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:

Distributed Energy Generation's Waste Heat to Power Project at XAWO
Version 02
Date: 20 July 2012

Version History
Document version History

PDD version 01, submitted to DOE on 16 February 2012	Version submitted for Global Stakeholder Process
Version 02, 20 July 2012	Revised version during validation

A.2. Description of the project activity:

Definitions as provided in ACM0012, Version 4.0.0 and how they apply to the project activity

Recipient facility. *The facility that receives useful energy generated using waste energy under the project activity from the waste energy generation facility. It may be the same as the waste energy generation facility (*Page 2/60, ACM0012*).*

- The recipient facility is Xstrata Alloy's Wonderkop Operations (XAWO) Ferrochrome Facility near Rustenburg in South Africa, which will receive electricity.

Waste Energy. *Energy contained in a residual stream from industrial processes in the form of heat, chemical energy or pressure, for which it can be demonstrated that it would have been wasted in the absence of the project activity. Examples of waste energy include the energy contained in gases flared or released into the atmosphere, the heat or pressure from a residual stream not recovered (i.e. wasted),* Page 3/60, ACM0012.

- The waste energy is in the form of waste heat in the baseline scenario, which is also the current scenario.

Waste Energy Carrying Medium (WECM). *The medium carrying the waste energy in form of heat, chemical energy or pressure. Examples of WECM include gas, air or steam carrying waste energy, (*Page 3/60, ACM0012*)..*

- The WECM is waste heat produced in Submerged Arc Furnaces (SAF's) of the semi-closed type at XAWO.

Waste energy generation facility ('the project facility'). *The facility where the waste energy, which is to be utilized by the CDM project activity, is available. The project activity can be implemented by the owner of the facility or by a third party (e.g. ESCO). If the waste energy is recovered by a third party in a separate facility, the 'project facility' will encompass both the waste energy generation facility and the waste energy recovery facility, (*Page 3/60, ACM0012*).*

- The project activity is implemented by a third party, an independent power producer (IPP), Distributed Energy Generation Proprietary Limited (DEG), in a separate power generation facility. Therefore, the 'project facility' includes (1)XAWO furnaces where the waste energy is produced and (2)the waste energy recovery plant and power generation plant owned and operated by DEG.

- The existing plant was established in 1995 and the first two furnaces were commissioned in 1996.
- There are in total six furnaces at XAWO, Furnace 1 & 2 commissioned in 1996, 3 & 4 commissioned in 1998 and 5 & 6 commissioned in 2002.
- During the ferrochrome production process carbon monoxide (CO) and hydrogen (H_2) is released from the raw material burden at a temperature of 750˚C, reacts with a large amount of ingress air above the furnace during which it combusts, resulting in air, products of combustion and dust to leave the furnace via off-gas ducts at elevated temperatures of 450˚C (±100˚C)
- All six furnaces have the same design philosophy around handling the waste heat, i.e. all waste heat produced in the furnaces are released to atmosphere.
- The quantity and the quality of the waste heat produced in the furnaces depend on the furnace raw material and electricity input.
- The waste heat is not utilised in any way at the existing facility, because the heat is of a low grade quality. The process design is such that the waste heat is not utilised, i.e the smelter was not designed to utilise waste heat from the furnaces in any way.
- No process heat from the furnaces is currently used for any energy recovery operations[1].

1. Purpose of the project activity

The proposed project activity is an initiative to recover waste heat from waste gas from six existing semi-closed type ferrochrome furnaces at XAWO. The envisaged project will divert the waste heat to an Organic Rankine Cycle (ORC) facility, which will convert low grade heat into usable electrical energy, with a maximum rated output capacity (MRC) of 35.8MW[2]. The project will generate an expected net total of 222,875MWh of electricity per annum. The electricity will be used by XAWO to replace electricity purchased from Eskom, the national power utility.

The implementation of the project will have no impact on the existing production operations at the smelter. Construction of the project is expected to start at the earliest in November 2012.

The crediting period selected is a fixed 10 years and the amount of emission reductions that will be generated during the crediting period is estimated at 247,064tons per annum.

2. Scenario existing prior to the implementation of the project activity and Baseline scenario

The scenario existing prior to the implementation of the project activity and the baseline scenario is the same.

a) Current scenario and baseline for electricity

XAWO currently purchases all the electricity needed for its production activities directly from Eskom, the national power utility. The electricity is delivered via the South Africa power grid.

Current scenario and baseline for waste heat

[1] Appendix 8 Expert Report, Baseline Energy Report, Revision 2

[2] Appendix 10 Equipment specification sheet

At present, the waste heat produced from the semi-closed submerged arc furnaces is collected from the furnace by ID-fans drawing the flue gas via gas ducting through trombone coolers introducing it into bag houses for the removal of dust particles before it is vented to the atmosphere via vents. The dust is removed by dedicated bag houses enabling the required air emission standards to be achieved.

Currently the following conditions apply for the XAWO site:

- No waste heat is currently recovered for the generation of electricity[3] or any other purpose at the site.
- No electricity generation equipment is installed on site that converts waste heat to electricity[4].

National grid information for South Africa

The national utility, Eskom, is a government-owned entity and generates approximately 95 per cent of South Africa's electricity[5]. Private generators produce approximately 3% of national electricity requirements and municipalities produce less than 1%. Approximately 90% of electricity in South Africa is derived from coal-fired power stations[6].

XAWO Background

Ferrochrome is produced by reducing iron and chrome bearing ore with carbon. Carbon is supplied in the process by adding a cocktail of coke, coal, char and/or anthracite. The process of reduction of the metal oxides takes place at high temperature of approximately 2 800°C. This high temperature is achieved by passing an electrical arc through the raw materials by means of three graphite electrodes. Additional chemical energy is released during the reduction reaction of carbon with the ore. The products of the process are ferrochrome liquid metal, liquid slag, and the off gas. The electricity demand of the site is a function of the amount of furnaces in operation and may exceed 300MW if all 6 are in operation at the same time.

Semi-closed furnaces of this type have a furnace (crucible) with a typical inside diameter of 11m to 12m and depth of 2.5m to 3.5m. A smoke hood is installed above each furnace from where 3 electrodes protrudes. Side skirts hangs from the smoke hood to shield the close proximity from heat and light radiation created by the electric arc and combustion taking place in the furnace. The refractory lined smoke hood as well as the side skirts are water cooled to protect it from heat damage. 3 gas ducts are installed on the smoke hood through which gas and ambient air is drawn by means of a flue gas fan installed some 100m from the furnace. The first 6m of the gas ducts are refractory lined and water cooled to protect it from heat damage. The gas ducts joins into a single 3m diameter mild steel duct connecting the furnace with the flue gas fans for transport of the flue gas.

Carbon monoxide and hydrogen gas is formed in the raw material burden during arcing. This gas rises from the furnace burden at approximately 750°C and reacts with oxygen supplied by air drawn in from

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[3] Appendix 8 Expert Report, Baseline Energy Report, 25 January 2012

[4] Appendix 8 Expert Report, Baseline Energy Report, 25 January 2012

[5]Appendix 15: Electricity Supply Industry of South Africa Report, page 6

[6] Appendix 15: Electricity Generation Statistics in South Africa, http://www.geni.org/globalenergy/library/energy-issues/south africa/index_chart.html

the sides of the furnace. The resulting fully combusted flue gas leaves the furnace at temperatures varying between 350°C and 550°C.

The flue gas carries a significant amount of dust from the furnaces. This dust consists primarily of oxides of a variety of metals (ash) and some unburned carbon. Trombone coolers are installed between the furnaces and the flue gas fans to allow cooling of the flue gas by transfer of heat from the gas to ambient air ensuring a target filtering temperature of between 190°C and 220°C. Cyclones are installed upstream of the trombone coolers for the removal of the bulk of the dust contained in the flue gas. The gas dust content still is at approximately 2.6g/Nm^3 once the gas exits the cyclones.

Cooling of the flue gas is necessary as the bag filter material is limited with regards to the temperature it can deal with. The amount of cooling is also limited as the gas needs to remain above its sulphuric dew point which is estimated to be as low as 80°C to 90°C. The gas temperature needs to be above the dew point once it leaves the infrastructure at the last bag of the bag house filters.

b) Project scenario

Project scenario for the electricity

Electricity generated from the project activity will be replacing electricity imported by XAWO from the national utility (Eskom) via the national grid. Greenhouse gas emissions associated with the electricity generation in the national grid will be reduced as a result.

Project scenario for the waste heat

The waste heat currently released at the site will be recovered, conditioned and diverted to an Organic Rankine Cycle (ORC) facility where heat extracted by heat exchangers from the furnace flue gas, heating thermal oil to a target temperature of 290˚C, will be transferred to an organic fluid to circulate through the ORC facility acting in accordance to the properties of the Rankine Cycle to convert the heat to electrical energy by driving expansion turbines connected to generators.

The primary new equipment components of the project activity include the following main equipment:

i. Flow valves for diverting gas to new gas ducting,
ii. heat exchangers,
iii. hot oil and cold oil piping network,
iv. ORC equipment including heat exchangers,
v. four turbines,
vi. two generators,
vii. condensers,
viii. electrical cabling; and
ix. switch gear.

The technology selected for the electricity generation is Organic Rankine Cycle (ORC) technology which uses a low boiling point organic medium (Iso-pentane) as working fluid heated and vaporised at elevated pressure by the heat source, being a thermal oil used to transfer the heat from the heat exchangers where heat is extracted from the flue gas, to expand across a turbine connected to a generator before condensed to a fluid in an air cooled condenser and returned to the heat exchangers by a pump thus completing the closed cycle.

3. Sustainable Development

The project will contribute to sustainable development in South Africa in the following ways:

Environment Benefits

The project will displace some coal-dominated power generation in South Africa with power generated from waste gas, thereby reducing the carbon footprint of South Africa.

Social Benefits

The proposed development also represents an investment in waste energy to power generation, which, given the challenges created by climate change, represents positive social benefit for society as a whole. The key social issues associated with the construction phase include the creation of employment and the opportunity for skills development and training. During the construction period there will be job creation and once the project is implemented, at least10 permanent employees will be employed.

Economic Benefits

Given the highly technical nature of the power plant, the opportunity for South African production and local content is likely to increase over time, however will be lower for the first number of waste energy to power projects.

Technology Transfer

There will be a transfer of technology to South Africa from Israel. The organic rankine cycle technology that are used to generate the electricity will be sourced from Ormat Technologies Inc. in Israel and will be imported to South Africa.

The proposed project activity will contribute to technology transfer to the host country South Africa.

A.3. Project participants:

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

XAWO

Xstrata South Africa (Pty) Ltd is the holding company of Xstrata Alloys of which Xstrata Alloys Wonderkop Operations (XAWO) is one of the ferrochrome producing plants. XAWO is located in the North-West Province some 15 km east south-east of the city of Rustenburg.

DEG

DEG is a privately owned Independent Power Producer (IPP) registered in South Africa. It is focussed on utilising wasted energy sources as input for the generation of electricity utilising the most appropriate technologies.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

South Africa

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

Rustenburg, North West Province

A.4.1.3. City/Town/Community etc.:

The project is located near the town of Rustenburg

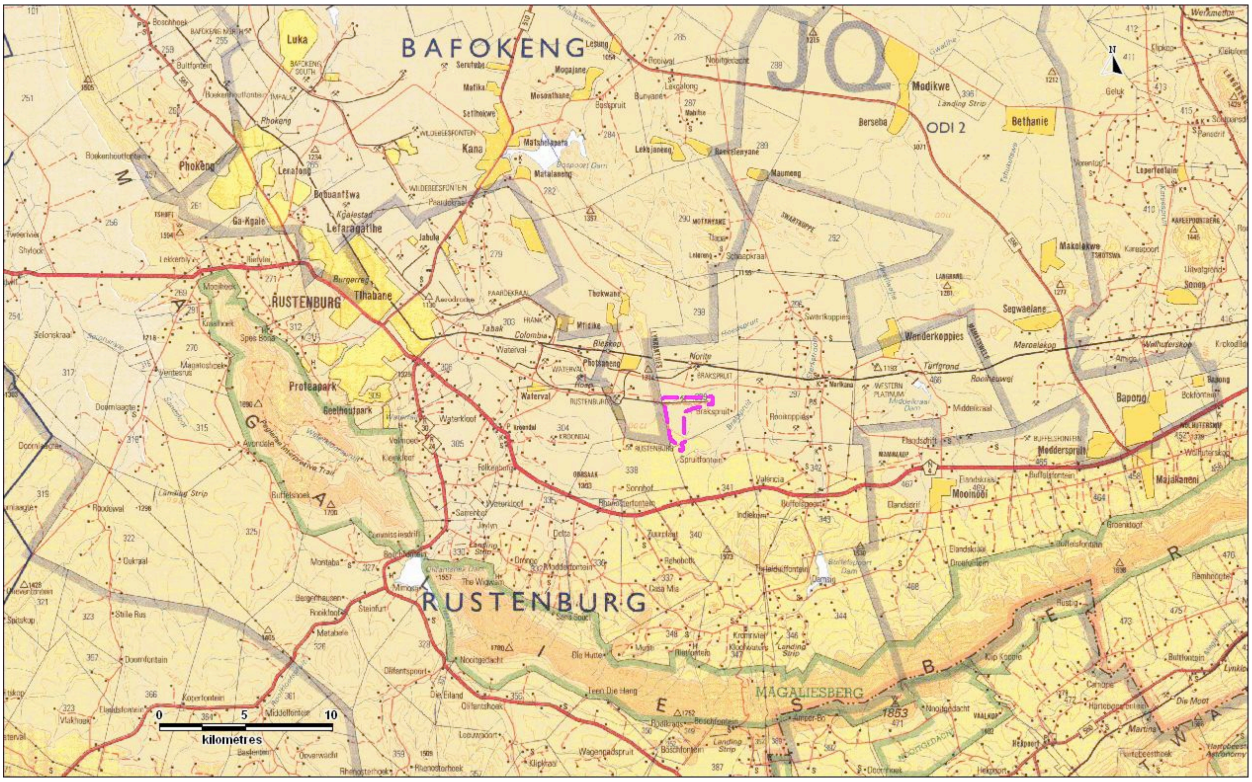
A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The Xstrata Alloys Wonderkop Operations (XAWO), where the DEG Waste Heat to Power Project will be conducted, is located in the North-West Province some 15 km east south-east of the city of Rustenburg.

GPS coordinates for the site (location of Furnace number 1):

25˚42’50.57” S
27˚24’12.66” E

Figure 1: Location of XAWO



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

Sectoral scope 01: Energy industries (renewable-/non-renewable sources)
Sectoral scope 04: Manufacturing industries

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

A.4.3.1 Description of the environmentally safe and sound technology and knowledge that is transferred to South Africa.

The technology used to generate the electricity will be sourced from Ormat Technologies Inc. in Israel and will be imported to South Africa. The technology is mature technology that is applied extensively internationally, although not in the ferrochrome industry.

A.4.3.2 Purpose of the project activity

DEG is to develop an electricity generation project with a maximum rated capacity of 35.8 MWe utilizing furnace waste heat generated at XAWO in Rustenburg Semi-closed submerged AC arc furnaces.

The electricity generated on site will displace 222,875MWh of the electricity imported from the South African national grid.

In the case of this project activity, the existing scenario and the baseline scenario is the same.

A.4.3.3 The scenario existing prior to the start of the implementation of the project activity, with a list of the equipment and systems in operation

The 6 semi-closed furnaces generate waste heat that by design is released to atmosphere as part of the business-as-usual production process since 1996 (Refer to Appendix 8). By design, all of the waste heat produced by is released. This gas typically contains 32MW of recoverable energy per furnace, which is to be utilised as a heat source for the project activity.

