risk of technology failure

The technology to be implemented is specifically limited to gas-fired reciprocating spark ignition internal combustion engines (to be four (4) GE-Jenbacher engines). The electricity generated will be utilized for own use. The project activity is a completely furnace-waste-gas based energy recovery system, without the option of co-firing of any other fuel source. Apart from the option to continue to use easily accessible electrical power from the local municipal grid, an alternative option available to SACC would have been the implementation of boiler and gas turbine technology. There is limited flexibility with the technology choice either way. If the gas fuel supply to the proposed gas engines is inappropriate or the technology choice (of engines) dysfunctional to SACC's current production of Calcium Carbide for any reason, the project will be a failure.

Project funding agencies, banks and prominent project development companies in South Africa highlight gas engines as *high risk* territory. As stated above, a similar project was recently terminated in South Africa and 3No. new GE-J 620 engines had to be sold owed to reported complications with flue gas quality.[6]. The existing landfill gas electricity generation projects in City of Durban (the eThekwini Municipality – Bisasar Road and Mariannhill Landfill sites) are widely reported to offer significant challenges to engine maintenance - and operational costs and *human efforts* are high.

There are no known installations in the world using this technology on a Calcium Carbide furnace off-gas for electricity generation. As mentioned previously, there are, however, three similar installations located in Spain that adopt this technology with similar gas compositions. It is therefore a first project of its kind in the Calcium Carbide industry worldwide.

2. *Barrier due to prevailing practice:*

As per Attachment A to Appendix B, *"Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions"*.

There are currently no national or sectoral policies that mandate flue or waste gas recovery in South Africa for South African Calcium Carbide operations. Moreover, there is currently no national legislation in place in South Africa which demands any utilization of furnace or smelter type flue gases.

Applicable national policies and circumstances (Policy requirements):

The only similar national policy currently in South Africa relates to Landfill Gas Recovery being National Environmental Management Act (NEMA): Waste Act (59/2008): Draft National Standards for the Recovery of Landfill Gas in South Africa (Department of Environmental Affairs – South Africa; 1st July 2011).

Barrier due to prevailing practice:

The GE Jenbacher internal combustion engines used in the project will be imported from an Annex-1 country in Europe. These engines have been used at five other registered CDM projects in South Africa. These projects are:

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

[6] Annex 10, Rio Tinto EOI

- Alton Landfill Gas to Energy Project (project 2549)

These projects are all biogas projects and differ fundamentally from the SACC project. The main difference lies in the fact that the fuel gas of this project does not contain any methane, but rather carbon monoxide and hydrogen.

Prevailing practice in South Africa is to flare flue gas released to atmosphere. Utilisation of flare or flue gas is very rare. As mentioned under point 1 above, there are very few gas electrical generation projects in South Africa and the ones that are implemented, are implemented under CDM. There is only one other operational project which is somewhat similar, namely the International Ferro Metals (IFM) Ltd. smelter gas to electricity generation project, in Mooinooi near Brits in the North Western province of South Africa, also a CDM project. There are currently no calcium carbide furnace gas utilisation projects in the western world[7].

The name of the calcium carbide western producers with submerged arc closed furnaces are:

1. White Martins, Brazil,
2. SACC South Africa,
3. CIL –USA
4. SKW - Carbide Sweden
5. Donau Chemie – Austria
6. Alzchem Germany

None of these operations generate electricity from furnace off-gas[8].

This project also aims to be the first CDM registered project in developing countries to operate the engines on the special gas mixture produced at a CaC_2 operation.

The proposed project activity passes all the necessary steps of additionality analysis and is additional.

In the absence of the proposed project activity, SACC will continue importing electricity from the carbon intensive national grid.

It is concluded then that the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As per AMS III.Q methodology, the baseline emissions from electricity generated by waste energy is calculated as follows.

[7] Refer to Annex 11, e-mail received from Juan Manuel Sabio, COO for the Andina Group, 19 September 2011

[8] Refer to Annex 11, e-mail received from Juan Manuel Sabio, COO for the Andina Group, 19 September 2011

Equation 1

$$BE_{elec,y} = f_{cap} \times f_{wcm} \times \sum_{j}\sum_{i}\left(EG_{i,j,y} \times EF_{elec\,i,j,y}\right)$$

With the relevant subscrips, Equation 1 becomes:

$$BE_{elec,y} = f_{cap} \times 1 \times \sum_{SACC}\sum_{Grid}\left(EG_{Grid,SACC,y} \times EF_{elec,Grid,SACC,y}\right)$$

Where

$BE_{elec,y}$	Baseline emissions due to displacement of electricity during the year *y* in tons of CO2
f_{cap}	From ACM0012: Factor that determines the energy that would have been produced in project year *y* using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year *y*. The ratio is 1 if the waste energy generated in project year *y* is the same or less than that generated at a historical level. The value is estimated The quantity of electricity supplied to the recipient *j* by generator, that in the absence of the project activity would have been sourced from *i*th source (*i* is the grid) during the year *y* in MWh using the equations in section 3.2 in ACM0012
f_{wcm}	Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 because the electricity generation is purely from use of waste gas.
$EG_{i,j,y}$	The quantity of electricity supplied to the recipient *j* by generator, that in the absence of the project activity would have been sourced from *i*th source (*i* is the grid) during the year *y* in MWh
$EF_{elec,i,j,y}$	The CO2 emission factor for the electricity source *i* (*i*=gr (grid)), displaced due to the project activity, during the year *y* in tons CO2/MWh
i	National grid in South Africa
j	The electricity delivered by the project to the recipient (the national grid) would have in the absence of the project activity been sourced by the grid connected power plants.

Capping of baseline emissions
According to AMS III Q the purpose of the capping factor is to exclude increased waste energy utilization in the project year y due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in project year y is the same or less than that generated in base years.

The amount of gensets selected for the project activity, i.e. 4, is selected based on the average amount of waste gas produced at various production rates. Figure 5 below shows that for production rates above 60,000 tons CaC_2 per year, the average gas production is estimated to remain below 6,000 Nm^3/h although the maximum instantaneous gas production could reach higher figures. The project activity will only implement 4 gensets, therefore, even if the production capacity increases in the furnace in the future compared to the 66,001 tons CaC_2 produced in the three baseline years, the amount of electricity produced can not increase, because the gensets have a limited design electricity generation capacity. So even if the production of CaC_2 goes beyond the 66,001 tons per year, the additional amount of waste gas produced cannot be utilized for electricity generation because of the limitation of the gensets. More gensets will have to be installed to utilize additional waste gas produced as a result of increased production.

From the last column in Figure 5 below, it is clear that for production rates of 60,000 tons per year and above, 4.2 or 4.3 gensets can be implemented to make use of the average amount of waste gas produced in the furnace. However, only 4 gensets are implemented which means that there will always be an excess of waste gas which is not utilized in the project activity. This waste gas will be flared to atmosphere as is done in the existing scenario.

