



# REQUEST FOR CEO ENDORSEMENT

**PROJECT TYPE: FULL SIZED PROJECT**

**TYPE OF TRUST FUND: GEF TRUST FUND**

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## PART I: PROJECT INFORMATION

Project Title: Promoting organic waste-to-energy and other low-carbon technologies in small and medium and micro-scale enterprises (SMMEs): Accelerating biogas market development.			
Country(ies):	South Africa	GEF Project ID: <sup>1</sup>	5704
GEF Agency(ies):	UNIDO	GEF Agency Project ID:	130310
Other Executing Partner(s):	Department for Environmental Affairs (DEA), Department of Energy (DoE), Department of Trade and Industry (DTI), Southern Africa Industry Biogas Association (SABIA).	Submission Date: Resubmission Date:	10/21/2015 11/17/2015
GEF Focal Area (s):	Climate change	Project Duration(Months)	48
Name of Parent Program (if applicable): ➤ For SFM/REDD+ <input type="checkbox"/>		Project Agency Fee (\$):	401,100

### A. FOCAL AREA STRATEGY FRAMEWORK<sup>2</sup>

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount (\$)	Cofinancing (\$)
CCM-1	Technology successfully demonstrated	Integrated biogas technologies in SMMEs demonstrated and deployed on the ground (3MW)	GEFTF	2,066,720	16,076,990
CCM-3	Investment in RE Technologies increased  Favorable policy and regulatory environment created for renewable energy investments	1. Renewable energy capacity biogas installed (6MW)  2. Renewable energy policy and regulation in place	GEFTF	2,155,390	25,807,898
<b>Total project costs</b>				4,222,110	41,884,888

### B. PROJECT FRAMEWORK

<b>Project Objective: Promote market-based adoption of integrated biogas technology in small and medium and micro-scale enterprises (SMMEs) in South Africa</b>						
Project Component	Grant Type	Expected Outcomes	Expected Outputs	Trust Fund	Grant Amount (\$)	Confirmed Cofinancing (\$)
1. Capacity building and technology support system	TA	Capacity of market players and enablers strengthened and technology support systems	1.1 Detailed assessment and characterization of waste streams from agro-processing SMMEs conducted and center for characterization of waste established	GEF TF	668,137	793,692

<sup>1</sup> Project ID number will be assigned by GEFSEC.

<sup>2</sup> Refer to the [Focal Area Results Framework and LDCF/SCCF Framework](#) when completing Table A.

		established	<p>1.2 Capacity of biogas support and low-carbon technologies support centre strengthened</p> <p>1.3 Biogas guidelines and decision support tools for integrated biogas systems in agro-processing SMMEs are developed and disseminated</p> <p>1.4 Professionals and technicians in biogas technology trained</p> <p>1.5 Targeted training workshops (10) for market players (project developers, enterprise executives, farmers and operators, current users of waste) on integrated biogas systems conducted</p> <p>1.6 Two Regional training workshops conducted to train experts from SADC countries on biogas technologies in SMMEs</p>			
2. Biogas market development and regulatory framework	TA	Market environment for biogas strengthened and regulatory framework for grid-connected small to medium scale waste-to-energy projects developed	<p>2.1 Two quality standards for integrated biogas plants in SMMEs developed, adopted and widely disseminated</p> <p>2.2 Guidelines and regulations (environmental, technical and legal) on the valorization of digestate and effluent developed and adopted</p> <p>2.3 Biogas license process streamlined</p> <p>2.4 Regulatory framework on access to the grid by small to medium scale biogas projects developed</p>	GEF TF	409,126	424,130
3. Technology demonstration	INV	Technical feasibility and commercial viability of waste-to-energy technologies demonstrated	<p>3.1 Detailed feasibility studies of selected 5 demonstration projects are conducted</p> <p>3.2 Five (5) integrated biogas demonstration projects implemented to achieve at least 3MW installed capacity</p> <p>3.3 Demonstration projects monitored, evaluated and showcased</p> <p>3.4 Best practice manual developed and widely disseminated</p>	GEF TF	2,066,723	18,360,971
4. Scaling up	INV	Investment in waste-to-energy	4.1 Investment strategy for integrated biogas developed and	GEF TF	807,071	21,506,095

		technologies promoted	disseminated 4.2 Technical assistance provided to realize at least 4 more investment projects (at least 6 MW) 4.3 Portfolio of at least 25 investment projects compiled and disseminated 4.4 Technical support to design financial support 4.5 National biogas investment forum organized regularly			
5. Monitoring and evaluation	TA	Project's progress towards objectives continuously monitored and evaluated	Mid-term review and final evaluation carried; project's progress monitored, documented and recommended actions formulated	GEF TF	70,000	150,000
Subtotal					4,021,057	41,234,888
Project management Cost (PMC) <sup>3</sup>				GEF TF	201,053	650,000
<b>Total project costs</b>					4,222,110	41,884,888

### C. SOURCES OF CONFIRMED CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME (\$)

Sources of Co-financing	Name of Co-financier (source)	Type of Cofinancing	Cofinancing Amount (\$)
National Government	Department of Environmental Affairs	Loans	11,945,164 <sup>4</sup>
National Government	Department of Environmental Affairs	In Kind	3,000,000
National Government	ARC	Cash	58,259
National Government	ARC	In-kind	489,389
National Government	IDC	Loans	23,000,000
Bilateral Aid Agency	GIZ	Cash	1,682,076 <sup>5</sup>
Private sector	REA/NOVELTO	Cash	250,000
Private sector	WEC	Cash	450,000
Private sector	GCX Africa	Cash	325,000
Private sector	CAE	Cash	100,000
Others	University of Venda	Cash	30,000
Others	University of Venda	In kind	270,000
GEF Agency	UNIDO	Cash	60,000
GEF Agency	UNIDO	In Kind	225,000
<b>Total Co-financing</b>			41,884,888

<sup>3</sup> PMC should be charged proportionately to focal areas based on focal area project grant amount in Table D below.

<sup>4</sup> Applied exchange rate is 1US\$ = 12,557 South African Rands

<sup>5</sup> Applied exchange rate is 1€ = 1.121 US\$

**D. TRUST FUND RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY<sup>1</sup>**

GEF Agency	Type of Trust Fund	Focal Area	Country Name/ Global	(in \$)		
				Grant Amount (a)	Agency Fee (b) <sup>2</sup>	Total c=a+b
	(select)	(select)				0
(select)	(select)	(select)				0
<b>Total Grant Resources</b>				0	0	0

**F. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:**

Component	Grant Amount (\$)	Co-financing (\$)	Project Total (\$)
International Consultants	420,000	205,000	625,000
National/Local Consultants	1,125,318	50,804	1,176,122

**G. DOES THE PROJECT INCLUDE A “NON-GRANT” INSTRUMENT?** No

**PART II: PROJECT JUSTIFICATION**

**A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN OF THE ORIGINAL PIF<sup>6</sup>**

At PPG stage a number of studies were carried out that are now included in the Technical annexes of the document. They are outline in table below:

ANNEX NUMBER	TITLE
Annex T2	Current Status of biogas in South Africa
Annex T3	Overview of South African policies and regulations related to waste to energy
Annex T4	Coordination between UNIDO-GEF project and GIZ – SAGEN programme
Annex T5	Overview of biogas potential in the agriculture and agri-processing sectors
Annex T6	Barriers to SMME uptake of biogas technology
Annex T8	Pre-Feasibility Reports for Demonstration projects

**A.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPA, NBSAPs, national communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.**

The project addresses the energy needs and the growing waste management problems in South Africa in line with the country’s National Communications and Technology Needs Assessments (TNA). The energy sector is identified as the priority sector for climate change mitigation since it is responsible for more than 85% of the country’s greenhouse gas (GHG) emissions. South Africa has committed to implement mitigation actions that will collectively result in a 34% and 42% deviation below its “business as usual” emissions growth trajectory by 2020 and 2025 respectively. The medium -term priorities are to develop and facilitate the implementation of a climate change adaptation and mitigation regulatory framework, which will enable the transition of the economy to a climate resilient, low carbon, job creating growth path.

Generating energy from organic waste to offset coal based energy is in line with national objectives and strategies as presented in various Government documents. Specifically the National Climate Change Response Strategy (2011) identified eight near-term priority programmes, among which are the Waste Management Flagship Programme and the Renewable Energy Flagship Programme, highlighting the importance that the Government puts on these two sectors to mitigate GHG emissions. The Renewable Energy Flagship Programme includes a scaled-up renewable energy

<sup>6</sup> For questions A.1 –A.7 in Part II, if there are no changes since PIF and if not specifically requested in the review sheet at PIF stage, then no need to respond, please enter “NA” after the respective question.

programme, based on the current programme specified in the country's Integrated Resource Programme (2010). Under the waste programme the potential of the waste management sector to mitigate GHG emissions is established.

In line with these priorities and South Africa's recognition of the need to move towards a more resource efficient and low carbon economy which can support growth and jobs, the Government has issued a number of policies and programmes to encourage green growth, to minimize pollution and emissions and to maximize resource use efficiency. These are detailed in Annex T3 and include the National Development Plan (NDP) 2030 which is a long-term economic strategy for the country, featuring steps to transform the South African energy system to reduce greenhouse gas emissions. The target was set at 20,000 MW of electricity generated from renewable energy resources by 2030. The National Strategy for Sustainable Development and Action Plan (NSSD), 2011-2014 also calls for the diversification of energy sources and implementation of energy efficiency programmes, as well as, investment in renewable energy.

In addition, the Government's Medium-Term Strategic Framework (MTSF) 2009-14 set out responses to the injunctions of the NDP with the objective to set the country on a higher and sustainable trajectory of economic growth. The Department of Energy (DoE) was mandated with ensuring security on supply of energy resources and pursuing an energy mix that includes clean and renewable resources to meet the needs of the country's fast-growing economy without compromising its commitment to sustainable development. The Department of Environmental Affairs Strategic Plan 2015/16 – 2019/20 has the objective of facilitating the contribution of the recycling economy sustainable development, livelihoods, green and inclusive economic growth through job creation for both women and men and establishment of 250 SMMEs and cooperatives by 2020.

At the same time South Africa has extensive environmental legislation governing waste management, as well as, water and air emissions. Primarily these are regulated by the National Environmental Management Act (NEMA), Act 107 of 1998 along with the National Environmental Management: Waste Act (NEM:WA), Act 59 of 2008 and the National Environmental Management: Air Quality Act (NEM: AQA) of 2008. These acts outline the environmental responsibilities and guidelines for operating facilities that may pose a potential environmental risk. The NEM:WA introduced the waste management hierarchy approach advocating waste avoidance, reduction, reuse, recycling and recovery as priority options before treatment and disposal of waste. The National Waste Management Strategy (NWMS) is a legislative requirement of the NEM:WA which sets the priority areas for the implementation of NEMWA. The aim is that the NWMS addresses many of the challenges in waste management in the country and so includes driving the recycling economy, implementing a varied regulatory system, creating jobs and SMMEs, promoting public awareness and supporting waste service delivery, amongst others. A proposed legislation, which will form part of a comprehensive waste management act that bans organic waste disposal at landfills, might be enforced by 2015. This could contribute significantly towards the growth of the waste to energy (WtE) sector.

The Government has also recently deployed a range of complementary and integrated measures to expand the economy and create jobs. The latest Industrial Policy Action Plan (IPAP) 2014/15 - 2016/17 is one of the key pillars of this broader approach. It builds on the National Industrial Policy Framework (NIPF) and represents the sixth annual iteration of the first IPAP launched. Each year the Department of Trade and Industry (dti) launches a revised three-year rolling IPAP with a 10-year outlook in a context of rapid economic change and significant global uncertainty. The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and waste management are both included under the Green industries sectoral focus area. The agro-processing industry is also among the sectors identified by the Industrial Policy Action Plan (IPAP), the New Growth Path and the National Development Plan for its potential to spur growth and create jobs because of its strong backward linkage with the primary agricultural sector. In addition the dti launched the South African Renewables Initiative which aims to mobilize domestic and international funding, and sector expertise, to support South Africa to scale-up renewable energy.

This project is clearly in line with these Government policies by facilitating investment in renewable energy and reducing environmental impacts associated with waste disposal and so will help the Government meet its objectives.

There is also a government support programme (the baseline project), which includes incentive schemes for renewable energy including biogas; yet it is acknowledged that this – despite its importance – provides an insufficient signal for

the agro-processing sector, and especially small and medium and micro-scale enterprises (SMMEs), to invest in biogas. Specific barriers remain at the financial level, as well as on technical and capacity building level. Due to a lack of a tailored policy framework and absence of nation-wide capacity building efforts, investment in waste-to-energy biogas in SMMEs has been marginal.

## **A.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities.**

The project will contribute to two GEF Climate Change Strategic Objective 1: Promote the demonstration, deployment and transfer of innovative low-carbon technologies and Objective 3: Promote investment in renewable energy technologies. The project aims to transform the market of renewables by using organic waste from agriculture and agro-processing industries for energy production in SMMEs and production of other low-carbon technologies such as the use of digestate as fertilizer. It aims to achieve this through triggering investment in integrated waste-to energy biogas projects in SMMEs that produce both energy and other low-carbon technologies. This will be achieved through market demonstration, improving data and knowledge products, capacity building providing a technology support system and by strengthening the policy and regulatory environment. Setting up the market environment that allows and catalyzes the use and replication of such technologies will lead to significant GHG emission reductions and will contribute to South Africa's economy transformation towards low carbon development.

## **A.3 The GEF Agency's comparative advantage:**

Since its establishment, UNIDO has built up a long track record assisting countries to implement industrial support programmes. UNIDO's Energy Branch pursues the integration of low-carbon objectives into industrial development policies and activities, especially with respect to small- and medium-sized industries. In particular, UNIDO helps its clients solve two fundamental problems: (i) de-linking intensity of energy and material use from economic growth, and (ii) reducing the environmental damage that occurs with energy and material use. UNIDO energy sector interventions are systematically synergized with other relevant industrial development programmes such as the Environmental Management, Business, Investment and Technology, Trade Capacity-Building and Agri-Business Development. Through this integrated approach, UNIDO interventions bring about long lasting and transformational change in industries and economies.

GEF council document GEF/C.31/5 states that UNIDO's overall comparative advantage is that it can involve the industrial / private sector in projects. This is also the case in this project, where the focus will be on facilitating a low carbon development pathway for agro-industries in South Africa and is in line with UNIDO's renewed mandate of promoting inclusive and sustainable industrial development (ISID). Critical factors for the success of the project are the implementation of technical solutions which are tailored to the local needs, the introduction of new technology, the effective operation and maintenance systems and the availability of required supportive capacity and regulatory set up. UNIDO's long standing experience in working with the industrial sector in general and small and medium-sized enterprises in particular will be deployed in implementing this project. Furthermore, the document illustrates the comparative advantages of UNIDO services in contributing to sustainable energy access and mitigating climate change, as well as, increasing productivity and competitiveness through the introduction of state-of-the-art renewable energy technologies, and reducing GHG emissions through capacity building.

UNIDO has widespread experience in interacting with stakeholders at all levels from the private and public sectors , financiers, as well as CSOs. The proposed GEF project draws on this experience by strengthening the competitiveness of local agro-processors through introducing renewable energy technologies. UNIDO gives special attention to mainstream gender equality throughout its technical cooperation project portfolio, and with agro-processing employing many women, this is expected to prove a very important aspect of this project. In addition, the project will actively engage women particularly in the training and awareness activities.

To ensure up-to-date know-how, UNIDO actively collaborates with a number of energy technology centers, networks and learning platforms worldwide, including the National Cleaner Production Centers (46 countries) and the Green Industry Platform to form strategic partnerships to promote knowledge management and best practices in technology transfer. In addition UNIDO has established regional centres of sustainable energy such as SACREEE that will provide a basis for reaching out to SMMEs in the SADC region.

