CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02 : In effect as of 8 July 2005

CONTENTS

SECTION A. General description of the small-scale project activity

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

PetroSA biogas to energy project – PDD version 11, 16 August 2006

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

PetroSA (The Petroleum Oil and Gas Corporation of South Africa) is a state owned corporation that has since 1987 operated a gas to liquids plant at Duinzicht, some 12 kilometres from the town of Mossel Bay on the south coast of South Africa. The production process at Duinzicht leads to waste process water that since the inception of the Plant has been dealt with by way of anaerobic digestion. The anaerobic digestion is continuous and a critical process for the operation of the PetroSA plant. In the anaerobic digestion process biogas is naturally generated.

The Plant is equipped with a smokestack that houses a flaring apparatus. Since the inception of the Plant, this biogas has been flared. It is estimated that the equivalent of at least 1 300 GigaWatthours of gross heat value has been wasted in this manner over the lifetime of the Plant.

The present project can be summed up very simply as using the waste gas presently flared to generate electricity to be used onsite by PetroSA. The corporation will henceforth need to purchase less electricity from the national grid.

The Plant will be owned, operated, and maintained by MethCap SPV1 (Pty) Ltd, the project developer, as an Independent Power Producer and will be financed from two essential revenue sources: Electricity sales to PetroSA and the sale of Certified Emissions Reductions through the CDM.

The project is not financially viable without carbon finance in the form of Certified Emissions Reductions and faces investment barriers, barriers of prevailing practice, barriers regarding capacity short-comings and other barriers. The developer has applied for a subsidy called a DSM (“Demand Side Management”) subsidy but submits that Executive Board 16 Annex 3 compels him to develop the baseline as if the subsidy does not exist. For purposes of transparency however the investment analysis in Section B.3. below is done both with and without the DSM subsidy to illustrate that the project is additional in either case and irrespective of whether the DSM subsidy is found to fall within EB 16 Annex 3, or not. Detail of the DSM Fund is given in section B.3. below.

Contribution to sustainable development

On an economic level the project makes a contribution towards national economic development and the aims of the white papers on energy and renewable energy in that it adds to South Africa’s energy supply, adds an Independent Power Producer, leads to energy diversification and creates a source of renewable energy. The project will create work for 60-100 people in the planning/construction phase and long term work for one or two people in operating/maintaining the plant.

On a social level the project will lead to the payment of a royalty by MethCap SPV 1 to the local municipality called Eden District Municipality, which payment has been earmarked specifically for poverty alleviation in what is not a rich region of South Africa. The royalty is expected to be in the order of R 100 000 per annum and will lead to social upliftment initiatives as identified and chosen by the local authority. The District Municipality will report back annually to the developer on how the funds were spent.

The environmental benefit from the project will be the more efficient use of energy and displacement of some grid emissions in South Africa.

A.3. Project participants:

Name of Party involved	Private and/or Public Entity(ies) Project participants*	Kindly indicate if the Party indicated wishes to be considered a project participant (yes/no)
South Africa (host)		No
	MethCap SPV 1 (Pty) Ltd* (private entity) – developer	
	PetroSA (Pty) Ltd (private entity) – project host	
	Eden District Municipality (public entity) - beneficiary	
	CDM Africa Climate Solutions (Private Entity) – PDD consultant	

MethCap SPV1 is the project developer and is a project participant. PetroSA is the project host and not a project participant. Eden District Municipality is the beneficiary of the contribution paid towards poverty alleviation and is not a project participant (details in section A.2. above). CDM Africa Climate Solutions (Pty) Ltd is the PDD consultant and not a project participant.

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

The existing biogas is the result of anaerobic digestion of high chemical oxygen demand reaction or process water originated from the synthetic gas process. The biogas is the result of a process that is essential to the operation of the PetroSA plant and particular care is thus taken by PetroSA to maintain the digesters in a good working order and to monitor their performance. A daily sample is taken and analysed by PetroSA to establish the COD ("Chemical Oxygen Demand") of the water going in and out of the digesters. The performance of the system is logged by a computer at PetroSA and the responsible person is Mr Claudio Miller, Process Engineer Process Technology. The gas normally collects in the tops of the digesters and rise up though the pipes to the flare. The gas flow rate is 1900 m^3/hr at 21 degrees Celsius.

The project activity involves:

- The building of an engine room on existing, already disturbed land inside the PetroSA plant;
- The installation of gas fired combustion engines;

- Piping the gas from the existing T-piece into the engines. Due to the corrosive nature of the gas, the new gas supply pipes to the engines will be of stainless steel or other suitable material;
- The design will ensure oxygen free gas lines and constant positive pressure in the digester and associated piping;
- Three 1.416 MW General Electric Jenbacher engines will be installed to establish an installed capacity (maximum output) of 4.248 MW (four point two four eight MegaWatt). The generation set ('genset') is complete with intercoolers and water coolers and will be housed in a specially built, 198 square meter plant room;
- The engines will drive coupled electrical generators that will produce electricity at 6,6 kV;
- The existing biogas flare stack will remain open and on-line to allow for engine shutdowns and to burn excess gas.
- The cable transporting the electricity from the genset to the grid will be approximately 500 meters long, and for the majority it will run with existing cables below the surface.
- The installed capacity of 4.248 MW if multiplied by 24 hours per day and 365 days per year yields a maximum annual generation of 37 212.48 MWh from the three Jenbacher engines. In every third year the PetroSA plant will have a shut-down and less electricity will be generated. There will probably also be down time/maintenance on the Jenbacher engines in other years (in such instances the biogas will again be flared). If a conservative, average, annual load factor of 85% is chosen, the project will generate approximately 31 631 MegaWatthours of electricity annually. The electricity will be introduced back into the local PetroSA grid at substation 6 and used onsite by PetroSA.

