CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Karbochem Combined Heat and Power Project.

Version 2
Date: 04/06/2008

Previous versions:
Version 1 : 28/04/2008

A.2. Description of the project activity:

The project activity involves replacing two coal fired boilers with a modern state-of-the-art cogeneration system. This new cogeneration system consists of a combination of gas turbines, waste heat recovery boilers, steam turbines and backup boilers and it will ensure electricity and steam are provided in a more environmentally friendly, sustainable and efficient way to the Karbochem industrial facility. In addition it will improve the energy efficiency of the plant while reducing the use of coal.

Two circa 1970 spreader stoker coal fired boilers have been supplying steam to the Karbochem industrial facility in Newcastle municipality, KwaZulu-Natal, South Africa. The industrial facility comprises three local manufacturers; namely Karbochem, an exporter of synthetic rubber used in car tyres; Chrome International South Africa PTY, and African Amines which produce chemical products for local and export markets.

The project will provide 14.6 MWe effective capacity through the installation of:

- 2 gas turbines (GT) of 5.1 MW nominal capacity; and
- 1 steam turbine (ST) of 4.4 MW nominal capacity.

Electricity generated will be sold under contract to Eskom and wheeled through the Newcastle municipal system. However the site uses significantly more electricity than will be generated by the project so it can be assumed that the project consumes all the power it produces.

The project will also install two 55 ton/hr boilers. These will generate steam to be exported to the three occupants of the Karbochem site.

The new plant will run on synthetic gas provided by Sasol Gas Ltd and will run as a combined heat and power facility. The facility will produce electricity as well as steam and will provide steam much more efficiently and reliably than the existing boilers. The plant will be one of the most efficient power generation plants in South Africa.

The gas will be burned in the two 5.1 MWe GEC-Alsthom EGT gas turbines. The exhaust heat from these turbines will be recycled to fire two large boilers that, with some auxiliary firing, will produce high pressure steam.

Steam from the boilers will be split into two channels, one that feeds high pressure (20 bar) steam directly into the manufacturing facilities and another that feeds into the 4.4 MWe steam turbine. This turbine will in turn feed lower pressure (5 bar) process steam into the manufacturing facilities.

The project will result in the closure of the coal-fired boilers currently used to provide steam to these participants.

Contribution to Sustainable Development

Environmental:
Through the introduction of the new cogeneration system, the amount of fossil fuels currently consumed by the Karbochem steam generation facility and by the local municipality (either directly through the burning of coal in the boilers or indirectly through the use of electricity from the Eskom grid) will be reduced, resulting in an estimated saving of 234 336 tonnes of CO_{2e}/year.

The use of gas as a fuel source for the co-generation plant, as opposed to coal for the existing boilers, will result in a substantial reduction (approximately 70% reduction) in atmospheric emissions and local pollutants including oxides of sulphur (SOx), thus improving air quality in the Newcastle region as a whole.

The project will contribute to the reduction in the amount of solid waste to landfill as the co-generation plant will not produce any solid waste. Ash production due to coal usage is currently disposed to landfill and this will be eliminated. The need for transportation of coal via rail to the site and the transportation of ash via road to the landfill site will also be eliminated.

Economic:
There is a growing and urgent need for power generation capacity in the country as Eskom's excess generation, especially of peak power, becomes depleted. As an embedded power generator the project will improve the local security of supply, thus the plant will benefit the whole of South Africa. It will contribute to emission reductions and will provide a reliable source of power for many years to come.

The project is the second of its kind in South Africa and the only other example is being developed as a CDM project. The project will result in a technology that is already used in Western Europe being implemented in South Africa. The successful completion of this project will pave the way for other co-generation projects to be implemented in the country. It will also contribute to local infrastructure development. The project will also boost economic development in the area by installing new, energy efficient and fuel-substituting equipment to export a reliable supply of heat to neighbouring industries, thereby underpinning their economic performance, sustaining jobs, and reinvigorating the overall economy of this area. It is hoped that this, in turn, will stimulate further economic development in the area.

Social:

The project will result in the creation of a number of jobs, during both the construction period and throughout the life of the plant. It is expected that the plant will employ 12 people on a full time basis and up to 120 people during its construction. In addition the project activity will enhance skills development and transfer of technology know-how as a specific training program has been arranged for the staff of Newcastle Co-generation (PTY) Ltd upon the implementation of the co-generation plant. This will contribute to capacity building of the plant engineers and will also ensure economic and safe power plant operation and maintenance.

The co-generation project will help to stimulate economic and social development in the area as a new employer and by improving energy supplies to other industries in the complex, supplying the local municipality with electricity and increasing the supply of electricity into the grid. It should result in overall social improvement through increased revenues from taxes to the local government. These changes may be measured by observing local employment data and monitoring governmental health and environment indicators.

Exhibit A (separate to the PDD) gives in more detail the contribution to sustainable development by the project under the South African sustainability requirements, as sent to the DNA.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Party involved wishes to be considered as project participant (Yes/No)
South Africa (Host)	Newcastle Cogeneration (Pty) Ltd	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

South Africa signed up to accession of the Kyoto Protocol on 31 July 2002.

The project proponent is Newcastle Co-generation (PTY) Limited, which is currently a wholly-owned South African subsidiary of IPSA Group PLC.

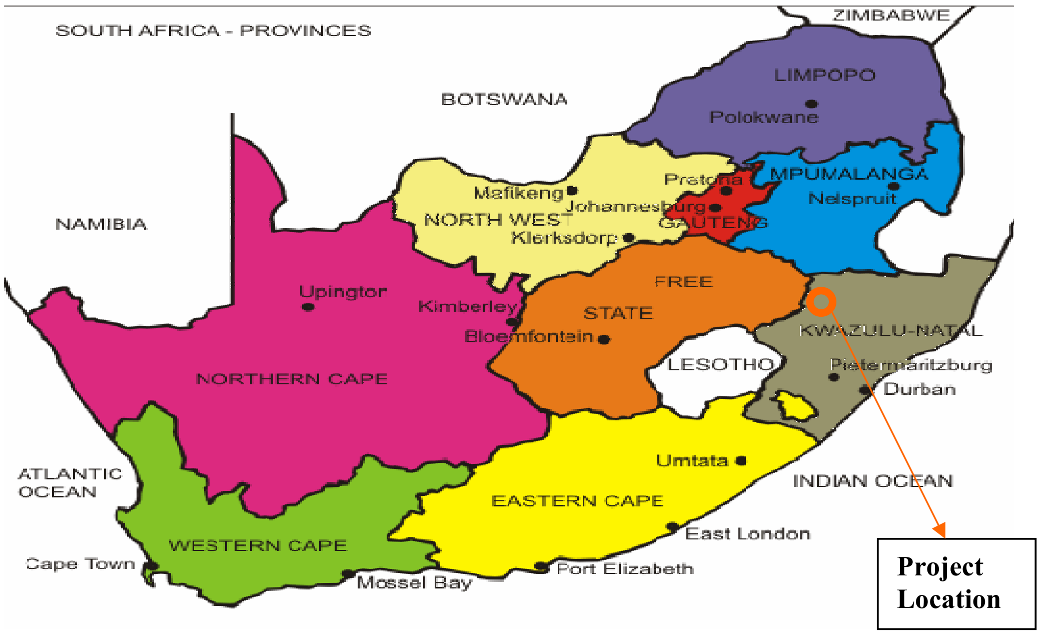
A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The project activity is located at the Karbochem Facility site in an industrial area south-east of central Newcastle, KwaZulu-Natal, South Africa. The project address is:

Karbochem Industrial Facility
Lot 13660/1, Karbochem Road
Newcastle, KwaZulu-Natal
South Africa.

Figure 1: Map of South Africa showing project location



A.4.1.1. Host Party(ies):

Republic of South Africa

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

KwaZulu-Natal

A.4.1.3. City/Town/Community etc:

Newcastle

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity is located in Newcastle of the KwaZulu-Natal province of South Africa and its GPS coordinates are: 27° 46’ 58” Latitude South
29° 58’ 22” Longitude East

The new co-generation/combined heat and power (CHP) plant will be located on a vacant piece of land within the fenced confines of the existing Karbochem property.

Figure 2: Location map and aerial photograph of project site

KwaZulu-Natal Province

Aerial Photo of Karbochem Power Plant

A.4.2. Category(ies) of project activity:

Energy Industries (non-renewable sources)

A.4.3. Technology to be employed by the project activity:

The proposed plant is based on the SIEMENS pre-engineered basic concept for advanced GUD-blocks which are designed to provide safe, highly reliable, efficient and low cost electricity realised by using:

- gas turbine island
- simple pressure heat recovery steam generators and
- optimised amount of balance of plant (BOP) equipment (common auxiliaries)

The state of the art combined heat and power (CHP) cogeneration plant will have two power trains each consisting of one GEC-Alsthom European Gas Turbine turbine. It involves the installation of:

- 2 gas turbines (GT) of 5.1 MW nominal capacity;

- 1 steam turbine (ST) of 4.4 MW nominal capacity.

In addition, two 55ton/hour heat recovery boilers will utilise the waste heat from the gas turbines together with some additional gas firing to produce high pressure steam. Components are directly cooled by means of a cooling water system. Heat is transferred to the cooling water via component-heat exchangers.

The gas will be burned in the two 5.1 MWe GEC-Alsthom EGT gas turbines and the exhaust heat from these turbines will be recycled to fire two large boilers that, with some auxiliary firing, will produce high pressure steam.

Steam from the boilers will be split into two channels, one that feeds high pressure (20 bar) steam directly into the manufacturing facilities and another that feeds into a 4.4 MWe steam turbine. This turbine will in turn feed lower pressure (5 bar) process steam into the manufacturing facilities.

Brief description of the main components:

Gas turbine – the combustion turbine is a single-shaft machine of single-casing design which burns gas. It has the following features;

- Disk-type rotor with central tie bolt and radial serrations
- Two outboard bearings
- Generator drive at compressor intake end
- Axial exhaust diffuser

This combustion system has all the advantages of optimal combustion including;

- Low NO_x and CO emissions
- Low pressure drop
- High operating flexibility
- Fully symmetrical design utilising a small number of different shapes of heat shields
- Optimal size and number of burners
- Compact design with good accessibility

Generator – this is a two-pole air cooled generator coupled to the gas turbine at the cold (compressor) end side. It operates as a motor in the converter mode and is fed by the start-up frequency converter. The benefits of the generator are;

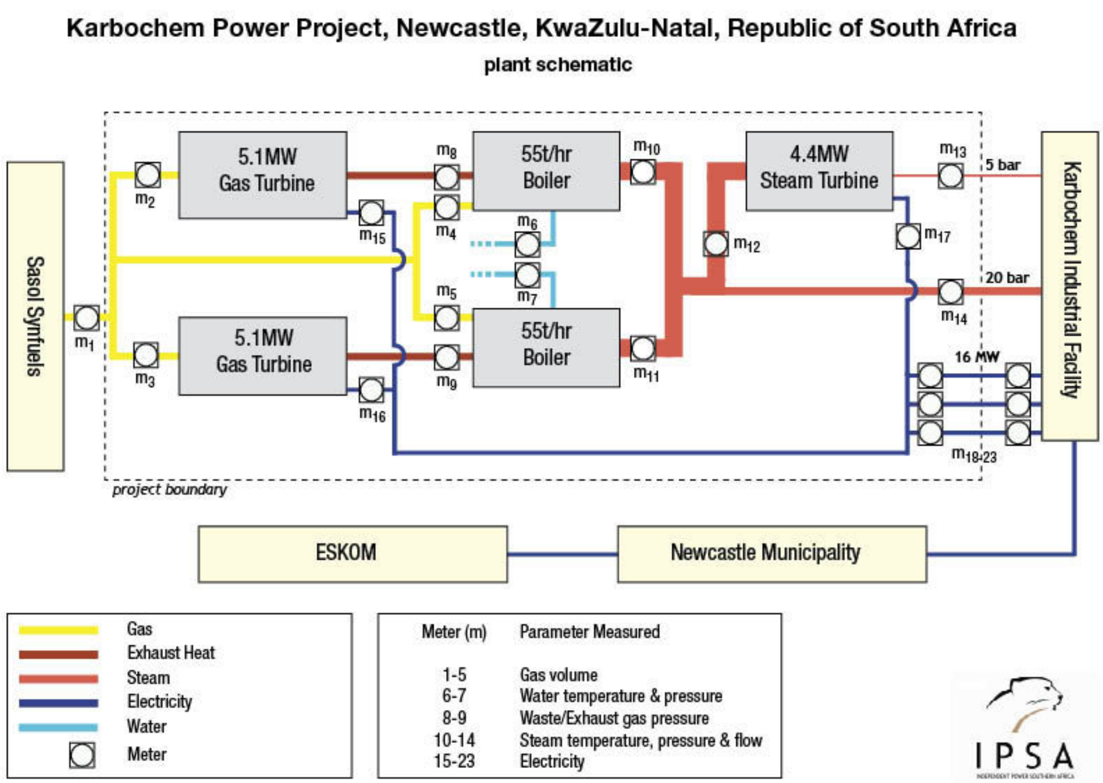
- High efficiency
- Post impregnation of stator winding
- Low maintenance costs

Heat Recovery Steam generator (HRSG) – this is a simple conversion natural-circulation drum-type generator which generates steam in an intermediate-pressure section. It is designed for outdoor installation and there is no bypass stack between it and the gas turbine. The HRSG is equipped with an exhaust stack at the end.

Instrumentation and Control (I&C) – the digital control system 'TELEPERM XP' has been developed by SIEMENS to meet the technical, economical and environmental aspects of the modern power plant. It will be used for almost the entire power plant including turbines, steam generator and main systems. The system is open for interfaces to automation systems supplied by other vendors and to a possible extension of the plant in the future.

Electrical Plant – this is designed to ensure sufficient reliability of the plant's auxiliary power supply in all modes of operation, using very reliable and well proven standardised equipment. The electrical and electronic equipment is arranged in container-type enclosures (Power Control Centre PCC) which are preassembled and factory tested.

Figure 3: Schematic Diagram of the Co-generation Process



The scope of this project encompasses the engineering, procurement, construction, erection, commissioning and handing over of the power plant. In addition, a specific training program has been arranged for the staff of Newcastle Co-generation (PTY) Ltd upon the implementation of the co-generation plant. This will contribute to capacity building of the plant engineers and will also ensure economic and safe power plant operation and maintenance.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

The crediting period chosen for the proposed Karbochem combined heat and power project is 7 years renewable 3 times. The total emission reductions to be achieved by the project are estimated to be approximately **1 640 356** tCO_2 over the first 7 years of the crediting period with estimates of 234 336 tCO_2e/yr (tonnes carbon dioxide equivalent per year).

The calculated average annual emission reductions achievable are conservative estimates based on an estimated grid emission factor of 1.270 tCO_2/MWh. This factor was calculated according to the "Tool to calculate the emission factor for an electricity system". The actual CERs will be calculated ex-post following the fulfilment of the project monitoring activities.

Table 1: Estimated emissions reductions

Year	Estimated emission reductions (tonnes CO_2)
2009	234 336
2010	234 336
2011	234 336
2012	234 336
2013	234 336
2014	234 336
2015	234 336
Total estimated reductions (tonnes CO_2e)	**1 640 352**
Total number of crediting years	7
Annual average over crediting period of estimated reductions (tonnes CO_2e)	234 336

A.4.5. Public funding of the project activity:

There is no public funding for the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline and monitoring methodology is **AM0049**[1] - Version 02 *"Methodology for gas based energy generation in an industrial facility"*.

It draws upon; Version 05 of the "Tool for Demonstration and Assessment of Additionality" and Version 01 of the "Tool to Calculate the emission factor for an electricity system".

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

The AM0049 baseline and monitoring methodology is applicable as the project activity meets all applicability requirements as demonstrated below;

The methodology is applicable to project activities that install gas based energy generation (electricity and/or steam/heat) system at an existing industrial facility to meet its own energy demand.

The Karbochem combined heat and power project involves the installation of a co-generation system including gas turbines at an already existing industrial site (the Karbochem industrial facility) and the power generated will meet its energy demands.

The methodology is applicable to the following types of project activities that:

1. *Generate on-site electricity and/or steam*
    a. *in separate generation systems on-site in an industrial facility; or*
    b. *co-generate electricity and steam on-site in an industrial facility;*

The project will produce electricity and steam on-site using a cogeneration system.

2. Generate non-steam thermal energy in one or several element processes

The two 5.1 MW gas turbines produce heat in addition to electricity

3. Switch from use of coal or oil to gaseous fuel for generating energy

---

[1] The approved baseline and monitoring methodology AM0049 is available on the UNFCCC-CDM website at http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_THIINLBNRN0K0UW871RO64UL72S2UF

The fuel switch is from coal to synthetic gas provided by Sasol Gas Ltd, also known as methane rich gas but referred to here as synthetic gas.

4. Use any of the following four technologies available for cogeneration of electrical energy and thermal energy: a) Topping cycle b) Bottoming cycle c) Topping cycle with steam turbine d) Topping cycle with gas turbine/engine applications

Topping cycle with gas engine applications is the technology employed by the project activity – Fuel is burned in a gas turbine, and the mechanical shaft power is used to drive an electrical generator. Waste heat from the gas turbine is captured and is sent to a waste heat boiler where, along with additional gas, it is used to produce steam for industrial processes.

Furthermore the following conditions are complied with by the project activity;

- The fuel used in the project activity is synthetic gas produced by a coal-to-liquid-products plant (henceforth referred to as 'project fuel');
- The existing industrial facility, where the project activity is implemented, prior to the project activity, meets its thermal energy demand through self generation;
- Prior to the implementation of the project activity, only coal was used in the steam generation facilities and/or element processes;
- 'Project fuel' (synthetic gas) is sufficiently available in the region or country, e.g. future 'project fuel' based energy generation additions, comparable in size to the project activity, are not constrained by the use of project fuel in the project activity;
- Regulations/ programs do not constrain the facility from continuing to use the fossil fuels used prior to the implementation of the project activity;
- Regulations do not require the use of specific fuel, including the 'project fuel', in steam and/or power generating facilities and/or element processes;
- Regulations do not stipulate a change or upgrade in technologies at the time of the project activity;
- There is no increase in the output capacity or lifetime of the steam or element processes during the crediting period (i.e. emission reductions are only accounted for to the end of the lifetime of the relevant equipment). There is no planned expansion in capacity of energy generation on-site during the crediting period;
- The project activity does not lead to a change in the quality of steam/heat required by the processes of the industrial facility where the project is implemented.
- The geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available; and
- For the coal-to-liquids plant producing the project fuel:
  a. There is no capacity expansion of the synthetic fuel production plant based on fuels other than natural gas.
  b. Data on fuel inputs and product outputs from the synthetic fuel plant are available to calculate energy and/or carbon balance for the synthetic fuel production plant.