UNIDO is well-placed to implement this project with its global network of experts and experience from its relevant (GEF funded) project portfolio. Furthermore, through this project, UNIDO will work towards the attainment of SDG 9 on promoting inclusive and sustainable industrialization, as well as SDG 7 on sustainable energy for all.

#### **A.4. The baseline project and the problem that it seeks to address:**

##### **A. 4.1. Background, energy and waste situation in South Africa**

South Africa is an emerging economy and had a GDP of approximately USD350.6 billion in 2014<sup>7</sup>. The economy has been traditionally dominated by mining, manufacturing, petrochemicals and agriculture but is currently experiencing a slight de-industrialization with a reduction of GDP growth due to industrial tensions and delays in fixing infrastructure gaps<sup>8</sup>. There is therefore a need for the economy to diversify and expand in order to create jobs, a top priority for the Government.

South Africa accounts for about 1.1% of global GHG emissions (ranked 18<sup>th</sup> worldwide) with emissions having increased by 24.9% between 2000 and 2010, totaling 579 million tons of CO<sub>2</sub>eq in 2010<sup>9</sup>. The energy sector, accounts for 85.1% of national GHG emissions, and therefore offers opportunities for mitigation actions to achieve substantial impact and for introduction of a low-carbon development path by incorporating renewable energy systems.

South Africa has been experiencing power shortages since 2008 due to rapidly increasing electricity demand combined with a lack of investment in new power generation capacity and in on-going maintenance. The situation has worsened again recently with daily load shedding experienced in 2015 across all sectors of the economy. Eskom predicts that power shortages are set to continue for the next four to five years until the commissioning of new generation capacity. Eskom, the national state-owned utility, owns and operates the national grid and supplies about 95% of the electricity consumed in the country. These power shortages are cited as one of the main reasons of the recent slowdown in growth forecasts of about 2% anticipated for 2015. While Independent Power Producers (IPPs) exist, Eskom has a practical monopoly on bulk electricity. It supplies electricity directly to large consumers such as mines and other large industries. In addition, it sells in bulk to municipalities, which distribute to consumers within their boundaries, and also supplies electricity directly to commercial farmers and to a large number of residential consumers.

In parallel to the power outages, electricity tariffs have been increased in an attempt to charge full cost recovery tariffs. The regulator, NERSA, has approved steady increases of tariffs over the last five years, in April 2011 an increase in tariffs of 25.8% was approved, followed by approvals of an increase of 16% from April 2012 and an increase of 8% per annum over five years from April 2013. In August 2014, however, NERSA stated that a 12.6% tariff rise had been approved, which was significantly above expectations. Although still relatively cheap by international standards (due to almost 90% of the country's electricity coming from coal-fired generation) the cost of production for the industry sector has been dramatically impacted by this electricity tariffs increase. The combination of power outages and increase in costs of power significantly affect investment and economic development of the country and specifically affect the economic outlook of SMMEs.

The National Waste Management Strategy has set targets to encourage (i) waste reduction, (ii) waste reuse and recycling, and (iii) waste recovery through treatment or energy retrieval. For this strategy to be successfully implemented, the situation of waste generation in the country needs to be documented as accurately as possible. For this reason, a National Waste Information baseline study was carried out to accurately model the prediction of waste generated, recycled, treated and landfilled in 2011. This baseline assessment of the waste situation in the country indicates that South Africa generated approximately 108 million tonnes of waste in 2011. About 98 million tonnes was disposed of at landfill, with 59 million tonnes classified as general waste and 49 million tonnes classified as hazardous and unclassified. Out of the 59 million tonnes of general waste generated about 36 million tonnes was estimated to be mainly biomass waste from industry and a further 3 million tonnes was designated as organic waste. Table 1 below shows the breakdown of general waste and the quantities recycled. It is estimated that only 10% of all waste generated

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<sup>7</sup> World Bank, 2014

<sup>8</sup> IMF, 2014

<sup>9</sup>GHG Inventory for South Africa 2000-2010, DEA, August 2013  
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in South Africa was recycled in 2011, whilst none of the ‘other’ biomass waste was recycled. Finding space for new landfills and within landfills is becoming a growing problem: there is some opposition to the establishment of new landfills so municipalities are increasing pressure to reduce the quantities of waste sent to landfill.

**Table 1: Breakdown of the general waste category and rates of recycling**

General Waste	Generated	Recycled	Landfilled	Recycled
	Tonnes			%
Non-recyclable municipal waste	8,062,934	-	8,062,934	0
Organic waste	3,023,600	1,058,260	1,865,340	35
Construction and demolition waste	4,725,542	756,087	3,969,455	16
Paper	1,734,411	988,614	745,797	57
Plastic	1,308,637	235,555	1,073,082	18
Glass	959,816	307,141	652,675	32
Metals	3,121,203	2,496,962	624,241	80
Tyres	246,631	9,865	236,766	4
Other (mostly biomass waste from industry)	36,171,127	-	36,171,127	0
<b>Total general waste</b>	<b>59,353,901</b>	<b>5,852,484</b>	<b>53,501,417</b>	<b>10</b>

The focus of this project is on SMMEs. Not only do they generate large quantities of waste, but they also employ up to 61% of the workforce in the country. With official unemployment levels at 25%<sup>10</sup> and youth unemployment at even higher levels, SMME success is crucial not only to GDP growth, but to job creation as well. As significant contributors to the national GDP, SMMEs<sup>11</sup> are also proportionally responsible for contributing to the generation of waste. Estimates of SMMEs contribution to the national GDP vary from between 27%-34%<sup>12</sup> up to as much as 52%-57%<sup>13</sup>. Therefore, using the above figures, SMMEs could be responsible for between 9.5 and 20 million tonnes of waste. The actual figure is likely to be much higher since many of the SMMEs are located in rural areas and do not dispose their waste in recognized sites and so their waste is not accounted for in national statistics. This is particularly true for SMMEs such as piggeries, dairies, beef lots, poultry farms, wineries and fruit and vegetable farms and processors which generate large quantities of waste on a regular basis.

#### A.4.2. Potential for agricultural and agro-processing waste to energy

The agro-processing sector continues to contribute significantly to South Africa’s economy and sustains large numbers of SMMEs. Since South Africa is a diverse country with an impressive range of vegetation types, climates and soil types the agriculture sector produces a wide variety of crops. Agro-processing contributed by 30.5% and 5.2% to the real value added (GDP) from the manufacturing sector and from the overall economy, respectively in 2011<sup>14</sup>. Though large enterprises in the agro-processing industry contributed a significant share of income and employment, the relative share of SMMEs to the total employment is higher, compared to their share in the total income of the industry. Therefore, SMMEs have greater potential of generating jobs in the agro-processing industry.

The country can be divided into distinct farming regions, and farming activities ranging from intensive crop production in high rainfall areas, to cattle ranching in the bushveld and sheep farming in the more arid regions. Climate-soil combinations leave only 12% of the country suitable for the production of rain-fed crops. Water availability is one of the most important factors limiting agriculture production in South Africa. This is likely to worsen in coming years due to increasing demands from other economic sectors and due to climate variability. However most of South Africa’s

<sup>10</sup> IMF, 2004

<sup>11</sup> In South Africa the definition of SMMEs depends upon the number of employees, annual turnover and value of assets. In addition the threshold for each of these categories is determined by the economic sector or sub-sector. A medium sized agricultural enterprise can have a maximum of 100 employees whereas a manufacturing enterprise can go up to 200 employees. The breakdown of sizes of these businesses is as follows: medium businesses are those with fewer than 100-200 employees; small have fewer than 50; very small fewer than 10-20; and micro have fewer than five. 1 (DTI Annual Review, Final Report 2008 from Small Business Act)

<sup>12</sup> Department of Trade and Industry (DTI) 2008. Annual Review of Small Business in South Africa 2005–2007. DTI: Pretoria.

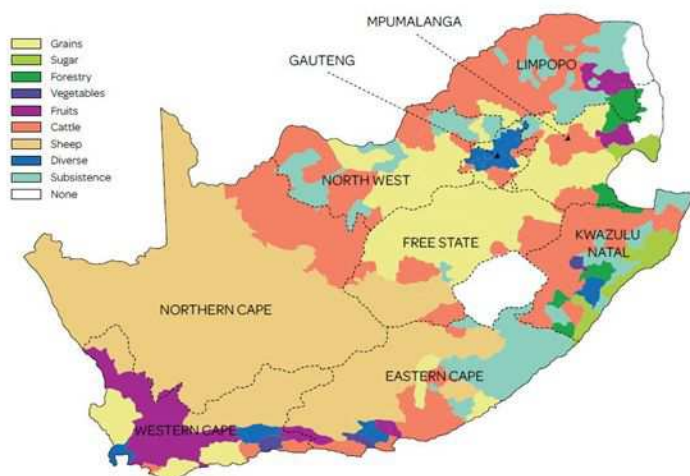
<sup>13</sup> Centre for Development and Enterprise (CDE) 2007. Young entrepreneurs must organise. Media release on May 30. [Online] Available: [http://www.cde.org.za/artile.php?\\_id250](http://www.cde.org.za/artile.php?_id250). (23 September 2011)

<sup>14</sup> DAFF website



land surface (69%) is suitable for grazing, and livestock farming is by far the largest component of the agriculture sector in the country. The following figure shows the main agricultural regions of South Africa

**Agricultural regions of South Africa**



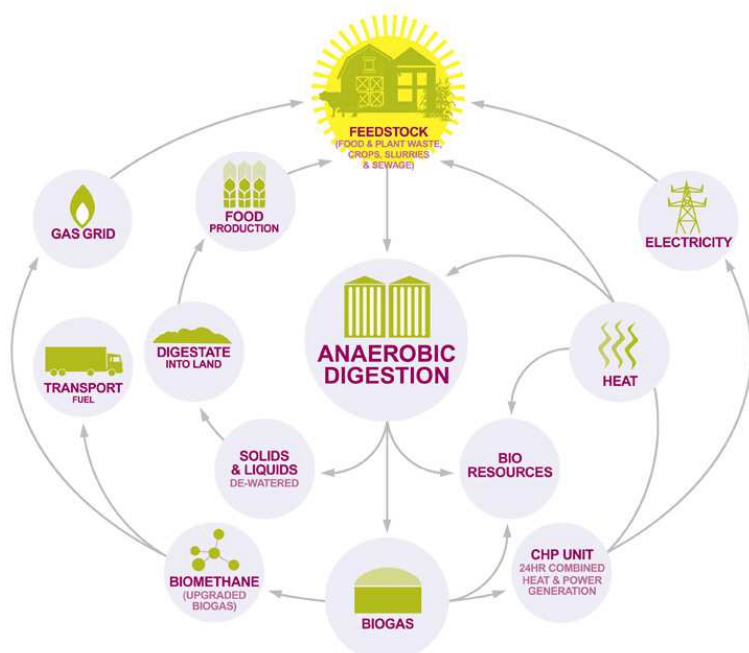
**Figure 1: Agricultural regions of South Africa (FAO Corporate Document Depository)**

For many of the companies in the agriculture sector the cost of energy (and its intermittent supply), water availability and waste disposal are increasing problems. In addition crops (for animal feed and consumption) are highly dependent on synthetic fertilizers. It is estimated that South Africa applied about 1.9 million tonnes of fertilizers in 2012<sup>15</sup>. The country is a net importer of fertilizers, importing more than 1 million tonnes per year<sup>16</sup> with the majority being urea. Not only is there a significant cost associated with this (in 2012 the custom value of imported fertilizers was USD 491m (R5.8 billion)), but there are also significant GHG emissions associated with its production and transportation. The three largest suppliers of fertilizers to South Africa are Saudi Arabia, Qatar, and Chile. Since the fertilizers are imported, it is not possible to control whether efficient technologies are being implemented in the manufacturing process or to ascertain the GHG emissions associated with their transportation.

Integrated biogas, or anaerobic digestion, projects can help SMMs by treating waste, generating energy and providing organic fertilizer. Anaerobic digestion (AD) is the natural breakdown of organic matter into carbon dioxide, methane and water in the absence of oxygen. Organic feedstock (from agricultural waste, food waste, municipal waste etc) is fed into the biogas system and the outputs are biogas (a mixture of methane and carbon dioxide gases), water and some organic material known as digestate or slurry. The biogas can be burned to produce heat and/or electricity, while methane can be used as vehicle fuel or, in some countries, injected into the gas grid. The digestate is a stable, nutrient-rich substance and can be used most usefully as a fertilizer, rich in nutrients, but also as feedstock for ethanol production, and in low-grade building materials, like fiberboard. Water, after treatment within the AD process, may be returned to the watercourses. The following diagram shows an overview of a typical integrated biogas cycle.

<sup>15</sup> Fertiliser Association of Southern Africa

<sup>16</sup> Compiled by Fertiliser Society of South Africa (FSSA) from statistics provided by Customs: Trade Statistics and Analysis, SARS, Pretoria  
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**Figure 2: The integrated anaerobic digestion cycle (UK’s Anaerobic Digestion and Bioresources Association <sup>17)</sup>**

Biogas projects can be attractive investments for agro-organizations with their ability to offset electricity costs and heat production costs as well as providing an opportunity for additional income from digestate sales (for fertilizer) and by off-setting any current waste disposal costs.

Some estimates have stated that there is potential for about 6000 biogas projects in the commercial sector, including landfills and water treatment. There exists a theoretical potential for generation of more than 2800 MW of power (or equivalent heat or gas) from the agro sector in South Africa. Even if only a small proportion of this is developed it represents significant potential for biogas projects in South Africa. During the PPG, Agriculture Research Council (ARC) have been calculating the potential for biogas projects in the agriculture and agro-processing sectors. The potential in the main sub-sectors is shown in the following table. Further details are provided in Annex T5.

**Table 2: Potential for biogas projects in the agricultural and agro-processing sectors**

Agro-sectors	Type of waste	No of units/cattle/poultry/animals/day in South Africa	Waste generation (tonnes & litres/annum)	Theoretical biogas generation potential (million m <sup>3</sup> /annum)	Energy recovery potential (GWh/annum)	Possible MW installed <sup>18</sup>
Poultry	Litter	23.15 million birds	0.17 million tonnes	11.8	71	10
Cattle	Manure	8.25 million cows	36 million tonnes	2168	13,008	1856
Beef feedlots	Manure	1.6 million cows	1.6 million tonnes	0.064	384	55
Piggeries	Manure	1.58 million	2.3 million tonnes	138.3	830	118
Sheep	Manure	21.43 million	9.4 million tonnes	563.1	3379	482
Goats	Manure	2 million	1.1 million tonnes	66.6	400	57
Abattoirs	Abattoir waste	2 million cattle 2 million pigs	76800 tonnes 2777 million litres	12.7	76	11

<sup>17</sup> <http://adbioresources.org/about-ad/what-is-ad/>

<sup>18</sup> Assuming 80% capacity factor on energy recovery potential  
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Agro-sectors	Type of waste	No of units/ cattle/poultry/animals/day in South Africa	Waste generation (tonnes & litres/annum)	Theoretical biogas generation potential (million m <sup>3</sup> /annum)	Energy recovery potential (GWh/annum)	Possible MW installed <sup>18</sup>
		5 million sheep 978 million chickens	54000 litres blood			
Dairy	Manure	2.2 billion litres	6.6 billion litres	10.6	63	9
Fruits processing	Peels and pulp	Apples, grapes, oranges, olives	105,802 tonnes >6 billion litres	210	1263	180
Breweries		7 breweries – 2500 million litres	537,500 t 15 billion litres	46	273	39
Wineries		564 wineries 958 million litres	411 tonnes 5.75 billion litres	0.09	0.544	0
Sugarcane		14 enterprises 17.8 million tonnes	887775 tonnes 3.2 million litres	25	149	21
<b>Total</b>					<b>19,897</b>	<b>2839</b>

The benefits of AD are multiple: emission reductions, diversity of fuel supply and energy security, reduction in fuel costs and reliance on fossil fuels, a reliable energy supply, reduction in imported fertilizer, economic growth as well as the global potential for technology transfer and innovation. In addition to the environmental and economic benefits of waste to energy projects it is also acknowledged that such projects can contribute to job creation for women, men and the youth. The IDC (Infrastructure Development Corporation), DBSA (Development Bank of Southern Africa) and TIPS (Trade and Industrial Policy Strategies) estimated the direct employment potential of green technologies in the country. Within this it was estimated that the WtE segment has a total net direct employment potential (long-term) of over 55,000. The EWSETA (Energy and Water Sector Education and Training Authority) Sector Skills Plan (SSP) also identifies skills in renewable energy as a priority area for development.