The biogas consists of the following gas components[1]:

Gas	Formula	Range of prevalence in percentage of total gas	Average prevalence as percentage of total gas as per PetroSA data
Methane	CH_4	52 – 62%	57%
Hydrogen	H_2	0 – 0,5%	0,4%
Carbon dioxide	CO_2	34 – 45%	39%
Nitrogen	N_2	0,1 - 3,6%	1,6%

The properties of the biogas may vary but on average, according to PetroSA data, are as follows:

Molar Mass g/mole	17,478
Gross Heating Value – molar basis kJ/mol	918,61
Relative density	0,6035
Real gas density kg/m^3@ 20 degrees Celsius	0,7290
Compression factor	0,9976
Wobbe index MJ/m^3	49,16

[1] The gas properties were spot checked by Agaricus Trading (Mr Paul de Mattos) during 2005 for purposes of the project pre feasibility study and his findings were in accordance with the PetroSA data. Mr De Mattos' particulars appear in section D.6. hereof.

Gross Heating Value – volumetric basis	38,19
Gross heating value – mass basis	52,56
Molar density kg-mole/m^3	0,0417

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

A.4.1.1. Host Party(ies):

South Africa

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

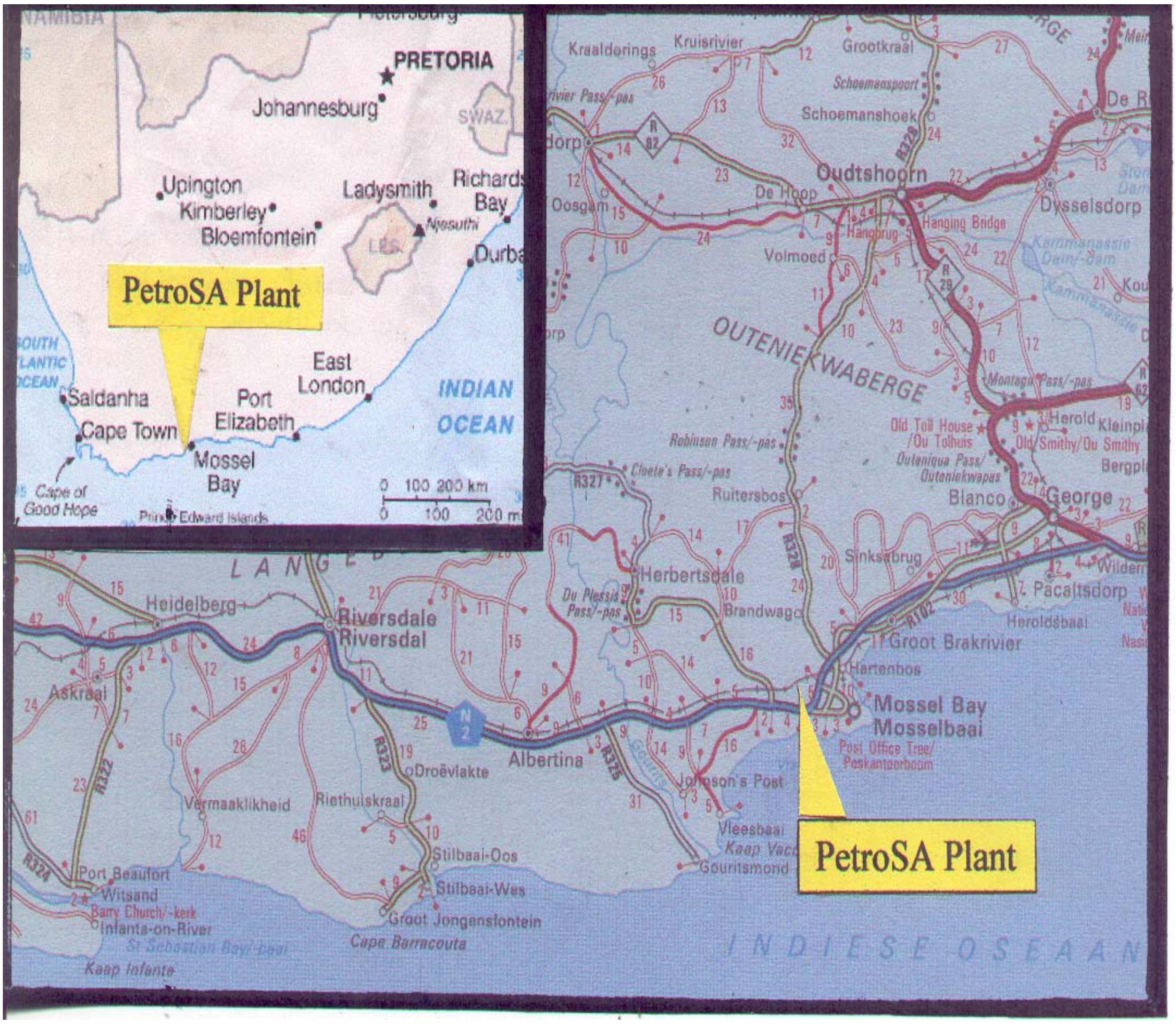
Western Cape

A.4.1.3. City/Town/Community etc:

Mossel Bay

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

The project activity will take place within the approximately 265 hectares PetroSA plant that is situated adjacent to the N2 highway (northern side) on the farm Duinzicht, approximately 12km from the town of Mossel Bay in the Southern Cape, some 360 kilometres east of Cape Town. The address is Duinzicht Avenue, Mossel Bay and the co-ordinates are S 34° 10' 10" and E 21° 59' 00". If driving east from Cape Town on the N2 highway look out for PetroSA on the left hand side some 12 kilometres from Mossel Bay. There are security measures in place and visitors need to be accompanied but PetroSA's Environmental Leader (Ms Eileen Green) will be able to point out the exact project site within the facility – opposite the anaerobic digesters.