Figure 5: Optimising the gensets utilisation (Source: Technical Study Report)

Calcium Carbide annual production (t)	Maximum estimated furnace power (MW)	Average furnace power (MW)	Maximum gas production (Nm^3/h)	Average gas production (Nm^3/h)	Estimated Number of engines for Maximum furnace power	Estimated Number of engines for Average furnace power
60 000	32.2	30*	6 020	5.850	4.3	4.2*
65 000	34.9	30*	6 521	5.850	4.7	4.2*
70 000	37.5	30*	7 023	5.850	5.0	4.2*
75 000	40.2	30*	7 525	5.850	5.4	4.2*
80 000	42.9	31.9	8 026	5 975	5.8	4.3

Determination of f_{cap}

ACM0012 requires the baseline emissions to be capped irrespective of planned or unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuel type and quantity resulting in an increase in generation of waste energy. The cap can be estimated using the three methods described below, following this hierarchy:

(i) Method-1 can be used to estimate the capping factor if required data is available

The amount of information to apply Method-1 over a 3 year period is not available for SACC.

(ii) In SACC's case, because of the variability in the waste gas quality (refer to Table 7) as a result of waste resource variability and furnace impacts, it is not possible to determine the historical waste energy produced, nor the specific amount of waste gas produced historically per unit of production (Method-2 requirement).

Table 7: Explanation of the variability of waste gas quality and quantity produced in the CaC2 furnace

Variability in the waste gas quality and quantity during production – the reason for applying Method-3

A three times daily proximate analysis of the anthracite, that is used in the process, is carried out as a matter of routine for approximately the last two years and these results are available at SACC. These results are analysed using a semi-automated "Leco" carbon analyser.

The variability in the gas experienced, the moisture in the raw material as well as the volatile material have an effect on the amount of hydrogen produced. The range of gas analysis varies from 60-65% for carbon monoxide and between 28-34% hydrogen. The hydrogen comes from the moisture and also from the breakdown of the volatile components into hydrogen and carbon.

In addition to this uncertainty the calcium carbide produced in the reaction, $CaO + 3C = CaC_2 + CO$, can, when too much electrical power is added reverse to form Ca^+ as a superheated gas which leaves the furnace as part of the gas stream but has no usable energy for the production of electricity but has the effect of diluting the concentration of the gas and increasing the volume. This dissociation happens all the time when the amount of electricity added is too great for the amount of carbide produced "Tapped" by the furnace. Normally 3.2-3.4MWhrs per ton of carbide produced would indicate the correct amount of electricity per ton of carbide above this quantity dissociation could occur.

In extreme cases (greater than 3.6mwhrs/ton) a furnace eruption can occur as a result of this disassociation of the calcium carbide. (See Attached document – entitled "Why a Carbide Furnace Erupts)

The above issues make the use of the gas flow produced at a given furnace power problematical as dependent on the conditions the flow could vary as will the CV values.

The process flow diagrams, by UHDE the suppliers of the furnace and the technology employed by SACC, indicates a normal 16tph and maximum of 20tph of calcium carbide. The 16tph at an electrical efficiency of 3.3MWhts of electricity per ton would give a rated capacity of 52MW. This is what is reflected on the design data sheets and is quoted as our theoretical maximum load. The 20tph can theoretically be produced as the absolute maximum of the furnace transformers, they are rated 25MVA each times three gives us 75MVA. Which would after conversion to MW and using the 3.3MWhrs/t give 20tph. **NB: The rest of the furnace bowl and ancillary however is not designed to handle this load so this quantity of carbide is purely theoretical.**

If you take the above furnace production rates then the gas production rates mentioned 6500 and 8000m^3/hr correlate with this furnace power.
What needs to be taken note of however is that these gas figures, quoted by UHDE are based on a very high percentage of carbon monoxide and **NO** hydrogen. In the current gas we have an additional 30% hydrogen gas which pushes the gas flow rate higher by this amount than would be expected based on the furnace loads. In other words the flow volume (not energy content) we are running at are higher than what the design intent was for a given load. This is due to the fact that the original design by UHDE was for the use of calcined anthracite which has no volatile components and this calcined anthracite would also have **no** moisture. Both of these components are the source of the hydrogen.

Case 1 as described in ACM0012 describes the project activity scenario: The energy is recovered from WECM (waste gas) and converted into final output energy (electricity) through waste heat recovery equipment (Jenbacher engines). For example, the useful energy (in this case waste gas) is produced using waste energy generated by a chemical reaction (in a calcium carbide furnace). For such cases f_{cap} should be the ratio of maximum energy that could be recovered (MER) by the waste heat recovery equipment implemented under the CDM project activity and the actual energy recovered under the project activity (using direct measurement). The MER is determined by considering the number and the design capacity of the engines.

The number of engines (four) selected as the optimum for the project, are based on the results of the technical feasibility study conducted for SACC by an energy consulting company in December 2010, Annex 24, page 5.

To demonstrate the variability and sensitivity of the waste gas the following:

- The volume and composition of the gas depends on the feed materials and their pretreatment methods, on the construction of the smelting furnace and on the furnace controls.
- The gas production varies both in time and place. It is affected by e.g. different temperatures, furnace electrical values, material flows, segregation, position of electrodes and the time to tapping.

f_{cap} is estimated by applying the following equations:

Equation 2

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}}$$

Where:

$Q_{OE,BL}$ = Electricity that can be produced (GJ), to be determined on the basis of maximum energy that could be recovered from the waste gas, which would have flared in the absence of CDM project activity.

$Q_{OE,y}$ = Quantity of actual electricity generated during year *y* (GJ)

Determination of the grid emission factor

The GHG emission calculation of the proposed project was based on the instruction of "Tool to calculate the emission factor for an electricity system". All the data employed in the calculation is based on the publicly available data. The baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors. The procedure to determine the grid emission factor is provided in Annex 3.

The following seven steps are applied to calculate the emission factor for an electricity system:

STEP 1. Identify the relevant electricity systems.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).

STEP 3. Select a method to determine the operating margin (OM).

STEP 4. Calculate the operating margin emission factor according to the selected method.

STEP 5. Calculate the build margin (BM) emission factor.

STEP 6 Calculate the combined margin (CM) emissions factor.

Baseline Emissions are calculated by multiplying the ex-ante determined baseline emission factor by annual power generation.

Project Emissions

According to the approved methodology AMS IIIQ, project emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and emissions due to consumption of electricity by the project activity. If the waste gas contains carbon monoxide or hydrocarbons, other than methane, and the waste gas is vented to the atmosphere in the baseline situation, project emissions have to include CO_2 emissions due to the combustion of the waste gas.

No auxiliary fuel will be used in this project activity and no waste gas is vented to the atmosphere in the baseline situation under normal operating conditions. Therefore, project missions are emissions associated with the electricity required for the operation of equipment related to the project activity.

$$PE_y = EC_y \times EF_{elec,i}$$

Where:

EC_y	=	Electricity consumption of all new equipment implemented in the project activity in year y (MWh)
PE_y	=	Project emissions in year *y* (t CO_2)
$EF_{elec,i}$	=	The CO_2 emission factor for the electricity source *i* (*i*=gr (grid)) determined ex-ante in tons CO_2/MWh

$$PE_y = \frac{(150kW + 156kW)}{1000} \times 7{,}157(hours) \times 0.9880$$

$PE_y = 2{,}165$ t CO_2

Leakage

If equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered. New equipment will be implemented. No leakage emissions are anticipated.