### A.4.3. Baseline project

#### a) Status of biogas technology in South Africa

The use of anaerobic digestion (AD) / biogas for treating agro-processing waste has a large potential in South Africa but its use is still very limited. More generally biological WtE technologies in South Africa focus on methane gas extraction from landfills and water treatment facilities. That said, only a few municipalities in South Africa generate electricity from landfill gas processes with larger metropolitan municipalities including Johannesburg, Durban, Tshwane, eThekweni and Ekurhuleni being at different stages of planning, constructing and implementing these WtE projects. Most large AD projects installed to date are based at waste water treatment works and/or use sewage and organic municipal solid waste (MSW). This includes two electricity generation projects in Johannesburg: one 1.1 MW project and one 750 kW project, and a number of projects in the Western Cape. Six WtE projects have registered with UNFCCC as CDM projects. This includes three landfill gas projects, one industrial waste water project (PetroSA, 4.25 MW) plus two agro-processing projects – one is a phased 2.2 MW project at a Dundee cattle feedlot and the second is at Kanhym piggery (1MW). Since 2011 the National Energy Regulator of South Africa (NERSA) has registered 92 biogas plants. These include the CDM projects, two landfill sites and numerous household or community scale biogas operations in rural areas consisting of a fixed dome plant producing biogas to supply heating appliances in peri-urban and rural dwellings in KwaZulu-Natal, Limpopo and Gauteng. There are a few commercial biogas units installed at piggeries, an abattoir, dairy and beef-lot, breweries and juice processing. The majority of these would still be classified as small, at below 250 kW. The largest is the 4.2 MW Bio2Watt plant currently being commissioned in Gauteng using manure from a large beef feedlot. An overview of the current status and existing projects is provided in Annex T2.

Most of the projects use the gas for electricity and / or heat generation for their own use although some of the piggeries just flare the gas. Connection and sale to the grid is not currently possible under 1 MW so the majority of projects are unable to sell power. The Bio2Watt is the first project to wheel power to another customer, BMW.

In terms of technology, the most common installations in South Africa are the residential/small scale systems and these use a fixed dome, bio-bag digester or PVC digester. The large scale biogas projects use either imported UASB technology or plug flow digesters; with the breweries and fruit farm using UASB technology; the dairies have used plug flow digesters. Bio2Watt will include some co-digestion but generally there are few, if any other examples of co-digestion and no examples of a centralized plant taking waste from a number of different organizations/sources.

This summary demonstrates that although there are some biogas units using agro-processing waste or animal waste/manure, the majority of these projects are very small (household or school size), with only a handful of medium (250kW- 1 MW) to large-scale (more than 1MW) projects, despite the large potential. Compared to this potential very few projects have been developed. In addition, in most projects the full potential of the biogas plant is not realized with only gas or heat being generated (not both), gas for transport not being investigated and the digestate not being valued.

### **b) Energy and waste policy framework and support initiatives**

South Africa, through a number of policy and regulatory initiatives has largely sought to encourage the utilization of waste and renewable energy. There are a number of support initiatives available to biogas projects in South Africa although not all of them are easy to access, or available to all types and scales of projects. A summary of the main initiatives is provided below.

- Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) - The Department of Energy (DoE) initiated the REIPPPP programme in 2011 to contribute towards the target of 3725 MW RE and to stimulate growth in the renewable energy industry in South Africa. Bidders of projects over 5 MW are asked to bid on tariff and the identified socio-economic development objectives of the DoE. Once successful the buyer pays the agreed tariff following a signed PPA. The REIPPPP has allocated 25 MW of electricity to be derived from landfill gas and 12.5 MW from each of biomass and biogas. However to date there have been no biogas projects. The majority of successful projects have been wind and solar projects.
- Small Projects Independent Power Producer Procurement Programme (SPIPPP) - Similar to the REIPPPP this programme exists for wind, solar PV, biomass, biogas and landfill gas projects between 1 MW and 5 MW with a combined capacity of 200 MW. As with the regular REIPPPP there have been no successful biogas projects.
- The (Facility for Investment in Renewable Small Transactions) FIRST initiative is a DoE initiative to address the issue of limited participation by small scale RE projects in the government IPP programmes. The facility offers debt and has a technical assistance component to support project developers to help bring down transaction costs. This includes the development of standardized documentation, for example legal contracting. The initiative is only commencing in the first half of 2015.
- The Department of Environmental Affairs (DEA) through the Green fund promotes innovative green programmes and projects which assist South Africa's transition to a low carbon, resource efficient and climate resilient development path. The Fund is managed by the Development of Bank of South Africa (DBSA) on behalf of DEA. The functional focus areas for the Green Fund include project development and/ or investment in green projects and programmes, capacity building and research and policy development. Financial support may take the form of grants (recoverable and non-recoverable), loans (concessional rates and terms), and equity. Several biofuel, biogas and WtE projects (2012-2013) have been approved for due diligence. The Green Fund has so far committed just under USD 59.3m (ZAR700m). The last call included a specific call for biogas and one project was approved. There is USD 21.2m (ZAR250m) available for 2015/16 and about USD 18.3m (ZAR216m) for 2016/17.
- The Green Energy Efficiency Fund (GEEF) supported by KfW through the International Development Corporation (IDC) supports the introduction of energy efficiency and renewable energy technologies. The focus is on SMMEs with USD 44.6m (€50 million support -€48m for loans and €2m for technical assistance)

from KfW. The 100 kW combined heat and power (CHP) abattoir project in the Northern Cape was supported by GEEF. Although there are funds allocated for a follow-up phase, this is yet to be operational.

- Agence Francaise de Developpement (AFD) has a Green Credit Line which includes support for biogas projects. The Credit Line's capitalization is USD 107m (€120 million) of which more than 50% has been disbursed and the remaining is committed. The Credit Line has a 7% grant built into it and includes a € 700,000 technical assistance through SANEDI to build capacity in the three implementing financial institutions, Nedbank, ASBA and IDC. The first phase was due to complete in May 2015 and a second phase is likely to expand the number of participating FIs. The Credit Line supported the 4.2 MW Bio2Watt project through IDC on a 12 year loan with a 3 year grace period.
- The Manufacturing Competitiveness and Enhancement Programme (MCEP) offers incentives for existing organizations to promote competitiveness improvements. This includes grants for using green technologies, energy efficiency measures and potential biogas projects. Grants are offered by the Department of Trade and Industry (**the dti**) for scoping studies, feasibility studies and equipment. A difficulty for smaller organizations is that the money must be spent first and then claimed.
- Tax incentives are available if businesses can show measurable and verifiable savings in energy: the 12L Tax Incentive is managed by the DoE and provides tax reductions.
- The DEA is developing/has developed an Advanced Integrated Solid Waste Management Knowledge base aimed at helping municipal waste service managers and operators. As part of the series of documents a guideline on Appropriate Technology for Advanced Waste Treatment identifies biogas/anaerobic digestion as an appropriate technology in the medium term.
- The National Cleaner Production Centre (NCPC) is a national programme that promotes the implementation of resource efficiency and cleaner production (RECP) methodologies to assist industry to lower costs through reduced energy, water and materials usage, and waste management. It is hosted by the CSIR on behalf of **the dti**. It aims to encourage use of renewable energy, energy efficiency and to reduce the quantity and toxicity of waste during manufacturing processes.

Despite the support described available there is limited uptake of biogas technology, particularly by SMMEs in the agro-processing sector. The main financial support available (the SPIPPPP) is only available for projects over 1 MW yet most of the potential for SMMEs is below this threshold. Many SMMEs are not aware of their biogas potential and need to understand the possibilities prior to accessing available finance. There are further factors that hinder biogas development as outlined in the section below.

### c) Baseline data on current energy use and practice of disposal of agri-wastes (for sector and specific projects)

Energy use at the agro-processing sites varies enormously depending on the site activities. All sites use electricity for lighting, motors, cooling, equipment, etc. which is imported from the local municipality electricity network or direct from Eskom. The cost of electricity is increasing and so impacting on the SMME's bottom line. In many cases units have invested in their own diesel generating sets to cover periods of outage from Eskom. Many sites also have hot water or steam demands which are met by on-site boilers, normally operated with coal. Some boilers and heat demand is met by LPG.

Current waste disposal methods depend on the site activities. In the most part piggeries and dairies use lagoons/dumps for their waste disposal with their associated methane emissions. Abattoirs produce hazardous waste and this is sent to landfills. This can have significant costs although landfill charges vary depending on the locality. As an example landfills operated by Ethekwini Municipality charge USD 19.3 (R228)/tonne of general waste and USD 6 (R71.6)/tonne for garden refuse.

To give an indication of scale, the current waste generation from the demonstration projects in this GEF project amounts to more than 200 tonnes of slurry a day, 269 million litres of waste water a day (or 53760 kg COD/day), 10 tonnes of blood a day plus 25 tonnes a day of other slaughter house waste. Compared to the total organic waste

generated in South Africa this is a small proportion. Figures for organic waste generated from the target sectors in South Africa are included in Table 2 and show that in total 52 million tonnes of solid waste is produced a year plus 36 billion litres of waste water a year.

#### A.4.4. The problem that the project seeks to address – key barriers to the use of agri-waste for biogas energy

Despite positive policies and some support programmes the successful implementation of integrated biogas projects in the agro-processing SMMEs sector of South Africa is still hindered by a number of factors. During the PPG consultation was carried out to understand the reasons behind the lack of development in this field. This was carried out primarily through meetings, workshops, attendance at the National Biogas Platform and conferences as well as site visits and phone calls. The consultation included the following consultee groups:

- Industry associations (incl. RMAA, Poultry association);
- Government departments (incl. DEA, DoE, DTI, EDD, DST, DBSD, DAFF)
- Teaching and Research institutions (incl. ARC, CSIR, University of Fort Hare, University of Venda, Free State University, SARETEC)
- Financial institutions (IDC, DSBA, Nedbank, ABSA, KfW, sefa)
- Donor organizations (AfD, GIZ)
- Project developers
- Civil society (incl. Earthlife, Women, Energy and Climate Change Forum, Mapungubwe Institute for Strategic Reflection)
- Agro-processing industry (dairies, piggeries, food processors, abattoirs)

The two workshops (Consultation and Validation) had a total of 126 participants comprising representatives from Government officials, technology suppliers, user groups, financial institutions and bio-energy consultants. A list of workshop participants is given in Annexes T11 & T12 along with the workshop proceedings.

The following table provides an outline of this feedback on the continued barriers and challenges. The barriers have been divided into four broad categories related to finance, capacity, policy and technology. Further details on these barriers are provided in Annex T6. The barriers below are the primary, or key, barriers which are critical to address for the increased uptake of biogas and which will be tackled in this project. The suggested mitigation activities are included in this project and will help to go some way to address the barriers identified. Further details of these barriers, and of other barriers identified, are included in the annex (Annex T6).

**Table 3: Key barriers to the development of biogas for SMME agro-processing**

Primary Barriers	Detail	Mitigation activities
<b>Regulatory and Policy Barriers</b>		
Lengthy and complicated approval processes	Environmental and legal compliance for biogas is a lengthy process. WtE projects trigger multiple environmental regulations (including NEMWA, NEMA, NWA and NEMAQ <sup>19</sup> ) some of which can take more than a year and result in significant costs.	Streamline process for compliance / develop guidelines.  Demonstrate best practice.
Difficulties in connecting to the grid and in selling power, particularly for small scale projects	Currently the minimum size of projects connecting to the grid is 1MW yet many potential projects are smaller than this. Where larger projects are able to connect it is a complicated process and there are challenges in securing off-take agreements (power purchase agreements – PPAs). Where secured, the tariffs available are low. Wheeling electricity has been demonstrated in two cases (Nelson Mandela Bay Municipality and Bio2Watt) but in each case it was the result of significant and complicated negotiations. Wheeling can provide an off-site market for surplus	Pilot sale of electricity for projects < 1MW  Guidelines for wheeling agreements are needed

<sup>19</sup> Details provided in Annex T3

	power thereby improving financial viability of otherwise marginal cases. However it is not easy to understand or to do.	
Lack of clarity on the use of organic hazardous waste	Where waste is classified as hazardous, such as abattoir waste, it is still not clear what additional treatments are required, such as pasteurization, and whether a full scoping and EIA study is required. It is not clear if DAFF registration is needed for digestate use on cultivated lands as fertilizer.	Clear guidelines for the use of hazardous organic waste, licensing requirements and triggers for full EIA.
Lack of biogas standards / certifications	There is a lack of industry standards to promote the safe use of biogas as well as quality biogas product and services. The implementation of standards can improve safety, reduce risks and increase the quality of service. SABIA and its members identified this as one of the key gaps.	Preparation of standards and certification framework.
Insufficient tailored incentives for target sectors/SMMEs	There are limited financial and regulatory incentives (grants, subsidies, tax) for projects below 1 MW.	Biogas is dispatchable so electricity peak incentives would work well. Negotiate for and consolidate biogas incentives for promotion of investment in this sector.
<b>Capacity / Institutional</b>		
Limited awareness and capacity among industrial SMME professionals (energy auditors, engineers, senior management). Limited demonstration examples and experience	There is limited awareness of opportunities for biogas technologies and the related benefits. For example even in cases of power shortages industry owners are typically not aware they have the resource to generate their own power. Similarly they have limited awareness that biogas could help to achieve their wastewater treatment objectives. There are few examples of biogas demonstrated for industry SMMEs. In addition, there is limited information sharing and of publicity of existing success stories. Furthermore some previous bad experience (piggeries) has provided disincentives for investment due to poor operation, low efficiency and feedstock problems.	A widespread capacity building and awareness raising targeted at the priority agro sectors.  Guidelines on how biogas can meet wastewater treatment objectives.  Guidelines for SMMEs to tender for such projects and for project developers.  Demonstration projects introducing what is possible at different scales, using gas differently plus co-digestion to trigger wide replication
Not core business for SMMEs	Organizations working in agriculture and agro-processing have not focused on energy generation as the national power utility has, until recently, supplied at relatively low prices. It is not core business and projects are viewed mainly as income-generation business rather than seeing the ability to offset costs.	
Limited design and construction experience in bio-CNG scrubbing and compression	Although there are a number of biogas project developers there is limited domestic biogas technology and no experience in biogas scrubbing and compression.	Demonstration projects to provide 'best practice' examples. Projects to include demonstration of scrubbing and CNG <sup>20</sup> compression
Shortage of skilled O&M manpower	There is a shortage of skills for running plants effectively. Equipment servicing and post installation services need to be strengthened. O&M is seen as a key operational risk for biogas.	Training targeted at operation and maintenance and optimizing processes
<b>Technological barriers</b>		
Inadequate availability and accessibility of accurate information / data	Developers need accurate information regarding the expected gas production from biogas plants to plan projects and to secure finance. There is very limited information available on this in South Africa let alone	South African waste characterization established. TA <sup>21</sup> assisting project developers