3.26MWth waste heat per ton ferrochrome produced in furnaces 1 to 6 is vented to atmosphere after particulates are removed to comply with environment air quality regulations. (Refer to Appendix 8, Expert Report, Baseline Energy Report, 25 January 2012[7])

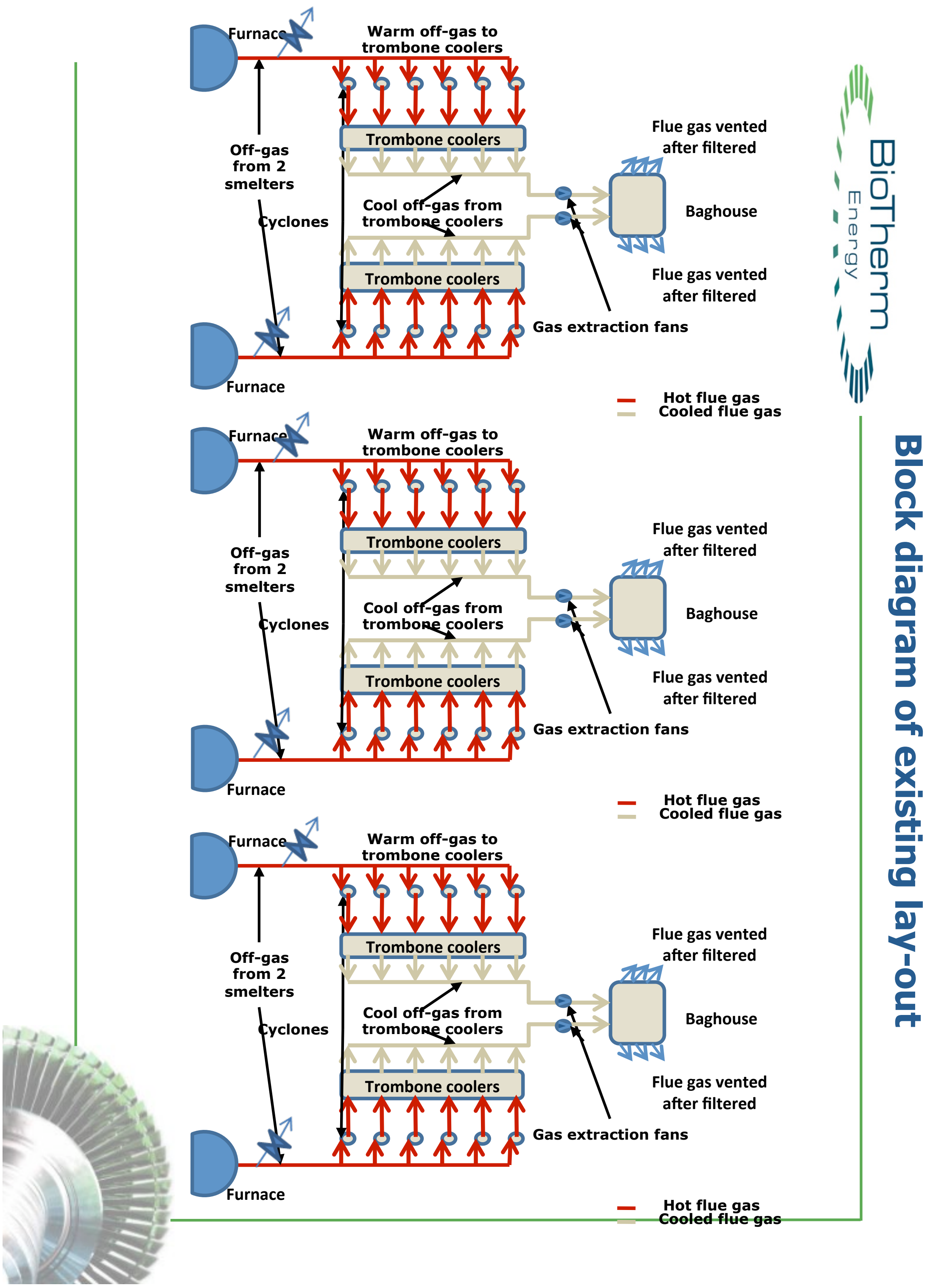
The existing equipment that is relevant to the project activity includes the following:

1. Six semi-closed submerged arc furnaces – where the waste heat is produced,
2. Gas cleaning equipment for each furnace – Gas ducting passing through trombone coolers, ID fans and bag houses

The **Error! Reference source not found.** below provides a layout of the existing gas handling system and shows that the process is designed to vent all heat energy produced in the furnaces.

[7] Baseline energy Report for Waste Heat Recovery at Xstrata Wonderkop Ferrochrome Smelters Engineer Calculations Summary, Energy balance information is classified and will be available to the validator.

Figure 2: Existing waste gas reticulation system



Furnaces Design Information

Table 1: Equipment information for the current scenario at XAWO

	Furnace 1 to 6
i. Age and average lifetime of the furnaces based on manufacturer's specifications	An independent study was conducted to ascertain the remaining lifetime of equipment. The external experts had access to XAWO information and had access to the process plant in order to conduct the study. Please refer to Appendix 9_Lifetime of Equipment_2012. The study concluded that the remaining life of plant is at least 20 years, considering the maintenance practises employed.
ii. Existing and forecast installed capacities for the existing two furnaces	Furnace design specifications[8] are provided by the technology supplier. Furnace 1 to 6: Semi-closed submerged arc furnaces Capacity: 6 X 45 MVA Design Production Capacity of XAWO: 460,000 tons/year
iii. The monitoring equipment and their location in the system	Electricity measurement equipment exists in the substations supplying the furnaces to measure the input into each furnace. Similarly raw material feed mass, ferrochrome production and flue gas temperature is measured and logged in the control system of each furnace
iv. The types and levels of services (normally in terms of mass or energy flows) provided by the systems and equipment that are being installed under the project activity and their relation, if any, to other manufacturing/production equipment and systems outside the project boundary.	- The type of service delivered by the project activity is electricity. - The level of service is 222 875MWh per year The primary new equipment components of the project activity include the following main equipment: • Flow valves for diverting gas to new gas ducting, • heat exchangers, • hot oil and cold oil piping network, • ORC equipment including heat exchangers, • four turbines, • two generators, • condensers, • electrical cabling; and • switch gear. - There is no relation between the type and level of service or the equipment installed with other manufacturing or production outside the project boundary
v. Explain how the same types and levels of services provided by the project activity would have been provided in	The 222,875MWh electricity will be provided by Eskom via the national grid in the baseline scenario.

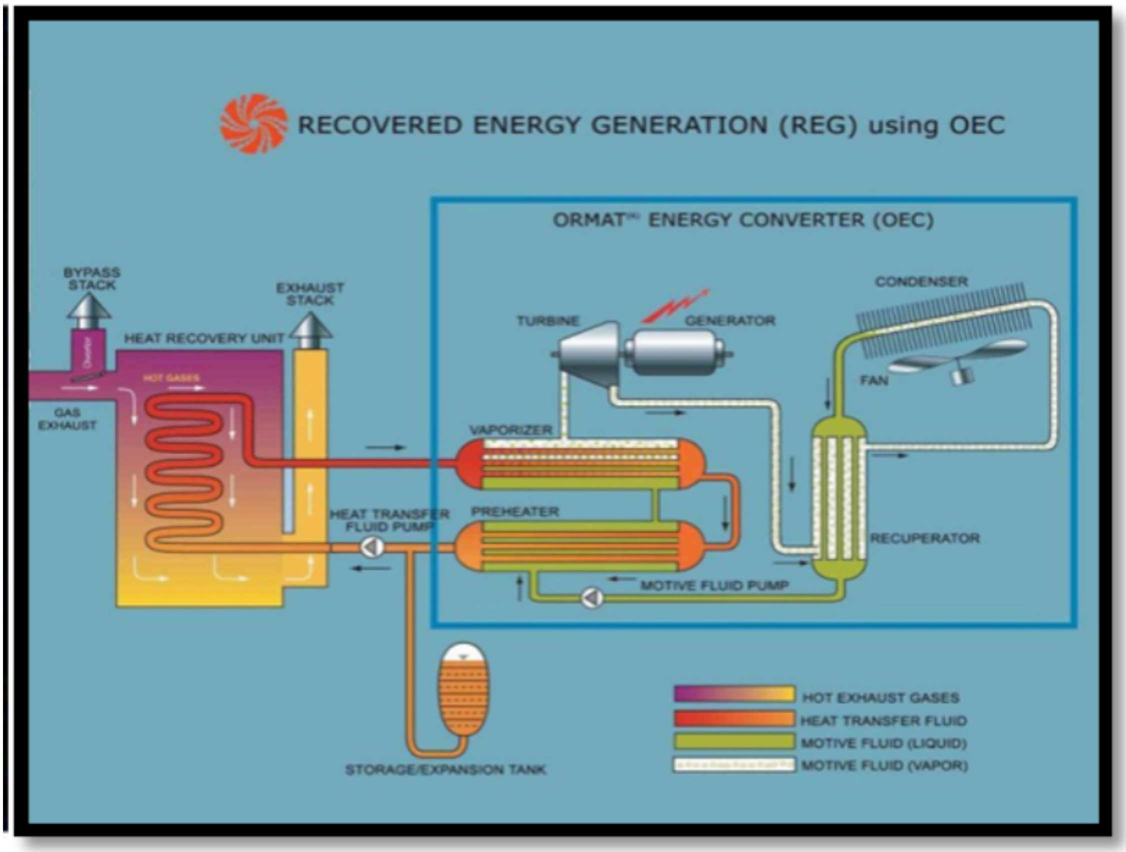
[8] Detailed Specifications for the furnaces are confidential and will be submitted to the validator only

	Furnace 1 to 6
the baseline scenario.	

A.4.3.4 The scope of measures that are being implemented within the project activity, with a list of the equipment and systems that will be installed

Figure 3 provides a layout of the proposed power generation system.

Figure 3: Proposed new power plant



Description of the new power plant

Waste heat from all six furnaces will be directed into the proposed new waste heat recovery plant to generate electricity. The equipment to be installed for each furnace includes the following;

- Hot operation diversion valves to be installed in the gas ducts of each furnace to divert hot gas streams from the current gas ducting into new dedicated heat insulated gas ducts to limit heat loss to the environment.
- Cyclones or multi-cyclones will be installed in the new heat insulated gas ducts of each furnace to

enable removal of large or course dust/ash particles.

- Heat exchangers will be installed in parallel to the existing trombone coolers to enable transfer of heat from the gas to thermal oil which will be used as heat carrier to transfer heat from the heat exchangers to two centrally placed Organic Energy Converters Unit (OEC's)
- An heat insulated oil piping network will be installed to transfer warm oil from the heat exchangers of each furnace to the OEC's and to return cool oil from the OEC's to the heat exchangers.
- Two new OEC units, of identical design and capacity will be installed to convert the heat in the thermal oil to drive 4 turbines connected to 2 generators. The OEC's will consist mainly of the following;
    - Organic fluid boilers which will use the warm oil input to boil pre-heated organic fluid (Iso-pentane) at elevated pressures,
    - The thermal oil, still quite warm, will transfer the remainder of its heat in pre-heaters which pre-heat the organic fluid before passing it on to the boilers,
    - Turbine expanders will be installed to allow the pressure and temperature energy of the organic fluid from the boilers to transfer its potential energy to the turbines of which two will each be connected to one of two newly installed generators to generate electricity at 11kV,
    - The organic fluid will pass through recuperators after exiting the turbines to transfer some latent heat and thus heat some condensed organic fluid as it exits the newly installed air cooled condensers.
    - Large air cooled condensers will be installed to condense the organic fluid so that the liquid can be pumped at elevated pressure by multi-stage liquid pumps,
    - Step-up transformers will be installed to step the electricity up from the generated 11kV to a targeted 33kV at which voltage it can be relayed via electrical cables to internal substations of XAWO.
    - The associated electrical switchgear and protection equipment will also be installed to ensure the new substation and all its auxiliary equipment as well as the internal grid of XAWO is protected.
    - Electrical cabling will be installed between the generators transformers and the XAWO substations where the electricity will be diverted to the XAWO electrical distribution system to.
    - Instrumentation and control equipment will be installed at the OEC's and heat exchangers to ensure effective and accurate control of the whole heat recovery power generation facility.

Refer to Appendix 10 for a comprehensive list of new equipment that will be implemented in the project activity.

The main equipment is the following:

1. **Ducting, Heat exchangers, Oil circuit, Heat exchangers, turbines, generators, condensers, cables and switchgear**

Information regarding the preferred technology

i. Average lifetime of the organic rankine equipment based on manufacturer's specifications is 40 years (Refer to Appendix 11_Letter for the life expectancy of the OEC.pdf).
ii. Existing and forecast installed capacities, load factors and efficiencies (see Table 2).

Table 2: Design parameters for the preferred technology (Appendix 6, page 15 of 40)

Site Conditions:	
Minimum/Maximum air temperature	0°C/40°C(1)
Elevation above sea level	1,220m
Seismic zone	TBD
Heat Source and cooling Design Point Conditions:	
Heat source:	
Thermal oil flow(2)	2,194 t/h
Thermal oil inlet/outlet temperature	280°C/125°C
Thermal power recovered by OEC	209.8 MWth
Cooling:	
Ambient temperature (dry bulb)	16.8°C(1)
Performance Specifications at Design Point Conditions:	
Net Generator output at generator terminals	40,500 kW
Net output available to Client(3)	36,000 kW
Other main OEC Specifications:	
Generator type	Synchronous, with power factor 0.85 Lagging
Generator voltage	11 kV
Frequency	50 Hz
Noise level	95 dB(A) at one (1) meter distance from source of noise (noise reduction is possible at an additional cost)

Parameter	Units	
Manufacturer: Ormat	2	20MW each Organic Energy Converters
Energy input	MWth	180
Electrical efficiency	%	17.78

iii. The monitoring equipment and their location in the system is described in Section 7.2.3.

iv. The types and levels of service: Organic Rankine Cycle will be implemented delivering an estimated 222,875MWh per year.

v. In the baseline scenario, the 222,875 MWh would be delivered by the national grid.

vi. The current scenario (pre-project) does not have any form of control on the flue gas temperature as it exits the furnaces. There is also no control of the flue gas temperature at the inlet to the bag filters, other than for the ability to draw in ambient air at the trombone coolers if the gas temperature at the bag house filter inlet exceeds the specified 220˚C allowable limit. During warm summer afternoons this ambient air inlet allows cooling of the flue gas to within the limit. During cold winter mornings the flue gas temperature at the bag house inlet may be below 100˚C. No low limit alarm condition is defined in the bag house control system.

vii. The installation of heat exchangers in the project scenario in parallel to the trombone coolers will allow the furnaces' flue gas to be cooled in a controlled way to below the upper limit temperature that the baghouse filter material is designed for. It will also allow energy currently lost to atmosphere to be utilised to generate usable electrical energy.

2. The estimated capacity factor for the power generation system

Electricity generation is based on (1) heat availability from the furnaces, (2) furnace availability, and (3) ORC availability.
The resulting electricity generation is further influenced by the furnace availability factor of 95% during these periods and an ORC availability factor of 98% in the low demand and 99% in the high demand periods. (References to availabilities will be provided to the validator). The following table summarises the expected output as a function of availability and capacity.

Applying 95% furnace availability to the above reduces the average output to 25.4MW. The capacity factor is therefore calculated as 25.4/32=79.4%.

The emissions sources and the greenhouse gases involved in the project activity, according to the methodology used

Backup equipment

No backup electricity generation equipment will be installed as part of the project in the case that the proposed power plant experiences outages or abnormal conditions. The DOE can check this during verification.

A.4.3.5 The baseline scenario with an indicative list of the equipment and systems that would have been in place in the absence of the project activity.

In the case of this project activity, the existing scenario and the baseline scenario is the same, so the information for the baseline scenario is provided under A.4.3.3.

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

Year	Annual estimation of emission reductions in tonnes of CO_2e
1	247,064

2	247,064
3	247,064
4	247,064
5	247,064
6	247,064
7	247,064
8	247,064
9	247,064
10	247,064
Total estimated reductions (tonnes of CO_2e)	2,470,640
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	247,064

A.4.5. Public funding of the project activity:

No public funding has been used in the development of this project and no public funding will be used in its implementation. Official Development Assistance (ODA) has not and will not be used in the development and implementation of this project.

SECTION B. Application of a baseline and monitoring methodology

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

1. Approved consolidated baseline and monitoring methodology ACM0012 "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects", Version 4.0.0.

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

2. "Tool to calculate the emission factor for an electricity system", Version 02.2.1;
3. "Tool for the demonstration and assessment of additionality", Version 06;
4. "Tool to determine the remaining lifetime of equipment", Version 01;

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

The following table summarises the applicability criteria for projects using ACM0012. Applicability criteria from the various Tools that are applied in the PDD are also provided.

This project activity meets all of the criteria – this is justified in the table below.

The consolidated methodology is applicable to project activities implemented in an existing facility converting waste energy carried in identified waste stream into useful energy. In this project activity, the WECM is waste heat produced in existing ferrochrome furnaces.