All of the above points are met by the project activity. The final point is true of the project fuel, synthetic gas by Sasol Gas Ltd and produced in the synfuel plant of Sasol Synfuel (Pty) Ltd.

B.3. Description of the sources and gases included in the project boundary

Table 2: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/ Explanation
Baseline	Heat (steam and non-steam) generation in baseline	CO_2	Yes	Main emissions source
		CH_4	No	Minor source
		N_2O	No	Minor source
	Power generation in baseline (grid based)	CO_2	Yes	Main emissions source
		CH_4	No	Minor source
		N_2O	No	Minor source
Project Activity	On-site fuel combustion due to project activity	CO_2	Yes	Main emissions source
		CH_4	No	Minor source
		N_2O	No	Minor source

See Figure 3 which indicates the project boundary by a dotted line. Sasol Synfuels (Pty) Ltd, the gas pipeline and the industrial facility all lie outside the project boundary.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The project activity involves a fuel switch (coal to synthetic gas) and a technology switch (coal fired boilers to cogeneration of steam and electricity) within the project boundary. Steps 1 to 4, according to Version 02 of AM0049, are applied to establish the most plausible baseline scenario for the generation of both power and heat. The key information and the data sources that were used in the determination of the baseline are included in Annex 3.

Step 1: Identify all realistic and credible alternatives to cogeneration systems
Step 2: Eliminate alternatives that are not complying with applicable laws and regulations
Step 3: Eliminate alternatives that face prohibitive barriers
Step 4: Compare economic attractiveness of remaining alternatives

Table 3: Summary of the steps to determine the baseline scenario for power generation

Step 1: Identify all realistic and credible alternatives to cogeneration systems	**Step 2: Complying with applicable laws and regulations?[2]**	**Step 3: Prohibitive barriers?[3]**	**Step 4: Relevant for comparison of economic attractiveness?[4]**
P1 Proposed project activity not undertaken as a CDM project activity	Yes. Not prohibited by any law or regulation.	Yes, there are investment barriers. The project does not provide a sufficient return on investment if it is undertaken without carbon finance (shareholder loans could not have been obtained). The only similar activity in South Africa is being carried out as a CDM project.	No
P2 On-site or off-site coal/oil fired co-generation plant	Yes. Not prohibited by any law or regulation.	None for an on-site coal fired co-generation plant	Yes for an on-site coal fired co-generation plant.[5]
P3 On-site or off-site coal/oil fired captive power plant	Yes. Not prohibited by any law or regulation.	Yes, there are technological barriers. The owners of the facilities that are off-taking the steam only have technical expertise in heat/steam generation and therefore are not able to develop a captive plant.	No
P4 On-site or off-site renewable energy based cogeneration plant	Yes. Not prohibited by any law or regulation.	Yes, there are prohibitive barriers as the only feasible renewable resource for a cogeneration plant would be biomass which is not available in sufficient or	No

[2] Step 2: Eliminate alternatives that are not complying with applicable laws and regulations, is undertaken (for both power and heat generation) by applying Sub-step 1b of the latest version of the “Tool for demonstration and assessment of additionality”.

[3] Step 3: Eliminate alternatives that face prohibitive barriers, is undertaken (for both power and heat generation) by applying step 3 of the latest version of the “Tool for demonstration and assessment of additionality”.

[4] Step 4: Compare economic attractiveness of remaining alternatives. The economic attractiveness without revenues from CERs is assessed for all alternatives by applying Step 2 of the latest version of the “Tool for demonstration assessment and of additionality”.

[5] In all cases off-site plant is not technically feasible as in order to provide low pressure steam from the cogeneration plant to the customer it is necessary to have the shortest distance over which to deliver steam. As well oil is more expensive than coal in South Africa and so is not relevant as the most cost effective alternative.

		consistent enough supply in the region to meet the demands of the facility for heat generation. Biomass use is widespread in RSA however this is primarily within households.[6]	
P5 On-site or off-site renewable energy based captive power plant	Yes. Not prohibited by any law or regulation.	Yes, other renewable electricity generating sources include solar, wind, biomass, hydro, and geothermal. For the purpose of industrial electricity generation these alternatives are not feasible because they are not available in sufficient supply in the region, and even if they were these sources are intermittent whereas the demand is constant.[7]	No
P6 Off-site fossil fuel based existing plant	Yes. Not prohibited by any law or regulation.	The local ESKOM plant in Newcastle (Ngagane) closed in 1990 due to economic reasons (maintenance expenses) and there are no other power plants in the region. There is also a 4 GW Eskom plant about 150 km away which supplies into the national grid. The closest captive plant is 350 km away in Richards Bay but they do not have additional capacity to supply to other industrial facilities.	No
P7 Electricity imported from Grid.	Yes. Not prohibited by any law or regulation.	None, the most likely future scenario for the facility would be to continue importing electricity from the grid.	Yes

Table 4: Summary of the steps to determine the baseline scenario for heat generation

[6] http://www.ukrenewables.com/documentation/MktSummarySAfrica.pdf

[7] Ibid.

Step 1: Identify all realistic and credible alternatives to cogeneration systems	Step 2: Complying with applicable laws and regulations?	Step 3: Prohibitive barriers?	Step 4: Relevant for comparison of economic attractiveness?
H1 Proposed project activity not undertaken as a CDM project activity	Yes. Not prohibited by any law or regulation.	Yes, there are investment barriers. The project does not provide a sufficient return on investment if it is undertaken without carbon finance (shareholder loans could not have been obtained). The only similar activity in South Africa is being carried out as a CDM project.	No
H2 On-site or off-site coal/oil fired cogeneration plant	Yes. Not prohibited by any law or regulation.	None for an on-site coal fired cogeneration plant.	Yes, for an on-site coal fired cogeneration plant.[8]
H3 On-site or off-site coal/oil fired element process.	Yes. Not prohibited by any law or regulation.	None for an on-site coal fired element process.	Yes, for an on-site coal fired element process. **Note: this is the same as alternative H6**.
H4 On-site or off-site renewable energy based cogeneration plant	Yes. Not prohibited by any law or regulation.	Yes, there are also prohibitive barriers for an on-site renewable energy based cogeneration plant. The only feasible renewable resource for this would be biomass which is not available in sufficient or consistent enough supply in the region to meet the demands of the facility for heat generation.	No
H5 On-site or off-site renewable energy based element process	Yes	Yes, there are also prohibitive barriers for an on-site renewable energy based element process. The only feasible renewable resource for an element process would be	No

[8] In all cases off-site plant is not technically feasible as in order to provide low pressure steam from the cogeneration plant to the customer it is necessary to have the shortest distance over which to deliver steam. As well oil is more expensive than coal in South Africa and so is not relevant as the most cost effective alternative.

		biomass which is not available in sufficient or consistent enough supply in the region to meet the demands of the facility for heat generation.	
H6 On-site coal/oil fired element process/es.	Yes	None, the most likely future scenario for the facility would be to continue firing the boilers with coal in order to generate steam.	Yes, for an on-site coal fired element process. **Note: this is the same as alternative H3**.
H7 Any other source such as district heat	Yes	Yes, there are no district heating systems in RSA.	No
H8 Other heat generation technologies (e.g. heat pumps or solar energy)	Yes	Yes, other heat generating sources include solar and geothermal. For the purpose of industrial heat generation, these sources are not practical alternatives because of the amount of heat required and the fact that it is required on a continuous basis whereas these sources are intermittent.	No

Step 4: Compare economic attractiveness of remaining alternatives

Apply step 2 of the latest version of the "Tool for demonstration and assessment of additionality" agreed by the CDM Executive Board to compare the economic attractiveness for all alternatives that are remaining after step 3.

Alternatives for Power Generation

As it is not possible to determine any of the possible investment indicators NPV/IRR/ROI/payback period for electricity from the grid, the levelised cost of electricity production[9] will be used in order to compare the economic attractiveness of the viable alternatives for power generation.

The levelised cost of electricity for Eskom is 0.13 Rand /kWh[10].

Table 5: Parameters used in financial assessment of viable alternatives for power generation

Parameter	P2 On-site coal fired co-generation plant	P7 Electricity imported from Grid

[9] Calculated according to the IEA methodology in http://www.iea.org/textbase/nppdf/free/2005/ElecCost.pdf

Construction Period	3 years	N/A It is not possible to obtain this information for electricity imported from the Grid. Levelised cost of electricity production will be used instead.[10]
Project Lifetime	15 years	N/A
Capital Expenditure	102 754 288 Rand (16.2% of total capital costs of 634M Rand can be attributed to electricity generation)	N/A
Fuel Cost	300 Rand / tonne	N/A
Coal Used	128 742 tonnes	N/A
Fuel Expenditure	6 259 681 Rand (16.2% of total fuel expenditure can be attributed to electricity generation)	N/A
Electricity Generation	120 625 MWh	N/A
Discount Rate	15%	N/A
O&M Expenditure	176 006 Rand	N/A
Levelised Cost of Production	0.204Rand/kWh	0.13 Rand /kWh

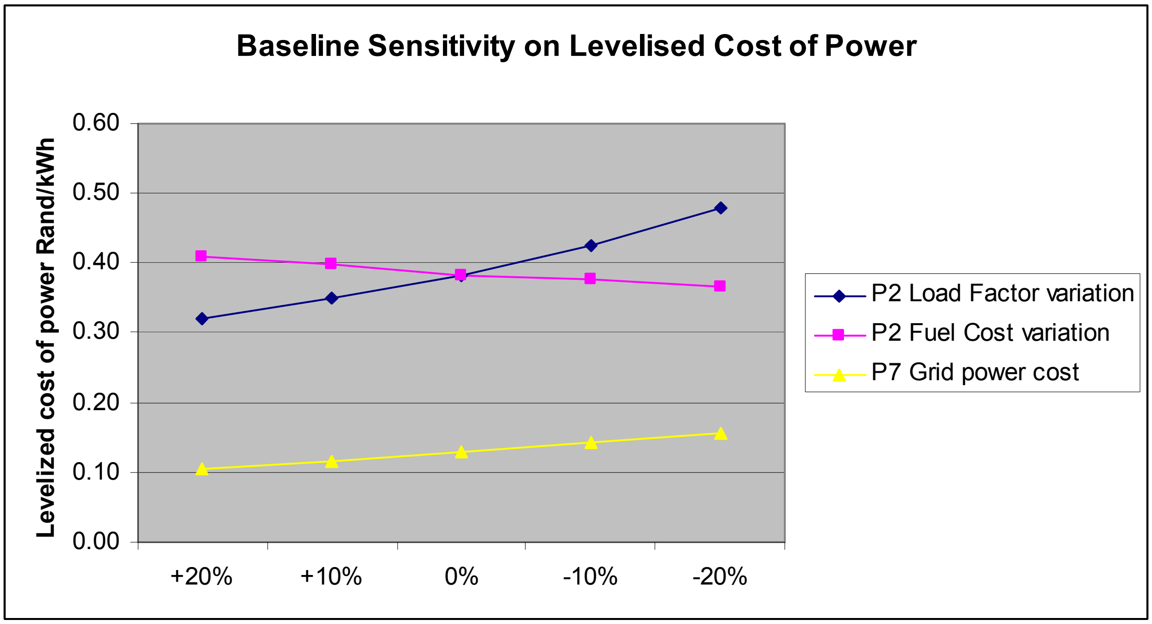
Based on the above parameters and the levelised cost calculation formula, the levelised cost of each plausible generation technology can be calculated, and a sensitivity analysis performed:

[10] Information for the calculation of Eskom's Levelised Cost of Electricity is based on the Mega Flex Tariff which is in place for the Karbochem Industrial Site. Background data can be found in Eskom's 2007-2008 Tariff Book: http://www.eskom.co.za/live/content.php?Category_ID=287

Table 6: Results and Sensitivity Analysis for Levelised Cost Calculations:

		Parameter change				
	Levelised Cost	(+)20%	(+)10%	0%	(-)10%	(-)20%
P2 On-site coal fired co-generation plant	LOAD FACTOR	0.17	0.19	0.20	0.23	0.26
P2 On-site coal fired co-generation plant	FUEL COST	0.22	0.21	0.20	0.20	0.19
P7 Electricity imported from grid	GRID COST	0.10	0.12	0.13	0.14	0.16

Figure 4: Variation of levelised cost of power:



According to version 02 of AM0049, the most cost-effective scenario (i.e. with the most attractive investment indicator) should be selected as the baseline scenario alternative.

As can be seen above, with changes in the critical variables of load factor and fuel cost, the on-site coal fired co-generation plant is always significantly more expensive than the supply of grid electricity. P7, electricity imported from grid, is therefore selected as the baseline for electricity.

Alternatives for Heat/Steam Generation

In a similar fashion to the electricity, alternatives for steam generation are compared using the levelised cost of heat production, measured in Rand per GJ heat produced over equipment lifetime.

Table 7: Parameters used in financial assessment of viable alternatives for heat generation

Parameter	H2 On-site coal fired cogeneration plant	H6 (and H3) On-site coal fired element process/s.
Investment requirements (major equipment cost, required construction work, installation)	531 245 712 R (83.8% of total capex of 634m, heat-electricity split as per Carron calculation)	Minimal. Karbochem confirm that old boilers could be maintained for duration of the project if necessary. Costs included in O&M cost.
A discount rate appropriate to the country and sector	15% (Newcogen FSR)	15% (Newcogen FSR)
Efficiency of each element process	95% (Carron Study)	65% (Karbochem proprietary data)
Current price and expected future price (variable costs) of fuel	12.75R (increase at 2.75%/yr) – (Carron study)	12.75R (increase at 2.75%/yr) – (Carron study)
Operating costs for each fuel (especially handling/treatment costs for coal)	Included in overall O&M cost	Included in overall O&M cost
Lifetime of the project, equal to the remaining lifetime of the existing heat generation facility	15 years	15 years
Other operation and maintenance costs	7,200,010 (Newcogen study)	9,950,000 (Karbochem)
Levelised cost of heat production	54.79 rand / GJ heat	30.12 rand / GJ heat

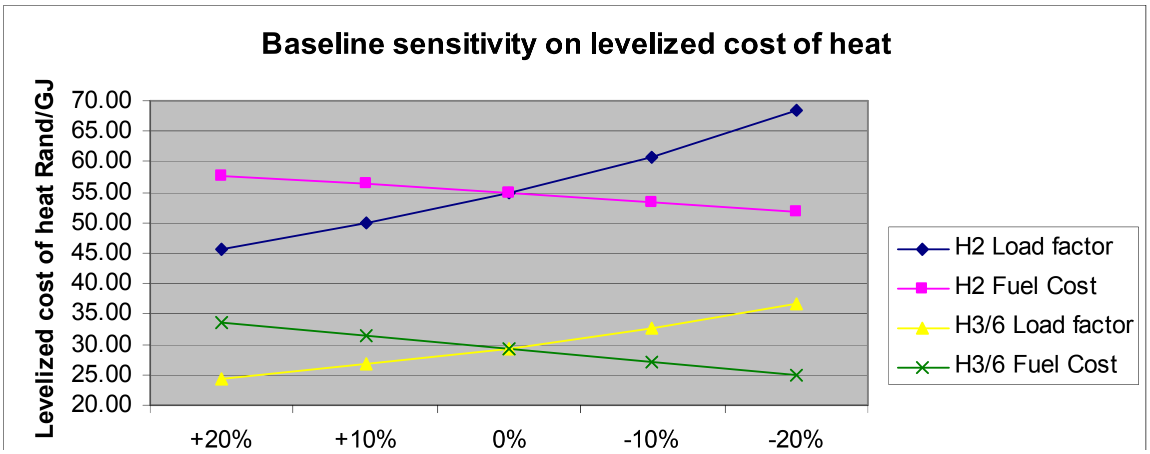
With the above assumptions, the cheapest option is clearly the on-site coal fired element process. As per AM0049, sensitivity analysis was carried out on core assumptions: load factor of plant and fuel cost.

Table 8: Sensitivity analysis of heat baseline

		Levelised Cost of Heat Rand/GJ				
		(+)20%	(+)10%	0%	(-)10%	(-)20%
H2 On-site coal fired co-generation plant	LOAD FACTOR	45.66	49.81	54.79	60.88	68.48

H2 On-site coal fired co-generation plant	FUEL COST	57.80	56.29	54.79	53.28	51.77
H6/3 On-site coal fired element process	LOAD FACTOR	24.42	26.65	29.32	32.58	36.65
H6/3 On-site coal fired element process	FUEL COST	33.70	31.52	29.32	27.13	24.93

Figure 5



The sensitivity analysis shows that under a range of reasonable variations in assumptions, the baseline option of coal-fired element process remains the cheapest. Scenario H6 is therefore chosen as the baseline scenario for steam production.

The methodology AM0049 is applicable because the baseline scenario is on-site generation of heat using coal (H6) and import of electricity from grid (P7) throughout the crediting period.

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 CDM project activity (assessment and demonstration of additionality):

The assessment of additionality shall be through the following two steps:

Step 1: Investment comparison analysis

As demonstrated above in Section B.4. the identified baseline scenario is the continued on-site generation of heat/steam using coal, and the import of electricity from the grid.

A benchmark analysis has been undertaken using the levelised cost of service (Rand/kWh for electricity production and Rand/GJ for steam production) in order to demonstrate that the project activity undertaken without the CDM is economically less attractive than the baseline scenario.