PRETORIA
Johannesburg
SWAZ.
Upington
Kimberley
Bloemfontein
Ladysmith
Richards Bay
Njesuthi
LES.
PetroSA Plant
East London
Port Elizabeth
Saldanha
Cape Town
Mossel Bay
INDIAN OCEAN
Cape of Good Hope
Prince Edward Islands
Kraaldorings
Kruisrivier
Grootkraal
Schoemanspoort
Schoemanshoek
Oudtshoorn
De Hoop
Hanging Bridge
Dysselsdorp
Volmoed
OUTENIEKWABERGE
Robinson Pass/-pas
Cloete's Pass/-pas
Ruitersbos
Montagu Pass/-pas
Old Toll House /Ou Tolhuis
Herold
Blanco
George
Sinksabrug
Herbertsdale
Brandwag
Du Plessis Pass/-pas
Pacaltsdorp
Heroldsbaai
Groot Brakrivier
Hartenbos
Mossel Bay
Mosselbaai
Post Office Tree/ Poskantoorboom
Heidelberg
Riversdale
Riversdal
Askraal
Albertina
Droëvlakte
Vermaaklikheid
Riethuiskraal
Stilbaai-Oos
Stilbaai-Wes
Groot Jongensfontein
Cape Barracouta
Port Beaufort
Witsand
Barry Church/-kerk
Infanta-on-River
St Sebastian Bay/-baai
Kaap Infante
Vleesbaai
Gouritsmond
PetroSA Plant
INDIESE OSEAAN

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

The present project fits broadly under the category "Type (i) project activities: renewable energy project activities with a maximum output capacity equivalent to up to 15 megawatts (decision 17/CP.7, paragraph 6 (c) (i))" and more particularly under the approved small-scale methodology AMS-1.D. "Grid connected renewable electricity generation (version 9)." The project will generate a maximum of 4.248 MW electricity from the combustion of methane generated from the PetroSA wastewater treatment.

In considering the chosen category and the title "Grid connected renewable electricity generation"", the first consideration is that indeed the energy is renewable and it displaces electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit. . The grid where the electricity will be fed in belongs to PetroSA but it is part of the national electricity grid. The grid for which the energy is generated is thus primarily the PetroSA grid (energy will be used onsite) and secondarily the national grid (indirectly through grid electricity being displaced/freed up for use elsewhere). The electricity replaced will be grid electricity. Furthermore the capacity of the project activity is well below the 15MW threshold and thus eligible as a small-scale CDM activity. The feedstock cannot increase and so the Project Activity will never go beyond 15MW.

Regarding compliance with the specific category AMS-1.D(version 9) , the project activity is aimed at generating renewable electricity from biogas emanating from wastewater treatment. This places the project activity squarely within the chosen category. There is no methane recovery as envisioned by AMS-III.D. - in the baseline scenario methane is already recovered and flared and thus AMS-III.D. is inapplicable. Further and in any event AMS-1.D. (version 9) explicitly deals with wastewater in subparagraph 7 where it is said:

> "*In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under category III.D. If the recovered methane is used for electricity generation the baseline shall be calculated in accordance with paragraphs 6 or 7 (sic) below…*"

It is thus submitted that the Project Activity complies in all respects with the requirements to use AMS 1D(version 9) .

Regarding technology, three GE Jenbacher gas engines with 1.416 MW capacity each will be used to generate electricity. These engines can be used not only in biogas applications but also in landfill gas applications. Jenbacher is arguably the foremost gas engine manufactured globally and has approximately 4 500 MW in installed capacity worldwide, the majority in the EU. The engine has not been used in South Africa successfully and not at all in the last two decades. The only known application in South Africa has been 2 previous generation engines at Sebokeng municipality, installed in 1983 and 1985 respectively. These engines have fallen into a state of disrepair as a result of failure by the municipality to maintain the units at all. At the moment the Project Activity is creating capacity in operation and maintenance and has led to GE Jenbacher appointing local agents to service, operate and maintain the engines. The project thus leads not only to the transfer of market leading, environmentally safe and sound technology to South Africa but also to capacity building in operations and maintenance.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The gas that is presently flared creates no energy benefit while at the same time PetroSA buys significant quantities of electricity from the national grid. If the GE Jenbacher engines are used to generate electricity from the gas that would otherwise have been flared, the CO_2 emissions from the project site will for practical purposes stay the same but there will be a displacement of grid electricity. At present the grid generates approximately 0,963 kg/kWh in CO_2 emissions and thus the approximately 31 631 MWh of electricity generated annually by the project activity will displace emissions from the grid of approximately 30 461 tonnes of CO_2e per annum. Over the lifetime of the project this figure will be an average of 29 933 per annum if 31 631 MWh of electricity is generated and the periodic PetroSA shut-downs are taken into account.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

The project developer has chosen a ten year crediting period. The project activity is inextricably linked to the existence and operation of the PetroSA refinery and the current secured gas feedstock is forecast to last until 2013. For purposes of viability the project activity has been modelled accepting the worst-case scenario where there is no more gas to feed the PetroSA plant beyond the end of 2013. There are however plans afoot to extend the life of the Plant well into the future. The project activity will thus end after 10 years or when the PetroSA plant shuts down, whichever event may occur the sooner.