Table 3: Demonstration that the proposed project activity complies with the Applicability Criteria from ACM0012

Applicability Condition from ACM0012	Comment on whether the Applicability Criteria applies to the project activity. If it applies, a discussion is provided to demonstrate how the project activity complies with the criteria.	Summary of Applicability of the project activity to the criteria
The WECM stream may be an energy source for: • Generation of electricity; • Cogeneration; • Direct use as process heat source; • Generation of heat in element process; • Generation of mechanical energy; or • Supply of heat of reaction with or without process heating.	The waste heat is an energy source for the generation of electricity only. The project activity is the implementation of an electricity generation system only.	Project activity complies with the criteria.
In the absence of the project activity, the WECM stream: a) Would not be recovered and therefore would be flared, released to atmosphere, or remain unutilized in the absence of the project activity at the existing or Greenfield project facility; or b) Would be partially recovered, and the unrecovered portion of WECM stream would be flared, vented or remained unutilised at the existing or Greenfield project facility.	In the case of this project activity, condition (a) applies, it is in the absence of the project activity, waste heat would not be recovered and would remain unutilized. • The waste heat produced by each of the 6 furnaces has been vented historically since the furnaces were commissioned and is still being vented currently after particulates are removed in bag houses for environmental air quality purposes.[9] • An independent expert report confirms that the waste heat that will be used to generate electricity in the project activity is currently released to	Project activity complies with the criteria.

[9] Appendix 19 Air Quality License (APPA Certificate for Scheduled Processes, Department of Environment)

Applicability Condition from ACM0012	Comment on whether the Applicability Criteria applies to the project activity. If it applies, a discussion is provided to demonstrate how the project activity complies with the criteria.	Summary of Applicability of the project activity to the criteria
	atmosphere and that it is not used for any other purpose at XAWO[10]. The expert report contains (1) an energy balance of the relevant sections of the plant, and (2) an assessment of energy bills to demonstrate that all the energy required for the process has been procured commercially and that no other energy source such as waste energy was used in the production process.	
Project activities improving the WECM recovery may: (i) capture and utilise a larger quantity of WECM stream as compared to the historical situation in existing facility, or capture and utilise a larger quantity of WECM stream as compared to a "reference waste energy generating facility"; and/or (ii) apply more energy efficient equipment to replace/modify/expand waste energy recovery equipment, or implement a more energy efficient equipment than the "reference waste energy generating facility".	(i) Currently, no waste heat is recovered for the purpose of generating electricity[11]. The proposed project activity will introduce waste heat recovery, i.e. the project activity captures and utilises a larger quantity of waste heat as compared to the historical situation in existing facility. (ii)The project activity does not replace, modify or expand any waste energy recovery equipment and it does not implement more energy efficient equipment, therefore condition (ii) does not apply to the proposed project activity.	Project activity complies with the criteria.
The methodology is applicable under the following conditions: • For project activities which recover waste pressure, the methodology is applicable where waste pressure is used to generate electricity only and the electricity generated from waste	This applicability condition does not apply as the project activity is not recovering waste pressure.	Not applicable

[10] Appendix 8 Baseline Energy Investigation, Rev 1, 25 January 2012

[11] Appendix 8 Baseline Energy Investigation, Rev 1, 25 January 2012

Applicability Condition from ACM0012	Comment on whether the Applicability Criteria applies to the project activity. If it applies, a discussion is provided to demonstrate how the project activity complies with the criteria.	Summary of Applicability of the project activity to the criteria
pressure is measurable;		
• Regulations do not require the project facility to recover and/or utilize the waste energy prior to the implementation of the project activity;	There are no regulations in South Africa that require XAWO to recover and/or utilize the waste heat produced in the furnaces prior to the implementation of the project activity. Refer to the Air Quality licence (Appendix 14).	Project activity complies with the criteria.
The methodology is applicable to both Greenfield and existing waste energy generation facilities. If the production capacity of the project facility is expanded as a result of the project activity, the added production capacity must be treated as a Greenfield facility;	• The proposed project activity will be implemented at an existing industrial facility, XAWO. • The production capacity of the furnaces that produce ferrochrome is NOT expanded as a result of the project activity. The electricity capacity of each furnace will remain 45MVA and will not change as a result of the project activity.	Project activity complies with the criteria.
Waste energy that is released under abnormal operation (for example, emergencies, shut down) of the project facility shall not be included in the emission reduction calculations.	In the case of abnormal conditions or emergencies such as total power supply outage, emergency let off valves are opened to ensure that the buoyant gas from the furnaces are vented to atmosphere. The emergency valves have to be opened for safety reasons. In this case the waste heat is vented directly to atmosphere and will not be channelled through to the ORC plant. Electricity can therefore not be produced under furnace emergency conditions and will therefore not be included in the emission reduction calculations.	Project activity complies with the criteria.
If multiple waste gas streams are available in the project facility and can be used interchangeably for various applications as part of the energy sources in the facility, the recovery of any waste gas stream, which would be totally or partially recovered in the absence of the project activity, shall not be reduced due to the implementation of CDM project activity. For such situations, the guidance provided	No waste energy is currently recovered for any purpose on site (Refer to Appendix 8). All energy needed for the XAWO process is imported/purchased. The recovery of waste heat will therefore not reduce the recovery of any other waste heat produced in the XAWO process.	Project activity complies with the criteria.

Applicability Condition from ACM0012	Comment on whether the Applicability Criteria applies to the project activity. If it applies, a discussion is provided to demonstrate how the project activity complies with the criteria.	Summary of Applicability of the project activity to the criteria
in Annex 3 shall be followed.		
The methodology is **not** applicable to the cases where a WECM stream is partially recovered in the absence of the CDM project activity to supply the heat of reaction, and the recovery of this WECM stream is increased under the project activity to replace fossil fuels used for the purpose of supplying heat of reaction.	No waste heat is recovered for heat of reaction purposes. This condition does not apply to the project activity.	Not applicable
This methodology is also **not** applicable to project activities where the waste gas/heat recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) to generate power. However, the projects recovering waste energy from single cycle and/or combined cycle power plants for the purpose of generation of heat only can apply this methodology.	The project activity is implemented in a chrome industrial facility, NOT in a single-cycle power plant.	Not applicable
The emission reduction credits can be claimed up to the end of the lifetime of the waste energy generation equipment. The remaining lifetime of the equipment should be determined using the latest version of the "Tool to determine the remaining lifetime of equipment".	The remaining lifetime of the chrome furnaces is determined by applying the "Tool to determine the remaining lifetime of equipment", version 01. The project participants obtained an expert evaluation for the lifetime of the furnaces[12].	PProject activity complies with the criteria.
The extent of use of waste energy from the waste energy generation facilities in the absence of the CDM project activity will be determined in accordance with the procedures provided in Annex 1 (for Greenfield project facilities) and in Annex 2 (for existing project facilities) to this methodology.	Annex 2 is applied to determine the extent of use of waste gas from the furnace in the absence of the CDM project activity.	Project activity complies with the criteria.

[12] Appendix 9 Lifetime of equipment

Table 4: Demonstration that the proposed project activity complies with the Applicability Criteria from Tools

Applicability Condition from the Tools that are applied in the PDD	Discussion of how the criteria applies to the project activity and how the project activity complies with the requirement	Applicability
"Tool to calculate the emission factor for an electricity system", Version 02.2.1 - This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). (Refer to page 2 of the Tool under "Scope and applicability")	The project activity supplies electricity to XAWO and displaces grid electricity that would be imported by XAWO in the absence of the project activity.	Applicable
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country. (Refer to page 2 of the Tool under "Scope and applicability")	The project electricity system is located in South Africa, which is not an Annex I country. Also, none of the neighbouring countries around South Africa are Annex I countries.	Applicable
"Tool to determine the remaining lifetime of equipment", Version 01 Methodologies referring to this tool should clearly specify for which equipment the remaining lifetime should be determined. The remaining lifetime of relevant equipment shall be determined prior to the implementation of the project activity. Project participants using this tool shall document transparently in the CDM-PDD how the remaining lifetime of applicable equipment has been determined, including (references to) all documentation used. (Source: Page 1 of the Tool)	- This criteria applies to methodologies and not to PDDs. - The remaining lifetime of the furnaces has been determined by the furnace supplier in February 2012. Construction of the project is expected to start at the earliest in November 2012. - The remaining lifetime of the furnaces has been determined by the furnace supplier, XAWO who designed and constructed all six of the furnaces. The following reference documentation will be supplied to the validator: Furnace supplier letter to confirm the lifetime of the	Applicable Does not apply to the project activity Applicable Applicable

Applicability Condition from the Tools that are applied in the PDD	Discussion of how the criteria applies to the project activity and how the project activity complies with the requirement	Applicability
	furnaces (Appendix 9).	
Under this tool, impacts on the lifetime of the equipment due to policies and regulations (e.g. environmental regulations) or changes in the services needed (e.g. increased energy demand) are not considered. Methodologies referring to this tool shall, where applicable, provide specific guidance on how regulations that warrant the replacement of the equipment before it has reached the end of its technical lifetime should be addressed. (Source: Page 1 of the Tool)	There are no regulations or policies in South Africa that impact the lifetime of ferrochrome furnaces. Also, any increase or decrease in the ferrochrome demand impacts on the production from the furnaces, but has no impact on the remaining lifetime of the furnaces. The lifetime of furnaces depends only on the quality of maintenance that is conducted.	Applicable

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

As per methodology ACM0012, the geographical extent of the project boundary shall include the relevant waste energy stream(s), equipment and energy distribution system in the following facilities:
(1) The project facility (DEG energy recovery plant);
(2) The recipient facility receiving the electricity (XAWO).

The spatial extent of the grid is as defined in the "Tool to calculate the emission factor for an electricity system".

As defined in ACM0012, the relevant equipment and energy distribution system covers:
• In the project facility where the electricity generation occurs (DEG), the waste gas streams from the gas cleaning plants for furnaces F1, F2, F3, F4, F5 & F6, waste gas condition plant and the power generation plant.
• In a recipient facility (XAWO), the transformers or busbars where the electricity is fed into.
In particular, the following are included:

- The furnaces generating the waste heat;
- The proposed electricity generation plant;
- The facility using the electricity XAWO, which in this case is the same as the facility generating the waste heat; and
- The national electricity grid, to the extent of determining the grid emission factor.

The project boundary is illustrated in Figure 4 below:

Figure 4: Project Boundary for the proposed project activity

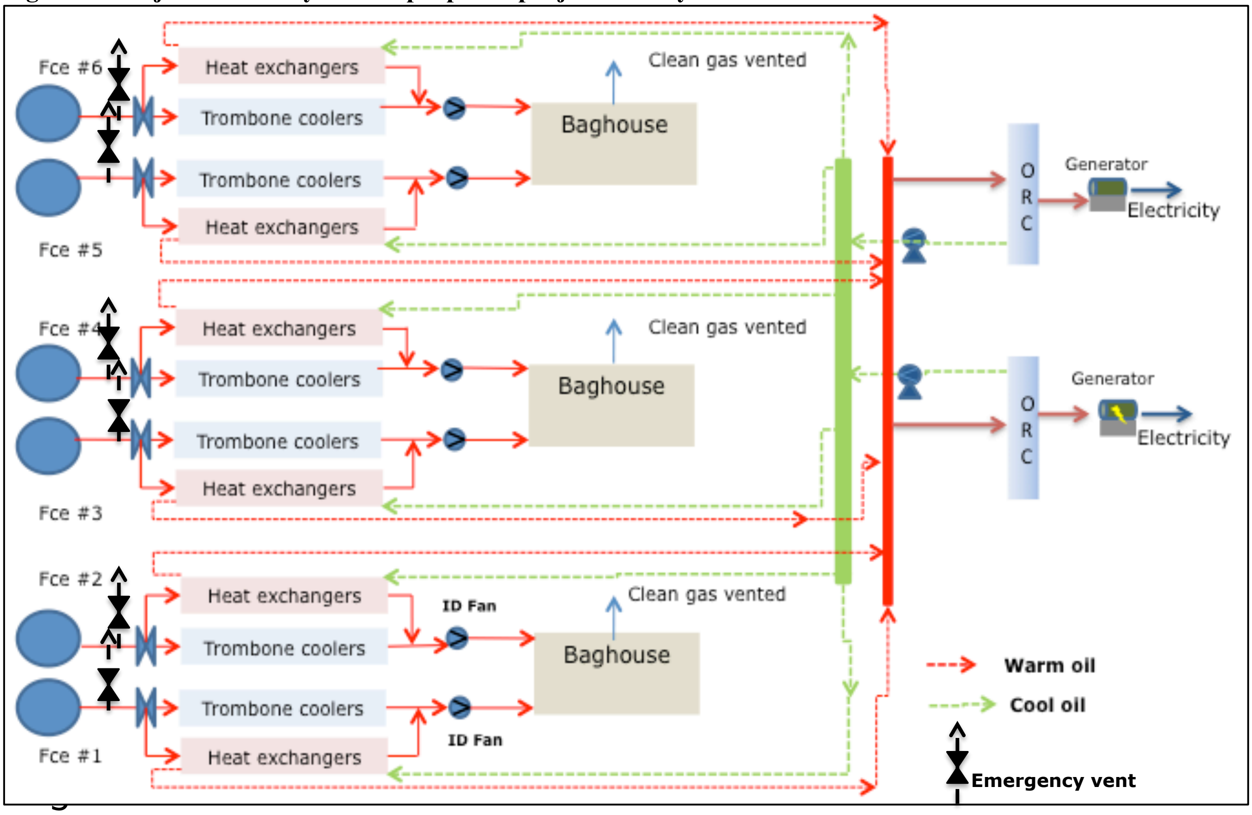


Table 5: Summary of gases and sources included in the project boundary and justification explanation where gases and sources are not included

	Source	Gas	Included?	Justification / Explanation
Baseline	Electricity generation, grid	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Fossil fuel consumption in boiler for thermal energy	CO_2	Excluded	Not applicable. The project activity does not involve the generation of thermal energy from waste gas.
		CH_4	Excluded	Not applicable. The project activity does not involve the generation of thermal energy from waste gas.
		N_2O	Excluded	Not applicable. The project activity does not involve the generation of thermal energy from waste gas.
	Fossil fuel consumption in	CO_2	Excluded	Not applicable. The project activity does not involve cogeneration.

	Source	Gas	Included?	Justification / Explanation
	cogeneration plant	CH_4	Excluded	Not applicable. The project activity does not involve cogeneration.
		N_2O	Excluded	Not applicable. The project activity does not involve cogeneration.
	Baseline emissions from generation of steam used in the flaring process, if any	CO_2	Excluded	Not applicable. Steam is not used in the flaring process.
		CH_4	Excluded	Not applicable. Steam is not used in the flaring process.
		N_2O	Excluded	Not applicable. Steam is not used in the flaring process.
Project Activity	Supplemental fossil fuel consumption at the project plant	CO_2	Excluded	No supplemental fossil fuel is used at the project plant. No backup fuel is used to generate electricity.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Supplemental electricity consumption	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Electricity import to replace captive electricity, which was generated using waste gas in absence of project activity	CO_2	Excluded	Not applicable. The baseline does not involve captive electricity.
		CH_4	Excluded	Not applicable. The baseline does not involve captive electricity.
		N_2O	Excluded	Not applicable. The baseline does not involve captive electricity.
	Project emissions from cleaning of gas	CO_2	Included	The electricity that will run the power plant equipment will be supplied from the Power plant using waste heat. Please refer to the description of how the electricity monitoring is done in Section B.7.
		CH_4	Excluded	As per the methodology
		N_2O	Excluded	As per the methodology

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

Identification of the baseline scenario

The baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternatives.

Realistic and credible alternatives are determined for:

- Waste heat use in the absence of the project activity;
- Power generation in the absence of the project activity;

There is only one recipient facility in the project activity, i.e. XAWO. The information on the utilization of electricity in the absence of the CDM project activity is sourced from XAWO and the information on the utilization of the waste gas in the absence of the CDM project activity will be sourced from the project facility, which is implemented by the project proponent, DEG, and from the recipient facility XAWO.

Hence, the CDM project proponent (DEG) determines the baseline options, identifies the most appropriate baseline scenario, determines the baseline fuel and demonstrates and assesses additionality in consultation with the recipient facility (XAWO) and the project facility (DEG).

Identification of the project facility: DEG will own and operate the project facility, i.e. the facility where the waste gas conditioning and power generation equipment will be implemented.

Identification of the recipient facility: XAWO is the recipient facility because the electricity will be supplied to the XAWO plant, thereby reducing their electricity consumption from the national grid managed by the national utility Eskom.

The amount of power generated by the project activity is 222,875 MWh, therefore the power alternatives identified will be based on 222,875 MWh.

The following baseline options are excluded as per the methodology instructions:

- Options that do not comply with legal and regulatory requirements; and
- Options that involve fuels used for the generation of power that are not produced or imported in South Africa.

Step 1: Define the most plausible baseline scenario for the generation of electricity using the following baseline options and combinations

The baseline candidates that are considered are:

- For the waste energy generation XAWO where the waste energy is generated; and
- For the recipient facility XAWO where the energy is consumed.