Emission Reductions

The emission reductions are calculated as follows:

Equation 3

$$ER_y = BE_y - PE_y - LE_y$$

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

$ER_y = 42{,}851 - 2{,}165 - 0$

ER_y = **40,686** tCO_2

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

Data / Parameter:	$EF_{GRID,CM,y}$
Data unit:	tCO_2 / MWh
Description:	Emission factor of the national electrical grid for the year y
Source of data used:	Calculated based on the Eskom information and IPCC information where applicable
Value applied:	0.9880
Justification of the choice of data or description of measurement methods and procedures actually applied :	The $EF_{grid,y}$ is calculated according to the 'Tool to calculate the emission factor for an electricity system'. The Simple OM method is used to calculate the Operating margin (using the ex-ante option); with the Build Margin also calculated ex-ante based on the most recent information.
Any comment:	None

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. For the sake of a conservative approach the IPCC default value at the lower limit of the uncertainty at a 95% confidence interval is used. For conservativeness, it is assumed that Eskom uses kerosene at their gas stations, Ankerlig and Gourikwa and not diesel.
Value applied:	Coal: 2007/8 to 2010: 0.0895 (t CO_2/GJ) Kerosene 2007/8 to 2010: 70.8 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Some information is available about the various coal resources in South Africa, all of which is classified as bituminous. However, sufficient information is not available for each coal fired power station and therefore the IPCC default will be used.

Data / Parameter:	f_{wcm}
Data unit:	Unitless
Description:	Fraction of total electricity generated by the project activity using waste energy.
Source of data used:	SACC information (plant records).
Value applied:	1
Justification of the	This fraction is 1 because the electricity generation is purely from use of waste

choice of data or description of measurement methods and procedures actually applied :	gas.
Any comment:	-

Data / Parameter:	$Q_{OE,BL}$
Data unit:	GJ
Description:	Electricity that can be produced (GJ), to be determined on the basis of maximum energy that could be recovered from the waste gas, which would have flared in the absence of CDM project activity.
Source of data used:	Genset supplier information
Value applied:	156,137
Justification of the choice of data or description of measurement methods and procedures actually applied :	The maximum electricity that can be generated based on a furnace availability of 86% and the guaranteed output capacity from the gensets. Please refer to Annex 24_Technical Feasibility Report, Dec 2010, page 5 for the background of the furnace availability figure of 86%.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions from Equation 1**:**

$$BE_{elec,y} = f_{cap} \times f_{wcm} \times \sum_{SACC} \sum_{Grid} \left(EG_{Grid,SACC,y} \times EF_{elec,Grid,SACC,y} \right)$$

$$BE_{elec,y} = 1 \; x \; 1 \; x \sum_{SACC} \sum_{grid} (43{,}371 \; x \; 0.9880 \;)$$

$$BE_{elec,y} = 42{,}851 \text{ t } CO_2$$

For demonstrating the calculation of Fcap:

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}}$$

Where:

$Q_{OE,BL}$ = Electricity that can be produced (GJ), to be determined on the basis of maximum energy that could be recovered from the waste gas, which would have flared in the absence of CDM project activity.

$Q_{OE,y}$ = Quantity of actual electricity generated during year y (GJ)

$$f_{cap} = \frac{EG_{max}\ (MWh) x\ 3.6\ (GJ\ per\ MWh)}{EG_y\ x\ 3.6}$$

EG_{max} = Max Expected Gross electricity (GJ) generated by the project activity if all 4 gensets are running at max rated capacity for all furnace operating hours in the year (1.515 MW per engine x 4 engines x 7,157hours per engine), assuming sufficient amount of waste gas is produced in the furnace during every operating hour of the furnace. This is the maximum amount of electricity generated, not accounting for parasitic load of the gensets.

$$f_{cap} = \frac{43{,}371\ x\ 3.6}{43{,}371\ x\ 3.6}$$

$$f_{cap} = 1$$

Calculation of the combined margin (refer to Annex 3 for the detailed calculations):

Table 8: Parameters for the grid emission factor

$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$	t CO_2/MWh	0.9880
$EF_{grid,OM,y}$	t CO_2/MWh	0.9257
w_{OM}	%	50
$EF_{grid,BM,y}$	t CO_2/MWh	1.0503
w_{BM}	%	50

Project Emissions

No auxiliary fuel will be used in this project activity and no waste gas is vented to the atmosphere in the baseline situation under normal operating conditions. Therefore, project missions are emissions associated with the electricity required for the operation of equipment related to the project activity. The electricity used for the equipment operated as part of the project activity, will be sourced from the gensets. Only in conditions where the entire power plant has to be started up will electricity be sourced from the national grid. The net electricity that is generated and distributed by the power plant to the industrial operation will be metered, and the parasitic load (imported electricity) for start up of the power plant is also metered.

$$PE_y = EC_y \times EF$$

Leakage emissions are zero.

Emission Reductions

The emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

ER_y = 42,851 - 2,165

ER_y = **40,686** tCO_2 /y

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

>>

Table 9: Summary of emission reductions for the project activity

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions (tonnes of CO_2 e)
1	2,165	42,851	0	**40,686**
2	2,165	42,851	0	**40,686**
3	2,165	42,851	0	**40,686**
4	2,165	42,851	0	**40,686**
5	2,165	42,851	0	**40,686**
6	2,165	42,851	0	**40,686**
7	2,165	42,851	0	**40,686**
8	2,165	42,851	0	**40,686**
9	2,165	42,851	0	**40,686**
10	2,165	42,851	0	**40,686**
Total (tonnes of CO2 e)	21,650	**428,510**	0	**406,860**

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

The parameters required for monitoring are the electricity generated under the project activity, and the electricity supplied to the project activity by the grid. The amount of waste gas produced under the project activity will be measured to determine the f_{cap}.

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	1.$EG_{i,j,y}$ ($EG_{grid,SACC,y}$)
Data unit:	MWh
Description:	The quantity of electricity supplied to the recipient (*j=SACC)* by generator, that in the absence of the project activity would have been sourced from *i*th source (*i* is the grid) during the year *y*.
Source of data to be used:	Plant records produced by SACC and electricity meters installed to meter the electricity generation.
Value of data	43,371 The expected amount of electricity that is generated is based on the guaranteed output of the gensets, assuming sufficient waste gas is available so that all four are operating 7,157 hours of the year at maximum capacity. Guaranteed rated capacity of the genset (1.515) x 4 x 7,157 hours per year = 43,371 MWh per year. Refer to CER calculation spreadsheet for the calculation, Cell D19.
Description of	An electricity meter will be installed to measure the electricity generated by the