Table 9: Levelised cost of electricity for baseline and project scenarios

Parameter	In Baseline (Grid Electricity)	Project Undertaken Without CDM
Construction Period	N/A (as above)	1
Project Lifetime	N/A	15
Capital Expenditure	N/A	37.5 million Rand (30% of total capital costs)
Fuel Cost	N/A	Price supplied by Sasol Gas Ltd, assumed to increase 2.5% per year
Gas Used	N/A	310 884 GJ (in 2007 - 30% of total gas used)
Electricity Generation	N/A	127 896 MWh
Discount Rate	N/A	15%
O&M Expenditure	N/A	3 085 719 Rand (in 2007)
Levelised Cost of Electricity Production	0.13 Rand /kWh	0.16 Rand/kWh

Table 10: Levelised cost of heat/steam for baseline and project scenarios

Parameter	In Baseline (Coal Fired Boilers)	Project Undertaken Without CDM
Construction Period	1	1
Project Lifetime	15	15
Capital Expenditure	Minimal (incorporated into O&M)	87.5 million Rand (70% of total capital costs)
Fuel Cost	12.75 Rand/GJ (2007) increasing 2.5% per year	Price supplied by Sasol Gas Ltd, assumed to increase 2.5% per year
Coal / Gas Used	2 318 400 GJ coal (in 2007, from Karbochem)	2 561 554 GJ gas (in 2007 - 70% of total gas used)
Heat / Steam Generation	1 506 960 GJ (calculated from quoted efficiency)	494 940 tonnes total steam, (2 397 067 GJ based on enthalpy calcs)
Discount Rate	15% (Newcogen FSR)	15% (Newcogen FSR)
O&M Expenditure	9 950 000 (2007) increasing 2.5% per year	7 200 010 Rand (in 2008) increasing 2.5% per year
Levelised Cost of Heat / Steam Production	29.32 Rand / GJ	39.95 Rand/ GJ

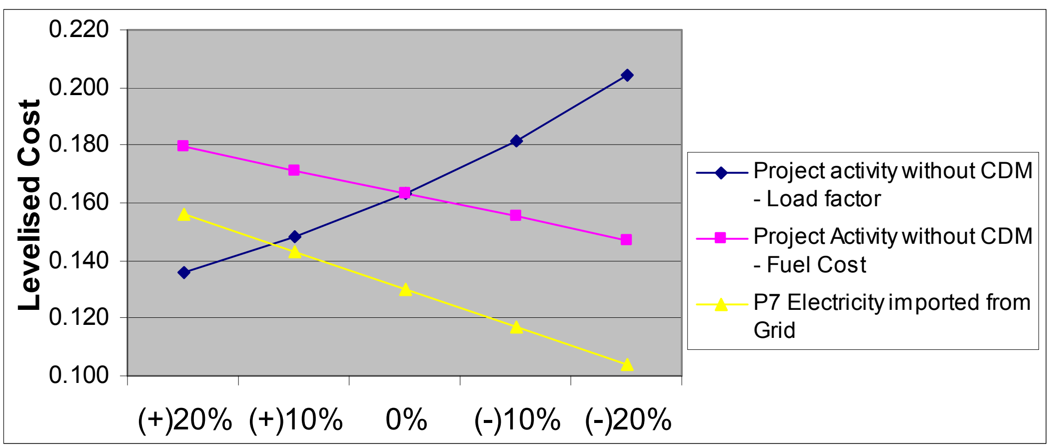
Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

A sensitivity analysis has been performed to test the robustness of the additionality conclusions drawn above. Both electricity and heat scenarios have been tested for variations of -20% to +20% in load factor and fuel cost. The levelised cost of grid electricity has also been tested for variations of 20% from the accepted central cost of 0.13 Rand / kWh.

Table 11 – additionality sensitivity analysis for power generation

	Levelised cost of power, Rand / kWh				
	(+)20%	(+)10%	0%	(-)10%	(-)20%
Project activity without CDM - Load factor	0.136	0.148	0.163	0.181	0.204
Project Activity without CDM - Fuel Cost	0.179	0.171	0.163	0.155	0.147
P7 Electricity imported from Grid	0.156	0.143	0.130	0.117	0.104

Figure 6 – Additionality sensitivity for power generation



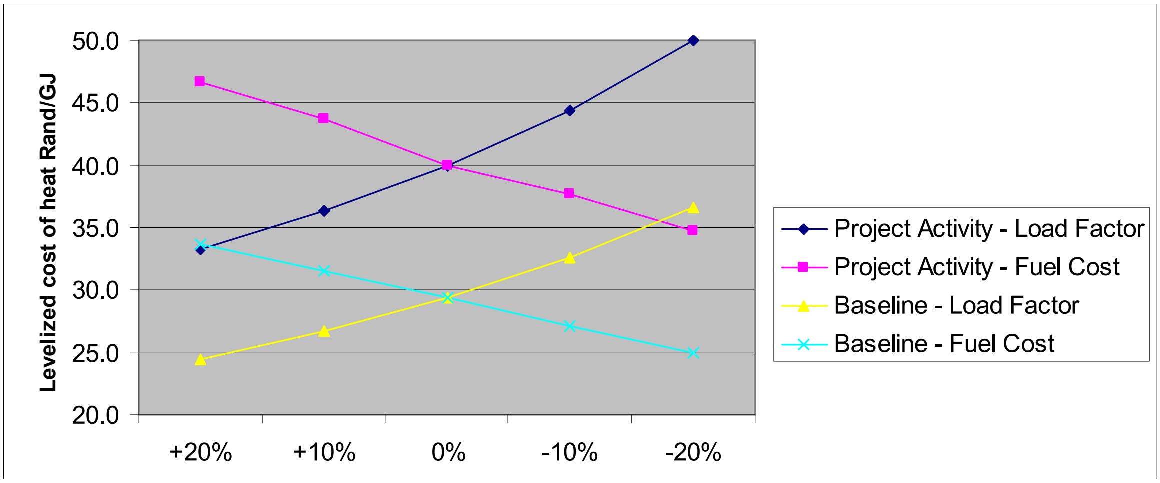
It is clear from the above analysis that the only situations where the project activity is more attractive than the cost of grid electricity is where grid electricity increases by more than 10% and either project load factor increases by more than 10% or project fuel costs decrease by more than 10%. These are both extremely unlikely scenarios. The FSR already assumes the plant operates at 100% of capacity so an increase on this is not likely. If grid electricity increases by 20% this would most likely be due to a significant increase in coal prices. If this occurs then the price of project fuel will also increase in line with market forces, rather than decrease, in price. The project activity is therefore additional for power generation.

Table 12 – Additionality sensitivity analysis for steam generation

	Levelised cost of heat production (Rand/GJ)				
	+20%	+10%	0%	-10%	-20%
Project Activity - Load Factor	33.30	36.32	39.96	44.40	49.95
Project Activity - Fuel Cost	46.66	43.68	39.96	37.73	34.76
Baseline - Load Factor	24.42	26.65	29.32	32.58	36.65

Baseline - Fuel Cost	33.70	31.52	29.32	27.13	24.93

Figure 7 - Additionality sensitivity analysis for steam generation



The analysis shows above that the only scenarios where the project activity could be more attractive than the baseline for heat generation is in the extreme cases where both project activity and baseline are imagined to fluctuate by 20% away from the expected value. These situations are extremely unlikely and are not realistic assumptions. For example, the project activity has already been modelled at full capacity in the FSR, so it is very unlikely to operate at a level significantly above this. However, even if that were to occur it would only be more attractive than the baseline if the fuel cost in the baseline increases by 20%. If fossil fuel costs had increased by 20%, it is even less likely that the project activity would operate at greater than capacity due to running costs. As such it can be concluded that the additionality of the project activity for heat generation is robust.

The two sensitivity analyses conclude that the project activity is less attractive than both selected baseline scenarios under all reasonable assumptions.

Step 2: Common practice analysis

Analyze other activities similar to the proposed project activity:

The project proposes to install new gas-fired co-generation technology which, despite being used in Europe, has only been applied in one other facility in South Africa, namely the Mondi Gas Turbine Co-generation Project in Richards Bay, South Africa. The Mondi Project is being undertaken as a CDM project.

Discuss any similar options that are occurring:

As outlined above, similar activities are not widely observed nor commonly carried out in South Africa.

The conclusion of this analysis is that the emissions reductions arising from the project activity are additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The approved baseline and monitoring methodology AM0049 defines the emission reduction by the project activity during a given year y (ER_y) as the difference between the baseline emissions (BE_y) and project emissions (PE_y) and leakage emissions (LE_y) i.e.

$ER_y = BE_y - PE_y - LE_y$

Where

ER_y = Emissions reductions due to the project

BE_y = Baseline Emissions

PE_y = Project Emissions

LE_y = Leakage Emissions

1. Determination of Baseline Emissions (BEy)

Baseline emissions represents the sum of the emissions from the generation of electricity and generation of heat for each element process. It is calculated as follows:

$BE_y = BE_{elect,y} + BE_{heat,y}$

$BE_{elect,y}$ = Baseline emissions from electricity generation during the year y (tCO_2e/yr)

$BE_{heat,y}$ = Baseline emissions during the year y in t CO_2e

1.1 Baseline electricity emissions

According to AM0049, the baseline electricity emissions ($BE_{elect,y}$) is calculated by multiplying the electricity generated by all electricity generation units ($EG_{PJ,i,y}$) in the project boundary and CO_2 emission factor ($EF_{BL,CO2,y}$) for electricity. It is calculated as follows:

$$BE_{elect,y} = \frac{\sum_i EG_{PJ,i,y} \times EF_{BL,CO2,y}}{1 - TDL}$$

where:

$BE_{elect,y}$ = Baseline emissions from electricity generation during the year y (tCO_2e/yr)

$EG_{PJ,i,y}$ = Electricity generated by electricity generation unit *i* included in the project boundary in year y (MWh/yr)

$EF_{BL,CO2,y}$ = Emissions factor of electricity generated in the baseline year y (tCO_2e/MWh)

TDL = Transmission and distribution losses for electricity imported from the grid in the baseline, expressed as a fraction ($0<TDL<1$)

1.1.1 Determination of $EF_{BL,CO2,y}$

According to AM0049, the $EF_{BL,CO2,y}$ should be calculated *ex-post* using "Tool to calculate emission factor for electricity systems" (version 1). However, at this stage, the $EF_{BL,CO2,y}$ can only be estimated *ex ante*. And the $EF_{BL,CO2,y}$ will be calculated by estimating the Operating Margin (OM) and Build Margin (BM) emission factors of the South Africa grid, using a 50:50 weight ratio.

Step 1: Identifying the relevant electric power system

There is no delineation of the project electricity system published by the DNA of the host country, i.e. South Africa. According to the definitions in the methodology tool, the **project electricity system** and **connected electricity system** are identified as following:

The project electricity system is identified as the one owned by Eskom, which encompasses 95% of electricity transmitted through the grid. It is, by definition, 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..

There are no other **connected electricity systems** for this project, and thus no existence of electricity imports or exports.

Therefore the project electricity system, owned by Eskom, is used as the grid boundary by default.

Step 2: Selecting an operating margin (OM) method:

Four options are available to determine EF_{OM} :
a) Simple OM
b) Simple Adjusted OM
c) Dispatch Data Analysis OM
d) Average OM

Option c) can not be used due to the lack of data and the prohibitive cost of processing such data, should it become available.

Option b) is also not possible due to the fact that the draw load duration curve is not available.

The possible next options are option a) and option d). The Average OM method (option d) should only be used in case that it is not possible to apply the Simple OM method. However, for the Simple OM method the low-cost/must-run power plants have to be identified and the Simple OM method can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in 1) average of the five most recent years, or 2) on long-term average for electricity production.

Option a), Simple OM method, can be used according to criteria 2) from the above, as low-cost/must-run resources (i.e. hydro, bagasse and nuclear in the South African grid) have always represented less than 50% of the electricity generation on the grid.

For the simple OM, the emissions factor can be calculated using either the *ex-ante* or *ex-post* approach. In this case the *ex-ante* option is used as follows:

• *Ex ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

The most recent data for electricity generation and fuel consumption from ESKOM power stations, as well as for electricity generation from municipal and private sources can be found in 2003, 2004 and 2005 as attached in Annex 3, for which the *ex ante* option shall be used.

Finally, there are no power plants registered as CDM project activities in the grid electricity system.

Step 3: Calculating operating margin emission factor according to the selected method:

The simple OM emission factor ($EF_{grid, OMsimple, y}$) is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generation power plants serving the system, excluding low-cost/must-run power plants/units. It may be calculated:

• Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or

• Based on data for net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or

• Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C)

Option A cannot be used because not all fuel consumption data is available for each power plant/unit from the grid of the year 2003, 2004 and 2005.

Option C should only be used if the necessary data for option A and option B is not available.

Option B is therefore used and $EF_{grid, OMsimple, y}$ is calculated using the formula:

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

Where:

$EF_{grid, OMsimple, y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m, y}$ = Net quantity of electricity generated and delivered to the grid by power plant 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 = Three most recent years, i.e. 2003, 2004 and 2005, for which data is available at time of submission of the CDM-PDD to the DOE for validation in this project, where *ex ante* option is used.

Each power unit *m* within the Eskom power plants treated by option B1, given the data for its electricity generation and fuel consumption is available on the ESKOM website for years 2003, 2004 and 2005, so its emission factor should be determined as follows:

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

where:

$EF_{EL,\,m,\,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,\,m,\,y}$ = Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,\,y}$ = Net calorific value (energy content) 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 plant unit *m* in year *y* (MWh)
m = All power units serving the grid in year *y* except low-cost/must-run power units
i = All fossil fuel types combusted in power unit *m* in year *y*
y = Three most recent years, i.e. 2003, 2004 and 2005, for which data is available at time of submission of the CDM-PDD to the DOE for validation in this project, where *ex ante* option is used.

And each power unit *m* from municipal and private sources is calculated by option B2, given the data for its electricity generation and fuel types used is available of year 2003, 2004 and 2005, its emission factor is determined based on the CO_2 emission factor of fuel type used and the efficiency of the power units, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,\,m,\,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,\,i,\,y}$ = CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$\eta_{m,\,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (%)
m = All power units serving the grid in year *y* except low-cost/must-run power units
i = All fossil fuel types combusted in power unit *m* in year *y*
y = Three most recent years, i.e. 2003, 2004 and 2005, for which data is available at time of submission of the CDM-PDD to the DOE for validation in this project, where *ex ante* option is used.

The most conservative (highest) efficiency values of $\eta_{m, y}$ are taken for coal-fired stations, given by Annex I in "Tool to calculate the emission factor for an electricity system", at 37% for power plants commissioned before 2000. For gas turbine stations commissioned before 2000, an efficiency value $\eta_{m, y}$ of 37.5% is taken.

The values and sources of all data used are given in Annex 3.

Step 4: Identifying the cohort of power units to be included in the build margin:

The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity. And the sample group of power units *m* used to calculate the build margin consists of the set that comprises the larger annual generation of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Option (a) is used to select the BM sample group *m*, i.e. the set of five power units that have been built most recently. This represents 36% of total power generation which is therefore higher than the 20% required level (in MWh). Details of all power unit commissioning dates and power capacity can be found in Annex 3.

Note: Using 2005 data to estimate the build margin underestimates the actual Build Margin emission factor, as the trend in RSA is to put back into use old, inefficient coal-fired power plants that had been shut down decades ago (Eskom 2006). This is due to "a sharp increase in the demand for electricity"; any effort to reduce this demand, such as the one undertaken in the project, could therefore directly avoid the production of electricity from these marginal plants (both in terms of operating margin and build margin), whose electricity production is more carbon intensive than any other plant on the grid.

In terms of vintage of data, project participants can choose between one of the following two options:

- *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 submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

- *Option 2*. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is used to calculate the build margin emission factor ($EF_{grid, BM, y}$), based on the most recent information available on units already built for sample group of power units *m*, for year 2005 (see Annex 3).

Step 5: Calculating the build margin emission factor:

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

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

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, which is for year 2005 in this case.

The CO_2 emission factor of each power unit *m* ($EF_{EL, m, y}$) should be determined as per guidance in step 3(a) for the Simple OM, using option B1, B2, B3 in the methodology tool, using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin, i.e. using exactly the same calculation method as described in Step 4 for calculation of operating margin emission factor, for year 2005 in this case.

Step 6: Calculating the combined margin emission factor:

The combined margin emissions factor ($EF_{grid, CM, y}$) is calculated as follows:

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

Where:

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

And the default values of $w_{OM} = 0.5$ and $w_{BM} = 0.5$ is used for the first crediting period.

1.2 Baseline heat emissions

There are two plausible project case scenarios for steam/heat generation;
(i) Scenario 1: Fuel switch in element process/es, which generates same amount of heat/steam as that in the baseline using the project fuel
(ii) Scenario 2: Heat is generated in cogeneration unit, which displaces the element process in the baseline

The case for this project activity is a combination of both scenarios as the co-generation system uses both waste heat (30%) and gas (70%) for steam generation.

It is calculated as follows:

$$BE_{heat,y} = \sum_i FF_{baseline,i,y} \times NCV_{FF,i} \times EF_{FF,CO2,i}$$

Where:
$BE_{heat,y}$ = Baseline emissions during the year y in t CO_2e
$FF_{baseline,i,y}$ = Quantity of coal or oil that would have been combusted in the absence of the project activity in the element process i during the year y in a volume or mass unit
$NCV_{FF,i}$ = Average net calorific value of coal or oil that would have been combusted in the absence of the project activity in the element process i during the year y in TJ per volume or mass unit
$EF_{FF,CO2,i}$ = CO_2 emission factor of coal or oil type that would be combusted in the absence of the project activity in the element process i in t CO_2/TJ

Scenario 1:

$$FF_{baseline,i,y} = FF_{project,i,y} \times \frac{NCV_{PF,y} \times \varepsilon_{project,i,y}}{NCV_{FF,i} \times \varepsilon_{baseline,i,y}}$$

Where:
$FF_{project,i,y}$ = Quantity of 'project fuel' combusted in the *element process i* during the year y in m³
$NCV_{PF,y}$ = Average net calorific value of the 'project Fuel' combusted during the year y in TJ/m³
$NCV_{FF,I}$ = Average net calorific value of fossil fuel that would have been combusted in the absence of the project activity in the element process i during the year y in TJ per volume or mass unit. This is calculated as a weighted average of coal and slop oil according to historical proportions consumed.
$\varepsilon_{project,i,y}$ = Energy efficiency of the element process i in year y
$\varepsilon_{baseline,i,y}$ = Energy efficiency of the element process i when fired with coal/oil corresponding to the load factor of the elemental process i in year y.

Scenario 2:

Where heat (HR *project, i, y*) , that in absence of the project activity was generated by element process *i*, is generated from cogeneration (combined heat and power) the baseline fuel consumption is estimated as follows:

$$FF_{baseline,y} = \sum_i \frac{HR_{project,i,y}}{NCV_{FF,i} \times \varepsilon_{baseline,i,y}}$$

$HR_{project,i,y} = FR_{heat,i,y} \times (h_{heatout,i,y} - h_{heatin,i,y}) \times hrs_{i,y}$

Where:
$FF_{baseline,y}$ = Quantity of coal or oil that would have been combusted in the baseline in absence of the project activity in year y in mass units
$HR_{project,i,y}$ = Project heat that in the absence of the project activity would have been generated in element process *i* during year y in TJ
$FR_{heat,i,y}$ = Flow rate of heat carrier (e.g., air or steam or thermic fluid) generated in the Waste Heat Recovery Source (element process *i)* in kg/hrs
$h_{heatout,i,y}$ = Enthalpy of heat carrier at outlet of the waste heat recovery source (element process *i*), in TJ/kg
$h_{heatin,i,y}$ = Enthalpy of heat carrier at inlet of waste heat generating source (element process *i*), in TJ/kg.
$NCV_{FF,i}$ = Average net calorific value of the fuel type (coal or oil) that would be combusted in the absence of the project activity in the element process *i* during the year *y* in TJ per volume or mass unit.
$\varepsilon_{baseline,i,y}$ = Energy efficiency of the element process *i,* which would have been used in absence of the project activity using coal or oil respectively and corresponding to the load factor of elemental process in year *y*.
$hrs_{i,y}$ = Hours of operation of the waste heat generating source (element process *i*) where heat is generated (which would have been generated by coal or oil in absence of the project activity) in year *y*.