The project activity will be implemented on waste heat generated in an existing ferrochrome production facility therefore the following combinations are relevant combinations to be investigated as they represent possible baseline scenarios of an existing facility.

For the use of waste energy the realistic and credible alternative(s) include:

W1: Waste gas is directly vented to the atmosphere without incineration.

Venting the waste heat to atmosphere without incineration has been the historic practise since the commissioning of the furnaces. There are no regulations that prohibit that the gas be emitted to atmosphere without incineration. Refer to Appendix 14_2010 APPA Certificate Documents.

Xstrata uses "semi-open" furnaces and ambient air is mixed with carbon monoxide on top of the furnace bed during which all combustible gases are oxidized. This is done by design of the furnace and the waste energy is not available as a combustible gas mixture, it is only available as waste heat after oxidation in the furnace.

Therefore, we define the WECM as the hot off-gases arising from the SAF furnaces.

W1 is therefore a realistic and credible alternative.

W2: Waste gas is released to the atmosphere after incineration.

Incineration is not an option since the waste energy does not contain combustible gases as discussed in more scientific detail below.

The waste gas consists of the product of combustion of CO and H2 released from the mix of raw materials in the crucible of the furnace. These gases are released from the raw materials at approximately 550˚C after which it gets in contact with air drawn in from the sides of the furnace. Approximately 12,000Nm^3/h of gas is released by the furnace, whilst a minimum of 250,000Nm^3/h of air is drawn in due to the suction created by the ID fan. Only 28,800 Nm^3/h of air is required for the stoichiometric combustion of the CO and H_2. The amount of excess air is therefore at least 8.6 times more than the required amount to achieve full combustion of the gas. The resulting composition of the flue gas with minimum air volume once it reaches the trombone coolers and bag houses is therefore as following:

H_2O	2.6%
CO_2	3.06%
O_2	17.9%
N_2	76.43%

No incineration is therefore required or indeed possible.

W2 is not a realistic and credible alternative.

W3: Waste energy is sold as an energy source.

There are no neighbouring industries next to the Xstrata site that could potentially use the low quality waste energy (Refer to Appendix 20_Aerial photograph of the site).

Thus, Alternative W3 is excluded from further consideration.

W4: Waste energy is used for meeting energy demand at XAWO

Description of energy demand at XAWO:

Heat energy: Pelletizing plant utilises energy, but the quality of the waste heat produced in the furnaces are insufficient for utilisation. The temperatures that are required in the pelletizing sinter furnace are much higher (1250 degrees Celsius) than what can be recovered from the off-gas of the furnaces (500 degrees Celsius). The temperature of the gas exiting the sinter furnace is around 250 degrees Celsius.

Electricity – The waste heat has to be recovered and converted to electricity before it replaces some of the electricity demand of the site. This is the proposed project activity not undertaken as a CDM project activity and is described under P1.

W4 is therefore not a feasible alternative. P1 describes the waste gas recovery to electricity generation not as a CDM project. So W4 = P1.

W5: A portion of waste gas is recovered for generation of heat and/or electricity and/or mechanical energy, while the rest of the waste energy produced at the project facility is flared/released to atmosphere/ unutilised.

The option of using of a portion of waste heat for generation of heat energy is not a realistic scenario as described under W4.

The only mechanical energy requirements on the site are for drives for rotating equipment, i.e. fans, pumps, conveyors and feed screws. Electrical motors are used in all these applications because of ease of installations, small footprint, safe operation, ease and accuracy of control and reliability.

Replacing an electrical drive (motor) with a waste gas fuelled drive (gas engine or turbine) is not feasible at XAWO for the following reasons:

a) Installation of a waste gas fuelled turbine also requires the installation of:

   - Gas supply pipelines and control stations
   - Cooling water system
   - Lubrication oil systems.
   - Instrument air supply system (safety and purging for maintenance)
   - Ventilation systems
   - Enclosure (for ventilation control)

The subsequent footprint (m^2/kW) and cost/unit output (ZAR/kW) is thus orders of magnitude larger than for an electric motor which only requires an electric cable connection.

W6: All the waste energy produced at XAWO is captured and used for export electricity generation or steam.

Export of Electricity

To export electricity to the national grid a Power Purchase Agreement has to be negotiated between the facility and Eskom. There is no regulatory or administrative process that can be followed to arrange a long term (10 to 15 year) PPA between Eskom and the ferrochrome facility (Refer to Appendix 21).

Therefore, producing and exporting electricity to the national grid is not a feasible option as long term PPAs cannot be secured.

Therefore, producing and exporting electricity to the national grid is not a feasible option.

Steam export

There is no neighbouring facility that can utilise steam. Therefore, producing and exporting steam to the neighbouring facility is not a feasible option.

Therefore, W6 is not a realistic alternative to consider any further.

Table 6: Summary of alternatives and outcomes

	Description of the alternative	**Summary of the investigation**
W1:	Waste gas is directly vented to the atmosphere without incineration	Current permit allows for this situation. This is also the prevailing practise and the current scenario. Refer to Appendix 14_2010 APPA Certificate Documents.
W2:	Waste gas is released to the atmosphere after incineration	At XAWO, it is not necessary to incinerate the waste gas stream before release to atmosphere.
W3:	Waste energy is sold as an energy source	Not realistic
W4	Waste energy is used for meeting energy demand at the XAWO;	Heat – not feasible to utilise the waste heat to meet the heat demand on the site. Electricity – The waste heat has to be recovered converted to electricity before it replaces some of the electricity demand of the site. This is the proposed project activity not undertaken as a CDM project activity. This is also the scenario discussed under P1.
W5:	A portion of the quantity or energy of waste gas is recovered for generation of heat, while the rest of the waste energy produced at the project facility is flared/released to atmosphere/ unutilised;	Not feasible
W6:	All the waste energy produced at the facility is captured and used for export electricity generation or	Not a realistic scenario because: There are no regulatory process

	steam.	through which XAWO can export and sell electricity to Eskom and there is no neighbouring facility that can utilise steam.

For power generation the realistic and credible alternative(s) include:

P1: Proposed project activity not undertaken as a CDM project activity;

This alternative is in compliance with all applicable legal and regulatory requirements. Therefore, this scenario is at first sight a credible baseline candidate.

P1 is carried to the Step 2.

P2: On-site or off-site existing fossil fuel fired cogeneration plant;

There is no existing fossil fuel based cogeneration plant on-site or off-site at the XAWO. Also, this alternative does not provide the same output as the proposed project activity. According to ACM0012 and the Tool for the demonstration and assessment of additionality, only alternatives, which provide the same output as the proposed project, need to be evaluated.

Therefore, P2 is not a realistic and credible alternative.

P3: On-site or off-site Greenfield fossil fuel fired cogeneration plant;

There is no demand for steam at the site and therefore it is not realistic to implement a cogeneration plant. Also, this alternative does not provide the same output as the proposed project activity. According to ACM0012 and the Tool for the demonstration and assessment of additionality, only alternatives, which provide the same output as the proposed project, need to be evaluated.

Therefore, P3 is not a realistic and credible alternative.

P4: On-site or off-site existing renewable energy based cogeneration plant;

There is no existing renewable energy based cogeneration plant on-site or off-site at the XAWO.

Therefore, P4 is not a realistic and credible alternative.

P5: On-site or off-site Greenfield renewable energy based cogeneration plant;

There is no demand for steam at the site and therefore it is not realistic to implement a cogeneration plant. Also, this alternative does not provide the same output as the proposed project activity. According to ACM0012 and the Tool for the demonstration and assessment of additionality, only alternatives, which provide the same output as the proposed project, need to be evaluated.

Therefore, P5 is not a realistic and credible alternative.

P6: On-site or off-site existing fossil fuel based existing identified captive power plant;

There is no existing fossil fuel based captive power plant on-site or off-site at XAWO.

Therefore, P6 is not a realistic and credible alternative.

P7: On-site or off-site existing identified renewable energy or other waste energy based captive power plant;

There is no existing renewable energy or other waste energy based captive power plant on-site or off-site at XAWO.

Therefore, P7 is not a realistic and credible alternative.

P8: On-site or off-site Greenfield fossil fuel based captive plant;

Recent studies have been conducted to determine the levelised cost of generating electricity from coal in power plants with less than 100MW capacity. The levelised cost estimates were based on a range of technical, operational and cost assumptions drawn from the South African Integrated Resource Plan (IRP2010) promulgated in May 2011. These represent a considered and official view of key power plant characteristics for the South African market based on recognised international benchmarks. The levelised costs determined in all cases[13] demonstrate a substantial cost premium associated with a greenfield coal fired power plant relative to the Eskom tariff.

P9: On-site or off-site Greenfield renewable energy or other waste energy based captive plant;

The potential renewable energy sources considered are biomass, hydro, wind and solar.
The production of electricity from biomass, wind, solar and hydro would be more expensive than purchasing it from Eskom as is indicated when comparing the levelized cost of electricity production from the renewables. Table 4 in Appendix 18[14], a report by the National Energy Regulator of South Africa (NERSA) shows the levelized cost for concentrated solar power trough without storage as R3.14/kWh, solid biomass as R1.18/kWh, wind as R1.25/kWh and small hydro as R0.96/kWh etc. Compared to these costs the megaflex tariff paid for electricity at XAWO for 2012 is R0.55/kWh[15]. This tariff is based on the typical operation of Xstrata which entails for them to operate 6 furnaces during the 9 low demand months (January to May and September to December) and 3 furnaces during the high demand winter months (June, July and August) of every year.

Therefore, P9 is not a realistic and credible alternative.

P10: Sourced from grid-connected power plants;

XAWO is contracted and has the capacity to obtain all of its required electricity from South Africa's national electricity provider, Eskom. This alternative envisages the continuation of the prevailing practice at the site.

P10 is realistic and also represents the current scenario.

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[13] Samancor Witbank Ferrochrome, Samancor Middelburg Ferrochrome and Hernic Ferrochrome

[14] Appendix 18 Table 4, page 10 of 24, National Energy Regulator of South Africa. (2009, October 30). *Decision in the matter regarding Renewable Energy Feed-In Tariffs Phase II by the National Energy Regulator of South Africa*.

[15] Appendix 59.

P11: Existing captive electricity generation using waste energy (if the project activity is captive generation using waste energy, this scenario represents captive generation with lower efficiency or lower recovery than the project activity);

There is no existing captive electricity generation at all on the site.

Alternative P11 is not considered as a realistic baseline scenario.

P12: Existing cogeneration using waste energy, but at a lower efficiency or lower recovery.

The Alternative P12 is not credible since there is no existing cogeneration plant at the project site, and construction of the new one does not make sense as there is no sufficient heat requirement in the process that can be satisfied with a cogeneration plant.

Alternative P12 is excluded from further consideration.

Table 7: Summary of alternatives for Power generation

Scenario	Description of alternative scenario	Comments and reference to support documentation
P1:	Proposed project activity not undertaken as a CDM project activity;	This alternative is in compliance with all applicable legal and regulatory requirements. Therefore, this scenario is at first sight a credible baseline candidate. *Alternative P1 is carried to the Step 2.*
P2:	On-site or off-site existing fossil fuel fired cogeneration plant;	Not feasible
P3:	On-site or off-site Greenfield fossil fuel fired cogeneration plant;	Not feasible
P4:	On-site or off-site existing renewable energy based cogeneration plant;	Not feasible
P5:	On-site or off-site Greenfield renewable energy based cogeneration plant;	Not feasible
P6:	On-site or off-site existing fossil fuel based existing identified captive power plant;	Not feasible
P7:	On-site or off-site existing identified renewable energy or other waste energy based captive power plant;	Not feasible
P8:	On-site or off-site Greenfield fossil fuel based captive plant;	Not feasible
P9:	On-site or off-site Greenfield renewable energy or other waste energy based captive plant;	Not feasible
P10:	Sourced from grid-connected power plants;	Current scenario and prevailing

		practise.
P11:	Existing captive electricity generation using waste energy (if the project activity is captive generation using waste energy, this scenario represents captive generation with lower efficiency or lower recovery than the project activity);	Not feasible
P12:	Existing cogeneration using waste energy, but at a lower efficiency or lower recovery.	Not feasible

Combinations of baseline candidates under different scenarios are presented in Table 8: Combination of realistic baseline candidates

Table 8: Combination of realistic baseline candidates for the waste gas and electricity use

Scenario	Waste heat	Electricity – Recipient facility	Description
1	W1 - Waste heat is released to atmosphere and remains unutilised.	P10 – Electricity is imported from the national grid	Current scenario and prevailing practise since the commissioning of the site.
2	W4	P1 – Electricity is generated from the recovered waste heat and used for captive purposes	The proposed project activity not undertaken as a CDM project activity.

Step 2: Step 3 (barrier analysis) of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used to identify the most plausible baseline scenarios by eliminating non-feasible options.

Scenario 1, 2 and 3 described in Table 8 are the feasible alternatives that are investigated further to determine the most plausible baseline scenario.

Summary:

The levelised cost of electricity production in a greenfield coal fired power plant is higher than purchasing electricity from the national grid. Therefore, P8 is eliminated as a plausible baseline scenario.

Scenario 1 and 2 described in Table 8 are the two feasible remaining alternatives.

There are no barriers that prevent Scenario 1, i.e. the current practice from continuing. The barrier analysis applied in Section B.5 demonstrates that the project activity faces a prevailing practice barrier. The outcome is clearly that the baseline scenario is therefore the existing scenario at XAWO.

Table 9: Combinations of baseline scenarios applicable under different project situations

Baseline Scenario	Description of project activity
Baseline scenario-1 1. The waste heat recovered in the project is released to atmosphere 2. The electricity is obtained from the grid.	Current scenario and prevailing practise since the commissioning of the furnaces.

Conclusion

The baseline scenario for the waste gas is continued venting to atmosphere. The baseline scenario for electricity is the continued import of power from the national grid.

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 additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board, available at the UNFCCC CDM website.[16]

The project participants will apply the barrier analysis for demonstrating additionality.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Define realistic and credible alternatives to the project activity(s) through the following Sub-steps:

Sub-step 1a: Define alternatives to the project activity:

From B.4, two realistic and credible alternatives remain:

Scenario 1:

- Waste heat released to atmosphere
- P10 – Electricity is imported from the national grid

AND

Scenario 2:

- W4 – Waste heat is recovered and used to generate electricity, not under CDM

[16] Please refer to: <http://cdm.unfccc.int/goto/MPappmeth>.

- P1 – Electricity is generated for captive purposes, not under CDM

Sub-step 1b: Consistency with mandatory laws and regulations:

Both scenario 1 and 2 meet all legal and regulatory requirements of the host country, South Africa.

Step 3: Barrier Analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

Barriers due to prevailing practice

The project activity is the first of its kind.

The First of Kind barrier is a special case of a barrier of prevailing practice as is clear from the additionality tool version 6, paragraph 40(2).

- "*The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project*;

  and

- *Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal*."

It is submitted that the existence of the prevailing barrier is investigated with reference to the geographical area, the sector and the technology.

As of 15 February 2012, no heat recovery on semi-closed ferrochrome furnaces are implemented with an organic rankine cycle technology of any capacity to generate electricity in South Africa or any other country of the world. Internationally, it is confirmed that the ORC technology has not been applied in the ferrochrome sector[17].

Within the geographical area of South Africa and Zimbabwe the prevailing practice in the ferrochrome sector is to flare waste gas (in the case of closed furnaces) or to vent waste heat (in the case of open furnaces). No projects have been done to utilise waste heat for electricity generation and the prevailing practice remains to vent waste heat.

In the present case the output (electricity) has never been delivered in the geographical area from waste heat by any technology source within the sector and indeed for the specific technology within the sector, never anywhere on the globe.

A non-renewable, 10 year crediting period has been chosen.

The use of waste heat in the ferrochrome sector creates at least the perception of a danger of impacting on the core production process of ferrochrome which creates an inertia preventing waste heat to electricity

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[17] Appendix 3_Letter from Ormat, 7 February 2012

technology adoption and further causes an adherence to the prevailing practice of venting waste heat.

An independent expert report has been appended as Appendix 68.

Because the technology measure is not defined as the measures in paragraph (6) of the “Tool for the demonstration and assessment of additionality”, Sub-step 3 b applies.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

None of the barriers described above prevent Scenario 1, i.e. the existing scenario where XAWO imports electricity from the national grid and releases waste heat to atmosphere unutilised.

Step 4: Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity:

Guidelines on Common Practice, (Version 01.0) is applied.