<sup>20</sup> CNG used loosely to include biogas

<sup>21</sup> Technical Assistance

	its accessibility	
Lack of clarity on use of biogas digestate	Project owners are not clear what they can do with the digestate and if there is a potential income associated with it. The nutrient content of the digestate from different types of feedstock is not clear and there is little knowledge of what is the best use for the digestate as replacement of inorganic fertilizer. It is not clear if DAFF registration is needed.	R&D on nutrient content of digestate and on its possible use in agriculture. Clarity on licensing requirements and guidelines on digestate use. Training and guidelines on digestate use.
Limited infrastructure for vehicle fuel use	Bio-CNG is a real value added option for the use of the biogas yet there is no infrastructure for vehicle fuel use.	The first steps are to target own fleets or fixed taxi routes until an infrastructure catches up. Fleet conversion to bio-CNG or dual fuel
<b>Financial barriers</b>		
<b>For industry</b>		
Low return on investment (for cheap existing fuels) Relatively low current waste disposal costs Relatively low energy costs and tariffs	High capital costs (R15-35 mil/MW, IDC 2012) combined with relatively high operation and maintenance costs along with low offset/income makes it difficult to ensure viable projects. Landfill rates are still relatively low, if rising, and organic waste is sometimes illegally dumped at no cost. Therefore these are still the preferred disposal route and there is little incentive to divert / use the waste. Although electricity tariffs are rising energy costs are still quite low based on cheap coal based power and so result in low return on investment (vs. cheap existing fuels).	Incentives to trigger initial innovative projects and demonstrate positive cost-benefit analysis.  Establish specific windows for financing biogas projects  Economic support needed for small business enterprises
Limited availability of equity and loans	It can be difficult to access finance for projects where the project is relatively small, the financing institution does not understand the risks and a high proportion of equity is expected (e.g. 40% equity expected + corporate guarantee) whilst the SMMEs have balance sheet constraints.	Demonstrations and pilot project support to unlock waste producers' equity investment into WtE projects in their premises in conjunction with project developers. Debt financiers can also then realize the risk sharing aspect and come onboard
<b>For financing sector</b>		
Feedstock security	The largest issue for financiers is the availability of the feedstock. To secure finance there needs to be 'cast-iron' feedstock agreements. Where projects are relying on third party this creates a challenge to finance.	TA to project developers to include the development of feedstock agreements (including hedging)

**A. 5. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by the project:**

#### **A.5.1 Proposed additional GEF activities (detailed design)**

The proposed project will focus on agro-processing organic waste streams for conversion to useful forms of energy for application in SMME units and/or clusters of units, with the primary focus being combined heat and power for on-site and off-site demand and bio-CNG for other downstream value addition such as transport or off-site heat depending on the applicable local circumstances and required energy forms. Each of the selected demonstration project will utilize the digestate from the digesters in various forms so as to demonstrate the concept of integrated biogas systems. The aim is to introduce these technologies to the agro-processing sector and address the specific challenges outlined above. The



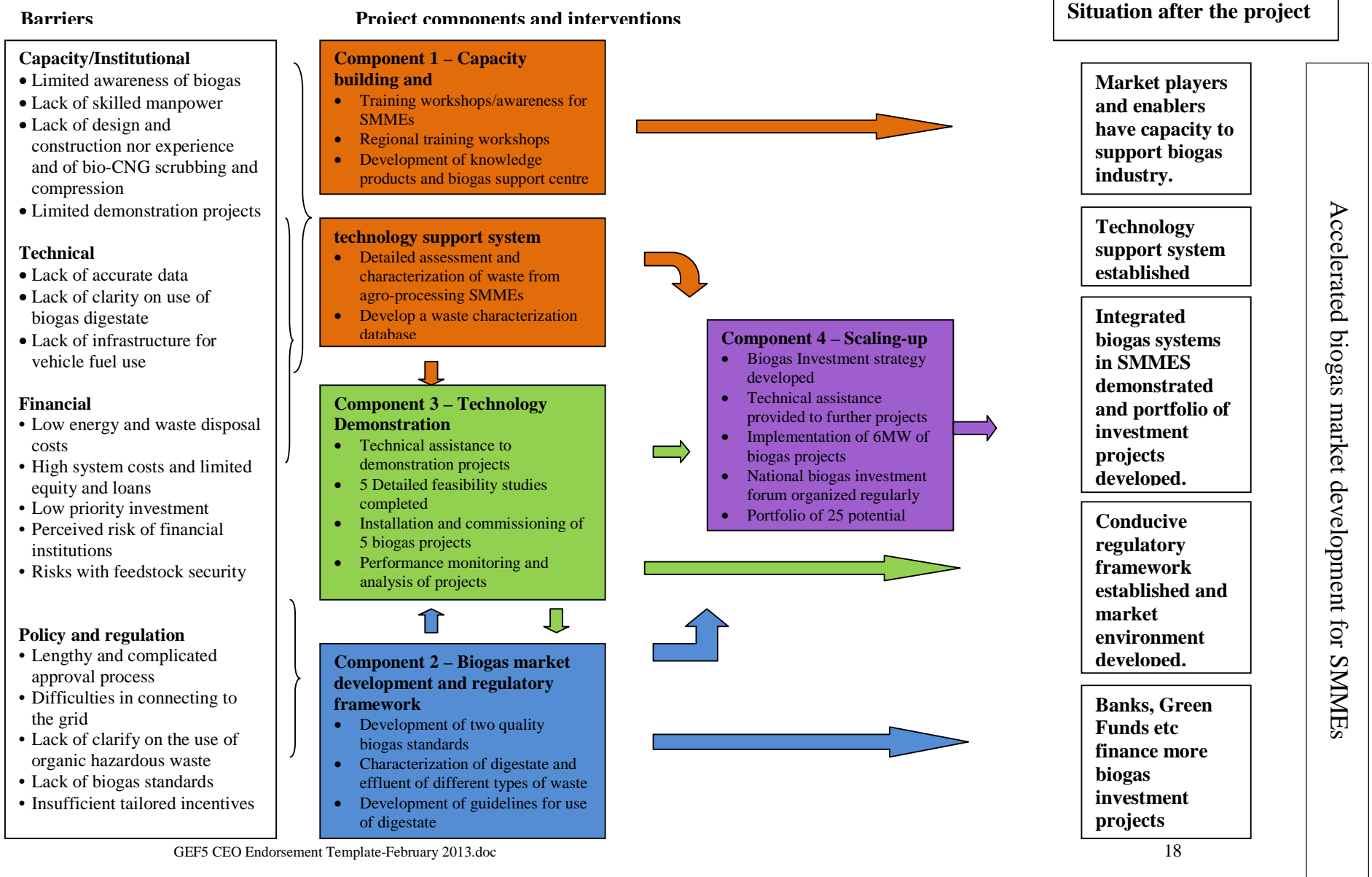
main objective of the proposed project will be to promote market-based dissemination of integrated biogas systems where there is good potential for recovery of energy from organic waste, ideally through co-digestion combining agro-residues from different sectors. This will be achieved by a combination of interventions at regulatory level, market development combined with specific investments as well as building the capacity of market players and enablers. To date only large scale industries (and small projects below 250kW and households/communities) in South Africa have received attention and the added value of this project will be to promote these technologies in the SMMEs sectors. Without GEF intervention these technologies are unlikely to have widespread uptake in SMMEs, even where useful organic waste streams are available and companies can demonstrate financial viability. The project will act as a trigger to demonstration and rapid replication in the uptake of the technology. The project will build on previous GEF programmes undertaken by UNIDO and have synergies with other proposed GEF projects to address an important sector hitherto omitted. In addition, the project will collaborate with other ongoing projects and programmes by various development partners.

The project is structured in four technical components, plus a monitoring and evaluation component, as set out below:

- **Component 1: Capacity building and technology support system.** This component will strengthen the institutional capacity as well as address the insufficient technical capacity training, awareness and the development of knowledge products, in support of reducing the (perceived) risk of industry. Activities under this component will be implemented in parallel with components 2 and 3 on regulatory framework and technology demonstration in order to jointly prepare for the scale up / mainstreaming phase in the second half of the project and beyond.
- **Component 2: Biogas market development and regulatory framework.** This component will strengthen the regulatory framework to effectively promote and support SMMEs to invest in integrated organic waste to energy technology, focussing on quality standards, the use of digestate and grid connection.
- **Component 3: Technology Demonstration.** This component will demonstrate technical feasibility and commercial viability of selected five (5) SMME integrated biogas projects in different sectors at different capacities demonstrating inter alia the use of digestate, scrubbing and compressing gas and co-digestion. Technical assistance and grants will be provided to facilitate the projects' development and bring about financial viability of these projects. These will build the confidence of both industry and the finance sector, create best practice examples to pave the way for replication in the scale-up component, on the basis of experience gained reduced (perceived) risk and increase capacity and awareness at multiple levels, i.e. industry (both at operational and decision-making level) and finance sector.
- **Component 4: Scaling up.** This component will support the establishment of a replication mechanism to mainstream the application of biogas for SMMEs by assisting additional biogas projects with technical assistance as required and helping to establish financial mechanisms targeted at promoting the use of integrated biogas technology in SMMEs sector..
- **Component 5: Monitoring and Evaluation.** A two pronged approach will be followed: 1) monitoring and evaluation against the GEF's strategic indicators and 2) monitoring and evaluation project specific technical indicators for outputs per component (components 1-4 as listed above). Ultimately this will provide an indication of the achievement of the goals that the project has set out to be achieved.

Figure 3 below demonstrates the interaction/integration of project components in facilitating the development of a sustainable market for the use of organic waste for energy in SMMEs in South Africa. Further details are provided in the following sections.

**Figure 3: Proposed project components and their interactions**



**Clarification and justification on investment (INV) budget shift from Component 4 to Component 3 compared to PIF**  
 Further to the extensive consultations with various stakeholders and feedback from the stakeholders consultation workshop, it became clear that demonstration project under Component 3 would need a greater level of support than envisaged at the PIF stage to prepare and realise their projects. From the analysis of information and current situational analysis of the biogas industry, which is in its infancy, the budget for this component was increased significantly compared to what was proposed at PIF stage so as to provide more realistic support for the demonstration projects. There was a corresponding decrease in the budget for component 4 since lessons from Component 3 will feed into the scale up, this budget will still support the delivery of Component 4 outcomes. This was also due to the recognition that once effectively demonstrated, the scale up phase could be easily supported by various existing and new financing mechanisms. Component 4 will include technical assistance (TA) to help facilitate the scale up/ additional projects but no grant will be provided for equipment. The TA will be project specific and will be based on demand.

### Description of each component and sub-component

The following section provides more details of each of the technical project components.

#### Component 1: Capacity Building and Technology Support System

Capacity Building of the major stakeholders including participating industry, banks/finance institutions (FIs), technology developers and suppliers and government agencies is essential to creating interest and a market for biogas technologies. Within this component knowledge products will be prepared and training will be delivered to service providers and industry as well as a course on household biogas. At the same time technical support for the industry will be provided through detailed waste assessment and characterisation carried out for local agro-processing waste streams.

Each of these activities has been designed with long-term sustainability in mind. For this to be practicable the capacity building needs to be owned by national institutions which will be responsible for taking it forward beyond the project. The training will include train-the-trainers sessions ensuring that staff in universities is in a position to pass on their knowledge beyond the end of the project. In particular SABIA<sup>22</sup> will help ensure replication through their members and can play a role in identifying possible clusters of units that could work together.

Following consultation during the PPG, a few amendments have been made in component 1, since the PIF, notably the exclusion of the support for the South African Waste Information System (SAWIS). Stakeholders were specifically asked about the need for SAWIS during the PPG. Although still important for the National Waste Management Strategy and for planning rural renewable energy electrification, it was not considered a real barrier to uptake of biogas by the key stakeholders.

In addition there has been an alignment of activities to improve value for money and additional activities have been included of an on-going training programme related to household biogas systems and training for Government agencies. This was in recognition of the fact that these training programmes will provide the skilled labour to work on biogas systems in SMMEs under this project. The funds intended for SAWIS will be used for the increased scope of the assessment and characterization of waste and for the additional training for household biogas systems and for government agencies.

1 Expected outcome: Capacity of market players enabled and strengthened, and technology support systems established		
Output	Activities	Partners involved
Support systems and knowledge products		
I.1 Detailed assessment and characterization of waste streams from agro-processing SMMEs conducted	<ul style="list-style-type: none"> <li>Detailed assessment and characterization of waste from agro-processing SMMEs</li> <li>Development of a South African waste characterisation database</li> </ul>	UFS <sup>23</sup> / REA <sup>24</sup> / ARC <sup>25</sup>

<sup>22</sup> Southern Africa Biogas Industry Association

<sup>23</sup> University of Free State

<sup>24</sup> Reenergise

<sup>25</sup> Agricultural Research Council

1.2 Capacity of biogas support and low-carbon technologies support centre strengthened	<ul style="list-style-type: none"> <li>Strengthen capacity of SABIA to enable it to offer services on biogas technologies to the South African biogas market in general but also to SMMEs</li> </ul>	SABIA
1.3 Biogas guidelines and decision support tools for integrated biogas systems in agro-processing SMMEs are developed and disseminated	<ul style="list-style-type: none"> <li>Develop knowledge products targeted at anaerobic digestion in the agro-waste sector</li> </ul>	National experts through SABIA
<b>Training and awareness raising</b>		
1.4 Professionals and technicians in biogas technology trained	<ul style="list-style-type: none"> <li>Develop biogas service technician course</li> <li>Train government staff incl. MCEP<sup>26</sup> and NCPC<sup>27</sup> staff to include biogas in their support packages</li> <li>Develop and deliver training on household biogas technologies</li> <li>Develop and deliver training on Use of Digestate</li> </ul>	SARETEC <sup>28</sup> UNIVEN <sup>29</sup> & UFH <sup>30</sup> ARC
1.5 Targeted training workshops (10) for market players (project developers, enterprise executives, farmers and operators, current users of waste) on integrated biogas systems conducted	<ul style="list-style-type: none"> <li>Prepare TOR for awareness raising workshops</li> <li>Prepare training material</li> <li>Deliver 10 training workshops around the country targeting a total of 200 trainees of which 30% will be women</li> </ul>	SABIA, National experts
1.6 Two regional training workshops conducted to train experts from SADC counties on biogas technologies in SMMEs	<ul style="list-style-type: none"> <li>Deliver 2 regional training workshops.</li> </ul>	

## 1.1 Detailed assessment and characterization of agro-processing waste

Many of the stakeholders consulted during the PPG mentioned the need for local waste stream analysis which will determine the waste composition and quantities of specific fractions. Currently estimates for waste content are based on European values and waste often gets sent to Europe to be analyzed although there are local laboratories with the capacity so some waste is analyzed locally. This can add considerable cost and time to the project development stage and if not carried out, results in unknown risks for the financiers. In response to this challenge it is intended to support the development of a dedicated local microbiological centre which will focus on anaerobic digestion and provide a standardized assessment and characterization of organic agro-processing waste. Many universities have a microbiology department but do not specialize in characterization of waste for biogas yields and may use different protocols. The aim here to have a standardized system which can be used as reference point in South Africa.

The aim is to:

- 1) Develop a laboratory testing service for organic material with a clear focus on anaerobic digestion<sup>31</sup>. The service will be offered to the private sector and shall provide clarity on the specific biogas yield of the substrate to increase the planning reliability of biogas projects in general. .
- 2) Develop a South African information database with information about the specific biogas yield of local biomass and conducting a validation process of existing European data samples on its applicability to South African conditions. In addition to using the results from the wastes analysed in this project the aim is to bring all test results for South African wastes together in one database. This will entail liaising with a number of universities and laboratories such as the CSIR and the University of Johannesburg.

<sup>26</sup> Manufacturing and Competitiveness Enhancement Programme

<sup>27</sup> National Cleaner Production Centre

<sup>28</sup> South African Renewable Energy Technology Centre

<sup>29</sup> University of Venda

<sup>30</sup> University of Fort Hare

<sup>31</sup> There is scope in South Africa for a number of such centres to be developed. This project will support one.

3) Implement successful demonstration and confirmation of laboratory results in larger-scaled commercial applications to generate references for the practical applicability.

The University of the Free State (UFS) has already identified co-financing from the National Research Foundation (NRF). It is proposed that GEF matches these funds to ensure the successful completion of the centre and database and for ARC to work with UFS on identification of agro-processing wastes for testing and links to the demonstration projects. In addition, the support from this project will ensure that services provided will be charged on a cost recovery basis. The university, as a public institution, will provide services to all members of the public at cost recovery rates.