Energy Efficiency of Element Processes in the baseline and the project scenario

This methodology allows for two options to determine the baseline efficiency of the boiler used ($\varepsilon_{baseline,i,y}$) stated as follows:

Option A: Assume a constant efficiency of the element process and determine the efficiency, as a conservative approach, for optimal operation conditions (i.e. optimal load, optimal oxygen content in flue gases, adequate fuel viscosity, representative or favourable ambient conditions for the efficiency of the element process, including temperature and humidity, etc).

Option B: Establish an efficiency-load-function of the element process. The fuel consumption is then determined separately for discrete time intervals *t*, based on the actual monitored heat generation during each time interval *t* and the baseline efficiency corresponding to that heat generation, determined with the efficiency-load-function.

For this project activity, option A has been chosen because insufficient data is available to build an efficiency-load-function. This is conservative.

2 Determination of Project Emissions

Project emissions (PE_y) are CO_2 emissions from the combustion of project fuel in all element processes, stand alone electricity generation units or cogeneration unit. Project emissions are calculated as product of the quantity of project fuel combusted, net calorific value, and CO_2 emission factors for project fuel ($EF_{PF,CO2}$), as follows:

$$PE_y = FF_{project,\,y} \times NCV_{PF,\,y} \times EF_{PF\ CO2,\,y}$$

$$FF_{project\,,y} = \Sigma\, FF_{project,\,i,\,y} + \Sigma\, FF_{project,\,j\,,y}$$

Where:

$FF_{project,y}$ = Quantity of project fuel combusted in all element processes and electricity generation units during the year *y* in m³

$FF_{project,i,y}$ = Quantity of project fuel combusted in the element process *i* during the year *y* in m³

$FF_{project,j,y}$ = Quantity of project fuel combusted in the electricity/co- generator *j* during the year *y* in m³

$NCV_{PF,y}$ = Average net calorific value of the project fuel combusted during the year *y* in TJ/m³

$EF_{PF,CO2,y}$ = CO_2 emission factor of the project fuel combusted in all element processes in the year *y* in t CO_2/TJ

3. Leakage

According to methodology AM0049, the two sources of leakage to be considered are;
(1) Leakage due to fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of project fuel. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring.
(2) Leakage from upstream emissions related to the production of project fuel, if the project fuel is synthetic gas produced in a coal to liquid fuels plant.

Total leakage emissions during the year *y* in tonnes CO_2e is calculated as follows:

$$LE_y = LE_{US,y} + LE_{p,y}$$

Where:

$LE_{US,y}$ = Leakage emissions due to upstream emissions from fuel extraction, processing, liquefaction, transportation (of both natural gas and synthetic gas) and re-gasification of natural gas in the year y in tonnes CO_2e

$LE_{p,y}$ = Leakage due to the production of synthetic gas in the year y in tonnes CO_2e.

Source 1 – Upstream emissions from fuel extraction, processing, liquefaction, transportation

Upstream emissions from the supply of natural gas and synthetic gas have been considered using standard factors as suggested in the Methodology AM0049 as follows:

$$LE_{CH4,y} = [\ FF_{proj,y} \text{ x } NCV_{NG,y} \text{ x } EF_{NG,upst,CH4} - \Sigma FF_{baseline,k,y} \text{ x } NCV_k \text{ x } EF_{k,upst,CH4}\ ] \text{ x } GWP_{CH4}$$

Where:

$FF_{proj,y}$ = quantity of fossil fuel consumed in the project (m^3 of synthetic gas)
$NCV_{NG,y}$ = calorific value of natural gas in TJ/m^3
$EF_{NGupst,CH4}$ = emissions factor for upstream natural gas, as quoted in AM0049

$FF_{baseline,k,y}$ = quantity of fossil fuel used in the baseline scenario (tonnes coal)
NCV_k = calorific value of coal used in baseline scenario (TJ/t)
$EF_{k,upst,CH4}$ = emissions factor for upstream emissions of natural gas from coal
GWP_{CH4} = Global Warming Potential of natural gas.

No Liquified Natural Gas (LNG) is used in the project so this has not been included in the upstream leakage calculation.

Source 2 – Upstream emissions from synthetic gas production is considered in this project activity. The gas used is synthetic gas produced at the synfuel plant of Sasol Synfuels (Pty) Ltd and supplied via Sasol Gas Ltd. Leakage emissions associated with the production of synthetic gas for year y in tCO_2e are calculated as follows:

$$LE_{PJ,y} = FF_{sg,pr,y} \times EF_{sg,y}$$

Where:
$FF_{sg,pr,y}$ = Quantity of synthetic gas consumed by project activity during the project in year y in TJ
$EF_{sg,y}$ = Emissions factor for the production of the synthetic gas used in the project activity in the year y in tonnes CO_2/TJ

Synthetic gas sold as pipeline gas by Sasol Gas Ltd represents a very small proportion of the total syngas production plant at the Secunda plant; the vast majority of syngas is used for production of liquid fuels and other products. The plant is economically driven by fuels production and syngas is a co-product. In this way marginal increases in syngas offtake for the pipeline gas market are absorbed in the overall plant balance and do not lead to increased coal throughput. For this reason the marginal approach to leakage emissions has been followed. This will be proven *ex-post* during the crediting period.

Therefore:

$$EF_{sg,\,prd,\,y} = \frac{((Q_{NGin,PJ,y} * EF_{NG} - \sum FF_{SGout,PJ,i,y} * EF_{SG,i}) - (Q_{NGin,Bly} * EF_{NG} - \sum FF_{SGout,BL,i,y} * EF_{SG,i}))}{(\sum FF_{SGout,PJ,i,y} - \sum FF_{SGout,BL,i,y})}$$

where:
$EF_{sg,\,prd,y}$ = Emission factor for production of synthetic gas used by the project in year y.
$Q_{NGin,PJ,y}$ = The sum of all natural gas used in the synthetic gas production processes during the project in year y in TJ
EF_{NG} = The emissions factor of natural gas in tCO_2/TJ
$\Sigma FF_{SGout,PJ,i,y}$ = The total quantity of synthetic gas produced from natural gas during the project in year y in TJ
$EF_{SG,i}$ = The emissions factor for synthetic gases in tCO_2/TJ
$Q_{NGin,BL,i,y}$ = Quantity of natural gas consumed by synfuel plant prior to project implementation in TJ
$\Sigma FF_{SGout,BL,i,y}$ = The total quantity of synthetic gas produced from natural gas prior to project implementation in TJ

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

Data and parameters not monitored

ID Number:	1
Data / Parameter:	**$EF_{CO2, coal}$, $EF_{CO2 slop}$**
Data unit:	tonnes CO_2/TJ
Description:	Emissions factor for fossil fuel in baseline (coal and slop oil)
Source of data used:	IPCC data (2006) for coal based on description from Karbochem. Chemical composition of slop provided by Karbochem
Value applied:	94.6 tCO_2/TJ coal, 71.46 tCO_2/TJ slop
Justification of the choice of data or description of measurement methods and procedures actually applied :	Karbochem to provide one time paper record of emissions factor for coal and slop oil (hexane). If Karbochem is not able to provide an emissions factor for the fuels they will provide an accurate description so that IPCC 2006 data can be used. Information will be kept at the Newcogen site for the duration of the project.
Any comment:	The parameter will not be monitored if a default value is used. Used in the assessment of additionality.

ID Number:	2
Data / Parameter:	**$EF_{BL,CO2,y}$**
Data unit:	tCO_2/MWh
Description:	Emissions factor of electricity generated in the baseline year *y* (tCO2e/MWh)
Source of data used:	ESKOM and municipal/private statistics
Value applied:	1.27 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according to the required tool. Detail provided in Annex 3.
Any comment:	The lowest value of emission factor is used as defined in baseline emissions section.

ID Number:	3
Data / Parameter:	**$EF_{k,upstream,CH4}$**
Data unit:	tonnes CH_4/t
Description:	Fugitive CH_4 emissions associated with upstream fugitive methane emissions from production of the fuel type *k*
Source of data used:	IPCC figure from table 2 in AM0049

Value applied:	0.0134 tCH_4/t coal
Justification of the choice of data or description of measurement methods and procedures actually applied :	Application of IPCC figure to the Sasol synthetic gas production from the synfuel plant
Any comment:	Used in the calculation of leakage.

ID Number:	5
Data / Parameter:	$\mathbf{EF}_{\mathbf{NG,upstream,CH4}}$
Data unit:	tonnes CH_4/TJ
Description:	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of natural gas fuel supplied to final consumers
Source of data used:	IPCC figure from table 2 in AM0049
Value applied:	0.016 tCH_4/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	As specified in AM0049
Any comment:	Used in the calculation of leakage

ID Number:	6
Data / Parameter:	*EFCO2,upstream,LNG*
Data unit:	tonnes CH_4/TJ
Description:	Emission factor for upstream CO2 emissions due to fossil fuel combustion /electricity consumption associated with the liquefaction, transportation, regasification and compression of LNG into a natural gas transmission or distribution system
Source of data used:	Measured or default values
Value applied:	N/A
Justification of the choice of data or description of measurement methods and procedures actually applied :	No LNG in project activity or baseline.
Any comment:	Used in the calculation of leakage

ID Number:	7
Data / Parameter:	$\mathbf{EF}_{\mathbf{FF,CO2,i,,y}}$
Data unit:	tCO_2/TJ
Description:	GHG Emission factor of baseline fuel (coal and slop oil) used in element process

	i in absence of project activity.
Source of data used:	Karbochem to provide one time paper record of emissions factor for coal and slop oil (hexane and butadiene/styrene). EF calculated based on chemical composition of slop
Value applied:	94.60tCO_2/TJ coal 71.46tCO_2/TJ slop
Justification of the choice of data or description of measurement methods and procedures actually applied :	Coal from IPCC data based on Karbochem description. Slop oil calculated from chemical composition.
Any comment:	No comment

ID Number:	8
Data / Parameter:	$\varepsilon_{baseline,,i,y}$
Data unit:	%
Description:	Energy efficiency of the element process (boiler) with baseline fuel (coal)
Source of data used:	One time calculation based on a year of measurements of coal use and steam production data from Karbochem Ltd. calculated as (tonnes per hour) steam delivered to plants / tonnes (per hour of coal used).
Value applied	65%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Operational data from Karbochem
Any comment:	This is a non-monitored parameter because it is based on unchanging historical data.

ID Number:	9
Data / Parameter:	$\mathbf{NCV_{FF,i}}$
Data unit:	TJ/t
Description:	Net Calorific Value of fuel coal used in element process *i*
Source of data used:	Karbochem to provide one time paper record of net calorific value (NCV) for coal and slop oil (hexane).
Value applied	0.0243 TJ/t coal, 0.0440 TJ/t slop
Justification of the choice of data or description of measurement methods and procedures	If Karbochem is not able to provide NCVs for the fuels they will provide an accurate description so that IPCC 2006 data can be used.

actually applied :	
Any comment:	Standardised to the lower heating value. Slop figure calculated from chemical composition..

ID Number:	10
Data / Parameter:	$\mathbf{EF_{NG}}$
Data unit:	t CO_2/TJ
Description:	The emissions factor of natural gas (and energy utilities) in tCO2/TJ
Source of data used:	IPCC 2006 country-specific emission factor.
Value applied	55.83 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Application of the IPCC figure to the natural gas consumption by the synfuel plant
Any comment:	Information used to determine whether there is additional leakage from the synthetic fuel production plant.

B.6.3 Ex-ante calculation of emission reductions:

The emission reduction by the project activity during a given year y (ER_y) is calculated as the difference between the baseline emissions (BE_y) and project emissions (PE_y) and leakage emissions (LE_y) i.e.

$$ER_y = BE_y - PE_y - LE_y$$

1. Determination of Baseline Emissions (BEy)

$BE_y = BE_{elect,y} + BE_{heat,y}$

= 164 068.6 + 217 053.6

= 381 122.3 tCO_2e

1.1 Baseline electricity emissions

The baseline electricity emission factor is calculated as the grid emission factor $EF_{grid,CMe,y}$ (tCO_2e/MWh) for South Africa. It is estimated according to the "Tool to calculate emission factor for electricity systems" (version 1), following the procedure described in section B.6.1. Detail of data and sources used is provided in Annex 3. The following table gives the results of the calculation of operating margin, build margin and combined margin:

Table: 13

Results

EF	tCO_2/MWh
OM	1.217
BM	1.323
CM	1.270

Baseline electricity emissions are therefore:

$$BE_{elect,y} = \frac{\sum_i EG_{PJ,i,y} \times EF_{BL,CO2,y}}{1 - TDL}$$

where:

$EG_{PJ,I,y}$ = 127 896 MWh

$EF_{BL,CO2,y}$ = 1.270 tCO_2/MWh

TDL = 0.01

So

$BE_{elect,y}$ = 164 069 tCO_2

1.2 Baseline heat emissions

The case for this project activity is a combination of both scenarios as the co-generation system uses both waste heat and gas for steam generation.

It is calculated as follows:

$$BE_{heat,y} = \sum_i FF_{baseline,i,y} \times NCV_{FF,i} \times EF_{FF,CO2,i}$$ = 217 053.6 tCO_2e

$FF_{baseline,i,y}$ = 94 088 874

$NCV_{FF,i}$ = 0.02442 TJ/tonne

$EF_{FF,CO2,i}$ = 94.456 tCO_2/TJ

Scenario 1:

$$FF_{baseline,i,y} = FF_{project,i,y} \times \frac{NCV_{PF,y} \times \varepsilon_{project,i,y}}{NCV_{FF,i} \times \varepsilon_{baseline,i,y}}$$ = 97 576 834 tonnes

$FF_{project,i,y}$ = 49 899 056m3

$NCV_{PF,y}$ = 0.00003389TJ/m3

$NCV_{FF,i}$ = 0.00002442 TJ/m3

$\varepsilon_{project,i,y}$ = 0.916

$\varepsilon_{baseline,i,y}$ = 0.65

Scenario 2:

$$FF_{baseline,y} = \sum_i \frac{HR_{project,i,y}}{NCV_{FF,i} \times \varepsilon_{baseline,i,y}}$$ = 85 950 300.5 tonnes

$HR_{project,i,y} = FR_{heat,i,y} \times (h_{heatout,i,y} - h_{heatin,i,y}) \times hrs_{i,y}$ = 1364.46TJ

$FR_{heat,i,y}$ = 55 000 kg/hr
$h_{heatout,i,y}$ = 0.000003276 TJ/kg
$h_{heatin,i,y}$ = 0.000000444 TJ/kg
$hrs_{i,y}$ = 8,760 hrs/year
$NCF_{FF,i}$ = 0.00002442 TJ/tonne
$\varepsilon_{baseline,i,y}$ = 0.65

2 Determination of Project Emissions (PEy)

$PE_y = FF_{project,y} \times NCV_{PF,y} \times EF_{PF\,CO2,y}$ = 160 230 tCO_2

$FF_{project,y} = \Sigma FF_{project,i,y} + \Sigma FF_{project,j,y}$ = m^3

$FF_{project,i,y}$ = 49 899 056 m^3
$FF_{project,j,y}$ = 36 693 272 m^3
$NCV_{PF,y}$ = 0.00003389 TJ/m^3
$EF_{PF,CO2,y}$ = 54.60 tCO_2/TJ

3 Determination of Leakage

LE_y = $LE_{US,y} + LE_{p,y}$
= -14 431 + 987
= -13 442 tCO_2

Where :

$LE_{US,y}$ = Upstream leakage due to fugitive CH_4 emissions:

$LE_{CH4,y}$ = $[FF_{proj,y} \times NCV_{NG,y} \times EF_{NG,upst,CH4} - \Sigma FF_{baseline,k,y} \times NCV_k \times EF_{k,upst,CH4}] \times GWP_{CH4}$

= -14 431tCO_2

$FF_{proj,y}$ = 86 592 328 m^3
$NCV_{NG,y}$ = 0.0115 MWh/m^3
$EF_{NGupst,CH4}$ = 0.000576 tCO_{24} / MWh

$FF_{baseline,k,y}$ = 94 089 tonnes coal
NCV_k = 7.8 MWh/t
$EF_{k,upst,CH4}$ = 0.0018 tCO_2 / MWh
GWP_{CH4} = 21

And:

$LE_{p,y}$ = Upstream emissions from synthetic gas production, estimated for one year of operation prior to project activity
= $FF_{sg,pr,y} \times EF_{sg,y}$
= 987 tCO_2

$FF_{sg,pr,y}$ = 2 934.6 TJ
$EF_{sg\ prd,y}$= 0.344 tCO_2/TJ
Where :

$$EF_{sg,\ prd,y} = \frac{((Q_{NGin,PJ,y} * EF_{NG} - \sum FF_{SGout,PJ,i,y} * EF_{SG,i}) - (Q_{NGin,Bly} * EF_{NG} - \sum FF_{SGout,BL,i,y} * EF_{SG,i}))}{(\sum FF_{SGout,PJ,i,y} - \sum FF_{SGout,BL,i,y})}$$

and :
$Q_{NGin,PJ,y}$ = 22 423 TJ
EF_{NG} = 55.83 tCO_2/TJ
$\Sigma FF_{SGout,PJ,i,y}$ = 22 285 TJ
$EF_{SG,i}$ = 55.83 tCO_2/TJ

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

Year	**Estimation of project activity emissions** (tonnes CO_{2e})	**Estimation of baseline emissions** (tonnes CO_{2e})	**Estimation of leakage** (tonnes CO_{2e})	**Estimation of overall emissions reductions** (tonnes CO_{2e})
1	160 230	381 122	-13 444	234 336
2	160 230	381 122	-13 444	234 336
3	160 230	381 122	-13 444	234 336
4	160 230	381 122	-13 444	234 336
5	160 230	381 122	-13 444	234 336
6	160 230	381 122	-13 444	234 336
7	160 230	381 122	-13 444	234 336
Total	**1 121 610**	**2 667 854**	**-94 108**	**1 640 352**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**T&D Technical electricity transmission and distribution losses (TDL)**
Data unit:	%
Description:	Transfer and distribution losses associated with electricity import. Losses include technical electrical energy losses that are incurred during transmission & distribution.
Source of data to be used:	ESKOM: Retail Tariff Restructuring Plan Non-local-authority tariffs 2008/9, page 12. Information to be supplied by the grid electricity provider (ESKOM) or sources such as the national energy regulator (NERSA) or national or local data published
Value of data applied for the purpose of calculating expected	1%