Table 10: Common Practice analysis

	Outcome of the Step applied to the project activity
Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.	The design capacity for the power plant is 35.8MW. Therefore the applicable output range is xx to xx MW.
Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities shall not be included in this step.	**Applicable Geographical Area:** The common practice analysis is limited to South Africa and the neighbouring country Zimbabwe, because these are the only two countries in Southern Africa that produce ferrochrome (Refer to Appendix 42, page 2). As of 15 February 2012, there are fifteen ferrochrome smelters in South Africa and three in Zimbabwe. (Refer to http://www.pyrometallurgy.co.za/PyroSA/index.htm). Technologies similar to the Organic Rankine Cycle that can be applied to semi-open / semi-closed type furnaces and that deliver electricity to ORC are (1)Kalina Cycle, (2)Steam Rankine Cycle and (3)Sterling engines. None of these have been implemented at any of the ferrochrome smelters in South Africa or in Zimbabwe. There are no waste heat recovery technologies of any kind in operation at any of the furnace ferrochrome operations in South Africa or in Zimbabwe that generates electricity. (Refer to Appendix 26, letter from the FerroMetal Association). $N_{all} = 0$.
Step 3: Within plants identified in Step	$N_{diff} = 0$, because N_{all} is 0

2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.	
Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.	**F is 0**

On the basis of the analysis, it is clear that the extent, to which similar initiatives have diffused in South Africa, is zero.

Sub-step 4a: Analyze other activities similar to the proposed project activity:

There are no other power plants using similar technology to produce electricity from waste energy produced in semi closed or open type furnaces in the ferrochrome industry in South Africa or Zimbabwe.

Describe how the CDM alleviates the barriers identified

Carbon finance through the CDM will provide an additional source of revenue that will assist the project activity to overcome the challenges posed to a first-of-kind project.

Conclusion

The project activity is additional as first-of-kind.

Notice of prior consideration

Construction of the project is expected to start at the earliest in March 2013. The project start date is 30 September2012, the date that the agreement is signed between DEG and XAWO, and the earliest date on which the order for the equipment will be placed. The milestones in the project development are provided in the timeline below:

Date	Activity
2 December 2010	Environmental Impact Assessment initiated, stakeholder participation initiated
November 2011	Agreement signed with CDM Africa to develop the CDM component
16 February 2012	Letter of prior consideration submitted to the UNFCCC
18 February 2012	PDD published for Global Stakeholder Participation on UNFCCC website

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The baseline emissions for the year *y* shall be determined as follows:

$$BE_y = BE_{En,y} + BE_{flst,y} \quad (1)$$

Where:

BE_y = The total baseline emissions during the year *y* in tCO_2

$BE_{En,y}$ = The baseline emissions from energy generated by the project activity during the year *y* in tCO_2

$BE_{flst,y}$ = Baseline emissions from fossil fuel combustion

1. Baseline emissions from energy generated by the project activity ($BE_{En,y}$)

1.1. No recovery on the waste gas streams in the absence of CDM project activity

1.1.1. Baseline emissions for baseline Scenarios 1 and 2

Baseline scenarios 1 and 2 represent the situation where the waste energy used in the project remains unutilised and the electricity is obtained from the grid.

Note: Only sub-sections (a)[18] as described in ACM0012, is applied in the project activity as sub-section (b)[19] in the methodology refers to "Baseline emissions for generation of thermal energy ($BE_{ther,y}$) and steam-generated mechanical energy" and these do not apply to the project activity.

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} \quad (2)$$

Where:

$BE_{Elec,y}$ = Baseline emissions from electricity during the year *y* in tCO_2

$BE_{Ther,y}$ = Baseline emissions from thermal energy (due to heat generation by elemental processes) during the year *y* (tCO_2)

$BE_{Ther,y}$ = 0 in the project activity

(a) Baseline emissions from electricity ($BE_{Elec,y}$) generation

Case 1: Waste energy is used to generate electricity

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad (3)$$

[18] Page 14/58 of ACM0012, "(a) Baseline emissions from electricity ($BE_{Elec,y}$) generation"

[19] Page 17/58 of ACM0012, "(b) Baseline emissions for generation of thermal energy ($BE_{ther,y}$) and steam-generated mechanical energy"

Where:

$BE_{elec,y}$	=	Baseline emissions due to displacement of electricity during the year *y* (tCO_2)
$EG_{i,j,y}$	=	The quantity of electricity supplied to the recipient *j* by generator, which in the absence of the project activity would have been sourced from source *i* (the grid) during the year *y* in MWh
$EF_{elec,i,j,y}$	=	The CO_2 emission factor for the electricity source *i* (gr for the grid), displaced due to the project activity, during the year *y* (tCO_2/MWh). The "Tool to calculate the emission factor for an electricity system" is applied to determine the emission factor for the electricity supplied by the national grid. The information and data to calculate the grid emission factor is provided in Annex 3.
f_{wcm}	=	Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy.
f_{cap}	=	Factor that determines the energy that would have been produced in project year *y* using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year *y*. The ratio is 1 if the waste energy generated in project year *y* is the same or less than that generated at a historical level. The value is estimated using the equations in section 3.2.
j	=	Recipient j is XAWO
i	=	National grid

The equation with the relevant subscripts that apply to the project activity becomes:

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_{XAWO} \sum_{grid} (EG_{grid,XAWO,y} * EF_{Elec,grid,XAWO,y}) \qquad (4)$$

2. Baseline emissions from flaring of waste gas ($BE_{flst,y}$) with fossils or steam

No flaring of waste gas/heat occurs at XAWO.

$$BE_{flst,y} = 0 \qquad \textbf{(5)}$$

3. Estimation of various baseline factors

f_{WCM} = 1, since the electricity generation is purely from the use of waste heat.

3.1. Capping factors

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

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

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

(ii) If the project activities implemented in a Greenfield facility, or in existing facilities where the required data is unavailable Method-2 shall be used.

Determination of f_{cap} applying Method-3

Motivation for applying Method-3

The raw materials used in the furnaces at XAWO is continuously changed as a result of the market conditions valid at the time. Depending on market prices, availability of raw materials, weather conditions or market demand for ferrochrome the host may elect to change the raw material composition allowing more or less coke, anthracite, coal or other reductants as may be available or required at the time. The fixed carbon and volatiles contained is different for the different reductants resulting in more or less carbon monoxide and hydrogen to be expelled from the raw material burden resulting in more or less energy being available as heat in the furnace flue gas. The typical coal used has a fixed carbon content of 54% to 58%, volatile content of 25 to 28% and ash of 15% to 18%. Anthracite and coke will typically have a fixed carbon content of 82% to 85%, volatile content of 2% to 4% and ash content of 8% to 12%. In a ferrochroom furnace the fixed carbon will basically all take place in the reduction reaction of metal oxides while the volatiles will all evaporate and combust in air resulting in higher heat content in the flue gas.

Case 1 as described in ACM0012 applies.

Case 1: The energy is recovered from waste heat and converted into electricity. f_{cap} is the ratio of maximum energy that could be recovered (MER) by the ORC implemented under the CDM project activity and the actual energy recovered under the project activity (using direct measurement of the electricity generated). The MER should be based on information on the characteristics of the key product, ferrochrome produced in the furnaces.

f_{cap} is estimated by:

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}} \qquad \textbf{(6)}$$

Where:

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

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

Determination of $Q_{OE,BL}$

Electricity that can be produced (GJ or TJ), to be determined on the basis of maximum energy that could be recovered from the waste gas, which would have vented in the absence of CDM project activity.

The maximum energy that could be recovered from the waste gas is limited by the installed capacity of the power plant. The amount of electricity that can be produced (MWh) from the ferrochrome flue gas over a year is determined by multiplying maximum electricity that can be generated by generators (35.8MW) by planned availability (98%) by furnace operating rate (95.0%) over a year.

Note that the design of the plant is such that flue gas temperatures will never be cooled to a value lower than 130˚C thus there will always be some excess amount of waste heat that will be vented from the current bag house installation. It is an operational requirement to always pass the gas through the bag house above its sulphuric dew point to eliminate corrosion from damaging the bag house infrastructure. The ORC system is also designed to return the thermal oil to the heat exchangers at 110˚C and due to thermal pinch in the temperature differences between flue gas and thermal oil it becomes virtually impossible to extract more heat from the flue gas.

$Q_{OE,BL}$ = 35.8MW x 0.98 x 0.95 x 365 x 24 x 3.6

= 1,051,088.6 GJ

Project emissions

Project Emissions include emissions due to consumption of electricity of new equipment installed as part of the project activity.

$$PE_y = PE_{AF,y} + PE_{EL,y} \quad \textbf{(7)}$$

Where:

PE_y	=	Project emissions due to the project activity (tCO_2)
$PE_{AF,y}$	=	Project activity emissions from on-site consumption of fossil fuels by the unit process if they are used as supplementary fuels due to non-availability of waste energy to the project activity or due to any other reason (tCO_2)
$PE_{EL,y}$	=	Project activity emissions from on-site consumption of electricity for cleaning equipment or other supplementary electricity consumption (tCO_2) (as per Table 1: Summary of gases and sources included in the project boundary)

Note: No auxiliary fossil fuel will be used to supplement the waste energy in the project activity. Therefore, there are no project emissions due to auxiliary fossil fuel combusted to supplement waste energy in the project activity.

$PE_{AF,y} = 0$. **(8)**

Project emissions due to electricity consumption of supplementary equipment electricity consumption

The electricity used by the equipment installed in the project activity will be generated from the ORC. In special circumstances where electricity is used from the national grid through XAWO's electrical network, the electricity meters will meter the amount consumed and this amount will be deducted from the electricity supplied to XAWO over the year. Therefore, the project emissions associated with electricity consumption is zero.

Leakage

No leakage is applicable under this methodology. No leakage applies to this project activity.

Emission reductions

Emission reductions due to the project activity during the year *y* are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(9)}$$

Where:

ER_y	=	Total emissions reductions during the year *y* in tons of CO_2
PE_y	=	Emissions from the project activity during the year *y* in tons of CO_2
BE_y	=	Baseline emissions for the project activity during the year *y* in tons of CO_2

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

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y*
Source of data used:	Calculated based on the national utility information for the South African national grid
Value applied:	Refer to Annex 3, **Error! Reference source not found.**
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics, publicly available and reliable data source
Any comment:	The data for the three most recent reporting years is provided.

Data / Parameter:	$FC_{i,m,y}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type i consumed by power unit m in year y
Source of data used:	Calculated based on the national utility information for the South African national grid
Value applied:	Refer to Annex 3, Table 12: Power stations in the Operating Margin
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics, publicly available and reliable data source
Any comment:	The data for the three most recent reporting years is provided.

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. For the sake of a conservative approach the IPCC default value at the lower limit of the uncertainty at a 95% confidence interval is used.

	For Coal, 0.0895 (t CO_2/GJ), GEF spreadsheet, Sheet, 'DV', Cell M31 For Other Kerosene: GEF spreadsheet, Sheet, 'DV', Cell M14 For Diesel: GEF spreadsheet, Sheet 'DV', Cell D16
Value applied:	Bituminous Coal: 0.0895 (t CO_2/GJ), for other bituminous at the lower limit. Other Kerosene 70.8tCO_2/TJ Diesel: 41.4 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Some information is available about the various coal resources in South Africa, all of which is classified as bituminous. However, sufficient information is not available for each coal fired power station and therefore the IPCC default is applied. Refer to Appendix 19: 'Future_of_South_African_Coal', Section 2 "Overview of South African coal sector", page 2 where it is mentioned that: "South Africa's economically recoverable coal reserves are estimated at between 15 and 55 billion tonnes. 96% of reserves are bituminous coal; metallurgical coal accounts for approximately 2% and anthracite another 2%. Production is mainly steam coal of bituminous quality."
Any comment:	Value applied as a constant.

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	• For coal: Eskom published data, *Source: Appendix 66_Eskom Divisional Report 2012 pages 88.* See GEF spreadsheet, Sheet Base_Data, Cells S12, T12 and U12. • For Other Kerosene: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. See GEF spreadsheet, Sheet 'DV', Cell D14 • For Diesel: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. See GEF spreadsheet, Sheet 'DV', Cell D16
Value applied:	Coal (GJ/ton) Eskom: Coal (GJ/ton) 2009/10 – 19.22 2010/11 – 19.5 2011/12 – 19.6 Other Kerosene –42.4GJ/ton Diesel- 41.4GJ/ton
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per "Tool to calculate the emission factor for an electricity system"

Any comment:	Information is used to calculate the combined margin emission factor

Data / Parameter:	$EF_{ELm,y}$
Data unit:	tCO2/MWh
Description:	CO2 emission factor of power unit m in year y (tCO2/MWh)
Source of data used:	Calculated from the information published by the national utility in South Africa. Annex 3, Table 13: Calculation of the Operating Margin emission factor, Refer to GEF spreadsheet, sheet "OM", Cells D(15:40), F(15:40), H(15:40)
Value applied:	Please refer to Annex 3, Table 13: Calculation of the Operating Margin emission factor, Refer to GEF spreadsheet, sheet "OM", Cells D(15:40), F(15:40), H(15:40) for all the values
Justification of the choice of data or description of measurement methods and procedures actually applied :	The three most recent years prior to the project implementation were used to calculate the factor as required by the Tool to calculate the grid emission factor.
Any comment:	As per the Tool to calculate the grid emission factor

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO2 emission factor in year *y*
Source of data used:	Calculated based on the national utility information for the South African national grid and IPCC information where applicable, GEF spreadsheet, Sheet "OM", Cell I10.
Value applied:	0.9896
Justification of the choice of data or description of measurement methods and procedures actually applied :	The $EF_{GRID,CM,y}$ is calculated according to the 'Tool to calculate the emission factor for an electricity system'. The Simple OM method is used to calculate the Operating margin (using the ex-ante option); with the Build Margin also calculated ex-ante based on the most recent information.
Any comment:	As per the Tool to calculate the grid emission factor

Data / Parameter:	$Q_{OE,BL}$
Data unit:	GJ
Description:	Electricity that can be produced, to be determined on the basis of maximum energy that could be recovered from the waste stream, which would have been vented in the absence of CDM project activity
Source of data used:	DEG process information and XAWO
Value applied:	1,051,088.6
Justification of the choice of data or description of measurement methods	Electricity that can be produced (GJ or TJ), to be determined on the basis of maximum energy that could be recovered from the waste gas, which would have vented in the absence of CDM project activity. The maximum energy that could be recovered from the waste gas is limited by

and procedures actually applied :	the installed capacity of the power plant. The amount of electricity that can be produced (MWh) from the ferrochrome flue gas over a year is determined by multiplying maximum electricity that can be generated by generators (35.8MW) by planned availability (98%) by furnace operating rate (95.0%) over a year. $Q_{OE,BL}$ = 35.8MW x 0.98 x 0.95 x 365 x 24 x 3.6
Any comment:	

Data / Parameter:	f_{wcm}
Data unit:	Unitless
Description:	Fraction of total electricity generated by the project activity using waste energy.
Source of data used:	PP
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	This fraction is 1 because the electricity generation is purely from use of waste gas.
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

The baseline emissions (BE_y) were calculated using equation (1):

$$BE_y = BE_{EN,y} + BE_{flst,y} \quad \text{where } BE_{flst,y} = 0$$

The baseline emissions from the energy generated by the project activity $BE_{EN,y}$ were calculated using equation:

$$BE_{EN,y} = BE_{Elec,y} + BE_{Ther,y} \qquad \text{where } BE_{Ther,y} = 0$$

For the purpose of demonstration, it is assumed that fcap is 1.

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

$$BE_{Elec,1to10} = f_{cap}\ x\ f_{wcm}\ x\ \sum_{Xstrata}\sum_{grid}\left(EG_{grid,Xstrata}\ x\ EF_{Elec,grid,Xstrata}\right)$$

$EF_{Elec,grid,XAWO}$ is determined in Annex 3.

The baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors. In terms of data vintages, the *ex ante* option were chosen to calculate the simple OM. The Combined Margin is determined as 0.9896 tCO_2 per MWh.

$BE_{Elec,1to10} = 1\ x\ 1\ x\ 222{,}875\ x\ 0.9896$

$BE_{Elec,1to10} = 227{,}332\ ton\ CO2$

$BE_{Elec,1to10} = B_{EN,y} = BE_y = 227{,}332\ ton\ CO2$

Project emissions were calculated using equation (8):

$PE_y = PE_{AF,y} + PE_{EL,y}$ where $PE_{AF,y} = 0$ as described previously and $PE_{EL,y}$ is zero because it is already accounted for in the net generation of electricity to XAWO.

PE_y is therefore zero.