## **1.2 Capacity of biogas support and low-carbon technologies support centre strengthened**

Southern Africa's Biogas Industry Association (SABIA) has successfully organized two national conferences and has contributed to the National Biogas Platform. However its ability to further promote biogas, to participate pro-actively in government driven policies which may affect the development of the industry, and to offer professional services to members is very limited. Therefore this project will support SABIA to help it become more established, become sustainable and to provide better services to the biogas industry. The aim is that SABIA (and its website) becomes the main point of information for biogas in South Africa. With this in mind the project will support SABIA to engage 1.5 full time staff that will be responsible for business development, for policy related work, lobbying and stakeholder engagement as well as to provide assistance and services to members such as information provision and advice during the life of this project. In addition, support will be provided for biogas guidelines (output 1.1.3) and standards and accreditation (output 2.1.1). It is envisaged that by the end of this project support, SABIA would have built critical mass of membership whose subscriptions would support the continuation of SABIA's activities and the services of the 1,5 staff members.

## **1.3 Biogas guidelines, decision support tools, operation manuals for integrated biogas systems in agro-processing SMMEs are developed and disseminated**

This activity will develop biogas technology guidelines including a decision tool with the basic information that will be required for the unit owner to decide whether the unit should opt for an integrated biogas system and then a step by step guide on how to take it forward. This addresses the lack of knowledge products targeted at the South African commercial market. With the exception of an operating guide published in 1992 for the South African water industry<sup>32</sup> and small scale biogas design and operation manuals from ARC<sup>33</sup>, there are no relevant knowledge products on a national scale. The National Biogas Platform is developing some tools including a technology matrix and financial information. The tools developed in this project will build on the existing information to ensure no duplication. The decision tool kits will be industry specific (abattoirs, piggeries, dairies, feedlots, food processing, crop waste) consisting of the following parts:

- **Technical:** detailed guidelines for selection of biogas technology, information on technology development status, waste characteristics, options of use of energy, technology packages, design and integration issues, flow diagrams, installation, construction and commissioning requirements and operation and maintenance (O&M) practices. It is clear that every site is different and therefore a fixed system, integration procedure and specification cannot be proposed that is applicable for all processes or industries. That said there are a number of common features that could be included in a technology package;
- For biogas plants, methane leakage is a significant challenge that should be attended to already in the early phases of conceptual and detailed design, construction and procurement of suppliers of components/facilities, as well as during operation of the plants. The central measure to minimize gas leakage is to ensure proper operation without major fluctuations of production/supply/fuelling of biogas and hence fluctuating gas pressures, regular controls and gas leakage checks. Therefore the technical part of the guidelines will provide practical guide to how to check for methane leakage, the frequency of check and how to remedy the situation.

<sup>32</sup> Ross, W.R., Novella, P.H., Pitt, A.J., Lund, P., Thomson, B.A., King, P.B. & Fawcett, K.S. (1992) Anaerobic Digestion of Wastewater Sludge. WRC Project no 390, TT 55/92. Pretoria, South Africa.

<sup>33</sup> <http://www.arc.agric.za/arc-iae/Product%20Catalogue%20Library/IAE%20publicationListOrderform.pdf>  
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- The guidelines on the use of digestate will be developed separately under Component 2.
- **Suppliers:** equipment lists, project developers; technology manufacturers/suppliers, balance of system manufacturers/suppliers;
- **Financial:** indicative capital costs, operating costs, cost of delivered energy, benefits, financing mechanisms and incentives available, financial analysis;
- **Business models:** outlining the various options available to an industrial owner with a focus on co-digestion (using the information generated in other Component 2 activities); and
- **Case studies** - results of some successful installations in South Africa.

These guidelines will be targeted at the participants in the training workshop (output 1.1.5) and will be circulated through industry associations and clusters and will be available on the SABIA website as well as on the DEA waste and DoE web portals. The aim is that it provides as much information as possible to the industry users to enable them to make an informed decision with respect to the use of organic waste for energy.

*Web-based knowledge management platform to exchange knowhow, expertise and experiences established and operated.* Although this activity was included in the PIF it was agreed during the PPG that better value for money would be achieved by providing specific on-line content to the SABIA website. The support will include: tool kits, decision support tools, manuals, guidelines and case studies developed under Components 1, 2 and 3.

#### **1.4 Training professionals and technicians in biogas technology**

During the PPG it became apparent that there were numerous training needs. During the consultation it was agreed to focus on the following areas: a) Biogas technician courses; b) Training government staff; c) Household biogas training; and d) use of digestate training. Details of each of these are provided below. In general, gender balance will be fostered with at least 30% of female participants.

##### **a) Biogas technician courses**

A fully South African Qualifications Authority (SAQA) accredited course and short courses on biogas will be developed by SARETEC. The SAQA course will cover the design, installation and commissioning, and operation and maintenance, safety and security of a biogas plant. In line with the PV<sup>34</sup> course currently being designed at SARETEC the biogas qualification would have three key areas/modules: knowledge module; practical skills; and work experience. In total the qualification would span three years and cater for the average high school graduate. Students could complete part of the full qualification depending on the purpose of their study.

The process will follow the Quality Control for Trades and Occupations (QCTO) model which puts emphasis on the practical side of training. QCTO checks, solicits public comment and approval of the curriculum developed under this model. Thereafter the curriculum document is forwarded to SAQA for another phase of public comment and after that process the qualification/ curriculum is issued with an SAQA ID number. The qualification/ curriculum then has legal status and can be trained and assessed against.

The short courses will be developed as one week training courses covering different aspects of biogas, such as design or operation, safety and security. These courses will be aimed at industry and will be paid for by participants.

##### **b) Training Government staff**

There is a need to build up the capacity in key government departments, such as DEA, DoE, DTI, DSBD and DAFF. Training for government staff will be provided as a two day training course covering technologies, policy, financing, risks and opportunities followed by a site visit to working biogas plants.

Specific training will also be provided to the staff of the departments mentioned earlier including those at MCEP and NCPC to ensure that staff members are adequately capacitated to undertake adjudication of related project proposals.

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<sup>34</sup> Photovoltaic

MCEP already receive many renewable energy applications which they are unable to adjudicate due to a lack of capacity and knowledge. Adjudication members included NCPC. By training these key personnel in NCPC, MCEP and other accreditation agencies it will allow the potential, benefits and challenges of the biogas market uptake to be understood by a new audience which has frequent contact with the target agro-processing industries. An assessment of the current capacity and needs will be carried out first. It is anticipated that two training sessions will be held at the Department of Trade and Industry (**the dti**) as well as organized trips to the demonstration projects.

### **c) Household biogas training**

Although household biogas systems are not the focus of this project during consultation it was agreed that it was an important area to increase training and awareness since household biogas has a large potential in South Africa and training could result in significant job creation. Moreover, biogas can replace traditional fuels in the households and therefore have a positive impact, including the improvement of health in particular for women and children, reduction of drudgery for women who often have to collect alternative fuel wood, keep fires alive and cook on open fires, as well as allowing women to free their time for other productive or community activities. As the SMME biogas market grows the household biogas market could be a spin off from the enterprise biogas market. There are currently no nationally recognized training courses on biogas and the newly trained technicians could support the biogas systems in enterprises especially for smaller enterprises and for other growing opportunities for institutional biogas systems such as at schools, hospitals, prisons etc.

The University of Venda is offering a household biogas training programme for unemployed youth with bricklaying skills, however it has only just started. To date they have trained just 9 men and one woman in design, construction, operation and maintenance in Limpopo Province. The course includes both theoretical and practical elements and in total takes 65 days with a certificate from the university. The University of Fort Hare also offers training on household biogas installation and maintenance targeting unemployed graduates, grade 10-12 school leavers and semi-skilled and self-taught plumbers and builders. Neither course is SETA accredited yet. SETA accreditation is an audit process of the training provider's quality system and of the learning programme offered. It ensures that learning and assessments result in nationally recognized credits, and ultimately in the achievement of a formal qualification. Under this GEF/UNIDO project the courses will be submitted for SETA accreditation and rolled out more widely, extending to cover all of the two provinces<sup>35</sup>. The universities will also work with technical colleges; mainly those nearby during trial of the material and eventually the material will be made available to all those TVET colleges ideally located to offer a biogas programme. The longer term aim would be that the training would be transferred to other provinces.

It is anticipated that the course will include:

- Theory behind biogas digesters;
- designs of biogas digesters;
- construction/installation of biogas digesters;
- maintenance of the biogas digesters;
- use of biogas;
- use of the effluent;
- environmental benefits of using biogas digesters;
- business development in the biogas industry;
- establishment and management of "Biogas" cooperatives; and
- social dimensions of biogas use, such as energy-gender related issues on the household level;

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<sup>35</sup> Limpopo and Eastern Cape Provinces  
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- health and safety concerns inclusive of methane leakage and the necessary measures needed to identify and resolve problems.

The majority of the training will be practical with each student being involved in the construction of at least three digesters. Following training the trainees will be divided according to geographical regions of their origin and encouraged to register cooperatives/small enterprises that will participate in the roll out of digesters under close supervision. DSBD will help in the enterprise development, specifically, in encouraging women to form and register women's biogas/ bio fertilizer enterprises.

Under this activity approximately 50 technicians/artisans and 30 local professionals will be trained. Women will be actively encouraged to take part in the training (target is to have at least 30% female participants). At least 30 household digesters will be built in rural areas.

Co-finance will be available from the participating universities, the household beneficiaries, Limpopo Department of Economic Development, Environment and Tourism (LEDET), Eastern Cape Department of Economic Development, Environment, Agriculture and Tourism (DEDEAT), South African National Energy Development Institute (SANEDI) and Water Research Commission (WRC).

#### **d) Use of digestate**

Following on from the outputs from Component 2.1.2 it is intended to develop a training programme on the use of the digestate, limitations on its use and any necessary testing. The course is intended for farmers and biogas project owners and will take place over 3 days. The work will include preparation of the modules and the delivery of 5 courses around the country training 100 farmers and waste generators. It is anticipated that this will be carried out by ARC and will use their network of stations to deliver the training.

### **1.5 Targeted training and awareness workshops**

This will be a two-day training workshop targeted at the management and technical personnel in agro-processing industries with potential biogas sites. The training will provide an overview of all the issues relating to biogas project development and will also act as an introduction to the more detailed design and operation training courses available from SARETEC. The training will help to identify projects each participant could develop at their sites and will help them to identify the technical aspects of such a project as well as to carry out a life cycle cost analysis of the project. Training will be open to any potential site owner with organic waste. Attendance at the workshops will be free and these workshops will be advertised through industry associations, DSBD and Provincial Government agencies responsible for economic development, agriculture and environment.

The training will be provided in classroom and at demonstration projects. The training workshops will cover the following:

- Biogas opportunities and potential
- Identification, development and management of biogas projects
- Detailed design and development of biogas projects (scale, feedstock, use of biogas)
- Operation and maintenance of biogas projects
- Safety and security
- Technical off-taker issues (electricity, digestate, heat, CNG)

The training will be tendered to, and provided by, national consultants and/or university personnel in conjunction with SABIA. The first step will be to develop the Terms of Reference for the training workshops. This will include provision for the preparation of training material and the delivery of training workshops around the country. A series of 10 of these two-day trainings is envisaged with the target of training 200 managers/personnel (at least 30% women).

In addition, in association with SABIA presentations will be made at relevant events such as the Red Meat Abattoirs Association, South African Pig Producers Organisation (SAPPO), and South African Poultry Producers Association (SAPA) annual congresses.

### **1.6 Regional training workshops**



Waste treatment is an issue for SMME industries across Southern Africa due to limited landfill sites, high costs of legal waste disposal and the high environmental impact of illegal waste disposal. Therefore the project management unit will liaise with the newly established SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) in Namibia to organize two regional training workshops for officials, experts and industry representatives (with at least 30% women). It is intended that the training material developed in Activity 1.1.5 will be used for the workshops. A budget allocation has been made for this activity but the final locations, trainees and format will be decided between SACREEE and the project. This activity will be coordinated with a UNDP- GEF funded biogas project in Botswana to ensure efficient use of resources and no duplication in effort. In addition, this activity will be carried out in support of the efforts by SABIA to network in the region and bring in participants from the SADC region to their events and programmes thereby creating a greater and regional market for some of the expertise that this project will build.

## Component 2: Biogas market development and regulatory framework

To develop a functional and effective market for biogas technologies in South Africa, it is critical to provide market development and assurance support that will guide the development of the industry. This component will develop tailored actions to promote project uptake in target SMME sectors. In particular, the work supported by GEF will develop tailored quality standards for biogas plants, will support characterization of digestate for fertilizer and develop recommendations and guidelines for its use, and finally will support work on the development of a regulatory framework for connection to the grid for sub-1 MW electricity generation plants. GEF funding will be used to bring best practice and international experience, with the co-financing for this exercise to come from national Government (as personnel working with consultants) and key stakeholders (SABIA, GIZ).

*There have been a few changes from the PIF: the scope of the quality standards has been increased to include the development of certified training materials which will make the work more sustainable by creating future revenues. In addition, an inter-disciplinary committee is envisaged to review current regulations related to different aspects of biogas technologies and to submit the regulatory framework on grid access. During the PPG it was clear that as part of the National Biogas Platform there was some research undertaken to identify all the relevant regulations to biogas and that there was already a de-facto inter-disciplinary committee reviewing the regulations relating to biogas. Therefore it was decided that this activity would focus only on the DEA license requirements building on DEA being the national counterpart for the project.*

Long term ownership and sustainability is ensured through working closely with national institutions such as the Southern African Gas Association (SAGA), South African Bureau of Standards (SABS), SABIA, ARC, DEA, DoE and National Electricity Regulator South Africa (NERSA) on the development of the quality standards, guidelines for digestate and grid connection regulations, respectively. GEF inputs will assist and support these organizations in their development and beyond this project the respective organizations will be responsible for the implementation of their outputs.

<b>2 Expected outcome: Market environment for biogas strengthened and regulatory framework for grid-connected small to medium scale waste-to-energy projects developed</b>		
<b>Output</b>	<b>Activities</b>	<b>Partners involved</b>
2.1 Quality standards for integrated biogas plants in SMMEs developed, adopted and widely disseminated	<ul style="list-style-type: none"> <li>Two biogas quality standards developed (above and below 0.5GJ/hr)</li> <li>NQF and SETA certified training materials &amp; modules developed</li> <li>Standards integrated in the Pressure Equipment Regulation (PER R719), as part of OHS Act</li> </ul>	SAGA SABIA SABS DoE
2.2 Guidelines and regulations (environmental, technical and legal) on the valorization of digestate and effluent developed and adopted	<ul style="list-style-type: none"> <li>Characterization of digestate and effluent of different types of waste</li> <li>Test use and efficacy as fertilizer</li> <li>Develop guidelines on application rates in agriculture</li> <li>Propose regulations (limitations in waste types, volumes to use, monitoring etc.)</li> <li>Consultation and adoption by DEA</li> </ul>	ARC's ISCW DEA DAFF

<b>2 Expected outcome: Market environment for biogas strengthened and regulatory framework for grid-connected small to medium scale waste-to-energy projects developed</b>		
<b>Output</b>	<b>Activities</b>	<b>Partners involved</b>
2.3 Biogas license process streamlined	<ul style="list-style-type: none"> <li>Identify and establish ways to streamline licensing within DEA for biogas plants</li> </ul>	DEA DBSD National consultant
2.4 Regulatory framework on access to the grid by small to medium scale biogas projects developed	<ul style="list-style-type: none"> <li>Review the existing/proposed regulatory framework (Electricity Regulation Act 4 (2006)) and development of new legislation and regulatory rules for sale and wheeling of small scale renewable energy projects.</li> <li>Test applicability for biogas projects.</li> </ul>	DoE NERSA Eskom International consultant

### **2.1 Development of two biogas quality standards and associated training material**

At present there are no standards that are directly applicable for biogas projects. This activity will develop clear and practical standards for the design, installation and operation of biogas plants (including pipes, equipment and appliances for use with biogas) with the aim of improving the quality and safety within the emerging South African Biogas industry. There are three components to standards development, with further details provided below:

- Drafting and adoption of two (2) South African standards for biogas projects;
- Integration of the standards within the Pressure Equipment Regulation (PER R719), as part of the OHS Act;
- Drafting of NQF and SETA certified training materials for the two standards and the design of associated training modules for biogas practitioners and professionals.