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Recorded annually from publicly available information.
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	E&I Superintendent will retain a copy of Eskom's annually published tariff booklets (data is calculated by ESKOM and published on their website), or those of other sources (NERSA) if data is no longer available through ESKOM.
Any comment:	Tariff book available at http://www.eskom.co.za/content/Tariff%20Book%202008_9%20for%20website%20v2~1.pdf

Data / Parameter:	$\mathbf{FF_{project,i,y}}$
Data unit:	m^3
Description:	Annual quantity of project fuel (synthetic gas) consumed in element process *i (boilers)* in the project activity in any year y
Source of data to be used:	One fuel flow meter at project boundary (M1) and four inside project boundary (M2-5)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	49 899 056
Description of measurement methods and procedures to be applied:	Sasol manages the boundary meter (M1) and the meter readings are highlighted on invoices sent through to Newcogen. For the Newcogen meters (M2-5) data is continuously updated in the plant computer. All data will be kept on the plant computer server as electronic records for at least 5 years.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The E&I superintendent with verify that the readings from M1 match those of M2-5 by checking against data in the plant computer and against gas bills received from Sasol. For M2-5 meters will be re-calibrated and maintained if there is a discrepancy in these readings. Paper records of calibration will be kept for at least 2 years following verification.
Any comment:	

Data / Parameter:	$\varepsilon_{project,i,y}$
Data unit:	%
Description:	Energy efficiency of the element process (boilers) with project fuel (synthetic gas)
Source of data to be used:	Measure from data on site. Ex ante based on assumptions in the Newcogen FSR.
Value of data applied	91.6%

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Will be completed by the Plant Manager with a third party collecting the data. The efficiency will also be measured: between two maintenance activities; if the characteristics of the 'project fuel' change substantially during the project activity; if major retrofits or changes to the element process are undertaken that may affect the efficiency of element process; and at the renewal of a crediting period.
Monitoring frequency:	Efficiency will be measured annually once the plant is running.
QA/QC procedures to be applied:	A certified third party will undertake the testing.
Any comment:	No comment

Data / Parameter:	$EF_{PF,CO2,i}$
Data unit:	TJ
Description:	Emissions factor for project fuel (which is synthetic gas)
Source of data to be used:	Calculated from data supplied by Sasol Gas Ltd (supplier of project fuel)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	54.60 tCO_2/TJ
Description of measurement methods and procedures to be applied:	Existing measurements of gas composition done by Sasol Synfuels (Pty) Ltd at the syngas plant. Standardised measurement protocols and procedures will be used
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	No additional QA/QC procedures may need to be planned.
Any comment:	This is the same as the factor $EF_{SG,i}$

Data / Parameter:	**$NCV_{PF,y}$**
Data unit:	TJ/m^3
Description:	Net Calorific Value of Project Fuel (synthetic gas) used in element process in project scenario.
Source of data to be used:	Sasol submits monthly invoices which include records of the fuel Net Calorific Value (standardised to higher heating value HHV).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.00003389

Description of measurement methods and procedures to be applied:	Sasol monitoring of Net Calorific Value of its product (synthetic gas) according to standardised measurement protocols and procedures and in line with the specifications in the gas supply agreement
Monitoring frequency:	Included in monthly invoices from Sasol.
QA/QC procedures to be applied:	No additional QA/QC procedures may need to be planned.
Any comment:	Standardised to the lower heating value

Data / Parameter:	$h_{heatout,i,y}$
Data unit:	TJ/kg
Description:	Enthalpy of heat carrier at outlet of the waste heat generating source (element process *i*) that would have been generated in the element process by coal or oil in absence of the project activity, in TJ/kg
Source of data to be used:	Measured at Newcogen site through M10 and 11. Enthalpy calculated by the project proponent using Standard Steam tables
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.000003276
Description of measurement methods and procedures to be applied:	Steam temperature and pressure values will be continuously monitored and entered into the plant computer. Electronic records will be kept on the server for up to 5 years. Enthalpy will be calculated using this data and standard steam tables.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The temperature and pressure monitoring equipment will be calibrated and maintained as per best practice by the E&I Superintendent. Records of calibration will be kept for at least 2 years.
Any comment:	No comment

Data / Parameter:	$h_{heatin\ ,i,y}$
Data unit:	TJ/kg
Description:	Enthalpy of heat carrier at inlet of waste heat generating source (element process *i)* in TJ/kg.
Source of data to be used:	Water temperature and pressure are measured at Newcogen site through M6 and 7. Enthalpy will be calculated using this data and a model based on standard steam tables.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.000000444
Description of	Water temperature and pressure (M6 and 7) values will be continuously

measurement methods and procedures to be applied:	monitored and entered into the plant computer. Electronic records will be kept on the server for up to 5 years.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The temperature and pressure monitoring equipment will be calibrated and maintained as per best practice by the E&I Superintendent. Records of calibration will be kept for at least 2 years.
Any comment:	No comment

Data / Parameter:	$FR_{heat,i,y}$
Data unit:	kg/hrs
Description:	Flow rate of heat carrier (steam) generated in the Waste Heat Generating Source (element process *i).*
Source of data to be used:	Measured at Newcogen site through M10 and 11.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	55,000
Description of measurement methods and procedures to be applied:	Steam flow values will be continuously monitored and entered into the plant computer. Electronic records will be kept on the server for at least 5 years.
Monitoring frequency:	Continuous basis
QA/QC procedures to be applied:	The flow rate monitoring equipment will be calibrated and maintained as per best practice by the E&I Superintendent. Records of calibration will be kept for at least 2 years.
Any comment:	No comment

Data / Parameter:	$hrs_{i,y}$
Data unit:	Hours
Description:	Hours of operation of Waste Heat Generating Source (element process *i).*
Source of data to be used:	Measured at Newcogen site through M10 and 11.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8760
Description of measurement methods and procedures to be applied:	The hours of plant operation are calculated based on boiler pressure records (which are measured on a continuous basis and input into the plant computer). The plant will be considered to be operational when pressure (in one of the boilers) is above 20 bar.
Monitoring frequency:	Continuous basis

QA/QC procedures to be applied:	Electronic records will be kept on the server for at least 5 years.
Any comment:	No comment.

Data / Parameter:	$\mathbf{FF_{project,j,y}}$
Data unit:	m^3
Description:	Annual quantity of project fuel (synthetic gas) consumed in electricity generator/ cogenerator *j (gas turbine)* in the project activity in year y
Source of data to be used:	Measured at Newcogen site through M4 and 5.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	36 693 272
Description of measurement methods and procedures to be applied:	Fuel flow will be continuously measured, and the readings will be input into the plant computer.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	Electronic records will be kept for at least 5 years. This data will be cross checked by adding it to the readings from M2 and 3 and comparing it against both the readings from M1 and those on the Sasol Gas invoices. The meters will be subject to regular maintenance (in accordance with stipulation of the meter supplier), calibration and testing to ensure acceptable monitoring accuracy by the E&I Superintendent. Records of calibration will be kept for at least 2 years following verification.
Any comment:	The total fuel consumption should be monitored both at the supplier and the project end for cross-verification

Data / Parameter:	$\mathbf{EG_{PJ,y}}$
Data unit:	MWh
Description:	Cogeneration electricity supplied to the industrial plant
Source of data to be used:	Measured at Newcogen site through M18-20
Value of data applied for the purpose of calculating expected emission reductions in section B.5	127 896
Description of measurement methods and procedures to be applied:	ESKOM is responsible for monitoring all 6 meters (M18-23) and flags differences between main meters and check meters. ESKOM submits monthly meter reading as part of invoicing to Newcogen.

Monitoring frequency:	Continuous
QA/QC procedures to be applied:	ESKOM flags differences between main meters and check meters. Paper files of invoices will be kept at Newcogen and ESKOM for at least 5 years.
Any comment:	No comment

Data / Parameter:	$\mathbf{EF_{sg,prd,y}}$
Data unit:	t CO_2/TJ
Description:	Emissions factor for the production of the synthetic gas used in the project activity in the year y
Source of data to be used:	Calculated by Newcastle Co-generation (PTY) Limited based on agreed data supplied by Sasol Gas Ltd, the supplier of the synthetic gas, on behalf of the producer of the gas, Sasol Synfuels (Pty) Ltd.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.344 tCO_2/TJ
Description of measurement methods and procedures to be applied:	Existing measurements for agreed data done by Sasol Synfuels (Pty) Ltd at the syngas plant. Standardised measurement protocols and procedures will be used
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	No additional QA/QC procedures may need to be planned.
Any comment:	These emission factors are used when it cannot be proven that the gas used in the project activity is attributable to natural gas on an equivalent energy basis. Then the information is used to calculate leakage associated with the production of synthetic gas at the synfuel plant

Data / Parameter:	$\mathbf{QS_{Pin,PJ,i,y}}$
Data unit:	Tonnes, MWh, TJ
Description:	Quantity of fossil fuel and fossil fuel derived utilities (*i*) consumed by synfuel plant for the duration of the project in year y.
Source of data to be used:	Information to be supplied by the synfuel plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel consumption will be monitored by the synthetic gas supplier and should be cross-verified with purchase information.

Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information should be recorded, compiled and reported for the duration of the project.
Any comment:	Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	$Q_{SPin,BL,i,y}$
Data unit:	Tonnes, MWh, TJ
Description:	Quantity of fossil fuel and fossil fuel derived utilities (*i*) consumed by synfuel plant in the baseline year y.
Source of data to be used:	Information to be supplied by the synfuel plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel consumption will be monitored by the synthetic gas supplier and should be cross-verified with purchase information.
Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information should be recorded, compiled and reported for the duration of the project.
Any comment:	Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	$Q_{SPout,PJ,i,y}$
Data unit:	TJ
Description:	Quantity of liquid fuels, products and fossil fuel derived utilities (*i*) produced by the synfuel plant in the base year y.
Source of data to be used:	Information to be supplied by the synfuel plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel products produced should be monitored by the synthetic gas supplier and should be cross-verified with sale information.
Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information will be recorded, compiled and reported for the duration of the project.
Any comment:	Information used to determine whether there is additional leakage from the

	synthetic fuel production plant.

Data / Parameter:	$Q_{SPout,BL,i,y}$
Data unit:	TJ
Description:	Quantity of liquid fuels, products and fossil fuel derived utilities (*i*) produced by the synfuel plant in the base year y.
Source of data to be used:	Information to be supplied by the synfuel plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel products produced should be monitored by the synthetic gas supplier and should be cross-verified with sale information.
Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information will be recorded, compiled and reported for the duration of the project.
Any comment:	Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	**CFi**
Data unit:	tC/TJ
Description:	It represents the corresponding emission factor for the fossil fuel 'i' and is expressed as tC/TJ
Source of data to be used:	Sasol Gas Ltd undertook to supply agreed data from Sasol Synfuels (Pty) Ltd, which Newcastle Co-generation (PTY) Limited will use to calculate.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	TBD
Description of measurement methods and procedures to be applied:	Default factors will be used based on fuel descriptions provided by Sasol Gas Ltd on behalf of Sasol Synfuels (Pty) Ltd
Monitoring frequency:	Once per year.
QA/QC procedures to be applied:	The information will be recorded, compiled and reported for the duration of the project.
Any comment:	Alternatively, use default values as stated above.

Data / Parameter:	$Q_{NGin,PJ,y}$
Data unit:	TJ
Description:	The sum of all natural gas in to the syngas processes during the project in year y in TJ.
Source of data to be used:	Sasol Gas Ltd undertook to supply agreed data from Sasol Synfuels (Pty) Ltd
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel consumption will be monitored by the synthetic gas supplier and cross-verified with purchase information.
Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information should be recorded, compiled and reported for the duration of the project.
Any comment:	Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	$Q_{NGin,BL,y}$
Data unit:	TJ
Description:	The sum of all natural gas in to the syngas processes during the baseline in year y in TJ
Source of data to be used:	Sasol Gas Ltd undertook to supply agreed data from Sasol Synfuels (Pty) Ltd
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel consumption will be monitored by the synthetic gas supplier and cross-verified with purchase information.
Monitoring frequency:	Monitoring frequency: Cumulative annual
QA/QC procedures to be applied:	The information should be recorded, compiled and reported for the duration of the project.
Any comment:	Any comment: Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	$FF_{SGout,PJ,i,y}$
Data unit:	TJ
Description:	Quantity of synthetic gas 'i' produced from natural gas out of synthetic gas processes and sold as pipeline gas during the project in year y in TJ

Source of data to be used:	Sasol Gas Ltd undertook to supply agreed data from Sasol Synfuels (Pty) Ltd
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel consumption will be monitored by the synthetic gas supplier and should be cross-verified with purchase information.
Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information will be recorded, compiled and reported for the duration of the project.
Any comment:	Data for all synthetic gas ‘i’ will be recorded and stored. Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	$FF_{SGout,BL,i,y}$
Data unit:	TJ
Description:	Quantity of synthetic gas ‘i’ produced from natural gas out of synthetic gas processes during the baseline in year y in TJ
Source of data to be used:	Sasol Gas Ltd undertook to supply agreed data from Sasol Synfuels (Pty) Ltd
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Confidential
Description of measurement methods and procedures to be applied:	The total fuel consumption will be monitored by the synthetic gas supplier and cross-verified with purchase information.
Monitoring frequency:	Cumulative annual
QA/QC procedures to be applied:	The information will be recorded, compiled and reported for the duration of the project.
Any comment:	Data for all synthetic gas ‘i’ will be recorded and stored. Information used to determine whether there is additional leakage from the synthetic fuel production plant.

Data / Parameter:	$EF_{SG,I}$
Data unit:	TJ
Description:	Emissions factor for synthetic gas
Source of data to be used:	Calculated from data supplied by Sasol Gas Ltd (supplier of project fuel)
Value of data applied	54.60 tCO_2/TJ

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Existing measurements of gas composition done by Sasol Synfuels (Pty) Ltd at the syngas plant. Standardised measurement protocols and procedures will be used
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	No additional QA/QC procedures may need to be planned.
Any comment:	Information used to determine whether there is additional leakage from the synthetic fuel production plant. Same as project fuel emission factor.

B.7.2 Description of the monitoring plan:

As per monitoring methodology in AM0049, the primary parameters to be monitored during the crediting period of the project activity are listed below. Other parameters will be calculated using the primary parameters.

Primary parameters for project emissions:
1. Annual fuel(s) (synthetic gas) consumption in project activity
2. Net Calorific Value(s) of the fuel(s) (synthetic gas) used in the project activity
3. Fuel emission factors for fuel(s) (synthetic gas) used in the project activity

Baseline Electricity emissions will be monitored per the “Tool to calculate emission factor for electricity systems”.

Parameters to be monitored for baseline emissions include:
1. Electricity generated by the project activity
2. Efficiencies of co-generation equipment units
3. Heat generated by the element process.

Parameters to be monitored for leakage emissions include:
1. Marginal increase of natural gas and coal as feed to natural gas/coal-to-liquid fuel plant.
2. Energy consumed in the production of synthetic fuels in the baseline including natural gas and coal consumption.

The full monitoring plan can be found in Annex 4.

Staff Responsible for Monitoring

Chris Louw	**Station Manager** Address: Newcastle Cogeneration Pty. Ltd, Karbochem Road, Newcastle, South Africa Phone: +27 (0) 343701250 Fax: +27 (0) 343701258 E-mail: clouw@ipsagroup.co.uk

Dilip Hutheram	**Electrical and Instrumentation (E&I) Superintendent** Address: Newcastle Cogeneration Pty. Ltd, Karbochem Road, Newcastle, South Africa Phone: +27 (0) 343122968 Fax: +27 (0) 343122993 E-mail: dilip.hutheram@yahoo.com and Dilip.Hutheram@indpow.co.uk

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

Date of completion: 28/04/2008

Andrew Prag (consultant; not project participant)
Energy for Sustainable Development (ESD) Ltd
172 Tottenham Court Road
London
W1T 7NS
Tel: +44 (0)207 1216141
Mobile: +44 (0)7747 605835
Fax: +44 (0)207 1216151
Email: andrew.prag@esd.co.uk

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:

03/08/2005

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

21 years.

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:

01/01/2009

C.2.1.2. Length of the first crediting period:

Seven (7) years renewable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The potential environmental impacts and issues that may arise as a result of this project are namely; water consumption and waste water, atmospheric emissions, energy consumption, solid waste, transport, land use, socio-economic aspects and health. These are described in more detail below;

Water consumption and waste water – there is no change in water consumption on the site or in waste water generated by the site. Waste water produced is treated by the existing water treatment plant.

Atmospheric emissions associated with Karbochem are improved in that the quantity of SO_2 generated by the facility is reduced significantly due to the reduction in coal usage. Although the synthetic gas to be burned in the co-generation plant does contain sulphur, it is present in very small concentrations and in the form of an organic odorant (THT = Tetrohydrothiopheen), which is added to pipeline gas for safety considerations. The plant's exhaust emissions is minimised by the Siemens dry low nitrous oxide (NOx) Hybrid Burner (HR3) when firing gas.

Energy consumption – there is no increase in on-site production / capacity and all services remain the same. The electricity requirements of the co-generation plant is generated by the co-generation plant itself. Due to the depletion of Eskom's excess generation capacity especially of peak power, the plant is capable of servicing a substantial peaking requirement for the surrounding community. The plant therefore has national benefit and is considered as a positive impact.

Solid waste – the co-generation plant does not produce any solid waste. Ash production due to coal usage is currently disposed to landfill and this is eliminated.

Transport – the need for transportation of coal via rail to the site and the transportation of ash via road to the landfill site is also be eliminated. This is because the plant consumes methane enriched gas from an existing underground pipeline. A tee off line is constructed from the existing on-site gas pipeline to supply the new boilers.

Land use – the proposed plant is located on a vacant piece of land within the fenced confines of the existing Karbochem property, along the south eastern property boundary. This area has been zoned for industrial development.

Socio-economic aspects – Karbochem industrial facility is a major employer in the Newcastle area employing around 1,200 permanent employees and a significant number of contractors and this project does not have a negative impact on employment levels.

Health – the implementation of the co-generation plant has initially significantly reduced (by approximately 70%) and will ultimately eliminate the production of ash and emissions associated with the burning of coal, thereby improving the atmospheric conditions on and around the site in terms of potential impacts on human health.

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

The project does not have any significant and permanent environmental or socio-economic negative impacts.

An approval to commence the project activity has been obtained from the KwaZulu-Natal Department of Agriculture and Environmental Affairs authorized by the National Minister of Environmental Affairs and Tourism.