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

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
1	0	227,332	0	227,332
2	0	227,332	0	227,332
3	0	227,332	0	227,332
4	0	227,332	0	227,332
5	0	227,332	0	227,332
6	0	227,332	0	227,332
7	0	227,332	0	227,332
8	0	227,332	0	227,332
9	0	227,332	0	227,332
10	0	227,332	0	227,332
Total (tonnes of CO_2 e)	0	2,273,320	0	2,273,320

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

B.7.1 Data and parameters monitored:

Data / Parameter:	1.$EG_{i,j,y}$ ($EG_{grid,DEG,y}$)
Data unit:	MWh/y
Description:	Electricity generated by the project activity displacing electricity in the national grid. This is the nett electricity delivered to Xawo. This electricity excludes the parasitic load and the electricity used from the grid during startup.
Source of data to be used:	Plant records provided by DEG
Value of data applied for the purpose of calculating expected emission reductions in section B.5	222,875 (Calculated from design data for the purpose of estimating the CERs.) For parasitic load: Installed capacity (Gross):35.8MW Installed capacity (Net):32.0MW Installed capacity of ORC parasitic load 35.8 – 32.0 = 3.8MW. Effective parasitic load during operation will always be < 3.8MW Parasitic load of oil circulation system = 311kW
Description of measurement methods and procedures to be applied:	Continuous monitoring will be done and the data will be logged daily. Location of electricity meters: See figure 7. Electricity meters will be installed to measure the electricity produced by the two generators as well as the electricity consumed by the auxiliary equipment of the facility allowing the net produced electricity exported to XAWO to be metered and reported. The electricity produced by the generators (not accounting for parasitic load, i.e.e $EG_{gross,y}$) will be used to determine $Q_{OE,y}$
QA/QC procedures to be applied:	• The electricity meters will be calibrated and maintained in accordance with manufacturer's specifications. • The electricity metered by DEG can be checked during verification by comparing the electricity records from XAWO. • Records of calibrations and maintenance procedures will be kept by the project participant.
Any comment:	The monitoring process and equipment for this procedure is standard. The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**2. $Q_{OE,y}$**
Data unit:	GJ
Description:	Quantity of actual energy output generated during year y, i.e. the gross electricity generated by the power plat from waste energy not taking into account the parasitic load of the power plant.
Source of data to be used:	Power plant process data provided by DEG
Value of data applied for the purpose of	1,051,088.6 For the purpose of calculating the expected emission reductions, it is assumed

calculating expected emission reductions in section B.5	that the project activity delivers the total amount of electricity output by design that can be delivered by the ORC with the available amount of waste heat. The electricity produced by the generators (not accounting for parasitic load) will be used to determine $Q_{OE,y}$. This will be called $EG_{gross,y}$.
Description of measurement methods and procedures to be applied:	Continuous monitoring will be done and the data will be logged monthly. See Figure 7 for a layout of the monitors.
QA/QC procedures to be applied:	The meter will be calibrated in accordance with manufacturer's specifications. Calibration records will be kept for references purposes. The volume and composition of the gas sent to the gen-sets will be checked against the electricity produced and the engine manufacturer's specifications.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**3. f_{cap}**
Data unit:	Unitless
Description:	Energy that would have been produced in project year y using waste heat generated in base year expressed as a fraction of total energy produced using waste heat in year y.
Source of data to be used:	Calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1.0
Description of measurement methods and procedures to be applied:	The relevant f_{cap} will be determined prior to each verification according to the calculation procedure described by ACM0012.
QA/QC procedures to be applied:	
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**5. Record of abnormal or emergency events in the project facility**
Data unit:	Number and duration
Description:	Record of abnormal/emergency events that occurs in the project facility
Source of data to be used:	DEG
Value of data applied for the purpose of	The project facility process control system will have an archive capability where all process data, including alarms and operator actions (like setpoint changes),

calculating expected emission reductions in section B.5	will be continuously stored for later retrieval into plant reports. Abnormal and emergency events and corrective actions will also be manually recorded in an operator's log.
Description of measurement methods and procedures to be applied:	Abnormal events can be cross-checked with electricity generation. Alarm lists will be automatically generated for weekly and monthly analysis and incorporation into the Monthly Operations Report that will be compiled by the Plant Manager. The loss of power generation associated with the abnormal events will also be captured in the Monthly Operations Report.
QA/QC procedures to be applied:	Abnormal events can be cross checked with electricity generation, i.e. the DOE will be able to confirm that no electricity is generated during abnormal events by cross checking the times and duration of abnormal events with electricity generation data.
Any comment:	Abnormal and upset conditions at the power plant will be as a result of failure of heat extraction and transfer equipment (Heat exchangers and thermal oil circuit), failure of heat to electricity conversion equipment (ORC plant), or electricity transfer and switch gear. During abnormal conditions the furnace flue gas is diverted to pass through the trombone coolers for cooling as is done in the current scenario. The waste heat will not be routed to the power plant during these conditions and therefore electricity will not be produced during abnormal conditions and emissions reductions will not be claimed.

B.7.2. Description of the monitoring plan:

7.2.1 Management structure for the facility during construction is provided in Figure 5.

The ultimate responsibility for the construction of the waste gas to electricity plant lies with DEG. DEG will have a project manager on site who will oversee the team.

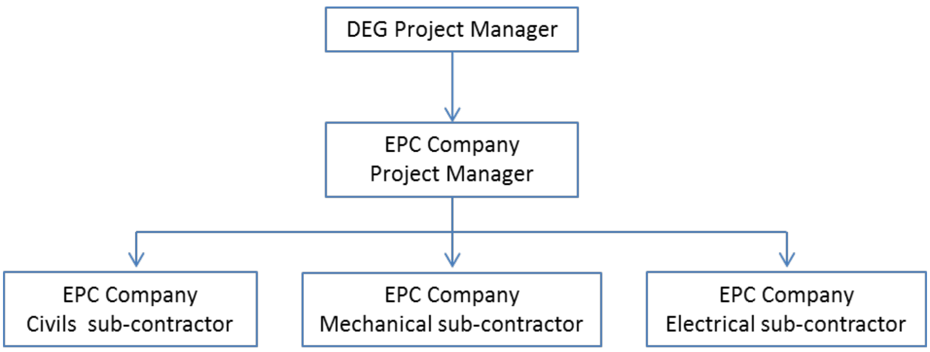


Figure 5: Management structure during construction of the proposed project activity

7.2.2 Management structure for the facility during operation is provided in Figure 6 below. After commissioning of the waste gas to electricity plant, DEG is responsible for the operation and maintenance of the site.

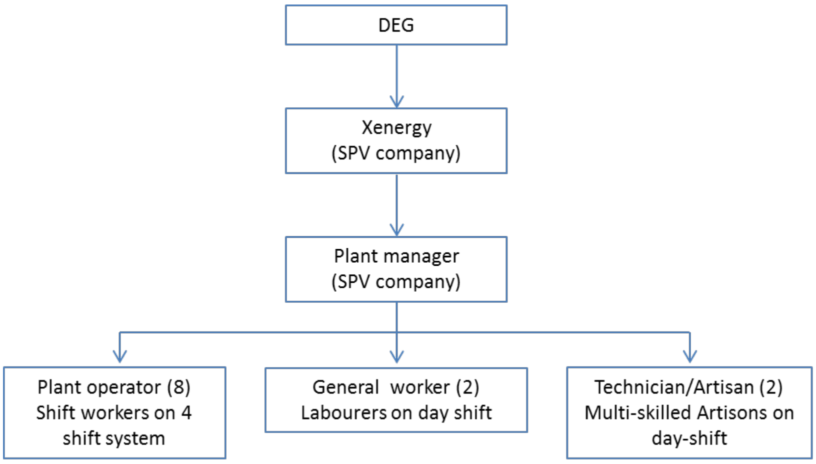


Figure 6: Management structure of the proposed project activity after commissioning

7.2.3 Monitoring Equipment

Electricity meters will measure the quantity of electricity supplied to XAWO. These meters are 4-quadrant billable class meters that are bi-directional – this means that they subtract any electricity used by the plant during start up, or when the plant is not producing electricity.

(i) Data to be monitored during the crediting period

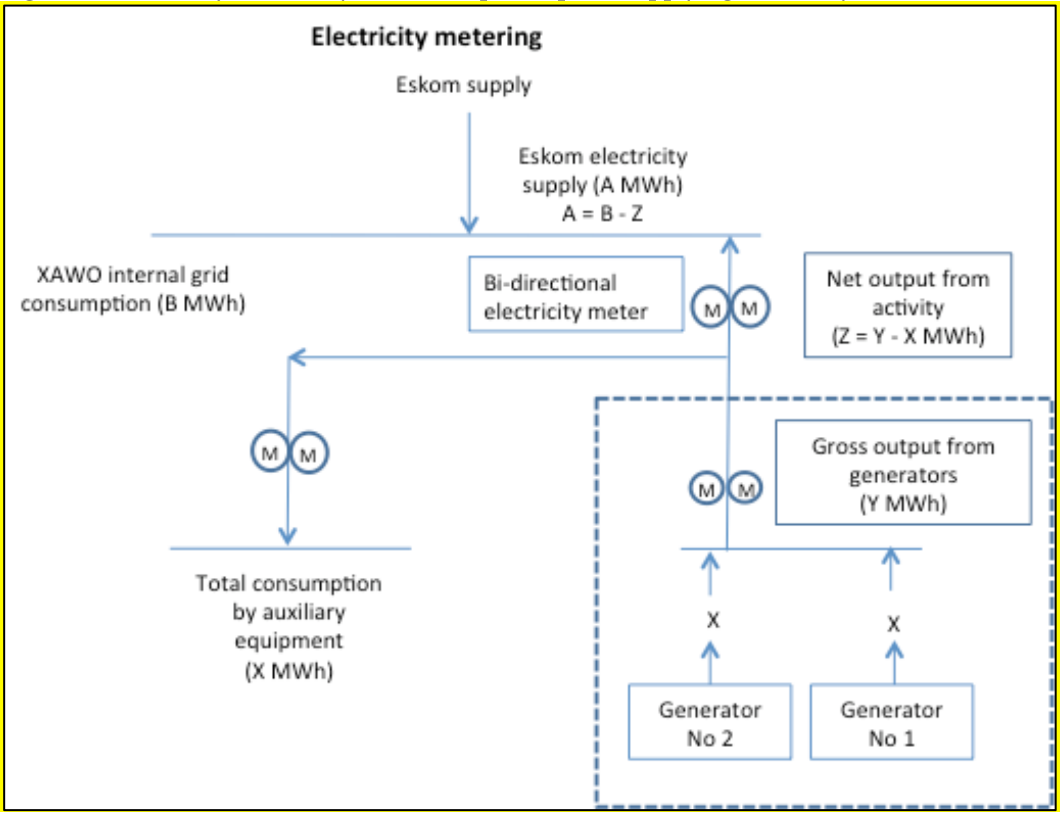
The following data will be monitored by DEG:

- Gross quantity of electricity from the generator terminals;
- Electricity consumption of auxiliary equipment in use by the project activity during start-up and operation.
- Net electricity supplied to XAWO being the difference between the above gross output from generator terminals and the usage of auxiliary equipment of the project activity.

(ii) Equipment

Two bi-directional electricity meters will be installed on the electrical feeds to XAWO – one main meter and one check meter. The metering configuration is illustrated in Figure 7 below.

Figure 7: Electricity meters layout for the power plant supplying electricity to XAWO



(iii) Monitoring accuracy

The electricity meters will be fitted with a telemetry system, and the data will be fed into the plant control system on a daily basis. The main and check meters will be reconciled monthly to check if their readings are within 2% from each other. The main meter will be used for billing and CDM monitoring purposes. If the main meter is out of commission for whatever reason the check meter will be used for billing and CDM monitoring purposes. Once a deviation of more than 2 % exists between the two meters the meters will be checked for possible malfunction which will be corrected. Meters will be calibrated against a calibrated standard meter once every year.

(iv) Data collection and storage

On a monthly basis, the power plant manager (or other designated employee) and a representative from XAWO will read the main and check electricity meters to determine the quantity of electricity produced by the plant. The electricity readings will be logged electronically for the purposes of billing and calculating emission reductions.

The information will be saved onto the power plant Supervisory Control and Data Acquisition (SCADA) system, as well as DEG's financial systems. Backups will be kept both on- and off-site, and all of the data will be available for CDM verification.

(v) Readings and inaccuracy

DEG shall be responsible for retrieving and analysing data from the main and check electricity meters.

Should either of the meters fail to register or, upon testing, be found to have a level of inaccuracy falling outside the maximum tolerance level, then the meter shall be recalibrated against a standard meter or if necessary, replaced with a new meter, and the other meter will be used to measure the quantity of electricity supplied to XAWO.

Should both the meters fail to register or, upon testing, be found to have a level of inaccuracy falling outside the maximum tolerance level, then both meters shall be recalibrated against a standard meter or if necessary, replaced with new meters before electricity measurement resumes.

(vi) Quality Assurance /Quality Control Procedures

The following quality assurance/quality control procedure will be applied in order to increase the reliability of the monitored data:

- The operators will be trained on CDM procedures.
- The operators will be trained on data recording procedures.
- Any abnormal circumstances will be recorded in a logbook).
- The supervisor will check the recorded data and sign off on the logbook on a daily basis.
- The plant manager will ensure that an audit is carried out of the electricity main and check meter information at least once during the monitoring period. The audit may verify the data on electricity generation by cross checking monthly electricity invoices to XAWO or spot-checking the electricity reading of electricity meter/s.
- Physical inspections of monitoring equipment and calibration frequencies will be logged onto the shift inspection report sheets when performed, and stored.
- **Audit**
    - Monthly net electricity supply data will be approved and signed off by the DEG Plant Manager before it is accepted and stored.
    - The Plant manager cross-checks main and check meter readings to the sales receipts
    - The Plant Manager also checks the validity of the calibration certificates of the electricity meters. If the data is correct and the meters calibrated, the data is approved, signed off and stored. If any errors are identified, such errors will be described and corrected, prior to approval, sign off and storage of the corrected data and error descriptions. This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years.

As per methodology ACM0012, all data collected as part of the monitoring plan will be archived electronically, and will be kept for a minimum if two years at the end of the crediting period.

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 of the application of the methodology to the project activity study:
8 February 2012
Contact Information:
CDM Africa Climate Solutions (Pty) Ltd
83 MacKay
Blairgowrie
Johannesburg
South Africa
ciska@cdmafrica.com
+27828985750

CDM Africa is not a project participant listed in Annex 1.

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:

30 November 2012

The date is the expected date on which DEG will put an order on the equipment.

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

15 Years 0 months

This is the minimum operational lifetime of the project activity and is based on the expected lifespan of the furnaces.

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:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

1 August 2014

C.2.2.2. Length:

10 Years 0 Months

SECTION D. Environmental impacts

The environmental impact assessment (EIA) for the proposed facility has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). No environmental fatal flaws were identified to be associated with the proposed energy facility. A number of issues requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within the Draft Scoping Report.

The project was approved by the Department of Environment and a Record of Decision was issued on 28 February 2012. Refer to Appendix 12_ XAWO Environmental Authorisation.

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

The following specialist studies were conducted to determine the impacts of the proposed project activity and are available as part of the Environmental Impact Assessment:

Meteorology Specialist Report
Topography Specialist Report
Soil Specialist Report
Land Capability and Land Use Specialist Report
Geology Specialist Report
Ground Water Specialist Report
Surface Water Specialist Report
Plant Life Specialist Report
Animal Life Specialist Report
Aquatic Ecology Specialist Report
Air Quality Specialist Report
Noise Specialist Report
Visuals Specialist Report
Heritage Specialist Report
Socio-Economic Specialist Report

Overall the project scored positive on environmental impacts.

No transboundary impacts were identified in the environmental impact study.

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

None of the environmental impacts were considered significant.

SECTION E. Stakeholders' comments

Chapter 11 of the Public Participation Program Report[20] deals with the Issues and Concerns that was raised by I&AP's throughout the process and also contains responses by the applicant on how these issues will be addressed.

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

Public Meetings Held

Public meetings were advertised and conducted according to requirements as stipulated in the EIA regulations. These meetings were conducted within the domain of the locally affected communities at XAWO Main Admin Lapa. The services of a Tswana translator was acquired during these meetings in order to accommodate as many people as possible during these meetings, as well as to provide

[20] Appendix 5 Public Participation Program Report, Version II, Date: 28 October 2011, DEA Reference: 12/12/20/2216

community members with the opportunity to ask questions in their native language. (Refer to page 25 of the Public Participation Programme Report Version II, Date: 28 October 2011, Project Reference: JMA / 10407).