Years	Annual estimation of emission reductions in tonnes of CO2e
2007	22 846
2008	30 461
2009	28 703*
2010	30 461
2011	30 461
2012	28 703*
2013	30 461
2014	30 461
2015	28 703*
2016	30 461
2017	7 615
Total estimated reductions (tonnes of CO2e)	299 336
Total number of crediting years	10
Annual average over the crediting period of estimated reductions	29 933
	* Periodic PetroSA shut-down

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

There is no public funding from an annex 1 country involved in the project activity

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

There is no larger project activity of which the present project is a part.

SECTION B. Application of a baseline methodology:

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

AMS-I.D. Grid connected renewable electricity generation(version 9).

B.2 Project category applicable to the small-scale project activity:

In considering the chosen category and the title "Grid connected renewable electricity generation", the first consideration is that indeed the energy is renewable and it is displaces electricity from an electricity distribution system that is supplied by at least one fossil fuel fired generating unit (the South African grid) generated for a grid. The grid where the electricity will be fed in belongs to PetroSA but it is part of the national electricity grid. The grid for which the energy is generated is thus primarily the PetroSA grid (energy will be used onsite) and secondarily the national grid (indirectly through grid electricity being displaced/freed up for use elsewhere). Furthermore the capacity of the project activity is well below the 15MW threshold and thus eligible as a small-scale CDM activity.

Regarding compliance with the specific category AMS-1.D(version 9)., the project activity is aimed at generating renewable electricity from biogas emanating from wastewater treatment. This places the project activity squarely within the chosen category. There is no methane recovery as envisioned by AMS-III.D. - in the baseline scenario methane is already recovered and flared and thus AMS-III.D. is inapplicable. Further and in any event AMS-1.D. (version 9) explicitly deals with wastewater in subparagraph 7 where it is said: "*In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under category III.D. If the recovered methane is used for electricity generation the baseline shall be calculated in accordance with paragraphs 6 or 7 (sic) below…*"

In the baseline scenario the methane recovered from the wastewater treatment plant at PetroSA has been flared since 1987. It is assumed that in the absence of the project activity, flaring would have continued to take place into the future. It is further assumed that the emissions from combusting the methane in the Jenbacher engines will be the same as the emissions generated by flaring the methane gas.

The emissions generated in the baseline scenario is calculated in accordance with paragraph 9(b) of AMS-1.D (version 9), being

"The weighted average emissions (in kg CO2equ/kWh) of the current generation mix.The data of the year in which project generation occurs must be used"

The Eskom 2005 annual report relates this figure as 0,963 kg/kWh (page 188 footnote 1).

It is anticipated that the grid emissions factor will increase in the next few years, as:

- Eskom, the national utility, is presently bringing three previously moth-balled, coal-fired power stations back online. The three stations (Arnot, Komati and Camden) have installed capacity of 2 100, 1 000 and 1 600 MW respectively (aggregate 4 700MW) and will further increase the proportion of grid electricity derived from fossil fuels;

- The renewable energy projects due to come on-stream in the next few years (Darling Wind Farm, Bethlehem hydro and possibly some others) are unlikely to even approach 100 MW of installed capacity in a national grid of approximately 42 000 MW installed capacity (0,23%);

- Eskom plans to ease pressure on capacity during peak hours by installing 1 000 MW of kerosene fired open cycle turbines as soon as possible.

Data/information	Value	Source
Grid emissions factor	0,963 kg/kWh	Eskom Annual Report 2005 p 188

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The developer has applied for a DSM subsidy and is awaiting the outcome of the application.

This section contains a discussion of national policies/laws/regulations relevant to the Project Activity, information on the DSM fund and an additionality analysis using the Tool for the Demonstration and Assessment of Additionality.

National legislation and policies relevant to the Project Activity

There are no laws or policies compelling PetroSA to use the gas presently flared for electricity generation and none such legislation is expected. Indeed, in the absence of the Project Activity, PetroSA would be at liberty to continue flaring the wastewater methane as they have done for over 15 years.

What is however important from a national policy perspective is a discussion of the Demand Side Management ("DSM") fund and the National Energy Regulator Energy Efficiency and Demand Side Management Regulatory Policy (May 2004). This discussion of the DSM fund is done in the context of Executive Board 16 annex 3.

Executive Board 16 annex 3

In terms of this decision and more particularly paragraph 1(b) and (3) thereof, if there is a national and/or sectoral policy that gives positive comparative advantages to less emissions-intensive technologies over more emissions intensive technologies (for example public subsidies to promote renewable energy or to finance energy efficiency programs) then, if the policy has been implemented after 11 November 2001 it may not be taken into account in developing the baseline scenario (i.e. the baseline scenario should refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place).

Eskom and DSM

> "Eskom Holdings is a South African utility that generates, transports and distributes electricity. It supplies approximately 95% of the country's electricity and 60% of the total electricity consumed on the African continent. Compared with other international utilities, Eskom is the eleventh in terms of generating capacity and ninth in terms of sales. **The ownership of Eskom vests in the South African Government**"

The National Energy Regulator

> "The National Energy Regulator (NERSA) is the regulatory authority established in terms of the National Energy Regulator Act, 2004 (Act No. 40 of 2004) with the mandate to undertake the functions of the Gas Regulator as set out in the Gas Act of 2001, the Petroleum Pipelines Regulatory Authority as set out in the Petroleum Pipelines Act of 2003 and the National Electricity Regulator as set out in the Electricity Act of 1987 as amended……
> **…….** NERSA's mandate is further derived from written government policies as well as Regulations issued by the Minister of Minerals and Energy. NERSA is expected to proactively take necessary regulatory actions in anticipation of and in response to the changing circumstances in the energy industry."