SECTION E. Stakeholders' comments

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

Interested and affected parties were contacted and invited to air their views on the proposed project. This involved local residents, local and district municipal officials and councillors, government departments, local associations and non-governmental organisations. The following methods were employed;

Newspaper Advertisements (see annex 5 for a copy)
A public notice was placed in three newspapers – Newcastle Advertiser, Natal Witness and Ilanga on 2 February, 2006. It informed the local residents and the wider public on the details of the proposed project and invited them to comment on it.

Background Information Letter and Amendment Letter (see annex 5 for copies of both)
A background information letter providing background information on the nature and scale of the proposed project, the requirements of the EIA regulations and the request for comments was sent out directly to stakeholders listed in the table below. Subsequently, an amendment letter was sent to the same contacts to make up for new information received.

Stakeholder List

Name	Organisation
Mr M. Mtashali	Amajuba District Municipality, Director of Community Services
Mr B.A. Dlamini	Newcastle Municipality, Mayor
Mr. J. van Rooyen	Newcastle Municipality, Chief Health Services
Mr J.N. Barkhuizen	Newcastle Municipality, Director of Community Services
Mr. G. Willis-Smith	Department of Agriculture and Environmental Affairs (DAEA)
Ms N. Mngoma	Department of Agriculture and Environmental Affairs (DAEA)
Mr J.R. van Graan	Department of Environmental Affairs and Tourism (DEAT)
Mr A. Brijball	Department of Water Affairs and Forestry (DWAF)
Ms. S. Brijnangh	Department of Education
Mr. S. Pillay	Department of Labour
Mr B. van der Berg	Department of Labour
Ms. B. McKelvey	Ezemvelo KZN Wildlife
Ms. D. Thambu	Ezemvelo KZN Wildlife
Mr E. Nipp	Chinese Chamber of Commerce
Mr F. Bergh	Afrikaanse Sakekamer
Mr G. Adamson	Newcastle Chamber of Commerce and Industry

No comments were received from the public notices placed in the three newspapers.

E.2. Summary of the comments received:

Out of the thirteen organisations (see table in E.1. above) which the background information and amendment letters were sent to, four of them responded and their comments are summarized in the table below. See annex 5 for copies of correspondence

SN	Date	Name	Organisation	Comment
1	25/01/2006	Mr B. van der Berg	Department of Labour	No comment
2	30/01/2006	Mr. J. van Graan	Department of Environmental Affairs and Tourism (DEAT)	The project is classified as a scheduled process in terms of the Atmospheric Pollution Prevention Act (Act 45 of 1965). Therefore an application for registration must be submitted to the DEAT Directorate for Air Pollution Control.
3	31/01/2006	Mr. J. Zoutendyk	Karbochem (Pty) Ltd	With reference to the SRK correspondence (dated 25 January 2006) regarding the amendment to the background information document: • The existing coal fired boilers only supply steam (not electrical energy) to various plants on the site. • The boilers are being operated at less than their nameplate capacity. • Following the commissioning of the new co-generation facility, the existing boilers will be operated at approximately 30% of the current load (not 30% of their original capacity). • Karbochem's average coal usage for the period September 2005 to December 2005 was 255t/d (not 11t/d)
4	31/01/2006	Ms. D. Thambu	Ezemvelo KZN Wildlife	No serious biodiversity concerns have been identified at this stage

				of the project

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

The comments received as stated in section E.2. above were responded to as follows;

Comment 1: No response required

Comment 2: An application for registration of the scheduled process has been submitted to DEAT (Directorate for Air Pollution Control).

Comment 3: These comments have been taken cognisance of and all the data has been updated in the relevant documents.

Comment 4: Should any biodiversity related issues arise, Ezemvelo KZN Wildlife will be contacted.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Newcastle Cogeneration (Pty) Ltd
Street/P.O.Box:	Karbochem Road
Building:	
City:	Newcastle
State/Region:	Kwa-Zulu Natal
Postfix/ZIP:	2940
Country:	South Africa
Telephone:	+27 (0) 34 370 1250
FAX:	+27 (0) 34 370 1258
E-Mail:	clouw@ipsagroup.co.uk
URL:	http://www.ipsagroup.co.uk/
Represented by:	Chris Louw
Title:	Station Manager
Salutation:	
Last Name:	Louw
Middle Name:	
First Name:	Chris

Department:	
Mobile:	+27 (0) 82 896 2054
Direct FAX:	+27 (0) 34 370 1258
Direct tel:	+27 (0) 34 370 1250
Personal E-Mail:	clouw@ipsagroup.co.uk

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There has been no public funding used in the development of this project.

Annex 3

BASELINE INFORMATION

GRID ELECTRICITY FACTOR
OPERATING MARGIN DATA
Data available from http://www.eskom.co.za/live/content.php?Item_ID=4226&Revision=en/3

EFcoal (kgCO2/TJ) =	91,997
Efficiency for coal =	37%
Efficiency for gas =	37.5%
Kerosene Density (Kg/m^3) =	817.15

Plant	Sample OM	Simple OM Parameters		Fuel Type					
		NCV(i, y)	EF(CO2, i, y)	Type	Effective CO2 Emission Factor (Lower)			NCV	
	(Y=1;N=0)	in GJ/t	in tCO2/GJ		in kg/TJ	in tCO2/TJ	in tCO2/t fuel	in TJ/t fuel	in TJ/Gg fuel
ESKOM									
Arnot	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Camden (re-instated 2005-06)	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Duhva	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Grootvlei	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Hendrina	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Kendal	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Komati	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Kriel	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Lethado	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Majuba	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Matimba*	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Matla	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Tutuka	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Acacia	1	42.20	0.0708	Gas (Kerosene)	70,800	70.8	2.988	0.0422	42.2
PortRex	1	42.40	0.0708	Gas (Kerosene)	70,800	70.8	3.002	0.0424	42.4
Gariep	0	-	-	Hydro	-	-	-	-	-
Vanderkloof	0	-	-	Hydro	-	-	-	-	-
Colleywobbles	0	-	-	Hydro	-	-	-	-	-
First Falls	0	-	-	Hydro	-	-	-	-	-
Second Falls	0	-	-	Hydro	-	-	-	-	-
Ncora	0	-	-	Hydro	-	-	-	-	-
Koeberg	0	-	-	Nuclear	-	-	-	-	-
Drakensberg	1	-	-	Pump-Storage	-	-	-	-	-
Palmiet**	1	-	-	Pump-Storage	-	-	-	-	-
MULNICIPAL									
Athlone	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Kroonstad	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Swartkops	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Bloemfontein	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Orlando	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Rooiwal	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Pretoria West	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Roggebaai	1	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Athlone	1	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Port Elizabeth	1	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Johannesburg	1	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Pretoria West	1	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Lydenburg	0	-	-	Hydro	-	-	-	-	-
Ceres	0	-	-	Hydro	-	-	-	-	-
Piet Retief	0	-	-	Hydro	-	-	-	-	-
Steenbas	1	-	-	Pump-Storage	-	-	-	-	-
PRIVATE									
Tongaat-Hulett Amatikulu	0	-	-	Bagasse/Coal					
Tongaat-Hulett Darnall	0	-	-	Bagasse/Coal					
Tongaat-Hulett Felixton	0	-	-	Bagasse/Coal					
Tongaat-Hulett Maidstone Mill	0	-	-	Bagasse/Coal					
Transvaal Suiker Ltd.	0			Bagasse/Coal					
Kelvin	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Sasol Synthetic Fuels	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Sasol Chemical Industry	1	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Friedenheim	0	-	-	Hydro	-	-	-	-	-
Mathematical Total	33	OM emission factor	1.2170						
Generation-Weighted Average			1.2410						
CM emission factor (BM 2005)= 1.270			-						
CM emission factor (BM 2004)= 1.277									

		Year 2003						
EFcoal (kgCO2/TJ) =	91,997							
Efficiency for coal =	37%	Actual		OM Sample				
Efficiency for gas =	37.5%							
Kerosene Density (Kg/m^3	817.15	Electricity Generated in MWh	Fuel Consumption in tonnes	Electricity Generated in MWh	Fuel Consumption in tonnes	Unit CO2 Emission in tonnes	EF(EL,m,y) in tCO2/MWh)	Unit Weight% by EG %
ESKOM								
	Arnot	14,135,237	6,654,629	14,135,237	6,654,629	15,360,190	1.087	6.88%
	Camden (re-instated 2005-06)		-		-	-	-	0.00%
	Duhva	21,384,335	9,988,679	21,384,335	9,988,679	23,055,833	1.078	10.41%
	Grootvlei	-	-	-	-	-	-	0.00%
	Hendrina	12,329,325	6,432,159	12,329,325	6,432,159	14,846,686	1.204	6.00%
	Kendal	27,820,202	15,745,646	27,820,202	15,745,646	36,344,043	1.306	13.54%
	Komati	-	-	-	-	-	-	0.00%
	Kriel	18,347,304	9,306,872	18,347,304	9,306,872	21,482,088	1.171	8.93%
	Lethado	23,505,543	16,410,189	23,505,543	16,410,189	37,877,939	1.611	11.44%
	Majuba	10,015,560	5,539,271	10,015,560	5,539,271	12,785,725	1.277	4.87%
	Matimba*	26,510,802	13,803,200	26,510,802	13,803,200	31,860,496	1.202	12.90%
	Matla	25,802,219	13,169,317	25,802,219	13,169,317	30,397,370	1.178	12.56%
	Tutuka	14,195,963	7,319,814	14,195,963	7,319,814	16,895,568	1.190	6.91%
	Acacia	50	15	50	15	45	0.892	0.00%
	PortRex	291	87	291	87	261	0.897	0.00%
	Gariep	357,076	-	-	-	-	-	0.00%
	Vanderkloof	419,965	-	-	-	-	-	0.00%
	Colleywobbles	-	-	-	-	-	-	0.00%
	First Falls	-	-	-	-	-	-	0.00%
	Second Falls	-	-	-	-	-	-	0.00%
	Ncora	-	-	-	-	-	-	0.00%
	Koeberg	12,662,591	-	-	-	-	-	0.00%
	Drakensberg	1,932,587	-	1,932,587	-	-	-	0.94%
	Palmiet**	799,735	-	799,735	-	-	-	0.39%
MULNICIPAL								
	Athlone	76,596	38,000	76,596	38,000	66,701	0.871	0.04%
	Kroonstad	-	-	-	-	-	-	0.00%
	Swartkops	-	-	-	-	-	-	0.00%
	Bloemfontein	19,444	10,000	19,444	10,000	16,932	0.871	0.01%
	Orlando		-	-		-	-	0.00%
	Rooiwal	826,217	413,000	826,217	413,000	719,479	0.871	0.40%
	Pretoria West	116,176	58,000	116,176	58,000	101,167	0.871	0.06%
	Roggebaai	2,787	31,350	2,787	31,350	1,453	0.521	0.00%
	Athlone	867	9,750	867	9,750	452	0.521	0.00%
	Port Elizabeth	0	0	-	-	-	-	0.00%
	Johannesburg	0	0	-	-	-	-	0.00%
	Pretoria West	0	0	-	-	-	-	0.00%
	Lydenburg	6,000	0	-	-	-	-	0.00%
	Ceres	1,082	0	-	-	-	-	0.00%
	Piet Retief	3,550	0	-	-	-	-	0.00%
	Steenbas	273,403	0	273,403	-	-	-	0.13%
PRIVATE						-	-	
	Tongaat-Hulett Amatikulu	26,781	0	-	-	-	-	0.00%
	Tongaat-Hulett Darnall	21,704	0	-	-	-	-	0.00%
	Tongaat-Hulett Felixton	66,510	0	-	-	-	-	0.00%
	Tongaat-Hulett Maidstone Mill	67,397	0	-	-	-	-	0.00%
	Transvaal Suiker Ltd.	76,925	0	-	-	-	-	0.00%
	Kelvin	1,721,353	861,000	1,721,353	861,000	1,498,973	0.871	0.84%
	Sasol Synthetic Fuels	4,738,677	2,369,000	4,738,677	2,369,000	4,126,491	0.871	2.31%
	Sasol Chemical Industry	919,418	460,000	919,418	460,000	800,639	0.871	0.45%
	Friedenheim	15,014	0	-	-	-	-	0.00%
Mathematical Total		**219,198,686**	**108,619,978**	**205,474,091**	**108,619,978**	**248,238,530**	**1.208**	100.0%
Generation-Weighted Average				**20,314,161**		**25,351,789**	**1.248**	
CM emission factor (BM 2005)=	**1.270**							
CM emission factor (BM 2004)=	**1.277**							

EFcoal (kgCO2/TJ) = **91,997**	**Year 2004**						
Efficiency for coal = **37%**							
Efficiency for gas = **37.5%**	**Actual**		**OM Sample**				
Kerosene Density (Kg/m^3 **817.15**	Electricity Generated in MWh	Fuel Consumption in tonnes	Electricity Generated in MWh	Fuel Consumption in tonnes	Unit CO2 Emission in tonnes	EF(EL,m,y) in tCO2/MWh)	Unit Weight% by EG %
ESKOM							
Arnot	13,630,490	6,608,536	13,630,490	6,608,536	15,253,799	1.119	6.39%
Camden (re-instated 2005-06)		-		-	-	-	0.00%
Duhva	24,872,400	11,907,947	24,872,400	11,907,947	27,485,880	1.105	11.65%
Grootvlei	-	-	-		-	-	0.00%
Hendrina	12,357,201	6,644,412	12,357,201	6,644,412	15,336,608	1.241	5.79%
Kendal	27,000,905	15,429,638	27,000,905	15,429,638	35,614,634	1.319	12.65%
Komati	-	-	-	-			0.00%
Kriel	18,333,797	9,297,070	18,333,797	9,297,070	21,459,463	1.170	8.59%
Lethado	24,717,191	17,041,971	24,717,191	17,041,971	39,336,216	1.591	11.58%
Majuba	11,340,178	6,363,395	11,340,178	6,363,395	14,687,965	1.295	5.31%
Matimba*	26,882,923	13,786,063	26,882,923	13,786,063	31,820,941	1.184	12.60%
Matla	25,848,215	13,445,117	25,848,215	13,445,117	31,033,970	1.201	12.11%
Tutuka	17,187,412	8,983,951	17,187,412	8,983,951	20,736,723	1.207	8.05%
Acacia	117	35	117	35	104	0.892	0.00%
PortRex	47	14	47	14	42	0.897	0.00%
Gariep	350,904	-	-	-	-	-	0.00%
Vanderkloof	369,441	-	-	-	-	-	0.00%
Colleywobbles	-	-	-	-	-	-	0.00%
First Falls	-	-	-	-	-	-	0.00%
Second Falls	-	-	-	-	-	-	0.00%
Ncora	-	-	-	-	-	-	0.00%
Koeberg	14,279,729	-	-	-	-	-	0.00%
Drakensberg	2,056,429	-	2,056,429	-	-	-	0.96%
Palmiet**	924,079	-	924,079	-	-	-	0.43%
MULNICIPAL							
Athlone	10,230	5,000	10,230	5,000	8,908	0.871	0.00%
Kroonstad	-	-	-	-	-	-	0.00%
Swartkops	-	-	-	-	-	-	0.00%
Bloemfontein	5,931	3,000	5,931	3,000	5,165	0.871	0.00%
Orlando	-	-	-	-	-	-	0.00%
Rooiwal	895,000	448,000	895,000	448,000	779,376	0.871	0.42%
Pretoria West	116,176	58,000	116,176	58,000	101,167	0.871	0.05%
Roggebaai	1,141	12,840	1,141	12,840	595	0.521	0.00%
Athlone	1,827	20,550	1,827	20,550	952	0.521	0.00%
Port Elizabeth	8	90	8	90	4	0.521	0.00%
Johannesburg	-	0	-	-	-	-	0.00%
Pretoria West	-	0	-	-	-	-	0.00%
Lydenburg	6,000	0	-	-	-	-	0.00%
Ceres	1,082	0	-	-	-	-	0.00%
Piet Retief	3,550	0	-	-	-	-	0.00%
Steenbas	-	0	-	-	-	-	0.00%
PRIVATE					-	-	
Tongaat-Hulett Amatikulu	26,781	-	-	-	-	-	0.00%
Tongaat-Hulett Darnall	21,704	-	-	-	-	-	0.00%
Tongaat-Hulett Felixton	66,510	-	-	-	-	-	0.00%
Tongaat-Hulett Maidstone Mill	67,397	-	-	-	-	-	0.00%
Transvaal Suiker Ltd.	9,945	-	-	-	-	-	0.00%
Kelvin	1,568,666	784,000	1,568,666	784,000	1,366,011	0.871	0.74%
Sasol Synthetic Fuels	4,738,677	2,369,000	4,738,677	2,369,000	4,126,491	0.871	2.22%
Sasol Chemical Industry	919,418	460,000	919,418	460,000	800,639	0.871	0.43%
Friedenheim	14,663	-	-	-	-	-	0.00%
Mathematical Total	**228,626,164**	**113,668,629**	**213,408,458**	**113,668,629**	**259,955,654**	**1.218**	100.0%
Generation-Weighted Average			**20,991,345**		**26,297,671**	**1.253**	**0**

EFcoal (kgCO2/TJ) = 91,997
Efficiency for coal = 37%
Efficiency for gas = 37.5%
Kerosene Density (Kg/m^3 817.15