- Public Meeting which was held on 7th of December 2010 at the XAWO Main Admin Lapa Facility. Refer to Appendix VIII of Appendix 16_ Public Participation Program Report for minutes of public meetings.
- A Focus Group Authority Meeting was held with ESKOM on the 1st of September, 2011. Refer to Appendix VII of Appendix 16_ Public Participation Program Report for minutes of focus group meetings.
- Press advertisements were also compiled and published in the local newspaper being the Rustenburg Herald as well as the Daily Sun newspaper. The advertisements also contained some information regarding the project along with details and invitation to the public meeting. (Refer to Appendix III of Appendix 16_Public Participation Program Report for copies of the press advertisements placed.)
- The EIA phase public meeting was scheduled and advertised to take place at 14:00 on Thursday 1st of September 2011, at the XAWO Main Admin Lapa Facility. Refer to Appendix VIII of Appendix 16_ Public Participation Program Report for minutes of public meetings.

Level of Advertising and Notification

The level of advertising and notification of I&AP's were done in strict accordance with the requirements and dimensions as stipulated in the EIA regulations. Refer to Section 7.2 of Appendix 16_Public Participation Program Report for minutes of public meetings, for a description of how the legal requirements were followed in the EIA process.

Protocol for Access to and Review of Information

During the various authority and public meetings that were conducted it was always ensured that everybody knew when and where draft documents for review would be made available. Electronic copies of the reports on CD disk were also distributed to I&AP's on request. Notifications were also sent out to all Registered I&AP's after the meetings were conducted. The timeframe for the obtainment of comments was always clearly indicated to Registered I&AP's and was set for a period of 40 days. The location of where the documents were available for I&AP review were at public institutions such as public libraries (Marikana Community Library & Rustenburg Public Library) and at XAWO Main Admin Building. Inputs from consulted I&AP's assisted with the decision on where the locations for these draft documents for review should be.

Copies of the Draft Reports were also presented to a Local NGO known as the North West Eco Forum as well as the Community Liaison Officer at XAWO for distribution to members of the Community Forum for review.

It must be noted that although the agreed timeframe for the review period was 40 days, some comments that were received after the review period formally expired were still included on a continuous basis as it was received.

Protocol for Comments on Information

During the various authority and public consultations guidance was given to I&AP's on what they are entitled to comment (which included anything they deemed as important, this was clearly emphasized), and also where they would be able to find information relating to the different aspects of the DEG Waste Heat to Power Project. Details of the different available formats in which comments can be submitted were provided to the I&AP's along with the relevant contact information.

Protocol for Recording of and Response to Comments

It was clearly indicated to all I&AP's that all comments that were received by the EAP would be recorded in an Issues & Response table. The EAP also explained the function of this table and what responsibility it generates for each of the affected parties. Each time the I&AP's were consulted the most up to date version of this table was available to all I&AP's.

E.2. Summary of the comments received:

Reference source of the tables below: Appendix IX (I%AP Issue and Response Register) of Appendix 16_ Public Participation Program Report.

NAME	MEANS OF COMMUNICATION	ISSUE/CONCERN	RESPONSE
SCOPING PHASE			
SCOPING PUBLIC MEETING – 07 December 2010			
André Brits (Anglo Platinum)	I&AP Meeting 07 December 2010	1. Asked with regards to focus group meetings that were conducted, how many was conducted to date and with whom. 2. Referred to the mentioned waste management activities relating to the expansion of the slag disposal facility, mention was made of liner systems being put into place for the new expansion footprint, but wanted to know what about the existing footprint, how will that be handled? 3. Asked to please put up the photo of the slag management area on the screen, and explained that the proposed expansion of the slag dump will be over underground workings and asked whether safety factors with regards to weight carrying capacity were considered and said the DMR usually requests such studies to be conducted for areas that will be undermined. 4. Raised the issue of Cr^{6+} contamination in and around the slimes dam facilities and said that the results thereof should be communicated to the I&AP's.	1. Riaan Grobbelaar (RG) explained that focus group meetings were held with all of the relevant authorities (NW DACERD, DWA, DMR), as well as a local NGO in the area, Mr Chris de Bruyn from the North West Eco Forum. RG also stated that if any of the I&AP's feel that they want to be consulted in a separate focus group meeting that they must contact JMA Consulting in this regard and such a meeting will then be scheduled. 2. RG explained that after discussions held with the DWA it became clear that there will have to be some form of rehabilitation of that footprint. RG gave background of SA Ferro-Alloy Association and their discussion with the department regarding the classification of slag as a hazardous waste. RG mentioned that their aim is to get relaxation on the current hazardous waste classification of waste. RG however said that slag will always constitute a waste management activity so an appropriate liner system will have to be put in place for the

			proposed expansion of the slag disposal facility. RG mentioned that under current legislation the slag dump will have to be capped and rehabilitated according to the regulations, but discussions held with DWA the current footprint will be extended on an appropriate liner system and when the site is not active any more rehabilitation of the entire site will be done. Jasper Muller (JM) added that geo-chemical information that came out of the geo-chemical investigations showed that more methane gas are found in natural geological formations than is the case in the slag dump. And methane is one of the biggest areas of concern with regards to the slag dump. 3. JM mentioned that they are aware of this and that details of this will be included in the detailed geo-technical reports that will be compiled. 4. RG explained the results of monitoring that was done for the baseline investigations as well as monitoring that was conducted after, and said that no Cr^{6+} were found in the ground water qualities. RG explained that the Cr^{6+} component results directly from the dust component in the furnaces and said that specific measures are in place to prevent contamination. RG also mentioned measures that are in place to reduce Cr^{6+} to Cr^{3+} which is less harmful.
Christo Gagiano (Fraser Alexander)	I&AP Meeting 07 December 2010	1. Said that mention was made of boreholes on site that was tested and sampled and asked whether properties' boreholes were also tested and if so what were the results there? 2. Asked whether the proposed storm water facilities and pollution control dams were designed to take into consideration the 1:100 year flood and whether uncontrolled run-off from neighbouring properties were taken into account, as this can lead to a failure of storm water management facilities on your site.	1. RG explained the manner in which the locations of boreholes on site are based on the source-pathway-receptor whereby boreholes are located at the source, in the pathway of ground water flow and on the perimeter of the property. RG said that no monitoring was done on neighbouring properties but that neighbouring properties' water qualities were covered in the hydro census that was conducted. 2. JM assured him that all relevant factors were taken into consideration by the surface water specialists when the storm water facilities were designed and said that all details pertaining to surface water management will be included in the reports.
Focus Group Meeting North West Eco Forum			
Chris de Bruyn (North West Eco Forum	Focus Group Meeting 07 December 2011	1. Asked whether a pollution plume was present at current slimes dam footprints	1. RG indicated that this was not the case and mentioned the extent of monitoring boreholes that are present

		2. Asked what the function of the EMPR Amendment would be and whether this was only a shortcut to authorisation. 3. Asked for more information on the DEG Project. 4. Asked whether this technology will be implemented at other Xstrata Operations throughout the province.	at the site as well as recent monitoring results that were obtained from these. 2. RG explained to him that the EMPR Amendment would enable JMA to draw up an extensive Environmental Management Plan for the entire site. RG then mentioned the different management areas into which JMA has divided the XAWO site into. RG then mentioned the function and benefits of this division of the site into smaller homogeneous management areas. RG also made mention of the different specialist baseline studies that were undertaken as part of the investigations that have been completed to date and also stated the function and contribution of the comprehensive set of baseline investigations to the compilation of an integrated environmental management plan for the entire XAWO site. 3. RG explained the project to him in more detail and stated that the scoping report for this project will be provided to him in electronic format for his consideration. 4. It was indicated to him that Xstrata Wonderkop will be the first to
			implement this and if it is seen to be effective it will in all likelihood be implemented at other Xstrata Operations throughout the province
Comments Received during Scoping Phase I&AP Review Period			
Boipuso Semenya **(Rustenburg Local Municipality Directorate: Planning and Human Settlement – Integrated Environmental Management Unit)**	Fax Received 22 June 2011	1. Proper mitigation measures that will be implemented must be stated clearly in the EIAR and EMP. The applicant will be held responsible for the implementation thereof and will be legally binding the contractor/subcontractor, employees, etc. 2. All hazardous and solid waste must be removed to a licensed waste disposal site for the type of waste produced. No solid waste may be disposed of on site. The storage of solid waste on site, until such time as it may be disposed of, must be in a manner acceptable to the Local Authority, the Department of Water Affairs (DWA) and/or Department of Environmental Affairs (DEA). 3. Precautionary measures must be taken during the construction and decommissioning phases of the project to reduce/mitigate the impacts of soil erosion and pollution. 4. Provision must be made for the adequate storage and handling of used and	1. Please refer to Chapter 6 & 7 of Final EIAR for all mitigation and impact management measures. 2. This project will produce no waste during its operational phase. Please refer to Chapter 7 of Final EIAR for management measures to be implemented during all of the projects's life cycle phases. 3. Please refer to Chapter 7 of Final EIAR for management measures to be implemented during all of the project's life cycle phases. 4. Please refer to Chapter 7 of Final EIAR for management measures to be implemented during all of the project's life cycle phases. 5. Please refer to Surface Water Baseline Report which forms part of Chapter 5 of the Final EIAR. Also refer to Chapters 6 & 7 Final EIAR.

		contaminated substances such as oil, lubricants and other petroleum products during the construction and operational phases of the development. The substances must be stored in such a way that it would not pose any threat to the environment. 5. A storm water management plan (i.e. storm water diversion channel must be put in place and the must take into account the storm water drainage system in the area and how the project could possibly affect it. 6. Dust generated by construction activities must be effectively controlled b water spraying and/or other dust-allaying agents. 7. Any complaint from the public during the construction and operation of this project must be attended to by the person involved as soon as possible to the satisfaction of the parties concerned. A complaint register must be kept up to date and should be produced upon request.	6. Please refer to Chapter 7 of Final EIAR for management measures to be implemented during all of the project's life cycle phases. 7. Applicant will be made aware of this comment.

EIA PHASE			
Comments Received during EIA Phase Public Meeting on 1st of September 2011			
Erica Wenholdt Kroondal Eco Forum	Public meeting 01/09/2011	1. Inquired whether this Waste Heat to Power project was the first of its kind in this country and where did it originate. 2. Asked whether this was the first for Xstrata. 3. EW replied that she would like to compliment them for looking at alternative greener ways of generating electricity. 4. EW inquired as to what is going to done with the oil, will it be re-used or will it be collected by an external service provider. 5. Asked whether the Department of Energy is involved in this and are they happy about this project.	1. Mr Nico Smith (NS) answered her by saying in general there are several forms of waste heat recovery already taking place, not necessarily the same technology, not necessarily for the ferrochrome industry. 2. NS replied that heat recovery for use in electricity generation will be a first for Xstrata. 3. Noted 4. NS explained that the oil will be in closed circuit. NS explained the complex nature of this oil and also that the oil will not come into any direct physical contact with gas or heat, thus the oil will not become contaminated and can be re-used again and again as it will remain functional for a long time. NS did however mention a filter system that will be put in place. 5. NS said he is not certain if the Department of Energy is aware and was informed of this particular project per sé but they will however receive information on this project due to the fact that DEG applied for Carbon

			Credits in order to capture extra financing for the project. JM also mentioned that DEA is the Competent Authority for this project and that it is their responsibility to inform any other department they may deem important to have knowledge about this project and to provide them with comments.
Chris Wenholdt Kroondal Eco Forum	Public meeting 01/09/2011	1. Would like to know what the effect of this system would be on the operation of the baghouse of the plant.	1. NS replied that this matter was indeed investigated and that Xstrata made it clear right at the beginning, that they will only approve the implementation of a project such as this if it will have no residual effect on the normal operation of the ferrochrome plant and also no residual impact on the environment. NS explained that this will be a closed system.
Peter Photsaneng Community	Public meeting 01/09/2011	1. Inquired if instead of appealing the decision if they make recommendations regarding the project will that be acceptable. 2. Asked if it is said that this project's normal operation will not affect the environment it goes without saying that the local community will also not be affected.	1. JM indicated that it would and that such recommendations must be provided to JMA during the I&AP review period. 2. JM indicated to him that that was indeed the case.
Martin Petlele Headman of surrounding communities	Public meeting 01/09/2011	1. Thanked JMA for the lecture and said that he was happy with the way in which it was conducted, but that he had to go back to his community and talk to them first after which comments from their side will submitted	1. JM said that he was more than welcome.
Unknown Lady of the Community	Public meeting 01/09/2011	1. Wanted to know how many furnaces there are currently at XAWO.	1. JM indicated that there were six furnaces currently in operation.
Peter Modubo XAWO Community Liaison Officer	Public meeting 01/09/2011	1. Asked how long will the timeframe for acknowledgement of comments received be, as well as where the reports that will be made available for review.	1. JM said acknowledgment will be within 24h and mentioned the different venues where the documents will be placed. These include XAWO Main Admin Building, Marikana Community Library and Rustenburg Public Library
Comments Received during EIA Phase I&AP Review Period			
Kelbogile Mekgoe **(Rustenburg Local Municipality Directorate: Planning and Human Settlement – Integrated Environmental Management Unit)**	Letter Received 28/09/2011	1. With regard to the Distributed Energy Generation Project, the Unit: Integrated Environmental Management acknowledges receipt of the draft EIA Report. The Unit is satisfied with the draft EIA report submitted, however, wishes to indicate that the recommendations stated for the Draft Scoping Report still stands and have no further comments.	1. Please refer to Comments & Responses received from The Unit: Integrated Environmental Management above.
Martin Petlele Headman of surrounding communities	Email Received 05/10/2011	1. Skills development from DEG to the locals. 2. Whether radioactive material/waste will be used in the plant production. 3. Jobs for locals. 4. Educational bursaries for locally affected people in the project.	1. Please refer to Chapters 4 & 5.15 as well as Appendix 5.15(A) of the Final EIAR for information relating to Socio-Economic Aspects and Strategies. 2. This project will not use nor produce any radioactive or any other type waste during its operational phase. Please refer to Chapter 7 of Final

		5. How much money generated from the project will be used to upgrade or promote local business? 6. Open communication channels between DEG and local village leaders. 7. Some of the IPP (Independent Power Projects) to benefit local resident and businesses. 8. How long the power project will run for in years. 9. BBBEE status within the company and local community. 10. Of the sold energy DEG plans to sell to Xstrata or Eskom how much money will be invested back into the community. 11. Opportunities for small scale companies. 12. Of the Biomass waste how much of it is radioactive and its impact on our soils, water and air. 13. Will local residents get some of DEG produced Energy at a lower price, since	EIAR for management measures to be implemented during all of the projects's life cycle phases. 3. Please refer to Chapters 4 & 5.15 as well as Appendix 5.15(A) of the Final EIAR for information relating to Socio-Economic Aspects and Strategies. 4. Please refer to Chapters 4 & 5.15 as well as Appendix 5.15(A) of the Final EIAR for information relating to Socio-Economic Aspects and Strategies. 5. Please refer to Chapters 4 & 5.15 as well as Appendix 5.15(A) of the Final EIAR for information relating to Socio-Economic Aspects and Strategies. 6. The applicant will be made aware of the request. 7. Please refer to Chapters 4 & 5.15 as well as Appendix 5.15(A) of the Final EIAR for information relating to Socio-Economic Aspects and Strategies. 8. The power generation project will be
		they will be the most affected by the project? 14. Another meeting to get various opinions from other organizations as we have tried to include academics from the University of Johannesburg and Earthlife Africa but are still waiting for a response.	operational for as long as XAWO plant is operational. 9. DEG is still classified as an Exempted Micro Enterprise as they are a start-up company with less than R5 million turn over. DEG's own status is thus not of importance at this stage. DEG will however ensure 30% BBBEE shareholding in the Special Purpose Company (SPC) to be registered for this project. 10. None 11. Please refer to Chapters 4 & 5.15 as well as Appendix 5.15(A) of the Final EIAR for information relating to Socio-Economic Aspects and Strategies. 12. This project will not use nor produce any radioactive or any other type waste during its operational phase. Please refer to Chapter 7 of Final EIAR for management measures to be implemented during all of the projects's life cycle phases. 13. No electricity will be released into the Eskom grid as all of the generated electricity will be

			circulated back into and used within XAWO's closed system. 14. The two public meetings held for this project in support of the Scoping & EIA conducted was extensively advertised as prescribed in the EIA regulations. Please refer to the Public Participation Programme report for details on the level of advertisement of these meetings. No further meetings will be held for this this particular EIA Process. The formal Public Participation Programme that was followed for this project has now been concluded with the review period of the Draft EIAR. The EIAR will now be finalized for submission to DEA. Registered I&AP's will however still have the opportunity to submit comments on the Final EIAR to DEA.