measurement methods and procedures to be applied:	gen-sets. Continuous monitoring will be done and the data will be logged daily. Monthly records will be available for verification. Location of meter: See Annex 7 for the diagram. The meter will be installed on the 11kV line after the Jenbachers on the feeder panel.
QA/QC procedures to be applied:	The electricity meters will be calibrated and maintained in accordance with manufacturer's specifications. The electricity meter reading will be checked against the individual electricity readings from each engine.
Any comment:	The monitoring process and equipment for this procedure is standard. The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	3. $EC_{PJ,y}$
Data unit:	MWh
Description:	Additional electricity consumed in year *y* for project related equipment that are installed as a result of the implementation of the project activity.
Source of data to be used:	The electricity consumption (parasitic load) of the gen-sets, the scrubber and the auxiliaries installed under the project will be recorded.
Value of data	2,191 Based on 39.040kW x 4 x 7,157hours (parasitic load for the 4 Gensets) and 150kw x 7,157hours (for the Scrubber) – See Annex 22:Specification sheet for the scrubber
Description of measurement methods and procedures to be applied:	An electricity meter will be installed to measure the electricity consumed by the gen-sets and the gas cleaning equipment (scrubber) that is installed as part of the project activity. Continuous monitoring will be done and the data will be logged daily. Monthly records will be available for verification.
QA/QC procedures to be applied:	The electricity meters will be calibrated and maintained in accordance with manufacturer's specifications. The electricity meter reading will be checked against the individual electricity readings from each engine.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**2. $Q_{OE,y}$**
Data unit:	GJ
Description:	Quantity of actual output generated during year *y*
Source of data to be used:	SACC power plant process data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	156,137
Description of	Continuous monitoring will be done and the data will be logged daily.

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	The electricity meters will be calibrated and maintained in accordance with manufacturer's specifications.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**4. f_{cap}**
Data unit:	Unitless
Description:	Energy that would have been produced in project year y using waste heat generated in base year expressed as a fraction of total energy produced using waste heat in year y.
Source of data to be used:	Calculated
Value of data	1
Description of measurement methods and procedures to be applied:	The relevant f_{cap} will be determined prior to each verification according to the calculation procedure described by ACM0012.
QA/QC procedures to be applied:	
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

B.7.2 Description of the monitoring plan:

>>This section details the steps taken to monitor the GHG emissions reductions on a regular basis at the SACC operation in South Africa.
The Monitoring set up for this project has been developed to ensure that the necessary information is monitored and stored for CDM purposes.

Project Management
Project Roles – the following positions and functions will be active in the project:

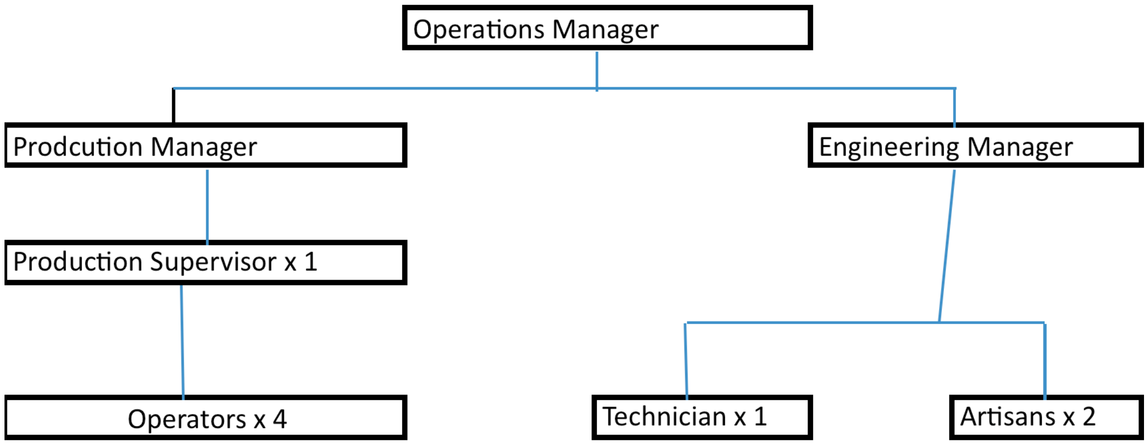
- General Manager
- Project Owner
- Project Manager
- Project Designers
- Coordinator
- Procurement
- Responsible engineer
- Final Safety Approval

The following positions will be involved during the Operations Phase

- General Manager
- Operations Manager
- Production Manager
- Responsible Engineer
- Production Supervisor

During the implementation phase GreenEng will supply the project management function. They will coordinate the various project disciplines. All the design work will be carried out in house by SACC and GreenEng with specialist help as required form engineering companies. A permanent construction coordinator will be appointed to supervise work on site as will an ECO officer. Once the construction phase of each section of the project is complete a full compliance check will be carried for safety, environmental, operations and engineering disciplines. Once approved the project will be handed over for operations.

The following diagram presents a layout of the proposed personnel.



Monitoring equipment and installation

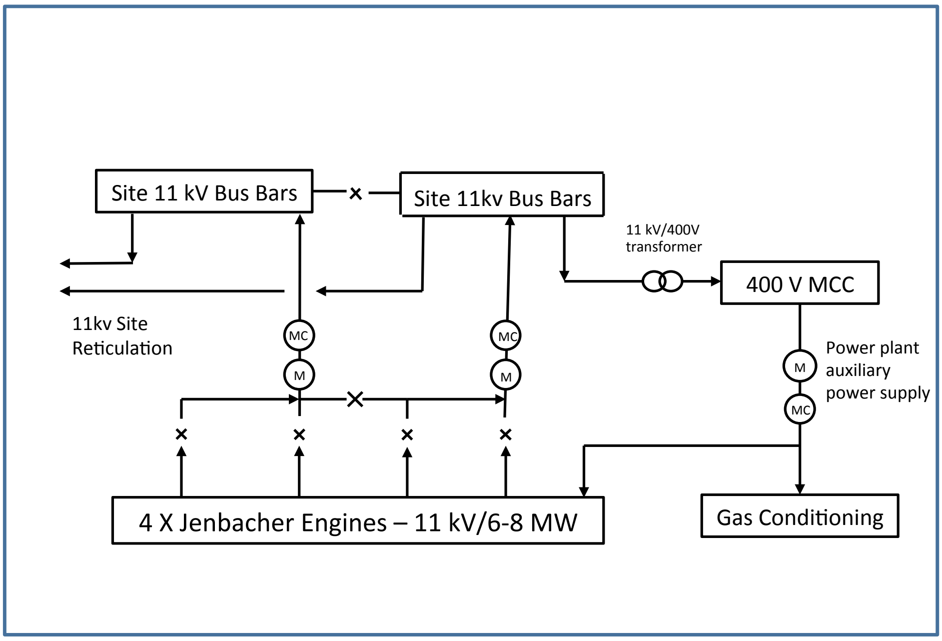
Given that the emission factor is calculated *ex-ante*, and referring to the Monitoring Methodology AMSIII.Q, the parameters to be monitored are electricity generated, electricity from grid to the project and the quantity of waste gas used for electricity generation. Appropriate metering equipment will be installed prior to the start of the project crediting period to measure these parameters.

Electricity Meters (Power Meters)
These instruments measure current and voltage simultaneously and continuously, and they compute all electrical metering parameters, including power, energy and power factor.

Location of the electricity meters
The diagram below shows the location of the electrical meters[9].

[9] Source document: Minutes of meeting regarding the electrical layout of the meters (Annex 7)

Figure 6: Diagram indicating the layout of electricity meters



Calibration

All metering equipment will be calibrated according to the supplier specifications.