		Year 2005						
		Actual		Sample OM				
		Electricity Generated in MWh	Fuel Consumption in tonnes	Electricity Generated in MWh	Fuel Consumption in tonnes	Unit CO2 Emission in tonnes	EF(EL,m,y) in tCO2/MWh)	Unit Weight% by EG %
ESKOM								
	Arnot	11,495,036	5,456,640	11,495,036	5,456,640	12,594,997	1.096	5.34%
	Camden (re-instated 2005-06	756,540	390,000	756,540	390,000	900,197	1.190	0.35%
	Duhva	24,479,488	11,765,290	24,479,488	11,765,290	27,156,600	1.109	11.38%
	Grootvlei	-	-	-	-	-	-	0.00%
	Hendrina	12,410,151	6,883,375	12,410,151	6,883,375	15,888,181	1.280	5.77%
	Kendal	26,461,793	15,161,339	26,461,793	15,161,339	34,995,348	1.322	12.30%
	Komati	-	-	-	-	-	-	0.00%
	Kriel	20,510,202	10,518,778	20,510,202	10,518,778	24,279,405	1.184	9.53%
	Lethado	22,498,940	15,602,785	22,498,940	15,602,785	36,014,292	1.601	10.46%
	Majuba	17,620,119	14,338,444	17,620,119	14,338,444	33,095,944	1.878	8.19%
	Matimba*	28,401,085	9,369,375	28,401,085	9,369,375	21,626,357	0.761	13.20%
	Matla	23,782,480	12,929,861	23,782,480	12,929,861	29,844,658	1.255	11.05%
	Tutuka	16,500,638	8,599,359	16,500,638	8,599,359	19,849,009	1.203	7.67%
	Acacia	47,848	14,291	47,848	14,291	42,697	0.892	0.02%
	PortRex	30,094	8,988	30,094	8,988	26,982	0.897	0.01%
	Gariep	402,432	-	-	-	-	-	0.00%
	Vanderkloof	322,928	-	-	-	-	-	0.00%
	Colleywobbles	-	-	-	-	-	-	0.00%
	First Falls	-	-	-	-	-	-	0.00%
	Second Falls	-	-	-	-	-	-	0.00%
	Ncora	-	-	-	-	-	-	0.00%
	Koeberg	-	-	-	-	-	-	0.00%
	Drakensberg	1,818,463	-	1,818,463	-	-	-	0.85%
	Palmiet**	79,602	-	79,602	-	-	-	0.04%
MULNICIPAL								
	Athlone	10,230	5,000	10,230	5,000	8,908	0.871	0.00%
	Kroonstad	-	-	-	-	-	-	0.00%
	Swartkops	-	-	-	-	-	-	0.00%
	Bloemfontein	5,931	3,000	5,931	3,000	5,165	0.871	0.00%
	Orlando	-	-	-	-	-	-	0.00%
	Rooiwal	895,000	448,000	895,000	448,000	779,376	0.871	0.42%
	Pretoria West	116,176	58,000	116,176	58,000	101,167	0.871	0.05%
	Roggebaai	1,141	12,840	1,141	12,840	595	0.521	0.00%
	Athlone	1,827	20,550	1,827	20,550	952	0.521	0.00%
	Port Elizabeth	8	90	8	90	4	0.521	0.00%
	Johannesburg	-	-	-	-	-	-	0.00%
	Pretoria West	-	-	-	-	-	-	0.00%
	Lydenburg	-	-	-	-	-	-	0.00%
	Ceres	-	-	-	-	-	-	0.00%
	Piet Retief	-	-	-	-	-	-	0.00%
	Steenbas	-	-	-	-	-	-	0.00%
PRIVATE						-	-	
	Tongaat-Hulett Amatikulu	-	-	-	-	-	-	0.00%
	Tongaat-Hulett Darnall	-	-	-	-	-	-	0.00%
	Tongaat-Hulett Felixton	-	-	-	-	-	-	0.00%
	Tongaat-Hulett Maidstone Mill	-	-	-	-	-	-	0.00%
	Transvaal Suiker Ltd.	-	-	-	-	-	-	0.00%
	Kelvin	1,568,666	784,000	1,568,666	784,000	1,366,011	0.871	0.73%
	Sasol Synthetic Fuels	4,738,677	2,369,000	4,738,677	2,369,000	4,126,491	0.871	2.20%
	Sasol Chemical Industry	919,418	460,000	919,418	460,000	800,639	0.871	0.43%
	Friedenheim	-	-	-	-	-	-	0.00%
Mathematical Total		**215,874,913**	**115,199,005**	**215,149,553**	**115,199,005**	**263,503,975**	**1.225**	100.0%
Generation-Weighted Average				**20,906,027**		**25,561,415**	**1.223**	**0.097169743**

BUILD MARGIN DATA

EFcoal (tCO2 91,997	Calculated in	BM Parameters		Fuel Type					
Efficiency for 37%									
Efficiency for 37.5%		NCV(i, y)	EF(CO2, i, y)	Type	Effective CO2 Emission Factor (RSA)			NCV (RSA)	
Kerosene De 817.15	Sample BM								
(Kg/m^3)	(Y=1;N=0)	in GJ/t	in tCO2/GJ		in kg/TJ	in tCO2/TJ	in tCO2/t fuel	in TJ/t fuel	n TJ/Gg fue
ESKOM									
Arnot	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Camden (re-instated 2005-06)	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Duhva	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Grootvlei	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Hendrina	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Kendal	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Komati	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Kriel	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Lethado	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Majuba	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Matimba*	1	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Matla	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Tutuka	0	25.09	0.0920	Coal	91,997	92.0	2.308	0.0251	25.1
Acacia	0	42.20	0.0708	Gas (Kerosene)	70,800	70.8	2.988	0.0422	42.2
PortRex	0	42.40	0.0708	Gas (Kerosene)	70,800	70.8	3.002	0.0424	42.4
Gariep	0	-	-	Hydro	-	-	-	-	-
Vanderkloof	0	-	-	Hydro	-	-	-	-	-
Colleywobbles	0	-	-	Hydro	-	-	-	-	-
First Falls	0	-	-	Hydro	-	-	-	-	-
Second Falls	0	-	-	Hydro	-	-	-	-	-
Ncora	0	-	-	Hydro	-	-	-	-	-
Koeberg	0	-	-	Nuclear	-	-	-	-	-
Drakensberg	0	-	-	Pump-Storage	-	-	-	-	-
Palmiet**	1	-	-	Pump-Storage	-	-	-	-	-
MULNICIPAL									
Athlone	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Kroonstad	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Swartkops	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Bloemfontein	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Orlando	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Rooiwal	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Pretoria West	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Roggebaai	0	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Athlone	0	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Port Elizabeth	0	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Johannesburg	0	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Pretoria West	0	46.50	0.0543	Gas	54,300	54.3	2.525	0.0465	46.5
Lydenburg	0	-	-	Hydro	-	-	-	-	-
Ceres	0	-	-	Hydro	-	-	-	-	-
Piet Retief	0	-	-	Hydro	-	-	-	-	-
Steenbas	0	-	-	Pump-Storage	-	-	-	-	-
PRIVATE									
Tongaat-Hulett Amatikulu	0	-	-	Bagasse/Coal					
Tongaat-Hulett Darnall	0	-	-	Bagasse/Coal					
Tongaat-Hulett Felixton	0	-	-	Bagasse/Coal					
Tongaat-Hulett Maidstone Mill	0	-	-	Bagasse/Coal					
Transvaal Suiker Ltd.	0	-	-	Bagasse/Coal					
Kelvin	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Sasol Synthetic Fuels	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Sasol Chemical Industry	0	19.90	0.0895	Coal	89,500	89.5	1.781	0.0199	19.9
Friedenheim	0	-	-	Hydro	-	-	-	-	-
Mathematical Total	5								
Generation-Weighted Average									

		Year 2004						
EFcoal (tCO2	91,997							
Efficiency for	37%							
Efficiency for	37.5%	Actual		BM Sample				
Kerosene De 817.15 (Kg/m^3)		Electricity Generated in MWh	Fuel Consumption in tonnes	Electricity Generated in MWh	Fuel Consumption in tonnes	Unit CO2 Emission in tonnes	EF(EL,m,y) in tCO2/MWh)	Unit Weight% by EG %
ESKOM								
	Arnot	13,630,490	6,608,536	-	-	-	-	0.00%
	Camden (re-instated 2005-06)		-	-	-	-	-	0.00%
	Duhva	24,872,400	11,907,947	-	-	-	-	0.00%
	Grootvlei	-	-	-	-	-	-	0.00%
	Hendrina	12,357,201	6,644,412	-	-	-	-	0.00%
	Kendal	27,000,905	15,429,638	27,000,905	15,429,638	35,614,634	1.319	29.72%
	Komati	-	-	-	-	-	-	0.00%
	Kriel	18,333,797	9,297,070	-	-	-	-	0.00%
	Lethado	24,717,191	17,041,971	24,717,191	17,041,971	39,336,216	1.591	27.20%
	Majuba	11,340,178	6,363,395	11,340,178	6,363,395	14,687,965	1.295	12.48%
	Matimba*	26,882,923	13,786,063	26,882,923	13,786,063	31,820,941	1.184	29.59%
	Matla	25,848,215	13,445,117	-	-	-	-	0.00%
	Tutuka	17,187,412	8,983,951	-	-	-	-	0.00%
	Acacia	117	35	-	-	-	-	0.00%
	PortRex	47	14	-	-	-	-	0.00%
	Gariep	350,904	-	-	-	-	-	0.00%
	Vanderkloof	369,441	-	-	-	-	-	0.00%
	Colleywobbles	-	-	-	-	-	-	0.00%
	First Falls	-	-	-	-	-	-	0.00%
	Second Falls	-	-	-	-	-	-	0.00%
	Ncora	-	-	-	-	-	-	0.00%
	Koeberg	14,279,729	-	-	-	-	-	0.00%
	Drakensberg	2,056,429	-	-	-	-	-	0.00%
	Palmiet**	924,079	-	924,079	-	-	-	1.02%
MULNICIPAL								
	Athlone	10,230	5,000	-	-	-	-	0.00%
	Kroonstad	-	-	-	-	-	-	0.00%
	Swartkops	-	-	-	-	-	-	0.00%
	Bloemfontein	5,931	3,000	-	-	-	-	0.00%
	Orlando	-	-	-	-	-	-	0.00%
	Rooiwal	895,000	448,000	-	-	-	-	0.00%
	Pretoria West	116,176	58,000	-	-	-	-	0.00%
	Roggebaai	1,141	12,840	-	-	-	-	0.00%
	Athlone	1,827	20,550	-	-	-	-	0.00%
	Port Elizabeth	8	90	-	-	-	-	0.00%
	Johannesburg	-	0	-	-	-	-	0.00%
	Pretoria West	-	0	-	-	-	-	0.00%
	Lydenburg	6,000	0	-	-	-	-	0.00%
	Ceres	1,082	0	-	-	-	-	0.00%
	Piet Retief	3,550	0	-	-	-	-	0.00%
	Steenbas	-	0	-	-	-	-	0.00%
PRIVATE						-	-	
	Tongaat-Hulett Amatikulu	26,781	-	-	-	-	-	0.00%
	Tongaat-Hulett Darnall	21,704	-	-	-	-	-	0.00%
	Tongaat-Hulett Felixton	66,510	-	-	-	-	-	0.00%
	Tongaat-Hulett Maidstone Mill	67,397	-	-	-	-	-	0.00%
	Transvaal Suiker Ltd.	9,945	-	-	-	-	-	0.00%
	Kelvin	1,568,666	784,000	-	-	-	-	0.00%
	Sasol Synthetic Fuels	4,738,677	2,369,000	-	-	-	-	0.00%
	Sasol Chemical Industry	919,418	460,000	-	-	-	-	0.00%
	Friedenheim	14,663	-	-	-	-	-	0.00%
Mathematical Total		**228,626,164**	**113,668,629**	**90,865,276**	**52,621,067**	**121,459,756**	**1.337**	100.0%
Generation-Weighted Average				**24,125,096**		**32,530,712**	**1.348**	**0**

EFcoal (tCO2 91,997	Year 2005						
Efficiency for 37%							
Efficiency for 37.5%	Actual		Sample BM				
Kerosene De 817.15	Electricity Generated	Fuel Consumption	Electricity Generated	Fuel Consumption	Unit CO2 Emission	EF(EL,m,y)	Unit Weight% by EG
(Kg/m^3)	in MWh	in tonnes	in MWh	in tonnes	in tonnes	in tCO2/MWh)	%
ESKOM							
Arnot	11,495,036	5,456,640	-	-	-	-	0.00%
Camden (re-instated 2005-06)	756,540	390,000	-	-	-	-	0.00%
Duhva	24,479,488	11,765,290	-	-	-	-	0.00%
Grootvlei	-	-	-	-	-	-	0.00%
Hendrina	12,410,151	6,883,375	-	-	-	-	0.00%
Kendal	26,461,793	15,161,339	26,461,793	15,161,339	34,995,348	1.322	27.84%
Komati	-	-	-	-	-	-	0.00%
Kriel	20,510,202	10,518,778	-	-	-	-	0.00%
Lethado	22,498,940	15,602,785	22,498,940	15,602,785	36,014,292	1.601	23.67%
Majuba	17,620,119	14,338,444	17,620,119	14,338,444	33,095,944	1.878	18.54%
Matimba*	28,401,085	9,369,375	28,401,085	9,369,375	21,626,357	0.761	29.88%
Matla	23,782,480	12,929,861	-	-	-	-	0.00%
Tutuka	16,500,638	8,599,359	-	-	-	-	0.00%
Acacia	47,848	14,291	-	-	-	-	0.00%
PortRex	30,094	8,988	-	-	-	-	0.00%
Gariep	402,432	-	-	-	-	-	0.00%
Vanderkloof	322,928	-	-	-	-	-	0.00%
Colleywobbles	-	-	-	-	-	-	0.00%
First Falls	-	-	-	-	-	-	0.00%
Second Falls	-	-	-	-	-	-	0.00%
Ncora	-	-	-	-	-	-	0.00%
Koeberg	-	-	-	-	-	-	0.00%
Drakensberg	1,818,463	-	-	-	-	-	0.00%
Palmiet**	79,602	-	79,602	-	-	-	0.08%
MULNICIPAL							
Athlone	10,230	5,000	-	-	-	-	0.00%
Kroonstad	-	-	-	-	-	-	0.00%
Swartkops	-	-	-	-	-	-	0.00%
Bloemfontein	5,931	3,000	-	-	-	-	0.00%
Orlando	-	-	-	-	-	-	0.00%
Rooiwal	895,000	448,000	-	-	-	-	0.00%
Pretoria West	116,176	58,000	-	-	-	-	0.00%
Roggebaai	1,141	12,840	-	-	-	-	0.00%
Athlone	1,827	20,550	-	-	-	-	0.00%
Port Elizabeth	8	90	-	-	-	-	0.00%
Johannesburg	-	-	-	-	-	-	0.00%
Pretoria West	-	-	-	-	-	-	0.00%
Lydenburg	6,000	-	-	-	-	-	0.00%
Ceres	1,082	-	-	-	-	-	0.00%
Piet Retief	3,550	-	-	-	-	-	0.00%
Steenbas	-	-	-	-	-	-	0.00%
PRIVATE					-	-	
Tongaat-Hulett Amatikulu	26,781	-	-	-	-	-	0.00%
Tongaat-Hulett Darnall	21,704	-	-	-	-	-	0.00%
Tongaat-Hulett Felixton	66,510	-	-	-	-	-	0.00%
Tongaat-Hulett Maidstone Mill	67,397	-	-	-	-	-	0.00%
Transvaal Suiker Ltd.	9,945	-	-	-	-	-	0.00%
Kelvin	1,568,666	784,000	-	-	-	-	0.00%
Sasol Synthetic Fuels	4,738,677	2,369,000	-	-	-	-	0.00%
Sasol Chemical Industry	919,418	460,000	-	-	-	-	0.00%
Friedenheim	14,663	-	-	-	-	-	0.00%
Mathematical Total	**216,092,545**	**115,199,005**	**95,061,539**	**54,471,943**	**125,731,941**	**1.323**	100.0%
Generation-Weighted Average			**24,442,328**		**30,860,951**	**1.263**	**0.257121109**

Annex 4

MONITORING INFORMATION

Management Structure

Newcogen has a clear defined management structure and the Plant Manager has overall responsibility and he/she is ultimately responsible for the project. See Section B.7.2.

Monitoring Plan

All data records will be kept for at least 2 years

Parameters	Where Monitored	Capacity	Procedure (monitoring and calibration)
TDL	Information to be supplied by the grid electricity provider (ESKOM) or sources such as the national energy regulator (NERSA) or national or local data published	E&I Superintendent	Will retain a copy of Eskom's annually published tariff booklets (data is calculated by ESKOM and published on their website), or those of other sources (NERSA) if data is no longer available through ESKOM.
$FF_{project,i,y}$	One fuel flow meter at project boundary (M1) and four inside project boundary (M2-5)	M1 - 5 by E&I Superintendent	Sasol manages the boundary meter (M1) and the meter readings are highlighted on invoices sent through to Newcogen. For the Newcogen meters (M2-5) data is continuously updated in the plant computer. All data will be kept on the plant computer server as electronic records for at least 5 years. The E&I superintendent with verify that the readings from M1 match those of M2-5 by checking against data in the plant computer and against gas bills received from Sasol. For M2-5 meters will be re-calibrated and maintained if there is a discrepancy in these readings. Paper records of calibration will be kept for at least 2 years following verification.
Parameters	**Where Monitored**	**Capacity**	**Procedure (monitoring and calibration)**
$EF_{PF,CO2,i}$	Sasol undertakes monitoring of emissions factor of its fuel	E&I Superintendent (using Sasol Records)	Sasol will submit a **one time testing record** of the fuel to Newcogen which includes information on the fuel emissions factor. E&I Superintendent will keep this paper record on file for at least 5 years.

$\varepsilon_{project,i,y}$	At Newcogen site through efficiency testing	Plant Manager	Efficiency will be measured annually once the plant is running. Will be completed by the Plant Manager with a third party collecting the data. The efficiency will also be measured: between two maintenance activities; if the characteristics of the 'project fuel' change substantially during the project activity; if major retrofits or changes to the element process are undertaken that may affect the efficiency of element process; and at the renewal of a crediting period.
$NCV_{PF,y}$	Sasol undertakes monitoring of Net Calorific Value of its fuel	E&I Superintendent	Sasol submits monthly invoices which include records of the fuel Net Calorific Value (standardised to higher heating value HHV). Paper records of these invoices will be kept on file for at least 5 years.
$h_{heatout,i,y}$	Measured at Newcogen site through M10 and 11.	E&I Superintendent	Steam temperature and pressure values will be continuously monitored and entered into the plant computer. Electronic records will be kept on the server for up to 5 years. Enthalpy will be calculated using this data and standard steam tables. The temperature and pressure monitoring equipment will be calibrated and maintained as per best practice. Records of calibration will be kept for at least 2 years.
$h_{heatin,i,y}$	Measured at Newcogen site through M6 and 7.	E&I Superintendent	Water temperature and pressure (M6 and 7) values will be continuously monitored and entered into the plant computer. Electronic records will be kept on the server for up to 5 years. Enthalpy will be calculated using this data and standard steam tables. The temperature and pressure monitoring equipment will be calibrated and maintained as per best practice. Records of calibration will be kept for at least 2 years.
$FR_{heat,i,y}$	Measured at Newcogen site through M10 and 11.	E&I Superintendent	Steam flow values will be continuously monitored and entered into the plant computer. Electronic records will be kept on the server for at least 5 years. The flow rate monitoring equipment will be calibrated and maintained as per best practice. Records of calibration will be kept for at least 2 years.
Parameters	**Where Monitored**	**Capacity**	**Procedure (monitoring and calibration)**
$hrs_{i,y}$	Measured at Newcogen site through M10 - 11.	E&I Superintendent	The hours of plant operation are calculated based on boiler pressure records (which are measured on a continuous basis and input into the plant computer).