This work will be led by SABIA with significant input from SAGA, SABS and DoE.

#### **a) Drafting and adoption of two (2) South African standards for biogas projects**

Two standards will be developed which aim to cover all sizes of biogas projects – split between those that are smaller than 0.5GJ/hr (139 kW – domestic/institutional scale) and those that are larger. The standards will include the construction, installation and commissioning of all the equipment needed from source of biogas up to and including appliances using biogas. For each standard 10-12 field experts will be commissioned to draft the documents. Initially a review of what is already available and relevant to South Africa for use as templates will be carried out. For example SAGA have already identified that SANS 827 – The installation of pipes and appliances for use with natural gas – will be used as the main template for the drafting of the Domestic Biogas standard for the installation of all required equipment needed from source of biogas up to and including appliance used or biogas. SANS 329 (Industrial thermo processing equipment - safety requirements of combustion and fuel handling systems) is expected to be used as a template for the drafting of the Commercial / Industrial Biogas standard for the installation of all required equipment needed from source of biogas up to and including appliance used or biogas. Following research the standards will be drafted, edited and cross-referenced. A standard consultation process then follows (3 months) for stakeholder input which will be administered by SABS. Following consultation the standards are adopted by SABS.

#### **b) Integration of the standards within the Pressure Equipment Regulation (PER R719), as part of the OHS Act**

Once the standards are adopted then SABIA and SAGA will support the integration of the standards into PER R719.

#### **c) Drafting of NQF and SETA certified training materials**

This work will be undertaken alongside the standards development. Several consultants will be selected through calls for proposals to undertake the work, i.e., two NQF and SETA certified training materials and two corresponding training modules. The training relates directly to meeting the standards adopted and once integrated into the Pressure Equipment Regulation accreditation through training attendance will be necessary. Following consultation on the material discussions will be held with relevant stakeholders to promote and disseminate the training materials and

modules, including at technical colleges and tertiary institutions. Initially, SAGA is expected to become the primary (though not unique) biogas training service provider while the registration of installers and practitioners shall be the sole responsibility of SABIA.

## **2.2 Development of guidelines and regulations (environmental, technical and legal) on the valorization of digestate and effluent**

As part of an integrated biogas project it is important that all the outputs are utilized and therefore that there are clear guidelines on the use of the digestate and effluent. Digestate and effluent can be used as fertilizer and animal bedding. However it is important from an environmental point of view that the digestate is used in a safe manner and that any pathogens or heavy metals that may have been introduced to the biogas feedstock have been suitably eradicated or reduced to acceptable levels. Therefore this activity aims to first characterize the digestate and effluent from different types of biogas feedstock and test its use and effect as a fertilizer prior to developing guidelines and proposing regulations, if required. A laboratory will be established at the ARC's Institute for Soil, Climate and Water (ISCW) which will characterize the resulting digestate and effluent from different biogas plants using different feedstocks. These will include biogas plants using abattoir waste, piggery waste, dairy waste and beef feedlot waste, as well as some co-digestion. The samples will come from laboratory simulations as well as from the demonstration projects around the country which will be coordinated by ARC. The characterization will include the quantities of Nitrogen (N), Phosphorous (P) and Potassium (K). This will be compared to different crop nutrient requirements, e.g., maize, and so the timing and rate of application of effluent can be fixed taking into account the significant climatic variations in the country. The next step will be to test with field trials over two agricultural seasons.

Following the trials guidelines will be developed and issued on how to use effluent and digestate as fertilizer in terms of crop types, rates of application, timing, limitations, monitoring, etc. International guideline on pathogen limits will also be included within the South African guidelines. Following consultation with DEA and DAFF it will be determined if it is necessary to develop regulations. An option is that biogas digestate is included in the Draft Norms and Standards for the manufacture and applicability of organic compost as well as the Organic Waste Composting and DAFF's Farm Feeds & Fertilizer Act being incorporated into that document. If considered necessary regulations will be proposed based on the guidelines and will be submitted to DEA for adoption.

In parallel to the development of guidelines work will be carried out to review the size of the potential South African market for digestate. This will help potential project owners and financiers to understand the markets available to them and give them confidence that a value can be applied to the digestate.

## **2.3 Streamlining of licensing for biogas technologies**

Under one of the working groups of the National Biogas Platform work has been carried out to identify the myriad of licenses and permits that are required to develop, build and operate a biogas project. As alluded to earlier this is seen as a key barrier to further uptake of biogas technology. A report has recently been finished which highlights all the licenses required and which makes a number of recommendations for streamlining<sup>36</sup>. This includes streamlining between all the different departments involved. However it is important to note that many of the different licenses required need to be issued by different branches of DEA. There is a need to bring together the DEA requirements so that the barriers to a project developer are not insurmountable and which allows them to take forward their project legally, but with lower project development costs and time associated with it. Specifically the report recommends that DEA develop a Norms and Standards document for biogas technology as they have already done with landfill gas. Alternatively they could be included in the existing landfill gas document. Therefore, it is proposed that a consultant will work with DEA and DSBD to identify and establish ways to streamline the process within DEA.

## **2.4 Development of Regulatory framework on access to the grid by small and medium biogas projects**

Currently it is not possible for biogas projects below 1 MW to connect to the electricity grid, or to wheel power to another site. This is a significant barrier to the uptake of small to medium biogas projects since it can both restrict the potential revenues from the project and restrict the size to a less than optimum scale. There has been some lobbying

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<sup>36</sup> This will be available on the SABIA website, <http://biogasassociation.co.za>  
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regarding these matters and NERSA is in the process of publishing a decision on embedded electricity (all technologies but with a focus on PV) which will identify gaps in policy. In line with this the Department of Energy (DoE) is currently reviewing the Electricity Regulation Act 4 of 2006 with a view to drafting legislation and regulatory rules associated with wheeling arrangements and small-scale embedded generation. With the provision of some international expertise this GEF-UNIDO project will assist the DoE (and NERSA and Eskom) in this review and in developments around the revision of the Act in particular in testing its applicability to biogas. A particular area that can be investigated is the provision of peak power since biogas can be stored. The regulatory adoption of a new framework is likely to catalyze the development of many other small to medium renewable energy projects that would be connected to the grid.

### Component 3: Technology Demonstration

This component will demonstrate the technical feasibility and commercial viability of biogas projects in the SMME agro-processing sector in South Africa. Five (5) representative and replicable projects will be supported with technical assistance or transaction advice and provided with a small grant.

The proposed activities have been designed to ensure that the preparation, implementation and operation of these projects will build up the capacity of the stakeholder groups to provide a basis for replication and scaling up. UNIDO will be responsible for the management and disbursement of the grants through a performance based grant contract. Under such contract, the grant will only be disbursed upon attainment of specific project milestones that will be verified by PMU and DEA. In terms of contracting, to establish the grant contract, UNIDO will send the owners of the demonstration projects a detailed Request For Proposal (RFP) with outline TORs on the project. The owners of the demonstration project will then submit a detailed design of the project, cost estimates, work plan and co-financing status. UNIDO will then evaluate the design and compare cost estimates with international levels as part of the finalisation of the submitted bid. Once technically and financially accepted by UNIDO, the detailed design will be used to develop a grant contract with the owner of the projects

A grant contract will be signed between UNIDO and the pilot project so that the grant will be disbursed by end of the construction period and based on actual progress on the ground to cover capital costs to have the project functional i.e. installed, but will also be tied to the actual GHG emission reductions achieved. In terms of the triggers of part payments, PMU and DEA will conduct actual onsite visits to certify that the actual work has been done on the ground before triggering all progress payments. Since the GHG emissions will only be achieved when the pilot projects operate, therefore, as part of the grant contract condition, the operator will make an undertaking to operate the plant for the agreed period as part of the grant contract. In the event of failure to comply with this requirement, the operator liable to return a proportionate component of the grant. DEA and DoE already work with the target industrial sectors on other technologies so they are in a good position to extend their support to these sectors. DEA expressed interested in continuing this support beyond this project through the Green Fund. Other government stakeholders involved will include the DST, DBSD and EDD. It is expected that experiences from this will inform DoE's future policies and the experiences will help to inform DBSD of the opportunities available and will allow it to promote co-operation between businesses. Finally, further sustainability and replication is ensured through the interaction with the financial institutions. Discussions securing finance and the banks' experience of extending loans to this sector in the demonstration projects will help to reduce perceived risk and encourage future lending.

Details of the component outputs and activities are described below.

<b>3 Expected outcomes: Technical feasibility and commercial viability of waste-to-energy technologies demonstrated</b>		
<b>Output</b>	<b>Activities</b>	<b>Partners involved</b>
3.1 Detailed feasibility studies of selected 5 demonstration projects are conducted	<ul style="list-style-type: none"> <li>Technical assistance and transaction advice for selected demonstration projects</li> </ul>	Consultants, EDD
3.2 Five (5) integrated biogas demonstration projects implemented to achieve at least 3MW installed capacity	<ul style="list-style-type: none"> <li>Installation and commissioning of demonstration projects</li> </ul>	Project developers, EDD, DST, FIs

3.3 Demonstration projects monitored, evaluated and showcased	<ul style="list-style-type: none"> <li>• Performance Monitoring and analysis of installed projects</li> </ul>	National consultants
3.4 Best practice manual developed and widely disseminated	<ul style="list-style-type: none"> <li>• Documentation of results of demonstration projects and preparation of case studies</li> <li>• Development of best practice manual</li> </ul>	National consultants

Five (5) integrated biogas projects were selected to be demonstration projects during the PPG. The selection of the GEF demonstration projects was a two staged process to ensure that the projects are additional, incremental, and replicable, co-finance would be available, and that they would be viable. During the PPG project developers were approached directly as well as through SABIA, Government departments and other organisations with connections to project developers. UNIDO delivered presentations on the opportunity for support from this project at the 2 National Biogas Conferences (<http://www.energy.gov.za/files/biogas/2015-Biogas-Conference/Day-2/Promoting-Organic-Waste-to-Energy.pdf>). Call for proposals were also posted on SABIA website (<http://www.biogasassociation.co.za/>). Project developers were invited to submit ideas for projects (or portfolio of projects) for biogas in the agro-processing sector and other SMMEs which were larger than 400 kW. Project selection criteria were prepared in consultation with project stakeholders. A copy of the criteria is included in Annex T7.

Initial information on projects interested and eligible to receive support was received from potential developers. As a minimum all the projects that were considered met the selection criteria. The key objective for the demonstration projects is to demonstrate both technical feasibility and commercial viability for as wide a range of projects as possible to allow for maximum replicability and maximum demonstration impact. Replicability is based on whether there are many other similar sites where the project could be reproduced. Therefore, the projects were selected to cover a range of locations (cover a number of provinces in South Africa); different capacities/sizes; different types of feedstock; different uses of gas; and on-grid and own use projects. The projects were mapped against these criteria. Based on information provided, the second phase of the selection process included getting further information and pre-feasibility studies were carried out for each of the short-listed projects. The pre-feasibility studies including technical and financial details are included in Annex T8. The level of grant support to be provided to each project was determined assessing the GHG emissions attainable, economic viability of the project, and need for technical assistance. In terms of economic viability of the project, the grant was determined to cover the exchange rate risk for the imported components of the equipment and to bring the project to economic viability. The need for technical assistance was then assessed, especially the need for international technical experts to bring the project to reality. The unit cost for each project varies according to the technology selected and use of biogas. To achieve the broad range of demonstration it was agreed that it was appropriate to support this range of costs. The following projects were pre-selected which give a good sample and which result in more than 3 MW of projects being developed (as foreseen for Component 3 in the PIF).

**Table 4: Proposed demonstration projects**

	Project	Province	Facility and waste description	Project description	Unique selling point / reason for selection	Size	Capex (mUSD)	Proposed grant (USD)	Estimated GHG reduction (tCO <sub>2</sub> e)
1	Western Cape abattoir - GCX	Western Cape	Abattoir waste. Currently generates 17t/day and will rise to 20t/day. Difficult and expensive for facility to meet legal requirements.	A biogas plant will be installed to treat the abattoir waste. The gas will displace coal used in the boiler. The digestate will be used on nearby crops. Project already has EIA.	Demonstrates biogas treatment for difficult waste (abattoir waste) and will show how resulting waste is within government guidelines and is safe for agriculture use. Replicable for all abattoirs.	~400 kW	3.8	325,000	48,600
2	Fort Hare	Eastern Cape	Waste from local piggery, dairy and crop waste.	Biogas will be scrubbed and compressed (bio-CNG) and used in local taxi fleet. First phase of a number of projects in EC looking to develop the CNG market ultimately aiming to sell to Daimler Chrysler who have expressed interest but need 'cast-iron' guarantees. Digestate will be used on local crops and vegetable gardens	Demonstrates co-digestion of animal waste plus crop waste. Will also demonstrate viable generation of bio-CNG and its use in a taxi fleet. Considerable support from local government. The model is highly replicable throughout South Africa.	~500 kW	3.8	400,000	41,000

	Project	Province	Facility and waste description	Project description	Unique selling point / reason for selection	Size	Capex (mUSD)	Proposed grant (USD)	Estimated GHG reduction (tCO <sub>2</sub> e)
3	Bela Bela & Uilenkraal	Limpopo & Western Cape	Bela Bela - Piggery Waste from 17,000 pigs (about 100t/day)  Uilenkraal – Dairy with 1500 cows (about 16t/day dry)	Waste is being processed in 10,000m <sup>3</sup> and 7000 m <sup>3</sup> lagoon digesters. At Bela Bela the engine will be upgraded from 250 kVA to a 330 kVA engine and GEF support is for the connection to the electricity grid. At Uilenkraal a grid connection and gas compressor will be added. Bela Bela town is also interested in signing an off-take agreement for the electricity.	Demonstrate connection to the grid for small scale RE generation and demonstrate wheeling of electricity at small scale. This is extremely important to future viability based on small-scale plants selling electricity off-site.	540 kW	0.76	100,000	50,700
4	Portfolio of five projects to be developed together	Gauteng Mpumalanga	5 x piggeries, abattoir and aquaculture. Waste includes feedstock from maize off-cuts, pig manure, pig blood, pig stomach, pig slaughter waste, fish manure, fish slaughter waste, carcasses of died fishes and grass.	Five sites including use of multiple standardized digester system design (500m <sup>3</sup> with CHP) with the intention to duplicate the technical concept. Energy used on site for heating and electricity needs. Digestate used for local maize crops replacing some synthetic fertilizer.	Demonstrates use of standardized digester system size and design to duplicate the technical concept to improve cost effectiveness. Project monitored centrally and costs reduced through interchangeability of spare parts. Applicable at numerous sites.	700 kW	6	475,000	86,000
5	WEC – food processor	KwaZuluNatal	Durban plant	CHP for onsite heat and electricity needs.	Demonstrate CHP at a food processing plant. High potential for replication at other food processing plants. Selected as a project more advanced in its development.	1.6MW	6.4	500,000	114,700

Further details of these projects are provided in Technical Annex T8. A full list of projects received is also included in the same Annex. Two alternative projects have also been identified to address the (unlikely) possibility that one of the selected projects is delayed due to unforeseen and unexpected reasons.

### **3.1 Technical assistance and transaction advice for demonstration projects**

Each of the demonstration projects described above is at a different stage of development and therefore their needs for assistance also vary. In the PIF it had been foreseen that assistance would be provided to each project to prepare a full feasibility study however it was observed that this was not necessary for all projects. Therefore, it is proposed that tailored assistance is provided to the project developers depending on their needs. For example help may be required in developing off-taker agreements, negotiating with the utility, transaction advice, helping to overcome local regulatory hurdles, and/or with Environmental Impact Assessments (EIA). UNIDO-GEF will work with EDD to provide assistance where necessary. EDD is committed to helping with local regulation hurdles and the project management unit (PMU) will have a roster of experts who can be called upon to assist where necessary. The output from the project developers' work plus assistance will be full feasibility studies and bankable plans. The feasibility studies will be enhanced with the use of UNIDO's Computer Model for Feasibility Analysis and Reporting (COMFAR). COMFAR assesses the short and long term analysis of financial and economic consequences for industrial and non-industrial projects.