Data Capturing and Processing

SACC will capture all the process data. The online data will be logged in the electronic system. Data will be logged, which will provide a full audit trail for the actual power exported/imported.

Data Storage

SA Calcium Carbide has an extensive computer server system with documented back up procedures. The storage of data will be expanded to include the storage of the data used in this project. The equipment installed will be connected to a PLC and SCADA system which allows for data to be collected and stored and retrieved as required for validation and verification purposes. All data related to the CDM monitoring parameters will be stored for the duration of the crediting period.

Quality Assurance

SA Calcium Carbide is ISO 9000-2001 certified company and as such all quality assurance issues and procedures will conform to the standard as outlined in the companies Quality Management Procedures so that compliance will be achieved.

Training Procedures for the Staff

SA Calcium Carbide has comprehensive training manuals which cover production, engineering and quality control. The relevant training manuals will be prepared and personnel trained in the correct operation of the equipment. In the preparations for operations some of the personnel will be sent to GEJenbacher in Austria for training. All staff employed permanently on this project will undergo internal training as specified and developed in conjunction with the suppliers of the equipment to be installed.

The details of the metering location, procedures and calibration are provided in Annex 4.

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

>>The study of the baseline and monitoring methodology was concluded 24 February 2011.

Ciska Terblanche
CDM Africa Climate Solutions (Pty) Ltd
407 Juliana, Princess Place, Parktown, South Africa
Tel: +27(0)828985750
Email: Ciska@cdmafrica.com

The entity is not one of the Project Participants listed in Annex 1 of the document.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>11 August 2011

The starting date of the project activity is the date that the deposit was paid on the equipment.

Since the starting date is after the date of publishing the PDD on the UNFCCC website, section B5 includes an analysis of the prior consideration of CDM.

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

>>15 Years 0 months[10]

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

C.2.1. Renewable crediting period

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

>>

C.2.1.2. Length of the first crediting period:

>>

[10] Based on the lifetime of the equipment supported by letter from the supplier

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>01/10/2012 or date of registration at the UNFCCC whichever is later.

C.2.2.2. Length:

>>10 years and 0 months

SECTION D. Environmental impacts

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

The only government body from which authorisation is required is the Department of Environmental Affairs who granted a positive Record of Decision with EIA reference number 12/12/20/1981 for the Environmental Authorisation Application for the project put forward by SRK Consulting SA (Pty) Ltd on 16th February 2011.

A technical evaluation was done to identify the environmental issues and impacts associated with the facility. More specifically it involved, but was no limited to, the following tasks:

- Site assessment;
- Survey of potential technical issues;
- Identification of issues related to the biophysical environment (e.g. ecological, atmospheric, surface and ground water);
- Identification of potential social and economic issues as well; and
- Consideration and assessment of feasible alternatives.

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

None of the environmental impacts considered were deemed significant. A Background document was produced: “Basic Assessment for the proposed furnace gas to electricity cogeneration CDM project at SA Calcium Carbide, Newcastle, KwaZulu-Natal [DEA Ref: 12/12/20/1981]”.

SECTION E. Stakeholders’ comments

>>

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

A Notice of Intent Form (Appendix 1 of this document) was submitted to the National Department of Environmental Affairs (DEA) on 24 June 2010. In addition, the following organisations were also sent copies of the Notice of Intent Form for their records:

KwaZulu-Natal Department of Agriculture, Environmental Affairs and Rural Development (DAEARD).

NOTIFICATION OF THE PROJECT TO THE PUBLIC

Public notice (newspaper advertisements – refer to Annex 12)
In order to canvass the issues and concerns of the broader public and to ensure that all IAPs are afforded the opportunity to comment on the proposed activity, public notices were lodged in the following newspapers:

The Newcastle Advertiser (in English) – on 09 July 2010;

The Inkanyezi Newspaper (in Zulu) – 16 July 2010.

Background Information Document
A Background Information Document (BID) was compiled which provided information about the Basic Assessment process being undertaken for the proposed SACC improvement project at its existing facility in Newcastle. The purpose of this document was to inform IAPs about the project and afford them the opportunity to comment thereon. Copies of the BID were distributed (mostly via email) to the relevant authorities and stakeholders from 13 to 15 July 2010.

Public notice (poster)
Three laminated site notices/posters (A2) informing IAPs of the application process were placed at key locations, on 26 July 2010, as follows:

- At the main security entrance to the Karbochem industrial complex (Plate 1);
- In the main Karbochem administrative building (Plate 2);
- At the entrance to the SACC furnace control room (Plate 3).

A copy of the notice, as well as photographs of where copies were displayed, is included as Appendix 5 of this report.

IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

A database of key authorities and IAPs in the area was compiled as part of the Basic Assessment and updated as required during the course of the PPP as additional IAPs were identified (see Table 5.1).

Table 0.1: IAP Database (as at 03 September 2010)

No.	Name	Organisation
1	Mr. D. Mthembu	Dept. of Env. Affairs (National)
2	Ms. S. Dlomo	Dept. of Env. Affairs (National)
3	Mr. Z. Mathenjwa	DAEARD – Impact Assessment (Amajuba District)
4	Mr. P. Moodley	DAEARD – Impact Assessment (Amajuba District)
5	Mr. F. Alberts	Newcastle Local Municipality - Director: Economic Development
6	Mr. S. Roberts	Newcastle Local Municipality: Planning Department
7	Mr. I. Scholtz	Amajuba Municipality: IDP Manager
8	Mr. S. Nzuza	Amajuba Municipality: Planning, IDP &PMS
9	Mr. M. Durham	Amajuba Municipality: Planning, IDP &PMS
10	Mr. G.M. Adamson	Ward Cllr. (Ward 25) and Newcastle Chamber of Commerce and Industry
11	Mr. L. Meyer	Karbochem

No.	Name	Organisation
12	Dr. M. Batz	Lanxess
13	Mr. K. Jansen	African Amines
15	Mr. S. Sunderlall	African Amines
16	Ms. P. Maseko	Department of Water Affairs
17	Mr. F. Bergh	Afrikaanse Sakekamer
18	Mr. B. Majola	Newcastle Cogeneration (Pty) Ltd. (part of the IPSA Group)

PUBLIC MEETING

Given the low interest in the proposed application from authorities, neighbours and the general public, the holding of a public meeting was not deemed necessary.

E.2. Summary of the comments received:

>>No comments were received regarding the CDM component of the project.