The DSM Fund

In accordance with the NER Energy Efficiency and Demand Side Management Regulatory Policy as approved by the NER on 25 May 2004, the DSM fund provides subsidies to projects that effect energy efficiency, load shedding, load shifting etcetera. The quantum of the subsidy varies according to the type of intervention.

The DSM fund and Executive Board 16 Annex 3

As appears from the paragraphs above the DSM fund is thus clearly established through a national policy by a public utility belonging to the South African Government and endorsed by the National Energy Regulator, the over-arching regulatory authority in South Africa. The DSM programme clearly started after 11 November 2001 and is aimed inter alia at financing energy efficiency programs.

The result of the above is that any DSM subsidy granted to a CDM project in South Africa amounts to a type "E-" policy and has the effect that the subsidy has to be disregarded for purposes of the baseline, that is the baseline should refer to the hypothetical situation where the DSM fund is not in place.

In light of the fact that the Project Activity would in the submission of the developer have been additional even in the absence of Executive Board 16 annex 3(1)(b) and (3), the calculations below are done also to illustrate same**.**

Additionality Tool

The inquiry will now move to a discussion of additionality using the additionality tool**.**

Step 1a: Identify alternatives to the project activity

- The project can notionally be undertaken not as a CDM activity, meaning that instead of two revenue sources (sale of electricity and sale of CER's) there will be one source of revenue only, namely sale of electricity;
- The project can be done not as a CDM activity with different technology - waste gas burnt in a boiler and a steam turbine used to generate electricity (instead of a GE Jenbacher gas engine)
- The status quo can be maintained and no activity engaged in.

Step 1b: Enforcement of applicable laws and regulations

All the alternatives are compliant with applicable laws and regulations.

Step 2: Benchmark analysis

Step 2a: Determine appropriate analysis method

Due to the fact that there is revenue in electricity sales the simple cost analysis is not applicable. The benchmark analysis will be used.

Sub-step 2b Option III: Apply benchmark analysis

The prime lending rate in South Africa is 11.50%. Private equity firms require returns in excess of 35%. The hurdle rate for investment in renewable energy in South Africa is in the order of 16-18% as a minimum.

Step 2c: Calculation and comparison of financial indicators

	Project Activity without CER's, with DSM	Project Activity without CER's or DSM subsidy
Net Present Value (ZAR)	*-17,119,771*	*-17,228,824*
Equity IRR	< 0%	< 0%
Discount Rate	13%	13%

Assumptions:

- Discount rate: related to historical lending rates of long term senior debt facilities – a figure of 13% was used.

- Lending rate: Average interest rate on loans provided by The Development Bank of Southern Africa is 11.8%. Lending margins on commercial limited recourse borrowing facilities are in the range of 2%-3%. A lending rate of 13% was used.
- Inflation: average of 4.8% based on historical data.
- Project duration: 8 years in accordance with the minimum lifetime of PetroSA.
- Revenue: single source of revenue is electricity sales at a rate not exceeding current utility (Eskom) tariffs.
- Investment: all capital expenditure including generation equipment, infrastructure, sub-station connection, power house required for reliable long term power generation.
- Costs: taken into account are associated operational expenses (mainly contractually determined long term operation and maintenance, labour and finance costs)

Sensitivity Analysis

A sensitivity analysis was conducted by altering the following parameters:

- Increase in electricity price by inflation rate + 2% whilst keeping expense constant
- Reduction in borrowing margin to zero%.

These parameters are the only significant variables which may fluctuate during the project life. If the DSM subsidy were disregarded these figures would be as indicated in the third and fifth column from the left.

	Equity IRR (%) no CDM, with DSM	Equity IRR (%) no CDM and no DSM	Project NPV (ZAR) no CDM, with DSM	Project NPV (ZAR) no CDM and no DSM
Original	< 0%	< 0%	-17,119,771	-17,228,824
Increase in electricity price	13.18%	-0.28%	-14,693,875	-14,781,897
Decrease in borrowing cost	2.62%	-9.2%	-15,544,828	-15,641,695

Step 3. Barrier Analysis

Sub-step 3(a) Identify barriers that would prevent the implementation of the Proposed Project Activity

The facts mentioned below should be read as a whole in order to create the proper contextualisation and understand the cumulative impact. They constitute investment barriers, barriers of prevailing practice, barriers regarding capacity short-comings and other barriers.

- This will be the first operation of its kind in South Africa;
- It is well known that the electricity price in South Africa is amongst the lowest in the world. It is thus very difficult for any new market entrant to be competitive, be it using a fossil fuel based or renewable energy source;
- New renewable energy generation developers need off-take agreements significantly higher than current electricity prices. It is nearly impossible for these new energy players to find an off-taker willing to pay electricity prices higher than the Eskom tariffs that are available to them.
- Eskom has been reluctant to sign any PPA agreements with potential private generators that cannot compete with the current Eskom generators. The obstacle is that any potential new entrant

is evaluated on its competitiveness with the low Eskom generation costs instead of being evaluated against the long run marginal costs of new generation;