### **3.2 Installation and commissioning of demonstration projects**

Following the agreement on support and finance for the projects, the installation and commissioning will be undertaken by the project developer and the beneficiary industry as detailed in the feasibility studies. The National Project Manager will be responsible for over-seeing each of the demonstration projects and for verifying progress on the ground. Regular reporting on the progress of each project will be required to process progress payments. Following the commissioning of the project the unit owner will submit a completion report to the Project Management Unit (PMU). A template for the Completion Report will be provided to the unit owner and will include details of the installation, photos, videos, and also at least six month's performance data for the system. Representatives for the Project management unit will visit the demonstration projects to verify the reports. On receipt of this Completion Report the final percentage of the GEF contribution will be released to the project owner.

### **3.3 Performance monitoring and analysis of installed projects**

An independent consultant will carry out the evaluation of the demonstration projects. PMU/UNIDO will coordinate the evaluation process. Each project evaluation should follow the same reporting structure developed and established for this project and in line with similar GEF projects. The performance will be monitored based on GEF monitoring guidelines, specify the data collection methodology, instruments used, performance parameters to be calculated and the procedures for calculation and presentation of results. The indicators against which the project will be monitored will also be finalised. This will include as a minimum: monitoring and verifying the energy generated and GHG emissions avoided directly due to the GEF project; assessing the operational record of the projects, assessing the economic and financial performance of the project; identifying any problems; compiling lessons learned, assessing the socio-economic benefits of the projects to the target beneficiaries; and recommendations from lessons learned and implication/strategy for scaling up or replication. Where applicable one of the key areas to be assessed will be alternative business models, for example cluster approaches, co-digestion, ESCOs or Build Own and Operate (BOO), and the lessons learned will feed into the development of clear replication business models for the use of organic waste for SMMEs. It is also anticipated that research and development lessons will be shared with DST/CSIR and any lessons learned could also feed back into policy development through the PMU and steering committee. The performance monitoring under this component will feed into the overall M&E component 5. The performance monitoring will focus only on the pilot project and the findings will be part of the overall monitoring and evaluation of the project.

### **3.4 Development and dissemination of best practice manual**

A best practice manual will be developed based on the experiences of the demonstration projects and will take into account the key issues relating to design, installation and importantly operation and maintenance. As part of this it will include case studies for each of the projects. The case studies should be designed in such a way that they are easily accessible by different stakeholder groups. The best practice manual will also be included on the SABIA website. The



dissemination programme will include dissemination through relevant industry associations especially SABIA, conferences, Government, websites and will form part of the project management component.

*Long-term sustainability of global environmental benefits and institutional continuity through national ownership for Project Component 3 – Technology demonstration*

The guidelines and case studies developed, as part of this component (and Component 1) will help agro-processing industry owners to truly understand the options available to them and to make informed choices, therefore increasing the replication potential of the project. The knowledge products will continue to be available on the DEA, DoE and SABIA website beyond the project ensuring their continued availability.

Demonstrating the technical feasibility and commercial viability of SMME based organic waste to energy projects provides national examples that can be replicated across the country. The pilots have been selected on a number of criteria including their GHG emission reductions and their replicability as outlined earlier. The potential for replication is enormous across South Africa. Not only will the demonstration projects show what is possible and the examples be disseminated widely in the country, but the implementation and operation of these projects will build up the technical capacity within the stakeholder groups to help in the replication of these projects. Given the commercial interest in these projects, the different proponents will have an interest in keeping the projects running and hence sustain the global environmental benefits beyond the life of the project.

The organisations for long-term national ownership for the technology demonstration component will be the industry owners, industry associations and state government.

#### **Component 4: Scaling-up**

Based on the experience of the technology demonstration phase, a financing scheme will be established; tailored towards effective replication and scale-up. This component will include the identification of a financing window specific to biogas. The learning from demonstration units through detailed reports and performance feedback will help in improvement and tuning of project development and financing. Ultimate success of the project would be evident if organic industrial wastes are not disposed of by the industry and instead are made use of for energy.

The planned outputs and activities under Component 4 need to be viewed as indicative in as much as the results from the demonstration phase will refine or possibly significantly alter the scope of activities required to ensure a sustained scale-up phase. The activities will therefore be revisited after the demonstration phase has yielded sufficient experience; this evaluation is expected to coincide with the mid-term project review.

<b>4. Expected outcomes: Investment in waste-to-energy promoted</b>		
<b>Output</b>	<b>Activities</b>	<b>Partners involved</b>
4.1 Investment strategy for integrated biogas developed and disseminated	<ul style="list-style-type: none"> <li>Development of investment strategy responding to National Biogas Strategy</li> </ul>	DoE National consult
4.2 Technical Assistance provided to realize at least 4 more investment projects (at least 6 MW)	<ul style="list-style-type: none"> <li>Recruitment of framework consultants</li> <li>Criteria for selection</li> <li>Selection of projects for assistance</li> <li>Provision of assistance (up to max 1.1mZAR (100,000 USD) per project)</li> </ul>	PMU / Consultants
4.3 Portfolio of at least 25 investment projects compiled and disseminated	<ul style="list-style-type: none"> <li>Recruitment of framework consultants</li> <li>Screening and Preparation of pre-feasibility studies</li> <li>Dissemination of studies to project developers and financiers</li> </ul>	PMU/DoE/DSBD Consultants/ FIs
4.4 Technical support to design financial support.	<ul style="list-style-type: none"> <li>Review options available for dedicated biogas financing window</li> <li>Increase scope of MCEP and NCPC</li> </ul>	PMU/DoE/DEA/dti National consultants/ FIs
4.5 National biogas investment forum organized regularly	<ul style="list-style-type: none"> <li>Support two investment forums at (or in conjunction with) the National Biogas Conference</li> </ul>	PMU/ SABIA

#### 4.1 Development of investment strategy for integrated biogas

Under on-going work at the Department of Energy with support from GIZ a National Biogas Strategy and Action Plan is being developed and is expected to be completed by March 2016. There is evidence to suggest that if there is no clear investment strategy associated with the National Biogas Strategy then it is difficult to implement the strategy, as seen with the biofuel policy framework. This GEF-UNIDO activity therefore aims to support this by developing an investment strategy which responds to the National Biogas Strategy. The investment strategy will outline possible sources of finance, or finance mechanisms, for the different elements of the strategy. The work will be carried out by the Department of Energy with liaison with other government departments and support from a national consultant.

#### 4.2 Technical Assistance to realize at least 6 MW of additional projects

Technical assistance and transaction advice will be made available to further support projects to get off the ground. A group of experts will be recruited under a framework agreement. Interested project owners and developers will be able to apply to the project to receive technical assistance. Once some experience has been gained from the demonstration projects in Component 3 more specific criteria for selection will be prepared and projects invited to apply. An upper limit of support will be available per project. The applicant will specify what type of assistance they are in need of – for example technical feasibility, bankable business plans, off-take agreements, feedstock agreements, assistance with licensing, etc. As with Component 3 any feasibility studies will be enhanced with the use of UNIDO’s Computer Model for Feasibility Analysis and Reporting (COMFAR). An expert with a framework agreement will then be allocated to that project. It is expected that at least another 6 MW (or equivalent in other forms of energy) worth of additional projects will be taken forward as a result. As part of the sustainability strategy for this intervention, it is foreseen that SABIA will in the long-term provide independent technical review and assistance to project that are in the development phase.

During the PPG a number of projects were identified to receive technical assistance. These will be added to following the procedure above once the project has started. The projects identified are shown in the table below.

**Table 5: Investment projects to receive technical assistance**

Project	Province	Facility and waste description	Project description	Size	Capex (mUS\$)	Unique selling point / reason for selection
Hamburg	Eastern Cape	Waste from local dairies plus Napier grass grown on 300 ha of redundant land.	Biogas will be scrubbed and compressed (bio-CNG) and used in local taxi fleet. An alternative would be to sell to Daimler Chrysler who has expressed interest but need definite ‘cast-iron’ guarantees. Can be combined with the Fort Hare project selected as a demonstration project.	Up to 6t CNG a day	5,3	Demonstrates co-digestion of animal waste plus napier grass. Shows good use of redundant land with associated high job potential in cropping grass. Inclusive in terms of gender, rural communities and employment creation. Will also demonstrate viable generation of CNG and its use in a taxi fleet. Considerable support from local government. The model is replicable throughout South Africa.

Project	Province	Facility and waste description	Project description	Size	Capex (mUS\$)	Unique selling point / reason for selection
Wilcofield	Gauteng	Manure for 10 years from Karan Beef feedlot plus water & sludge Supply from Erwat for 2.7 ML/day	Propose hybrid biogas plant with either peaking power (2MW) or compressed gas (9.2 m litres p.a. diesel eqv.) with digestate used on local farming land.	2MW	16,7	Demonstrates large scale co-digestion with high potential for job creation. Demonstrates use of compressed gas and has support from DEA's Green Fund.
Hamburg co-operative	Eastern Cape	Dairies and napier grass from 500 ha community held land.	Biogas will be scrubbed and compressed (bio-CNG) with aim to sell to car manufacturers.	Up to 10 t CNG a day	6.8	Increasing the scale of the first demonstration project, improving likelihood to sign off-take agreement with Daimler / Chrysler, significant increase in jobs. Support from local government. Cooperatives may already receive support from GEF-SGP with the understanding that they will link up with this FSP at a later stage.
Roodeport biogas	Gauteng	Feedstock will be food waste in the Gauteng Province with a reliable source of waste feedstock from Interwaste and an offtake agreement from AfriSAM, a cement manufacturer	2 MW electricity and 2 MW of biogas to offset LPG sold to AfriSAM	4MW	16.6	
Large dairy	Western Cape	Feedstock would be dairy waste	Gas would be used either for electricity wheeled to a processing site or for bio-CNG for dairy vehicles	500 kW	3.8	

#### 4.3 Portfolio of at least 25 investment projects screened, compiled and disseminated

Working with trainees at the training workshops, with SABIA and the industry associations at least 25 biogas projects will be identified to form part of a portfolio of projects for investment. For preparing this portfolio, more specific criteria will be considered, learning from the experience from implemented projects. In order to mainstream gender in the biogas sector, the involvement of women and youth in the project will be integrated, meaning that SMMEs led by women or empowering women will be prioritized. Support will be provided to the SMMEs to help them to develop pre-feasibility studies using COMFAR which will allow them to make informed decisions, to help them find project developers suited to their needs and to start the process of finding suitable finance. Support will be provided by independent consultants (which hold a framework agreement with UNIDO) and projects selected for support will be those who express interest following the training workshops and that look promising. It will be on a first-come first-served basis. The pre-feasibilities will be circulated to developers and financiers for their interest. As a result it is hoped that further projects will be installed during or shortly after the project schedule.

#### 4.4 Support to identify financial support

*At the PIF stage it had been intended that a dedicated window of the Green Fund would be designed for biogas projects. On 10 October, the government confirmed that the Green Fund would be extended to run for another 3years. As such, the conditions of the Green fund will reviewed to increase uptake of biogas project. In addition, during the first year of operation, this project will focus and investigate different avenues for funding with the aim to develop*

*specific funding windows for biogas.* Currently there are a number of avenues for renewable energy financing but all technologies are considered and it is easier for financiers to fund ‘simpler’ wind or solar projects. If specific windows were allocated for medium sized biogas projects this would provide an incentive to finance these projects. The follow-on scheme of the Green Fund from DEA could have a biogas window and this will be negotiated with DEA. In addition, work will be undertaken with Government owned banks, DBSA, IDC and SEFA, on further services they could provide to the biogas industry. Other specific options to review will be the Green Credit Line and Green Climate Fund from AfD and KfW, respectively and also to approach other potential funders in this space such as the Norwegian and Danish Governments.

In parallel, other project development support will be identified such as widening the scope of the dti’s MCEP and NCPC to include biogas and support for feasibility studies.

#### **4.5 Support for national biogas investment forum**

Following the success of the two National Biogas Conferences in 2013 and 2015, SABIA are planning to continue to organize regular national biogas conferences. It is therefore proposed that GEF-UNIDO support an investment forum within the, or in conjunction with, the conference rather than support a separate event. Funds have been allocated for support of this activity at the two conferences. One of the domains where UNIDO intends to support in the Forum, is on gender representativeness. In particular, the project will support gender sensitive initiative to ensure that women participate in meeting and panels of the forum. This will be planned and coordinate with the financing group of the National Biogas Platform. Following that, it is expected that the investment forum will be accepted and form part of the regular National Biogas Conference format. The conferences will be fee paying and will form part of the revenue streams required to keep SABIA sustainable.

### **Component 5. Monitoring and Evaluation - please see section C.**

#### **A.5.2 Value added through incremental reasoning**

Sector analysis, review of existing barriers, meetings with various stakeholder groups and discussions with other agencies regarding organic waste to energy for agro-processing - all carried out during the project preparation phase - have shown the strong relevance of the GEF-UNIDO project, its additionality, incremental reasoning, cost effectiveness and complementarity to ongoing and planned national programmes to promote and support increased organic waste energy use in South Africa.

GEF funding is being requested to provide the incremental policy, technical and financial inputs required to support and effectively leverage national efforts in facilitating the increased uptake of biogas by SMME agro-processing industries, using their organic waste. The funds will help in the introduction of innovation, will stimulate the creation of a SMME industrial biogas market and support GHG emission reductions. GEF financing will provide the necessary catalytic support to create and sustain a market environment conducive to investments in biogas. Specifically, GEF will be used to demonstrate the technical and commercial viability of selected and high replicability innovative biogas projects by SMMEs. The demonstration effect will be significant in helping to remove barriers currently preventing SMME industries from implementing projects. GEF financing will provide technical assistance to develop technical guidelines will support further replication projects and will help establish financing windows for industrial biogas. Further, GEF financing will provide technical assistance for institutional strengthening, capacity building and awareness raising to create a supportive institutional framework. Finally, GEF support will contribute to project management and co-ordination. In so doing the project will multiply the impact and global environmental returns of resources allocated to biogas by the Government as well as by other international initiatives and programmes.

##### **A.5.2.1 Business-as-usual scenario / baseline**

Agro-processing industries rely on electricity and on fossil fuels to meet their energy requirements. The rising cost of electricity and the high cost of fossil fuels and the fluctuating and volatile oil market create a significant burden on industry and frequent power outages do limit production. The reliance on fossil fuels for heat and coal based electricity results in relatively high greenhouse gas emissions. Although there is experience with biogas, it is predominately limited to waste water and large scale industries or at the small scale/community level. There are significant limitations in terms of the capacity of the stakeholders to facilitate a SMME biogas market. Agro-processing industries are unaware

of the opportunities and many finance institutions do not have experience of industrial biogas and therefore do not understand the risks and opportunities, particularly for SMMEs, and therefore are not lending to potential projects. The Government is well aware of its resource and capability constraints and for this reason is seeking international support from both multilateral and bilateral donors.

In the absence of the proposed GEF-UNIDO project the agro-processing biogas market will develop but very slowly and concentrating on the large scale industries with little inroads into SMMEs, despite the huge potential and benefits available. The level of investment from SMMEs will remain low and further diesel and oil fuelled boilers will be installed with their associated GHG emissions and waste will continue not to be optimally managed. Waste will be dumped illegally with associated environmental impacts and limited landfills will fill up. Many industries will continue to be wholly reliant on fossil fuels and impacted by changes in world oil prices. They will be tied to rising Eskom electricity prices and frequent outages in the short to medium term. The vast majority of potential stakeholders will continue to suffer from lack of information, understanding and technical capacity of the biogas opportunities. There will be few demonstration projects showing what is technically feasible and financially viable at SMMEs. Without support limited resources will be directed at raising standards, improving connection policy and devising guidelines for use of digestate since there is a lack of resources to enable it to happen.