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

All comments received during the communication with stakeholders were responded to by the EIA Consultant. The comments did not include any comments relating to CDM.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	SA Calcium Carbide (Pty) Ltd.
Street/P.O.Box:	Karbochem Road
Building:	
City:	Newcastle
State/Region:	KwaZulu-Natal
Postfix/ZIP:	2940
Country:	South Africa
Telephone:	+27 (0)34 370 1172
FAX:	+27 (0)34 370 1164
E-Mail:	juans@sacarbide.com
URL:	www.sacarbide.com
Represented by:	Juan Sabio
Title:	(Operations Manager)
Salutation:	Mr
Last Name:	Sabio
Middle Name:	
First Name:	Juan
Department:	Operations
Mobile:	+27 (0)83 626 6301
Direct FAX:	+27 (0)34 370 1164
Direct tel:	+27 (0)34 370 1172
Personal E-Mail:	juans@sacarbide.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

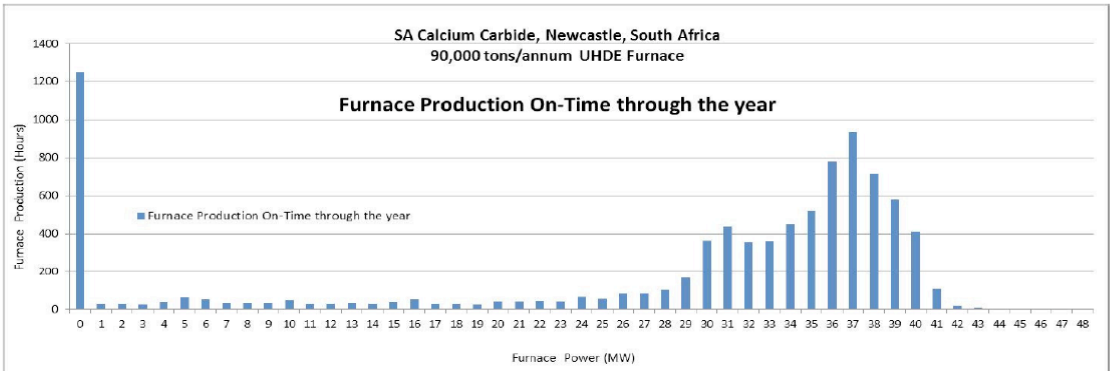
There is no public funding related to Annex 1 Countries in the Project Activity.

Annex 3

BASELINE INFORMATION

1. Furnace load (refer to Annex 24 for detail information)

Variance in the furnace power and hence production rates throughout a year time profile:



Source: Annex 24, SACC Summary for Calcium Carbide Production vs Gas Production_Dec 2010_rev2

2. Electricity consumption
   The report is provided in Annex 9.

3. Production Information and Electricity consumption figures

Table 2: Electricity consumption information - historical

	Source of information	2008	2009	2010
Total Production (t CaC_2)	Historical production records provided by SACC. The product is weighed on a weighbridge (see Annex 29 provides weighbridge procedures and calibration certificates).	67,456	64,933	65,614
Total Furnace electricity consumption (MWh)	Historical production data provided by SACC (Annex 9).	228,339	222,462	223,357

The average production for the three year period prior to project implementation is 66,001 t CaC_2 produced for the three year period 2008 to 2010.

4. Grid emission factor

Determination of the grid emission factor

The GHG emission calculation of the proposed project was based on the instruction of "Tool to calculate the emission factor for an electricity system". All the data employed in the calculation is based on the available data from South African Power Grid. The baseline emission factor (EFy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors:

The following steps are applied to calculate the emission factor for an electricity system:

STEP 1. Identify the relevant electricity systems.
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Provide evidence that the simple operating margin is still the applicable selection.
STEP 4. Calculate the simple operating margin emission factor according to the selected method, ex-ante
STEP 5. Calculate the build margin (BM) emission factor, ex-ante.
STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electric power system

For determining the electricity emission factors, a **project electricity system** is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

Project electricity system

The DNA of South Africa has, to date, not published a delineation of the project electricity system and connected electricity systems.
Spot markets: There exists no spot market in South Africa for electricity. The National Electricity Regulator (NER) regulates the prices at which electricity can be sold. There are no public information available regarding the operation of transmission lines and therefore it is not possible to define a grid boundary. Electricity generated by the proposed project activity will displace the power production in the national grid of South Africa which is defined as the project electricity system by default.

The project electricity system forms part of a connected electricity system whereby it is connected by transmission lines to the national grid of Botswana (Botswana Power Corporation), Mozambique, Namibia (NamPower), Zimbabwe (ZESA), Lesotho (Lesotho Electricity Company), Swaziland and Zambia (ZESCO).

Connected electricity system
The South African grid is connected by transmission lines to grids in neighboring countries Mozambique, Botswana, Namibia and Zimbabwe. South Africa exports some electricity to neighboring countries and import some as well. Therefore, this larger grid is defined as the **connected electricity systems**. The connected electricity systems are not partially or totally located in Annex 1 countries.

For the purpose of determining the operating margin emission factor, the CO_2 emission factor(s) for net electricity imports from a connected electricity system is 0 tCO_2/MWh, because information is not available for emission factors of any of the neighboring countries.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Off-grid power plants are not included in the calculations as information is not available at the time of including the CPA in the PoA.

Step 3: Provide evidence that the simple operating margin can be applied
Motivation for using Option (c): Simple Operating Margin

The simple OM method can be used for as long as the low-cost/must-run resources constitute less than 50% of the total grid generation in the five most recent years prior to the inclusion of the CPA in the PoA.

	2011	2010	2009	2008	2007
Coal-fired (GWh)	**220 219**	215 940	211 941	222 908	215 211
Hydro-electric (GWh)	**1 960**	1 274	1 082	751	2 443
Pumped storage (GWh)	**2 953**	2 742	2 772	2 979	2 947
Gas turbine (GWh)	**197**	49	143	1 153	62
Nuclear (GWh)	**12 099**	12 806	13 004	11 317	11 780
Wind energy (GWh)[6]	**2**	1	2	1	2
Total own production (GWh)	**237 430**	232 812	228 944	239 109	232 445

Source of information for the table: Eskom Integrated Report 2011, page 13

Total GWh from coal from 2007 - 2011= 1,086,219
Total GWh production from 2007 – 2011 = 1,170,740

%Share of coal fired in power stations: 92.78%.
It is therefore confirmed that the low-cost/must-run resources constitute less than 50% of the total grid generation.

In terms of data vintages, the *ex ante* option were chosen to calculate the simple OM.

In this option a 3 year generation-weighted average are used for the grid power plants.

Step 4: Calculate the simple operating margin emission factor

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

Option A1 - Calculation based on average efficiency and electricity generation of each plant

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

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

Equation 4

Where:

Where:

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

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

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

Equation 5

Where:

$EF_{ELm,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2 /GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
I	=	All fossil fuel types combusted in power sources in the project electricity system in year *y*
M	=	The power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid
Y	=	The relevant year as per the data vintage chosen in Step 3