- Renewable energy not only competes with coal (of which the country has abundant and cheap reserves), but in addition most of the coal-fired power stations belonging to the national utility (Eskom) have already been amortised and are thus able to produce electricity at a very low price;
- The overwhelming bulk of electricity in South Africa is produced by Eskom, the national utility which represents an installed capacity of about 42 000 MW;
- The balance of electricity is generated by a local authorities and the private sector;
- Only one independent power producer of any note currently exists, Kelvin Power Station, which was sold by the City of Johannesburg in November 2001 and has an installed capacity of approximately 600MW (7x60 MW + 6x30 MW) – the other is Friedenheim hydro which is a 2,5 MW facility owned by the Friedenheim Irrigation Board and has been operated by MBB Consulting Engineers Incorporated since 1988.
- In the last fifteen years the project developer is not aware of the emergence of a single Independent Power Producer in South Africa producing renewable energy exclusively for the grid – some large energy users like Sasol and Tongaat Hulett do generate electricity primarily for their own use.
- Independent power producers have limited scope for financial viability, although it constitutes a new commercial challenge in South Africa;
- Renewable energy project developers face several challenges which for instance have seen the Darling National Demonstration Windfarm being in development for eight years now without financial close having been reached. This was due mainly to an environmental impact assessment for a 5,2 MW windfarm that took over six years to approve;
- However, IPP's face other challenges, particularly obtaining licences, permits and approvals which can be a bureaucratic and time-consuming process;
- Due to lack of transaction volume, there is limited capacity in the legal fraternity to provide contractual and legal advice;
- Exchange rate risk and/or the very high cost of hedging an exposure to the South African currency over the lifetime of a project has made it difficult for foreign companies/investors to invest in the South African Energy Sector;
- As against this, most hardware needed for energy projects has to be imported and paid for in hard currency. The Rand is however at a much stronger level and more stable than 3-4 years ago;
- There is a lack of capacity to operate and maintain renewable energy assets and in some instances it would be costly to use the services of expatriate technicians.

<u>Sub-step 3(b)</u> <u>Show that the barriers would not prevent at least one of the alternatives</u>

The continuation of the status quo as an alternative would not be prevented by the obstacles mentioned above – in fact the obstacles would tend to lead to a continuation of the status quo

<u>Step 4</u> <u>Common practice analysis</u>

<u>Sub-step 4a and b</u>

The project proponent is unaware of any similar project in South Africa that is not a CDM project.

<u>Step 5</u> <u>Impact of CDM Registration</u>

If the project is registered as a CDM project activity it will raise the projected IRR to a level that makes the project viable. The carbon finance stream will make the project bankable and thus facilitate debt finance. As a consequence a projected several hundred thousand tonnes of CO_2e will be prevented from entering the atmosphere over the lifetime of the project.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

AMS-1.D. (version 9) prescribes that the project boundary will encompass the physical, geographical site of the renewable generation source, being in this case the building within which the GE Jenbacher engines will be housed plus the flare.

B.5. Details of the baseline and its development:

The baseline for AMS-1.D(version 9) is determined in accordance with paragraph 9 and 9(b) of AMS-1.D.

> "*For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as*:
>
> *(a) ………; or*
> *(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.The data of the year in which project generation occurs must be used"*

The emissions from flaring the gas is assumed to be equal to the emissions generated by combusting the same flow and quantity of the same gas in a Jenbacher gas engine. This means that the emissions from flaring/combustion must either be disregarded both in the baseline and in the Project Activity or in the alternative must be added in both the baseline and the Project Activity. The result is mathematically the same either way.

Because the combustion during the Project Activity will generate emissions from within the project boundary, it was deemed as most correct to add the CO_2 generated by flaring/combustion in both the baseline and the Project Activity.

The baseline is thus the weighted average emissions (in kg CO_2equ/kWh) of the current generation mix plus the CO_2 emissions generated by flaring.

Baseline compiled by Johan van den Berg of CDM Africa Climate Solutions (Pty) Ltd, formulation for version 6 of the PDD on 14 December 2005, left unchanged for version 11 on 16 August 2006 but for linguistic and numerical changes corresponding with the amendment of the applicable methodology

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

Construction on the project is project to start in October 2006 and commissioning is planned for 1 April 2007. The latter date will be the starting date of the Project Activity.

C.1.2. Expected operational lifetime of the small-scale project activity:

The feedstock for the main PetroSA refining plant is forecast to last until at least 2013 and possibly much longer. The Project Activity will thus continue for ten years or for as long as PetroSA facility persists operationally, whichever may be the shorter period.

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

C.2.1. Renewable crediting period:

Left open on purpose – not applicable

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

Left open on purpose – not applicable

C.2.1.2. Length of the first crediting period:

Left open on purpose – not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

1 April 2007 (construction on the project is project to start in October 2006 and commissioning is planned for 1 April 2007).

C.2.2.2. Length:

10 years 0 months

SECTION D. Application of a monitoring methodology and plan:

D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

AMD-1-D Grid connected renewable electricity generation (version 9)

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

The monitoring methodology is prescribed by AMS 1.D. In section B.2 above, reasons were given why the Project Activity falls squarely within AMS 1-D “Grid connected renewable electricity generation (version 9). AMS 1.D.(version 9) prescribes that the only monitoring to be done is electricity generated, as described more fully below.

D.3 Data to be monitored:

In accordance with AMS 1-D(version 9) paragraph 13, monitoring shall consist of metering the electricity generated by the renewable technology. Detail in section D5 below. The baseline emissions factor from the year in which generation occurs will be used. Leakage is not considered. Monitoring will include national environmental legislation and regulations, to ensure these are complied with.