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

All the comments provided are listed in the tables in E.2. above.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Distributed Energy Generation (DEG) (Pty) Ltd.
Street/P.O.Box:	44 Mandeville Street
Building:	1 Martha's Vineyard
City:	Bryanston
State/Region:	Gauteng
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Country:	South Africa
Telephone:	+27 11 462 0534
FAX:	
E-Mail:	Charles@degpl.com
URL:	
Represented by:	Nico Smith
Title:	Mr
Salutation:	Director
Last name:	Smith
Middle name:	Jacobus
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Direct tel:	+27 11 465 1857
Personal e-mail:	nico@degpl.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the development of this project

Annex 3

BASELINE INFORMATION

Determination of the grid emission factor

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

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

STEP 1. Identify the relevant electricity systems.

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

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

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

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

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

Step 1. Identify the relevant electric power system

Project electricity system

The DNA of South Africa has, to date, not published a delineation of the project electricity system and connected electricity systems.

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

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

Connected electricity system

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

For the purpose of determining the operating margin emission factor, the CO2 emission factor(s) for net electricity imports from a connected electricity system is assumed to be 0 tCO2/MWh.

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

The project developer chooses not to include off-grid power plants because the relevant information is not freely available.

Step 3: Select a method to determine the operating margin (OM)

The simple OM will be used to determine the OM. The simple OM method can be used, because the low-cost/must-run resources constitute less than 50% of the total grid generation in the five most recent years.

Motivation for using Simple Operating Margin

The simple OM method may 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) based on long-term averages for hydroelectricity production.

Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. In South Africa, these resources include hydro, wind and nuclear.

Table 11 shows the energy resources used in South Africa for the most recent five years for which information is publicly available. Electricity from coal makes up over 92.7% (please refer to figures in Table 5) of the electricity produced in South Africa. Therefore, the simple operating margin can be applied.

Table 11: Resource information for electricity production in the national grid

Statistical overview

	2012	2011	2010	2009	2008
Sales					
Total sold (GWh)[1, 2]	224 785	224 446	218 591	214 850	224 366
Growth/(reduction) in GWh sales (%)	0.2	2.7	1.7	(4.2)	2.9
Electricity output					
Total produced by Eskom stations (GWh (net))	237 291	237 430	232 812	228 944	239 109
Coal-fired stations (GWh (net))	218 212	220 219	215 940	211 941	222 908
Hydroelectric stations (GWh (net))	1 904	1 960	1 274	1 082	751
Pumped storage stations (GWh (net))	2 962	2 953	2 742	2 772	2 979
Gas turbine stations (GWh (net))	709	197	49	143	1 153
Wind energy (GWh (net))	2	2	1	2	1
Nuclear power station (GWh (net))	13 502	12 099	12 806	13 004	11 317

*Source of information for the table: Appendix 60_*Eskom Divisional Report 2012, page 88

%Share of coal fired in power stations: More than 90%.

It is therefore confirmed that the low-cost/must-run resources constitute less than 50% of the total grid generation.

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

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

The data used in OM calculations are for the 3-year period indicated in the following Table. This is the latest public available data.

Step 4: Calculate the simple operating margin emission factor

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

The *Option A* is used as data on the net electricity generation of each power plant is available and a CO_2 emission factor for the power plants can be determined.

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

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

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

Equation 1

Where:

Where:

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

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

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

Equation 2

Where:

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

Table 12: Power stations in the Operating Margin

No.	Name of Power Unit/country	Net Electricity Generation (MWh) *Source: Appendix 61_GEFdata170712Final_vr1 published by Eskom* Website short cut access is: http://www.eskom.co.za/c/article/236/cd			Main Fuel Type/ Energey Source	Main Fuel Consumption (t (mass or volume unit)) *Source: Appendix 61_GEFdata170712Final_vr1 published by Eskom* Website short cut access is:		
		2009-2010	2010-2011	2011-2012		2009-2010	2010-2011	2011-2012
Electricity import								
i-1	International imports *(Source: Eskom Integrated Report, 2012, page 01),*	13,754,000	13,613,000	13,038,000				
i-2	IPPs *(Source: Eskom Integrated Report, 2012, page 01),*	0	1,833,000	4,107,000				
Electricity generation in the project electricity system								
1	Arnot	13,227,864	12,194,878	12,229,098	Other Bituminous Coal	6,794,134	6,525,670	7,035,460
2	Duvha	22,581,228	20,267,508	17,556,459	Other Bituminous Coal	11,744,606	10,639,393	9,154,172
3	Hendrina	12,143,292	11,938,206	11,412,357	Other Bituminous Coal	6,905,917	7,139,198	6,849,996
4	Kendal	23,307,031	25,648,258	27,309,297	Other Bituminous Coal	13,866,514	15,174,501	15,174,501
5	Kriel	15,906,816	18,204,910	15,289,169	Other Bituminous Coal	8,504,715	9,527,185	8,360,504
6	Lethabo	25,522,698	25,500,366	24,274,937	Other Bituminous Coal	18,170,227	17,774,699	17,293,334
7	Matimba	27,964,141	28,163,040	27,899,475	Other Bituminous Coal	14,637,481	14,596,842	14,953,397
8	Majuba	22,340,081	24,632,585	25,325,348	Other Bituminous Coal	12,261,833	13,020,512	13,529,252
9	Matla	21,954,536	21,504,422	20,650,022	Other Bituminous Coal	12,438,391	12,155,421	11,367,521
10	Tutuka	19,847,894	19,067,501	20,504,886	Other Bituminous Coal	10,602,839	10,191,709	11,368,184
12	Ankerlig	23,367	130,241	391,049	Gas/Diesel Oil	6,395	35,411	104,465
13	Gourikwa	22,612	62,233	314,651	Gas/Diesel Oil	5,902	16,412	82,443
14	Acacia	2,187.0	992	1,163	Other Kerosene	900.7	354	368
15	Port Rex	889.0	5,507	2,162	Other Kerosene	298.2	224	658
24	Camden *** Commissioning information source: Appendix 67_Eskom Holdings Limited Integrated Report 2011, page 148	7,472,070	7,490,836	7,267,648	Other Bituminous Coal	4,732,163	4,629,763	4,329,462
25	Grootvlei * Commissioing information source: Appendix 63_Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2,656,230	3,546,952	6,094,910	Other Bituminous Coal	1,637,371	2,132,979	3,821,963
26	Komati **Commissioing information source, Appendix 64_Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	1,016,023	2,060,141	2,398,132	Other Bituminous Coal	664,497	1,271,010	1,390,186

Source: GEF Spreadsheet and Appendix 61_GEFdata170712Final_vr1 published by Eskom. Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/

Table 13: Calculation of the Operating Margin emission factor

Operating Margin Calculation Option	Simple OM

No.	Name of Power Unit	2009-2010		2010-2011		2011-2012	
		Net Electricity Generation	CO2 Emission Factor	Net Electricity Generation	CO2 Emission Factor	Net Electricity Generation	CO2 Emission Factor
		MWh	t-CO_2/MWh	MWh	t-CO_2/MWh	MWh	t-CO_2/MWh
Electricity import							
i-1	International imports	13,754,000		13,613,000		13,038,000	
i-2	IPPs	0.0		1,833,000.0		4,107,000.0	
Electricity generation in the project electricity system		-		-		-	
1	Arnot	13,227,864	0.8835	12,194,878	0.9315	12,229,098	1.0097
2	Duvha	22,581,228	0.8947	20,267,508	0.9138	17,556,459	0.9151
3	Hendrina	12,143,292	0.9783	11,938,206	1.0410	11,412,357	1.0535
4	Kendal	23,307,031	1.0234	25,648,258	1.0299	27,309,297	0.9752
5	Kriel	15,906,816	0.9197	18,204,910	0.9110	15,289,169	0.9597
6	Lethabo	25,522,698	1.2246	25,500,366	1.2134	24,274,937	1.2503
7	Matimba	27,964,141	0.9004	28,163,040	0.9022	27,899,475	0.9407
8	Majuba	22,340,081	0.9442	24,632,585	0.9202	25,325,348	0.9376
9	Matla	21,954,536	0.9746	21,504,422	0.9840	20,650,022	0.9662
10	Tutuka	19,847,894	0.9189	19,067,501	0.9305	20,504,886	0.9730
12	Ankerlig	23,367	0.8226	130,241	0.8172	391,049	0.8029
13	Gourikwa	22,612	0.7845	62,233	0.8172	314,651	0.7875
14	Acacia	2,187	1.2363	992	0.8172	1,163	0.7875
15	Port Rex	889	1.0069	5,507	0.8172	2,162	0.7875
24	Camden	7,472,070	1.0894	7,490,836	1.0759	7,267,648	1.0144
25	Grootvlei	2,656,230	1.0604	3,546,952	1.0468	6,094,910	1.8912
26	Komati	1,016,023	1.1250	2,060,141	1.0740	2,398,132	1.1843
Annual Electricity Generation in Total		229,742,959		235,864,576		236,065,763	
Simple Operating Margin CO2 Emission Factor		EFgrid, OMsim	0.9208	EFgrid, OMsin	0.9216	EFgrid, OMsimp	0.9396
Operating Margin Emission Factor(t-CO_2/MWh)							**0.9274**

Step 5 Calculate the build margin (BM) emission factor

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

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

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

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

Source of information:
***Re-commissioned power plant,** Eskom Holdings Limited Integrated Report 2011, page 148
****Re-commissioned power plant,** Eskom Annual Report 2010, page 126, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf
*****Re-commissioned power plant,** Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf

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

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

SET≥20%						
26	Komati **Commissioing information source, Appendix 64_Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2,398,132	1.1843	2,840,204.9
25	Grootvlei * Commissioing information source: Appendix 63_Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	6,094,910	1.8912	11,526,543.5
13	Gourikwa	2007	Gas/Diesel Oil	314,651	0.8029	252,642.4
12	Ankerlig	2007	Gas/Diesel Oil	391,049	0.8029	313,984.6
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	2005	Other Bituminous Coal	7,267,648	1.0144	7,372,217.8
8	Majuba	1996	Other Bituminous Coal	25,325,348	0.9376	23,745,122.5
4	Kendal	1988	Other Bituminous Coal	27,309,297	0.9752	26,632,690.8

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

(c) AEG $SET_{5\text{-units}}$ = 16,466,390MWh (see grid emission spreadsheet, sheet BM-D)
(c) AEG $SET_{>20\%}$ = 69,101,035 MWh (see grid emission spreadsheet, sheet BM-D)

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

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

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

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

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

- Kendal (1988)
- Majuba (1996)

The only CDM project activity that started supply electricity to the grid, is the Bethlehem Hydro plant. It is assumed that the Bethlehem Hydro plant delivers the expected MWh per year that is indicated in the PDD on page 12, i.e. 34,031 MWh.

SETsample-CDM						
26	Komati **Commissioing information source, Appendix 64_Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2,398,132	1.1843	2,840,204.9
28	Bethlehem Hydro (Source: Appendix 65_http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99, CDM PDD, page 12)	2009	Hydro	34,031	0.0000	0.0
25	Grootvlei * Commissioing information source: Appendix 63_Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	6,094,910	1.8912	11,526,543.5
13	Gourikwa	2007	Gas/Diesel Oil	314,651	0.7875	247,794.3
12	Ankerlig	2007	Gas/Diesel Oil	391,049	0.8029	313,984.6
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	2005	Other Bituminous Coal	7,267,648	1.0144	7,372,217.8

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

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

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

No.	Name of power unit	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t-CO_2/MWh$) of the latest year	CO2 Emissions ($t-CO_2$)
26	Komati **Commissioing information source, Appendix 64_Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2,398,132	1.1843	2,840,205
28	Bethlehem Hydro (Source: Appendix 65_http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99, CDM PDD, page 12)	2009	Hydro	0	0.0000	0
25	Grootvlei * Commissioing information source: Appendix 63_Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	6,094,910	1.8912	11,526,543
13	Gourikwa	2007	Gas/Diesel Oil	314,651	0.8029	252,642
12	Ankerlig	2007	Gas/Diesel Oil	391,049	0.8029	313,985
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	2005	Other Bituminous Coal	7,267,648	1.0144	7,372,218
8	Majuba	1996	Other Bituminous Coal	25,325,348	0.9376	23,745,123
4	Kendal	1988	Other Bituminous Coal	27,309,297	0.9752	26,632,691
Total				**69,101,035**		**72,683,407**

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

Equation 3

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

Where:

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

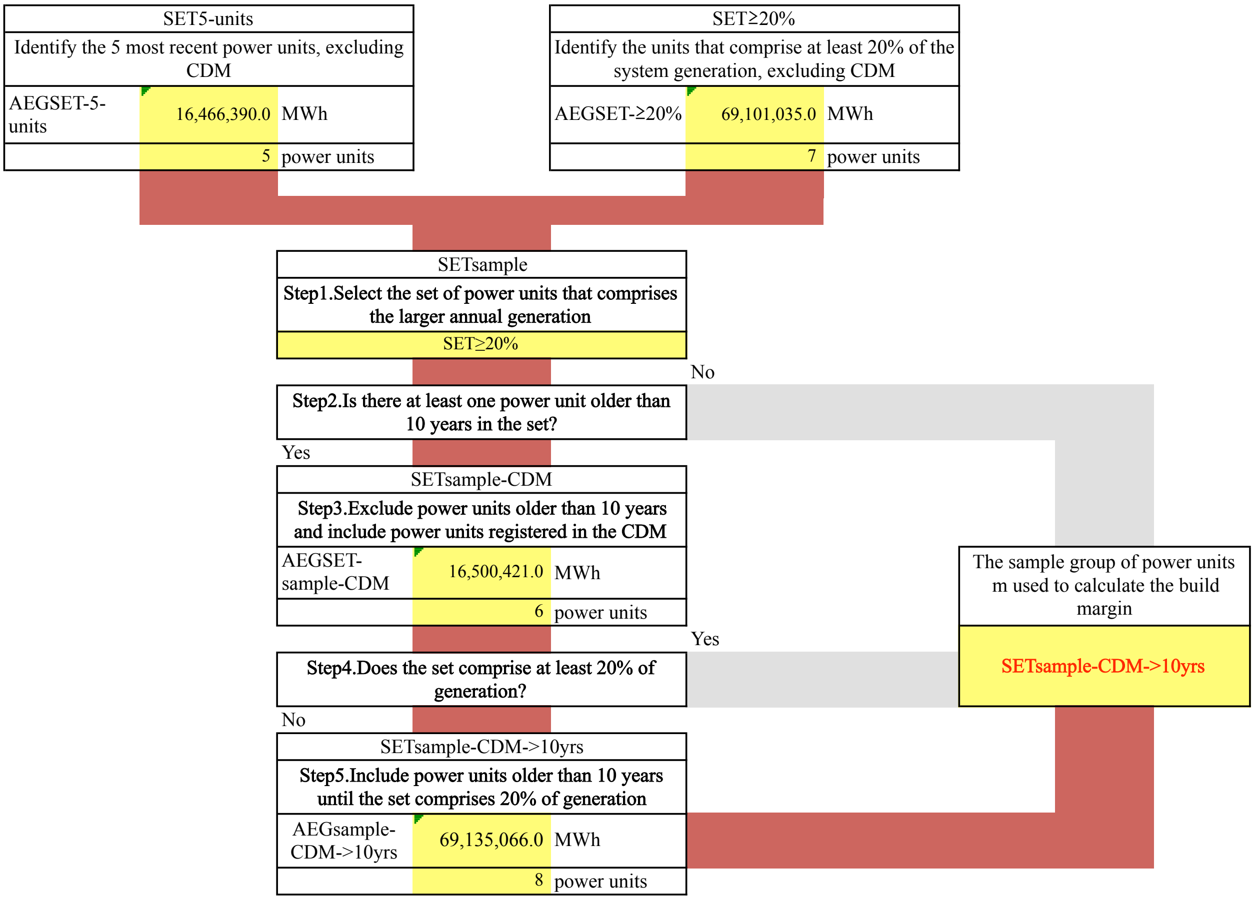
The emission factor for each power unit is calculated applying Option A1, if the electricity generation and fuel consumption information for the generating units are publicly available.

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

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

The BM is calculated as 1.0518 tCO2/MWh (refer to GEF spreadsheet, Sheet BM)

The diagram below demonstrates the build margin determination process in diagram format. The diagram can be found in the grid emission spreadsheet on sheet 'BM Diagram'.



Step 6: Calculate the combined margin emissions factor

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

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

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

Equation 4

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)
The methodology specifies default values of wOM = 0.5 and wBM = 0.5.

The combined margin is calculated as 0.9896 tCO_2/MWh (refer to GEF spreadsheet, Sheet CM, Cell I10)

Annex 4

MONITORING INFORMATION

No further information provided in this section.