Table 3: Power stations in the Operating Margin

No.	Name of Power Unit/country	Installed Capacity (MW) *Source: FuelConsumptionElectricityGen.xls puplished by Eskom, Appendix 61*	Net Electricity Generation (MWh) *Source: Appendix 61_FuelConsumptionElectricityGen.xls puplished by Eskom.* Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/			Main Fuel Type/ Energey Source	Main Fuel Consumption (t (mass or volume unit)) *Source: Appendix 61_FuelConsumptionElectricityGen.xls puplished by Eskom* Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/		
			2008-2009	2009-2010	2010-2011		2008-2009	2009-2010	2010-2011
Electricity import									
i-1	International imports *(Source: Eskom Integrated Report, 2011, page 13), Appendix 60*		12,189,000	13,754,000	13,613,000				
i-2	IPPs *(Source: Eskom Integrated Report, 2011, page 13), Appendix 60*		0	0	1,833,000				
Electricity generation in the project electricity system									
1	Arnot	1980	11,987,281	13,227,864	12,194,878	Other Bituminous Coal	6,395,805	6,794,134	6,525,670
2	Duvha	3450	21,769,489	22,581,228	20,267,508	Other Bituminous Coal	11,393,553	11,744,606	10,639,393
3	Hendrina	1895	12,296,687	12,143,292	11,938,206	Other Bituminous Coal	7,122,918	6,905,917	7,139,198
4	Kendal	3840	23,841,401	23,307,031	25,648,258	Other Bituminous Coal	15,356,595	13,866,514	15,174,501
5	Kriel	2850	18,156,686	15,906,816	18,204,910	Other Bituminous Coal	9,420,764	8,504,715	9,527,185
6	Lethabo	3558	23,580,232	25,522,698	25,500,366	Other Bituminous Coal	16,715,323	18,170,227	17,774,699
7	Matimba	3690	26,256,068	27,964,141	28,163,040	Other Bituminous Coal	13,991,453	14,637,481	14,596,842
8	Majuba	3843	22,676,924	22,340,081	24,632,585	Other Bituminous Coal	12,554,406	12,261,833	13,020,512
9	Matla	3450	21,863,400	21,954,536	21,504,422	Other Bituminous Coal	12,689,387	12,438,391	12,155,421
10	Tutuka	3510	21,504,122	19,847,894	19,067,501	Other Bituminous Coal	11,231,583	10,602,839	10,191,709
12	Ankerlig *(Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13, Appendix 60. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152, Appendix 62)*	1327	143,000	49,000	190,501	Other Kerosene	24,776	13,803	53,901
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	740	0.0	0.0	0.0	Other Kerosene	0.0	0.0	0.0
14	Acacia	171	0.0	0.0	992	Other Kerosene	0.0	0.0	381
15	Port Rex	171	0.0	0.0	5,507	Other Kerosene	0.0	0.0	242
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	1600	6,509,079	7,472,070	7,490,836	Other Bituminous Coal	3,876,211	4,732,163	4,629,763
25	Grootvlei * Commissioing information source: Appendix 63_Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	1200	1,249,556	2,656,230	3,546,952	Other Bituminous Coal	674,538	1,637,371	2,132,979
26	Komati **Commissioing information source, Appendix 64_Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	1000	0	1,016,023	2,060,141	Other Bituminous Coal	0	664,497	1,271,010

Source: GEF Spreadsheet and Appendix 61_FuelConsumptionElectricityGen.xls published by Eskom. Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/

Table 4: Calculation of the Operating Margin emission factor

Operating Margin Calculation Option	Simple OM

No.	Name of Power Unit	2008-2009		2009-2010		2010-2011	
		Net Electricity Generation	CO2 Emission Factor	Net Electricity Generation	CO2 Emission Factor	Net Electricity Generation	CO2 Emission Factor
		MWh	t-CO_2/MWh	MWh	t-CO_2/MWh	MWh	t-CO_2/MWh
Electricity import							
i-1	International imports	12,189,000		13,754,000		13,613,000	
i-2	IPPs	0.0		0.0		1,833,000.0	
Electricity generation in the project electricity system		-		-		-	
1	Arnot	11,987,281	0.9121	13,227,864	0.8835	12,194,878	0.9315
2	Duvha	21,769,489	0.8947	22,581,228	0.8947	20,267,508	0.9138
3	Hendrina	12,296,687	0.9902	12,143,292	0.9783	11,938,206	1.0410
4	Kendal	23,841,401	1.1011	23,307,031	1.0234	25,648,258	1.0299
5	Kriel	18,156,686	0.8870	15,906,816	0.9197	18,204,910	0.9110
6	Lethabo	23,580,232	1.2118	25,522,698	1.2246	25,500,366	1.2134
7	Matimba	26,256,068	0.9109	27,964,141	0.9004	28,163,040	0.9022
8	Majuba	22,676,924	0.9464	22,340,081	0.9442	24,632,585	0.9202
9	Matla	21,863,400	0.9922	21,954,536	0.9746	21,504,422	0.9840
10	Tutuka	21,504,122	0.8928	19,847,894	0.9189	19,067,501	0.9305
12	Ankerlig	143,000	0.5201	49,000	0.8456	190,501	0.8494
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	0	-	0	0.8456	0	0.8494
14	Acacia	0	-	0	0.8456	992	0.8494
15	Port Rex	0	-	0	0.8456	5,507	0.8494
24	Camden	6,509,079	1.0180	7,472,070	1.0894	7,490,836	1.0786
25	Grootvlei	1,249,556	0.9228	2,656,230	1.0604	3,546,952	1.3979
26	Komati	0	-	1,016,023	1.1250	2,060,141	2.1776
Annual Electricity Generation in Total		224,022,925		229,742,904		235,862,603	
Simple Operating Margin CO2 Emission Factor		EFgrid, OMsimple,y1	0.9269	EFgrid, OMsimple,y2	0.9208	EFgrid, OMsimple,y3	0.9293
Operating Margin Emission Factor(t-CO_2/MWh)							0.9257

Step 5 Calculate the build margin (BM) emission factor

(a) According to the information provided by the national utility, $SET_{5\text{-units}}$ consist of the following 5 units (based on the power stations most recently added to the national grid):

$SET_{5\text{-units}}$		
Plant Name	Fuel type	Commission year
Komati***	Coal	2009
Grootvlei**	Coal	2008
Gourikwa	Other Kerosene	2007
Ankerlig	Other Kerosene	2007
Camden*	Coal	2005

Source of information:

***Re-commissioned power plant,** Eskom Holdings Limited Integrated Report 2011, page 148

****Re-commissioned power plant,** Eskom Annual Report 2010, page 126, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf

*****Re-commissioned power plant,** Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf

(a) Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of the annual electricity generation of the project electricity system, AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$).

(b) $SET_{\geq 20\%}$ consist of the following power stations indicated in the table below.

No.	Name of power unit	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t\text{-}CO_2/MWh$) of the latest year	CO2 Emissions ($t\text{-}CO_2$)
SET≥20%						
26	Komati Commissioing information source, Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2,060,141	2.1776	4,486,265.9
25	Grootvlei * Commissioing information source: Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	3,546,952	1.3979	4,958,140.8
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	2007	Other Kerosene	0	0.2537	0.0
12	Ankerlig (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152.)	2007	Other Kerosene	190,501	0.2537	48,330.9
24	Camden * Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2005	Other Bituminous Coal	7,490,836	1.0786	8,079,616.7
8	Majuba	1996	Other Bituminous Coal	24,632,585	0.8872	21,854,396.1
4	Kendal	1988	Other Bituminous Coal	25,648,258	1.1470	29,417,684.9

(c) In the GEF spreadsheet, the set of power units will be selected from $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ that comprise the larger annual generation to calculate the build margin (SET_{sample}).

AEG $SET_{5\text{-units}}$ = 13,288,430 MWh (see grid emission spreadsheet, sheet BM-D)

AEG $SET_{>20\%}$ = 63,569,273 MWh (see grid emission spreadsheet, sheet BM-D)

SET_{sample} is equal to $SET_{\geq 20\%}$ because $SET_{\geq 20\%}$ comprises the larger annual generation.