ID number	*Data type*	*Data variable*	*Data unit*	*Measured (m) calculated (c) or estimated (e)*	*Recording Frequency*	*Proportion of data to be monitored*	*How will the data be archived (electronically or paper)*	*For how long is archived data to be kept?*	*Comment*
1	Electricity delivered to the grid	CG	kWh	M	Continuous	100%	Electronically and paper	Crediting period plus 2 years	

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

The meter measuring electricity output will be bought from Alstom, a company who’s quality management systems complies with ISO 9001. The Alstom meter complies with IEC standards and VDEW demands. The metering system will be calibrated by an accredited laboratory and recalibrated at intervals required by the accredited laboratory, accredited to ISO 17025. A certificate of calibration will be provided with the meter.

The meter is designed and manufactured in such a way that it does not need any maintenance interventions in the entire lifetime. Measuring stability assures that no recalibration is required. However, the meter will be re-calibrated at 10 year intervals which is the industry standard.

The meter with the internal battery assures sufficient capacity for performing battery supported functions for the entire lifetime. The meter is designed for a 20-year lifetime at normal operating conditions.

The meter continuously records active energy and stores data accumulatively. The data is transmitted electronically and readings are taken online.

The General Electric Jenbacher engines that will be installed at PetroSA will be equipped with the DIA.NE WIN monitoring system. This system allows real-time, online monitoring of electricity usage via a PC. DIA.NE WIN is a new Windows-based man/machine interface for GE Jenbacher gas engines. The system offers both customers and GE Jenbacher maintenance staff a wide range of functionalities for commissioning, monitoring and maintaining installations and for diagnostic purposes. DIA.NE WIN makes it possible to control and monitor the engines using a standard PC and Internet Explorer. The operating stations can be connected to the central on-site computer (server) via a local area network (LAN), a dial-in connection (modem) or via the Internet. Various operating stations can be operated parallel to and independent of one another. GE Jenbacher has used state-of-the-art technology to develop DIA.NE WIN.

The system is built around a fast industrial PC (server) which is integrated into the switch cabinet of the installation and which stores historical data and generates alarms. This computer also functions as a web server and modem server. The system is operated (by the customers) via ordinary PCs. Internet Explorer is used as an operating platform.

Data from both systems will be archived electronically and in printed form and will be available until 2 years after the Project Activity has ended for analysis by the verifier.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

As explained above, the Alstom meter measuring electricity output will be calibrated and sealed in a laboratory in terms of a procedure accepted by the South African Buro of Standards (SABS) and in compliance with the ISO 9001 standard and then be sent to the project site with a certificate of calibration. Data will be archived by MethCap SPV1 Compliance Officer (Elzette Gaigher) and can be made available electronically in real time if necessary. In accordance with the methodology AMS 1-D (version 9) no leakage is considered.

D.6. Name of person/entity determining the monitoring methodology:

Compiled by Johan van den Berg of CDM Africa Climate Solutions (Pty) Ltd Tel 021 883 3474. Assisted by Martin Kruse of Ergon Utility Solutions (Pty) Ltd Tel 083 282 0846 and Paul de Mattos of Agaricus Trading CC Tel 031 763 3222.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

AMS 1-D (version 9) does not currently provide a formula for establishing the baseline – it gives the developer a choice of two options of which the present project developer has chosen to use the weighted average of the emissions generated by the current generation mix.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

It is submitted that given the assumption that the emissions from flaring and combustion are the same, the emissions produced on the project site in the baseline and the project activity is a constant and need not strictly speaking be calculated and can be assumed as say "c". Nevertheless, the formulae and values used are given below.

The baseline emissions from the project site are generated by the flaring of methane rich biogas while the project activity emissions are generated by the combustion of methane rich biogas, both activities leading to the formation of CO_2**.** The data and formulae are as follows:

Biogas flow rate	1900 m^3/hr at 21 degrees Celsius	
Kilogrammes/tonne	1 000	
Properties of the biogas:	CO_2 - 39%	
	CH_4 – 57%	
	Other – 2%	
Density of gas at 20 degrees C	CO_2 – 1.82947731 kg/m^3	
	CH_4 – 0.666776098 kg/m^3	
Weight of CO_2	1466.23459 kg/hr	11 875 tonnes/annum
CH_4 atomic weight	16.042	
$C0_2$ atomic weight	44.1	
Conversion factor (1 kg forms how much CO_2 when combusted)	2.74342351	
CO2 released due to CH4 combustion	2217.87322 kg/hr	17 354 tonnes/annum
Total emissions		**29 229 tonnes/annum**

Formulae:

Calculating CO_2 emitted as inherent in biogas

Mass of CO_2 emitted inherent in biogas in tonnes per annum = (Biogas flowrate) * (the % CO_2 in biogas) * (density of CO_2) * days per year * hours per day / 1000

= 1900 m^3/hr * 39% * 1.82947731 kg/m^3 * 365 * 24 / 1000

= 11 875 tonnes per annum

Calculating CO_2 emitted by methane combustion

According to atomic weights every kilogram of CH_4 combusted produces 2.74342351 kilograms of CO_2

Mass of CO_2 due to CH_4 combustion in tonnes per annum	=	(Biogas flowrate) * (the % CH_4 in biogas) * (density of CH_4) * conversion factor * days per year * hours per day / 1000
	=	1900 m^3/hr * 57% * 0.666776098 kg/m^3 * 2.74342351 * 365 * 24 / 1000
	=	17 354 tonnes per annum

Calculating total CO2 emitted

Total CO_2 emitted in tonnes per annum	=	mass of CO_2 emitted inherent in biogas + mass of CO_2 due to CH_4 combustion
	=	11 875 tonnes per annum + 17 354 tonnes per annum
	=	29 229 tonnes per annum

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

In accordance with par 12 of AMS 1-D(version 9) no leakage is considered as no equipment is transferred from another site.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