			The plant will be considered to be operational when pressure (in one of the boilers) is above 20 bar. Electronic records will be kept on the server for at least 5 years.
$FF_{project,j,y}$	Measured at Newcogen site through M4 and 5.	E&I Superintendent	Fuel flow will be continuously measured, and the readings will be input into the plant computer. Electronic records will be kept for at least 5 years. This data will be cross checked by adding it to the readings from M2 and 3 and comparing it against both the readings from M1 and those on the Sasol Gas invoices. The meters will be subject to regular maintenance (in accordance with stipulation of the meter supplier), calibration and testing to ensure acceptable monitoring accuracy. Records of calibration will be kept for at least 2 years following verification.
$EG_{PJ,y}$	Measured at Newcogen site through M18-20	Plant Manager	ESKOM is responsible for monitoring all 6 meters (M18-23) and flags differences between main meters and check meters. ESKOM submits monthly meter reading as part of invoicing to Newcogen. Paper files of invoices will be kept at Newcogen and ESKOM for at least 5 years.
$EF_{FF,CO2,i,y}$	IPCC 2006	Plant Manager	Karbochem to provide **one time paper record** of emissions factor for coal and slop oil (hexane). If Karbochem is not able to provide an emissions factor for the fuels they will provide an accurate description so that IPCC 2006 data can be used. If both are available need to use the lowest of the two. Information will be kept at the Newcogen site for the duration of the project.
Parameters	**Where Monitored**	**Capacity**	**Procedure (monitoring and calibration)**
$\varepsilon_{baseline,i,y}$	Measured by Karbochem Ltd.	Plant Manager (using data from Karbochem Ltd.)	**One time calculation** based on a year of measurements of coal use and steam production data from Karbochem Ltd. Records of these measurements will be kept at the Newcogen site for the duration of the project.
$NCV_{FF,i}$	Measured by SABS	Plant Manager (using	Karbochem to provide **one time paper record**

	at Spring Lake Colliery (sent through to Karbochem Ltd.)	data from Karbochem Ltd.)	of net calorific value (NCV) for coal and slop oil (hexane). If Karbochem is not able to provide NCVs for the fuels they will provide an accurate description so that IPCC 2006 data can be used. If both are available need to use the lowest of the two. Information will be kept at the Newcogen site for the duration of the project.

PARAMETERS MONITORED BY SASOL SYNFUELS (PTY) LTD (THE PRODUCER OF THE SYNTHETIC GAS) AND DATA SUPPLIED BY SASOL GAS LTD ON BEHALF OF SASOL SYNFUELS (PTY) LTD

Parameters	**Where Monitored**	**Capacity**	**Procedure (monitoring and calibration)**
$FF_{SGout, ,i,y}$	Synfuels plant	Sasol Gas Mgr	Sasol Gas Ltd to provide annual paper documentation of measured quantity of MRG leaving plant sold as pipeline gas
$\mathbf{Q_{NGin,,y}}$	Synfuels plant	Synfuels Mgr	Sasol Gas Ltd to provide annual paper documentation of measured quantity of natural gas supplied to Synfuels plant
$Q_{SPout,,i.y}$	Synfuels plant	Synfuels Mgr	Sasol Gas Ltd to provide annual paper documentation of measured quantity of all products of synfuels plant
$Q_{SPin,,i.y}$	Synfuels plant	Synfuels Mgr	Sasol Gas Ltd to provide annual paper documentation of fossil and utilities inputs to Synfuels plant – coal and electricity (natural gas covered under $Q_{NG,in,y}$

The following procedures will be implemented by the Newcogen operation prior to validation and verification:

- Establish and maintain data measurement, collection and record keeping systems for all monitoring parameters and sustainable development indicators
- Quality assurance procedures for internal and external data acquisition
- Procedures for project performance review before submitted for verification

ANNEX 5

Stakeholder Consultation Information

Newspaper Advert

SRK Consulting
Engineers and Scientists

Notification of Exemption from the Environmental Impact Assessment Regulations (Act No. 73 of 1989) for the Proposed Construction of a New Co-generation Heat and Power Plant at Karbochem (Pty) Ltd, Newcastle - Phase 2

Karbochem (Pty) Ltd propose constructing a co-generation heat and power plant at their facility located in Karbochem Road, off Madadeni
Road, i
involvec
approve
Regulat
propose
of the c

Implem
municip
coal fire
atmosp
The ult
boilers
given in
(No.73
develop
interest
before 1

Should
require
develop
at:
Tel :
Fax :
Email:

SRK Consulting
Engineers and Scientists

Suite 201 Sinodale Centre
345 Burger Street
3201 Pietermaritzburg

P O Box 460
Pietermaritzburg
3200 South Africa

e-Mail:
pietermaritzburg@srk.co.za
URL: http://www.srk.co.za

Tel: +27 (0) 33 345 6311
Fax: +27 (0) 33 345 6403

16 November 2005
338837

Mr. Gerald Willis-Smith
Environmental Services
Department of Agriculture and Environmental Affairs
Private Bag X22
Ulundi
3838

Attention: Mr. Gerald Willis-Smith

Dear Mr. Willis-Smith

Background Information for Phase 2 of the Proposed Construction of a New Co-generation Heat and Power Plant with Gas Turbines at the Karbochem (Pty) Ltd. Facility in Newcastle, KwaZulu-Natal

1. Introduction and Background

The Karbochem (Pty) Ltd. facility (Karbochem) is located in an industrial area south-east of the centre of Newcastle. Karbochem comprises several process plants, which are located on the premises to which the Karbochem Utility Company provides process steam, electricity and other services on site. The users currently receive their electricity from the Newcastle Municipality, via the Karbochem Utility Company, and the steam on site is generated by two Circa 1970 spreader stoker coal fired boilers, which are nearing the end of their lifespan. The boilers are consistently failing leading to an unreliable steam supply and high maintenance costs.

Background

The first phase of the project which involves the replacement of the coal-fired boilers with gas-fired package boilers, was approved in terms of the Environmental Impact Assessment (EIA) Regulations (No. 73 of 1989) in March 2005. The second phase involves installation of the co-generation plant i.e. for the generation of steam and electricity, and this document provides background information in this regard.

2. Requirements of the Environmental Impact Assessment Regulations

The Environmental Impact Assessment (EIA) Regulations as promulgated under the Environment Conservation Act (No. 73 of 1989) (ECA) require that an application be made to the relevant authority for authorisation to undertake any activity that could have a detrimental impact on the environment. The relevant authority in terms of implementation of the EIA Regulations in KwaZulu-Natal is the Department of Agriculture and Environmental Affairs (DAEA).

The proposed development constitutes a listed activity in terms of the EIA Regulations as follows:

- *No. 1a) The construction, erection or upgrading of facilities for commercial electricity generation with an output of at least 10 megawatts and infrastructure for bulk supply; and*
- *No. 1c) The construction or upgrading of transportation routes and structures, and manufacturing, storage, handling or processing facilities for any substance which is dangerous or hazardous and is controlled by national legislation.*

SRK Consulting (SRK) has been appointed to undertake the necessary environmental investigations to ensure the requirements of the EIA Regulations are met.

3. Motivation for the Project

Decommissioning of the existing coal fired boilers and replacing them with a new co-generation plant will eliminate the production of ash and emissions associated with the burning of coal, thereby providing electricity and steam in a more efficient manner. The new plant will be equipped with emission control facilities to ensure emission levels comply with the latest European Union standards, thereby providing a significant improvement in air quality emissions.

4. Process Overview

As noted in Section 1 above, the project will occur in two phases, although Phase 1 of the project is currently underway.

Phase 1

Phase 1 involves replacement of the existing coal-fired boilers with new gas-fired package boilers. Gas is currently supplied to site via an underground pipeline from which a connection will be constructed to supply the new gas boilers. Therefore, only the boilers will be replaced and all services will remain as is.

A public involvement process was undertaken and an exemption from the EIA process, in terms of Section 28A of the ECA, was applied for in January 2005 (EIA/5238). Environmental Authorisation for Phase 1 was granted by the DAEA on 3 March 2005.

Phase 2

Phase 2 will involve the construction of a new co-generation plant with gas and steam turbines. The boilers constructed as part of Phase 1 will then become the emergency energy and steam supply for the co-generation plant. For Phase 2, a separate exemption from the EIA process is being applied for.

Activities being undertaken for the exemption application for Phase 2 include:

- Advertisements in the local press to inform the public of the proposed development and invite comments on the proposed project (Natal Witness, Ilanga and Newcastle Advertiser during November 2005);
- Identification of interested and affected parties (IAPs);
- Distribution of background information letters (this letter);
- Consultation with IAPs to identify their concerns; and
- Compilation of an Exemption Report for submission to the authorities who will take a decision on whether Phase 2 of the project should be approved.

The process being run by SRK is an independent and objective one in which all relevant information, and issues and concerns identified by interested and affected parties, will be collated and submitted to the authorities to aid informed decision-making.

5. Potential Environmental Impacts / Issues

Potential environmental issues / impacts which will be assessed include:

- Water consumption and waste water;
- Contamination of groundwater and surface water;
- Atmospheric emissions;
- Energy consumption;
- Solid waste;
- Transport;
- Land use;
- Socio-economic aspects; and
- Health.

Additional environmental issues may be identified during the course of the project.

Should you have any issues or concerns pertaining to the proposed project, please contact **Marius van Huyssteen** of SRK (contact details as per letterhead). The closing date for comments on the project is **7 December 2005**.

Yours faithfully,

SRK Consulting

Marius van Huyssteen
Environmental Scientist

Nick Holdcroft
Partner

Amendment Letter

SRK Consulting
Engineers and Scientists

Suite 201 Sinodale Centre
345 Burger Street
3201 Pietermaritzburg

P O Box 460
Pietermaritzburg
3200 South Africa

e-Mail:
pietermaritzburg@srk.co.za
URL: http://www.srk.co.za

Tel: +27 (0) 33 345 6311
Fax: +27 (0) 33 345 6403

25 January 2006
338837

Mr. Gerald Willis-Smith
Environmental Services - DAEA
Private Bag X22
Ulundi
3838

Attention: Mr. Gerald Willis-Smith

Dear Mr. Willis-Smith

Amendment to Background Information Document for Phase 2 of the Proposed Construction of a New Co-generation Heat and Power Plant with Gas Turbines at the Karbochem (Pty) Ltd. Facility in Newcastle, KwaZulu-Natal

Distribution of the background information document dated 16 November 2005 regarding the project detailed above refers. Subsequent to distribution of this document, it has come to SRK Consulting's (SRK) attention that the coal fired boilers as operated by the Karbochem Utility Company, which supply energy and steam to various process plants at the Karbochem (Pty) Ltd. facility in Newcastle, would still remain in operation following installation of the new gas fired co-generation heat and power plant. However, following commissioning of this facility, the coal fired boilers would only operate at approximately 30% of their original capacity. This equates to a reduction in the daily use of coal from 11 to 4 tons. It is, however, the ultimate intention of the Karbochem Utility Company to cease all operations associated with the coal fired boilers and, although no guarantees can be provided in this regard, it is envisaged this would occur within 1-2 years. The existing situation, whereby the use of the coal fired boilers would be reduced by 70%, is still considered to be a substantial improvement over the current situation given the associated reduction in emissions and solid waste generated.

Should you have any issues or concerns pertaining to the proposed project, please do not hesitate to contact **Marius van Huyssteen** or **Nick Holdcroft** of SRK on the contact details as provided on the letterhead. In addition, please note that the closing date for comment on the project has been extended to 1 February 2006.

Yours faithfully,

Marius van Huyssteen
Environmental Scientist

Nick Holdcroft
Partner

Correspondence Received

Marius van Huyssteen

From: Melissa Joubert [mjoubert@srk.co.za]
Sent: 25 January 2006 02:19 PM
To: Marius Van Huyssteen
Subject: FW: Amendment to Background Information - Phase 2 of Karbochem (Pty) Ltd. Project, Newcastle, KZN

See message below from IAP

-----Original Message-----
From: Brandt Van Der Berg (NCT) [mailto:Brandt.vdBerg@labour.gov.za]
Sent: 25 January 2006 02:10
To: Melissa Joubert
Subject: RE: Amendment to Background Information - Phase 2 of Karbochem (Pty) Ltd. Project, Newcastle, KZN

Thank you for the update, no comment at this point.
Brandt

-----Original Message-----
From: Melissa Joubert [mailto:mjoubert@srk.co.za]
Sent: Wednesday, January 25, 2006 12:59 PM
To: Brandt Van Der Berg (NCT)
Subject: Amendment to Background Information - Phase 2 of Karbochem (Pty) Ltd. Project, Newcastle, KZN

Dear Sir / Madam

Amendment to Background Information for Phase 2 of the Proposed Construction of a New Co-generation Heat and Power Plant with Gas Turbines at the Karbochem (Pty) Ltd. Facility in Newcastle, KwaZulu-Natal

Please find attached a letter amending the background information for the above mentioned proposed upgrade of the Karbochem (Pty) Ltd. Facility in Newcastle, KwaZulu-Natal.

Should you have any issues or concerns pertaining to the proposed project, please do not hesitate to contact Marius van Huyssteen of SRK, on the contact details provided below, by no later than 1 February 2006.

Regards
Marius van Huyssteen
SRK Consulting
Tel: (033) 345 6311
Fax: (033) 345 6403
Email: mvanhuyssteen@srk.co.za

Marius van Huyssteen

From: Melissa Joubert [mjoubert@srk.co.za]
Sent: 30 January 2006 12:34 PM
To: Marius Van Huyssteen
Subject: FW: Amendment to Background Information - Phase 2 of Karbochem (Pty) Ltd. Project, Newcastle, KZN

Application Form.doc (60 KB)

See below and attached!

-----Original Message-----
From: lugskoon@iafrica.com [mailto:lugskoon@iafrica.com]
Sent: 30 January 2006 12:09
To: Melissa Joubert
Subject: RE: Amendment to Background Information - Phase 2 of Karbochem (Pty) Ltd. Project, Newcastle, KZN

Ms Joubert,

Please note that the project is classified as a sheduled process in terms of APPA. Therefore an application for registration must be submitted to this Directorate.

An application form is attached herewith.

Regards

Julius van Graan

-----Original Message-----
From: Melissa Joubert [mailto:mjoubert@srk.co.za]
Sent: 25 January 2006 13:10
To: lugskoon@iafrica.com
Subject: Amendment to Background Information - Phase 2 of Karbochem (Pty) Ltd. Project, Newcastle, KZN

Dear Sir / Madam

Amendment to Background Information for Phase 2 of the Proposed Construction of a New Co-generation Heat and Power Plant with Gas Turbines at the Karbochem (Pty) Ltd. 'acility in Newcastle, KwaZulu-Natal

Please find attached a letter amending the background information for the above mentioned proposed upgrade of the Karbochem (Pty) Ltd. Facility in Newcastle, KwaZulu-Natal.

Should you have any issues or concerns pertaining to the proposed project, please do not hesitate to contact Marius van Huyssteen of SRK, on the contact details provided below, by no later than 1 February 2006.

Regards
Marius van Huyssteen
SRK Consulting
Tel: (033) 345 6311
Fax: (033) 345 6403
Email: mvanhuyssteen@srk.co.za

KARBOCHEM (PTY) LTD

KARBOCHEM
Reg 2002/015590/07

PRODUCTION
Bunsen Street,
PO Box 19,
SASOLBURG 1947
SOUTH AFRICA
Tel : +27 16 970 1911
Fax : +27 16 976 2672

Karbochem Road,
Private Bag X6600,
NEWCASTLE 2940
SOUTH AFRICA
Tel : +27 34 370 1111
Fax : +27 34 312 1577

MARKETING
Eastgate Office Park
Block B, Ground Floor
South Boulevard
P O Box 581
BRUMA 2026
SOUTH AFRICA
Tel : +27 11 601 1660
Fax : +27 11 616 6851

31st January 2006

SRK
Attention Mr Nick Holdcroft
P.O. Box 460
Pietermaritzburg
3200

Dear Sir

Re: Amendment to Background Information Document for Phase 2 of the Proposed Construction of a New Co-generation Heat and Power Plant with Gas Turbines at the Karbochem (Pty) Ltd Facility in Newcastle, Kwa Zulu-Natal.

The Newcastle Chamber of Commerce sent us a copy of your letter dated 25 January 2006 on the above subject and this is attached for easy reference.

We wish to draw your attention to the following:

- The existing coal fired boilers only supply steam (not electrical energy) to various plants on the site.
- The boilers are being operated at less than the nameplate capacity.
- Following the commissioning of the new co gen facility the existing boilers will be operated at approximately 30% of the current load (not 30% of original capacity).
- Our average coal usage for the period September 2005 to December 2005 was 255 t/d (not 11t/d).

Yours sincerely

Jack Zoutendyk
General Manager: Projects

EZEMVELO KZN WILDLIFE

Enquiries: Dinesree Thambu **Your Ref:** No Ref Provided

31 January 2006

SRK Consulting
P O Box 1731
DURBAN
4000

ATTENTION : MR M VAN HUYSSTEEN

Dear Mr Huyssteen

PROPOSED NEW CO-GENERATION HEAT AND POWER PLANT AT KARBOCHEM

The abovementioned application has been reviewed by Ezemvelo KZN Wildlife (EKZNW) staff.

No serious biodiversity concerns have been identified at this stage. Should any biodiversity related issues arise, or should you have any biodiversity related queries, please do not hesitate to contact us.

Yours sincerely

Coordinator IEM
for CHIEF EXECUTIVE OFFICER
c:DT\Industrial\DT(Karbochem Co-Generation Heat & Power Plant, Newcastle)

P O Box 13053
Cascades, 3202.
KwaZulu-Natal.
South Africa.
Tel:
(033) 845 1999.
Fax:
(033) 845 1699
Reservations:
Tel:
(033) 845 1000.
Fax:
(033) 845 1001.
Information
Tel:
(033) 845 1002.
Ibhokisi 13053
Cascades, 3202.
KwaZulu-Natali.
Eningizimu
Africa.
Ucingo:
(033) 845 1999.
Isikhahlamezi:
(033) 845 1699
Ucingo
Lokubhukha:
(033) 845 1000.
Isikhahlamezi:
(033) 845 1001.
Ucingo Lolwazi:
(033) 845 1002.
Posbus 13053
Cascades, 3202.
KwaZulu-Natal.
Suid Afrika.
Tel:
(033) 845 1999.
Faks:
(033) 845 1699
Besprekings
Tel:
(033) 845 1000.
Faks:
(033) 845 1001.
Inligting
Tel:
(033) 845 1002.

IUCN