Identify the date when the power units in SET_{sample} started to supply electricity to the grid.

If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

It is clear that Kendal and Majuba in SET_{sample} have started to supply electricity to the grid more than 10 years ago.

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. This excludes the following power plants from SET_{sample}.

- Kendal (1988)
- Majuba (1996)

The only CDM project activity that started supply electricity to the grid, is the Bethlehem Hydro plant.

No.	Name of power unit	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t\text{-}CO_2$/MWh) of the latest year	CO2 Emissions ($t\text{-}CO_2$)
SETsample-CDM						
26	Komati Commissioing information source, Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2,060,141	2.1776	4,486,265.9
28	Bethlehem Hydro (Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99, CDM PDD, page 12)	2009	Hydro	34,031	0.0000	0.0
25	Grootvlei * Commissioing information source: Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	3,546,952	1.3979	4,958,140.8
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	2007	Other Kerosene	0	0.2537	0.0
12	Ankerlig (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152.)	2007	Other Kerosene	190,501	0.2537	48,330.9
24	Camden * Commissioing information source: Eskom Holdings Limited Integrated Report 2011, page 148, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2005	Other Bituminous Coal	7,490,836	1.0786	8,079,616.7

$AEG_{SET\ sample\ CDM} < 0.2 \times AEG_{total}$. Therefore, continue to the next step below:

(e) The plants that have to be added to make up the set that comprises 20% of the grid are Majuba and Kendal.

The sample group of power units m used to calculate the build margin	SETsample-CDM->10yrs

No.	Name of power unit	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t\text{-}CO_2$/MWh) of the latest year	CO2 Emissions ($t\text{-}CO_2$)
26	Komati Commissioing information source, Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2,060,141	2.1776	4,486,266
28	Bethlehem Hydro (Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99, CDM PDD, page 12)	2009	Hydro	34,031	0.0000	0
25	Grootvlei * Commissioing information source: Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	3,546,952	1.3979	4,958,141
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	2007	Other Kerosene	0	0.2537	0
12	Ankerlig (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152.)	2007	Other Kerosene	190,501	0.2537	48,331
24	Camden * Commissioing information source: Eskom Holdings Limited Integrated Report 2011, page 148, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2005	Other Bituminous Coal	7,490,836	1.0786	8,079,617
8	Majuba	1996	Other Bituminous Coal	24,632,585	0.8872	21,854,396
4	Kendal	1988	Other Bituminous Coal	25,648,258	1.1470	29,417,685

Data Vintage – Option 1 is selected (ex-ante)

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

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

Equation 6

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
M	=	Power units included in the build margin
Y	=	Most recent historical year for which power generation data is available

The emission factor for each power unit is calculated applying Option A1, if the electricity generation and fuel consumption information for the generating units are publicly available.

Determination of $EF_{EL,m,y}$ according to Option A1:

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

The BM is calculated as 1.0503 tCO_2/MWh (refer to GEF spreadsheet, Sheet BM, Cell G:H42)

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin emission factor ($EF_{grid,CM,y}$) is determined by the Weighted average CM.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

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

Equation 7

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)
The methodology specifies default values of wOM = 0.55 and wBM = 0.5.

The methodology specifies default values of w_{OM} = 0.5 and w_{BM} = 0.5.

The combined margin is calculated as 0.9880 tCO_2/MWh (refer to GEF spreadsheet, Sheet CM, Cell I10)

Gas production vs Furnace Power
The amount of gas produced is monitored in the project activity and capped by applying fcap.
The graph below extends across an extrapolated series of production data obtained through test trials (Levego et al; 2006). The graph shows the calculated gas evolution from a reduced load of 10MW to 45MW. The first GE-J 620 engine would be brought on line at approximately 15MW and the second at approximately 25MW, the third on at 30MW and the fourth at about 34MW.

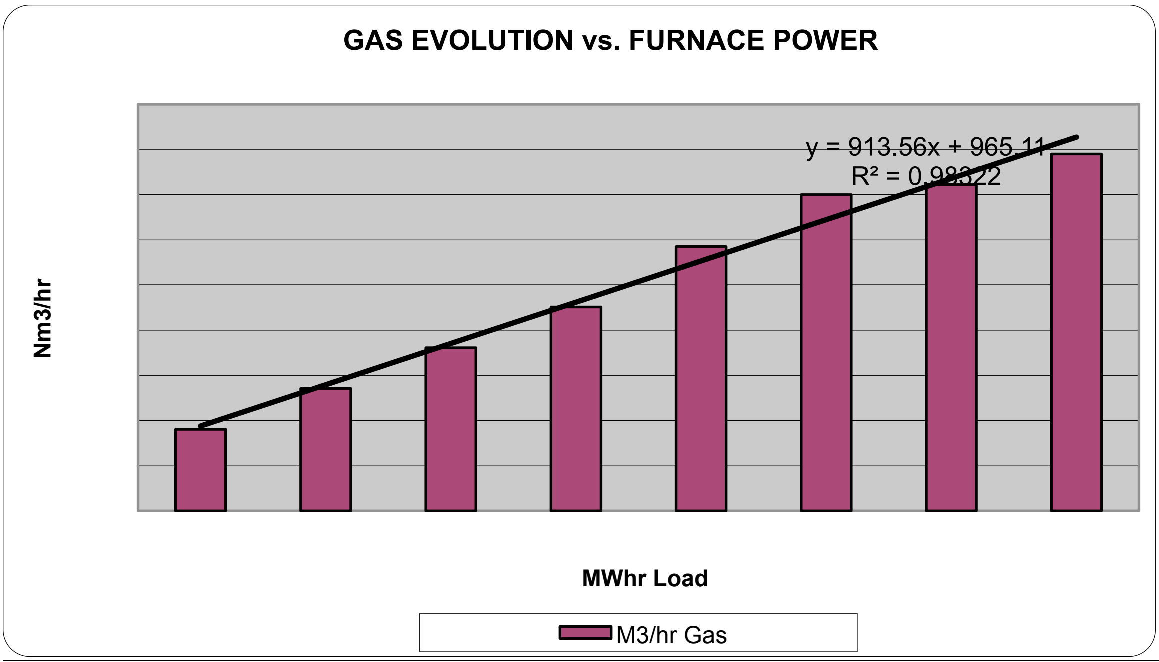


Figure T6: Gas Evolution vs Furnace Power

Annex 4

MONITORING INFORMATION

Operating Hours for gen-sets
(i)The Operating hours for all of the gen-sets are to be communicated from each engine to a PLC via a Profibus Nework (which is a supplied built-in function of the GE-Jenbacher control system);
(ii)The values are monitored/logged and saved to a PCS7 server;
(iii)Each engine is equipped with a separate multifunction Power Meter and the kWh's from each engine (engine meter) are transferred to a PLC via a Profibus Network and the values are monitored/logged and saved on the PCS7 server;
(iv)Also installed are Electrical Meters for the metering of (1) Exported electrical power from the gen-sets to the SACC furnace grid and (2) Imported electrical power from the National grid when required in specific situations such as engine start-up. The 'Net electrical power' can, therefore, be ascertained by calculation and logged on the PC.

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