Project Activity emissions	=	CO_2 emissions from baseline + CO_2 emissions from leakage
	=	29 229 tonnes per annum + 0 tonnes per annum
	=	29 229 tonnes per annum

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

The published grid emissions factor of 0,963 kg/kWh as published in the 2005 annual report of Eskom was used. The grid emissions factor will be converted to an emissions reduction from displaced electricity using the formula:

$Emissions_{baseline}$ in tonnes CO_2/MWh	=	Grid emissions factor * (annual generation MethCap SPV1) + emissions due to flaring

or:

$E_{baseline}$ (t CO2/MWh) = 0,963kg/kWh * MG (MWh/y) + 29 229 tonnes CO_2/annum

Where MG is the annual generation of electricity by MethCap SPV1 at the PetroSA site and 29 229 is the amount of emissions generated by flaring.

$Emissions_{baseline}$ in tonnes CO_2/MWh	=	Grid emissions factor * (annual generation MethCap SPV1) + emissions due to flaring
	=	0,963kg/kWh * 31 631MWh/y + 29 229 tonnes CO_2/annum
	=	59 690 tonnes per annum

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Emissions reductions in tonnes of CO_2 per annum for Project Activity	=	Grid emissions factor * annual electricity generated in MWh + emissions due to flaring – emissions due to Project Activity
	=	(0.963kg/kWh * 31 631MWh) + 29 229 tonnes per annum - 29 229 tonnes per annum
	=	30 461 tonnes of $C0_2$e per annum

If the emissions generated by flaring and combustion is taken as a constant “c” the equation becomes:

0,963*electricity generated + c – c and thus simplifies to:

Emissions Reductions for year “y” in tonnes CO_2equ = 0,963 * electricity generated in MWh in year “y”

E.2 Table providing values obtained when applying formulae above:

Sr No	Operating years	Baseline emissions (tonnes CO_2)	Project Activity emissions (tonnes CO_2)	Annual reductions in tonnes of CO_2e
1	2007 - 2008	59 690	29 229	30 461
2	2008 – 2009	59 690	29 229	30 461
3	2009 – 2010	57 932*	29 229	28 703*
4	2010 – 2011	59 690	29 229	30 461
5	2011 – 2012	59 690	29 229	30 461
6	2012 – 2013	57 932*	29 229	28 703*
7	2013 – 2014	59 690	29 229	30 461
8	2014– 2015	59 690	29 229	30 461
9	2015 – 2016	57 932*	29 229	28 703*
10	2016 – 2017	59 690	29 229	30 461
Total		591 626	292 290	299 336
* Periodic PetroSA shut-downs				

SECTION F.: Environmental impacts:

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

The Project Activity is a listed activity in terms of the Environment Conservation Act and the regulations thereto. A pre-application meeting was held with the provincial environmental authorities and in the light of the very limited environmental impact of the project (the sole adverse environmental impact is expected to be negligible noise) the project developer was advised to apply in terms of Section 28A of the Environment Conservation Act for an exemption from doing a full environmental impact assessment. The sole adverse environmental impact is expected to be negligible noise. After a public participation process the project was submitted for the requisite exemption in terms of the Environment Conservation Act. The exemption was granted on the 6th of December 2005, subject to a 30 day appeal period that lapsed on 5 January 2006. The submission made to the authorities is available in hard copy.

SECTION G. Stakeholders' comments:

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

There is only one neighbouring property within significant range of the project site. Initially, these neighbours were personally visited and the project was explained to them. They expressed qualified verbal support for the project with the proviso that they should not be bothered by noise in excess of what was already emanating from the Plant. This support later became written and unqualified.

Inquiries revealed that the relevant local NGO is the Mossel Bay Environmental Partnership (Ms Tonia Scholken). The NGO was informed of the project telephonically and informed of the date on which the advertisement mentioned below would appear.

Thereafter a comprehensive public information document was compiled and forwarded to three locations where the public could inspect same for three weeks – the public library, the municipal offices and PetroSA (Environmental leader - Ms Eileen Green). An advertisement was then placed in the local newspaper apprising the public of the intended project and inviting interested and affected parties to register themselves by email or telephone. One party registered namely the Dana Bay Resident's Association.

Finally a public meeting was convened that included a site visit. The Mossel Bay Environmental Partnership indicated their satisfaction with the project and felt it unnecessary to attend, but the neighbours and the Dana Bay Resident's Association did attend. At the end of the meeting the attendees were requested to record their comments in writing and the comments were collated and archived.

G.2. Summary of the comments received:

At the start of the process the neighbours said that they did not want the project to add significantly to the noise presently generated by the Plant. At the end of the site visit the following comments were received in writing:

> "Is baie tevrede met die proses en die inligting verskaf. Ek voel die proses is tot voordeel van die omgewing…..ek keur die projek in beginsel goed" ("I am very satisfied with the process and the information supplied. I feel that the project is advantageous to the area/environment*…I approve in principle of the project" – M Vlok, Dana Bay Residents' Association
>
> "Should be done on more plants countrywide and in more industries" – Mrs R Joubert, neighbour
>
> "I believe that the project is very advantageous to the environment…it meets with my total acceptance" – Mr A Swanepoel, Dana Bay Residents' Association

* "omgewing" can be translated either as "area" or "environment"

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

The initial concern about noise led the project developer to include the construction of a special 198 square meter plant room in the project planning. This plant room will limit noise to 65 decibels at 10 meters, about the same as a vacuum cleaner. This addition satisfied the neighbours, as can be seen from the positive response above.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable left open on purpose