In conclusion, in the short-term, the baseline scenario would not be able to address the barriers to the uptake by SMMEs of organic waste to energy biogas projects and therefore there will be little change in the investment in biogas. The underlying critical problems of the lack of awareness of opportunity, lack of adequate institutional capacity and good technical expertise and skills on the market would remain unresolved. The SMME potential for organic waste to energy would not be realised; further coal-fired electricity generation and fossil fuelled heat generation would be built with consequent GHG emissions that could otherwise be avoided and waste would continue to result in environmental problems.

#### **A.5.2.2 GEF Project Alternative scenario**

**At the regulatory level** the project would provide the additional technical assistance needed to strengthen the regulations to provide the assurances required to get offtake agreements for electricity and for the use of the digestate which will facilitate investment in small to medium biogas projects. GEF financing is sought to support the review and development of the regulatory framework for access to the grid and wheeling for biogas projects as well as to assist in developing guidelines on the use of digestate as a fertilizer, to help streamline the licensing requirements and finally to help in the development of quality standards for biogas projects.

**At the biogas project implementation level** the project would provide project-specific technical assistance and financing support through Project Component 3 and 4 by facilitating the implementation of five selected highly replicable biogas demonstration projects in SMMEs sector. GEF financing is sought to provide assistance to approximately 5 pilot biogas projects in different agro-processing sectors leading to the installation of an estimated 3-4 MW (or equivalent) of projects. The GEF financing will facilitate these projects to get off the ground and will introduce international best practice by leveraging co-finance and where necessary providing technical assistance. Without the GEF support these projects would not go ahead. In addition, GEF financing is sought to provide technical assistance and/or transaction advice to a further 5-6 projects to facilitate their investment and installation within the timeframe of the project. This will result in a further 6MW (or equivalent) in installed capacity. The realisation of these projects would generate South African case studies and demonstrate success stories which will then be disseminated through the other project activities. This is expected to fuel the interest in organic waste to energy projects and reduce the associated perceived investment risk.

**At the institutional level**, through an extensive technical assistance, knowledge and capacity building programme the GEF financing will add the technical assistance needed to strengthen local expertise, knowledge and capacity in developing, implementing and maintaining effective small to medium biogas projects. GEF financing will be used to develop knowledge products, training courses and to develop new standards which would not be possible without the funding. All training will actively promote the inclusion of women with the project targeting 30% female participation.

**At the market level** the project would target all players. For agro-processing managers and engineers, the project will provide the knowledge to fully understand the economic and environmental benefits of biogas projects; and the technical capacity and tools to take such projects forward. Increased awareness across the sector of biogas project

potential and benefits delivered by the project will boost demand for biogas projects from SMMEs generating the pull for market creation. Providing assurances to financiers and demonstrating success will encourage further financing institutions to lend. Creation of the basis of an on-going sustainable training programme will enable the market to continue to develop and create technicians and engineers able to service the future growing market.

Considering the proposed structure of the GEF-UNIDO project, its implementation will provide critical contributions for the creation of a market environment that will facilitate greater investment by South African SMMEs in organic waste to energy biogas projects.

#### **A.5.3 Global environmental benefits (GEBs)**

The investments, as part of the technology demonstration (five projects), are initially estimated to result in at least 341,000 tCO<sub>2</sub>eq (direct GEBs) emission reduction over a 15 year lifecycle duration of the systems. The additional replication projects under Component 4 (scaling up) which will receive technical assistance are likely to result in emission reductions of 683,000 tCO<sub>2</sub>eq equating to a total of 1 million tCO<sub>2</sub>eq.

After the completion of this project, investments are expected to be increased due to the long term outcomes of the project activities; work undertaken under the regulatory Component will strengthen the policy and institutional framework to enhance penetration and scaling up of the use agro-processing waste for energy by SMMEs; awareness raising and capacity building activities will contribute to significant indirect CO<sub>2</sub> emissions reduction.

Considering the agro-processing industry and using outputs from the study being carried out by ARC, a conservative estimate for a replication factor of 3-5 can be used on the demonstration projects, which will result in deployment of a further biogas projects with the cumulative amount of emission reductions achieved at 4,000,000 tCO<sub>2</sub>eq over the project and post-project duration. Using the GEF top-down methodology, indirect emission reductions attributable to the project are estimated at 1,800,000 tCO<sub>2</sub>eq. The range of indirect CO<sub>2</sub> emission reductions is therefore 1,800,000 to 4,000,000 tCO<sub>2</sub>eq.

More information on how the emissions reductions were estimated is provided in Annex G.

#### **A.5.4 Innovativeness, sustainability and potential for scale-up** **Innovativeness**

Innovation has been incorporated in all components of the project but particularly in the demonstration projects. New concepts will be demonstrated in South Africa for the first time. These include the use of heated digesters to improve performance, the scrubbing and compression of biogas for use as bio-CNG in vehicles (and the conversion of the vehicles), the use of the digestate for fertiliser as a key integrated part of the project and the connection to the grid of sub 1MW plants. Each of these will show what is possible and have the potential to improve the commercial viability of the projects and so help in scale up.

In addition new regulations and recommendations will be introduced for small scale grid connection and for the use of digestate which will be new to South Africa and will help in increasing uptake of biogas.

#### **Sustainability**

The design of each project activity and selection of counterparts is premised on ensuring long-term sustainability of the change that this GEF project will catalyse. Fundamentally, there needs to be national ownership of all interventions and their mainstreaming into the operations of the national entities to ensure that institutions will be responsible for taking actions forward beyond the project implementation period. Biogas training will be incorporated into curricula of SARETEC, UNIVEN and UFH and technical colleges. The trainings will include train-the-trainers sessions ensuring that staff from these universities and technical colleges will be in a position to mainstream biogas training in their institutions and be in a position to provide similar training to more people. Training, either as part of the mainstream courses or targeted short-term training courses, will continue to be offered beyond the project implementation by these institutions on a full cost-recovery basis.

Long term ownership and sustainability is also ensured through working closely with national institutions such as the Southern African Gas Association (SAGA), South African Bureau of Standards (SABS), SABIA, ARC, DEA, DoE and National Electricity Regulator South Africa (NERSA) on the development of the quality standards, guidelines for

digestate and grid connection regulations, respectively. After completion of these project activities, the respective organizations will be responsible for the monitoring of the results of the project interventions as it is part of their mandate. In addition the knowledge products will continue to be available on the DEA, DoE and SABIA websites beyond the project implementation ensuring their continued availability.

The demonstration sub-projects are real investment projects where the owners would provide equity and secure debts/loans from the Green Fund, IDC and other banks. As such, the owners i.e. the industries, will have a vested interest that the sub-projects operate successfully for them to recover their investments and also repay the loans. As such, given the commercial interest in sustaining the operations of the projects, the different proponents will have an interest in keeping the projects running and hence sustain the global environmental benefits beyond the project lifetime. Furthermore, the providers of debt investments to these projects, The Green Fund, IDC and others will provide continuous monitoring for the projects and provide support where required. On the technical side, SABIA will now operate as a proper association and will provide technical support to more biogas projects upon request.

### Scale-up

The strategy for scale-up and replication in other sectors has been described under each of the project components. The focus of the activities presented is to develop capacities, particularly within SABIA, Government Departments, State Owned Entities, Research and Academic Institutions, and banks and other FIs, to support the scaling up of biogas investment projects. This is particularly so since these organisations they have a mandate related to investments in biogas projects in SMMEs. Financing partners i.e. Green Fund, IDC and DBSA will extend their interventions in biogas markets once they see the biogas sub-projects as technical feasible and commercially viable investments. DoE and NERSA will review and implement tailored regulations to further promote biogas investment projects. Training and academic institutes will mainstream biogas into their teaching activities and training future biogas engineers, technicians whose skills are critical for the operation of biogas projects. SABIA will engage with their members to raise awareness and ensure that they appreciate the benefits of biogas and also provide technical know-how to biogas projects in the country. The outputs to be generated by the GEF UNIDO Project will contribute to create an enabling environment that supports a national market for SMME based organic waste to energy projects. All planned outputs are consistent with and instrumental to achievements of the objectives of South Africa's key energy policies and legislation.

Therefore, the combined efforts of the four technical project components are designed in such a way to ensure the scale-up of biogas systems and related environmental benefits beyond the project lifetime.

*Capacity Building and Technology Support System (Component 1)* – The interest group that best represents the biogas industry is the Southern African Biogas Industry Association (SABIA) which was formed in 2013 through voluntarism of individuals involved in the subject matter. While it has the best intentions for the biogas industry, it lacks adequate capacity to address the plethora of the barriers and challenges faced by the industry. The contribution of biogas to the national energy mix is currently negligible and that compounds the challenges of mobilising resources towards the sector. By empowering SABIA to deliver on pertinent requirements of the industry players such as development of knowledge products into training material, improvement of the relevant skills sets available to support the industry, and removal of doubt on the feasibility and commercial viability of biogas as an energy option, more biogas projects will be successfully developed and implemented.

The creation of a group of biogas experts skilled and fully equipped in the development and implementation of integrated biogas projects is expected to play a most important role in generating and implementing new projects during and after the completion of the GEF project implementation. During the GEF project implementation period not only will stakeholders be trained directly but trainers will be trained to ensure that the training continues beyond the timeframe of the project. Training will continue to be offered beyond the project as a result of increased demand, kicking-off the development of provider start-ups and the growth of a national biogas market.

*Biogas Market Development and Regulatory Framework (Component 2)* – While there is no doubt of the existence of a market for biogas based energy, there are currently perceived insurmountable barriers to accessing the market. The project will complete the development of two biogas quality standards that will form the foundation for the professional practice of biogas production and handling. The two standards will cover small (<500MJ/hr or 139kW) as well as larger (>500MJ) biogas units thereby allowing for an entry and growth path with requisite regulatory

framework. Currently the value of digestate/effluent is not included in the assessment of value obtainable from the AD process. With the characterisation of the digestate/effluent for possibility of use as organic fertiliser and the determination of its equivalency to the traditional NPK inorganic fertiliser application rates, the true value of digestate/effluent will finally be integrated into the assessment of the AD process. The new findings will influence the regulations around disposal of digestate/effluent with specific reference to waste classification as general or hazardous waste. Regulations will also be revised relating to connecting to the grid for small scaler biogas project and the biogas licensing procedure will be streamlined. The availability of clearer support and transparency for biogas project development, use of digestate and connecting to the grid will provide assurances to project developers and financiers and therefore provide conducive market conditions for progressive and sustained scaling-up of integrated biogas, and consequent global environmental benefits. The support from the Government of South Africa for these provides strong foundations for institutional continuity, sustainability and further development of the GEF UNIDO project outputs as well as achievement of expected project's outcomes.

*Technology Demonstration (Component 3)* Demonstrating the technical feasibility and commercial viability of integrated biogas projects provides national examples that can be replicated across the country. The pilots have been selected on a number of criteria including their GHG emission reductions and their replicability. The main constraint to investment in the waste to energy technologies is the lack of demonstrated technical feasibility and commercial viability of projects that are actually in operation within the South African context. Theoretically there are several feasible and possibly commercially viable projects, but there is a *fear of taking the first step* syndrome that is stagnating the industry. The five demonstration projects will address all the uncertainties of prospective investors and a 7.9-10% grant from the UNIDO-GEF Project encourages the projects to be implemented. Not only will the demonstration projects show what is possible and the examples be disseminated widely in the country, but the implementation and operation of these projects will build up the technical capacity within the project developer institutions to help in the replication of these projects. The projects will give confidence to all parties involved in biogas projects, i.e., from developer, owner to financier. In addition, some of the myths on which irrational regulations are founded will be disproved and the regulations amended and licensing harmonised. The actual financial performance of the various project business models will also be tested using real performance data over the four-year period of the Project. The five case studies will open opportunities for future investors in the improved designs from lessons learned during the implementation of the project.

*Scaling up (Component 4)* – The UNIDO-GEF Project has deliberately tried to eliminate the possibility of failing to translate the lessons learned during the Project into implementation by including the scaling up phase. Besides at least four additional projects to be fully developed during the Project to yield at least an additional 6MW equivalent, there will be another 25 projects screened at pre-feasibility stage and introduced to financiers for further development and finance. Importantly financing facilities will be identified which will ensure that finance is available for further future biogas projects. The investment strategy will facilitate the further replication through both the identification of projects around the county and of potential finance. The continuation of the Green Fund is a major boost to the scaling up. As part of the project preparatory phase, the project identified several equity funds that could be blended with the Green Fund to fund biogas projects. However, the renewable energy sector in South Africa is fast changing, therefore, once this project is operational, efforts will be made to assess equity funds that would be existing then and then link them to the Green Fund so as to support a broader scaling up on investments in biogas projects by SMMEs.

**A.6 Risks including climate change, potential social and environmental risks that might prevent the project objectives from being achieved and measures that address these risks:**

The results of risk assessment carried out during the PPG identified the following major project risks and risk mitigation measures:

<b>Risk Factors</b>	<b>Description of risk</b>	<b>Risk Level</b>	<b>Mitigation measures</b>
Political risk	Lack of government commitment to support the project	L	The project objectives and activities are in line with national policies and objectives. DEA and DoE have taken steps to promote the valorization of waste. The project will actively involve representatives from DEA, DAFF, DoE and the dti to ensure their full support throughout the project and beyond.



<b>Risk Factors</b>	<b>Description of risk</b>	<b>Risk Level</b>	<b>Mitigation measures</b>
Implementation risk	Lack of interest from SMMEs to take up WtE projects	M	Development of detailed activity plans in close cooperation with in-country project partners, stakeholders and developers. A thorough stakeholder consultation process conducted during the project preparation phase identified industries willing to invest in WtE
	Lack of interest from project developers / technology providers	L	Technology developers expressed their interest in the project during the PPG and assisted in the identification of potential demonstration projects. Throughout the project, there will be regular and continued contact with project developers which should lead to their continued interest and participation.
	Unsuccessful demonstration at selected sites due to, inter alia: Lack of capacity to operate and maintain biogas SMMEs go bankrupt Fluctuation in waste availability and prices	L	Suitable sites have been selected through careful analysis of target sectors and plants to ensure success of demonstration projects including: - Selection of proven technologies - Assessment of waste streams - Clear financial commitment from the developers - Training to the operation personnel in the industry
	Lack of management and coordination capacity	L	Strengthening and expansion of management and coordination capability through activities undertaken in Component 1. PMU at the National level set up and monitored under a defined M&E plan Clear indicators for tracking outcomes and outputs with a focus on implementation milestones (targets), baseline values and project results and impacts
Technical risks	WtE technologies do not succeed; the technology may not perform as described mainly due a lack of skills to operate the technologies.	L	There is limited technical risk since technologies are widely used in many other countries. Detailed assessment of suitable sites for technologies will be carried out and training of operating personal will be provided, including from technology importers, when necessary.
Project Sustainability	Lack of collaboration by key agencies	L	A task team has been established between the key government departments. These same members will be members of the Steering Committee which will oversee project implementation. Members include representatives of DEA, DoE, <b>the dti</b> , DST, EDD, DSBD and DAFF.
	Failure to achieve project outcomes and objectives after successful delivery of outputs.	L	By making market players fully aware of the economic potential of biogas technologies and by equipping them with the capacity and tools to realize and reap the benefits of such potential, the project aims to generate a self-reinforcing market. In addition, the financial mechanisms that will be put in place will create a positive context that is expected to ensure the attainment of the project outcomes and their sustainability.
	Lack of technical capacity	L	Strengthening and expansion of technical capability through training built into existing training institutes in Component 1. Training activities will be closely monitored and supported under the M&E plan. Close collaboration with experts and specialized institutions for training and support will be established and coordinated.
	Failure to scale-up the project activities	L	To ensure that financial services providers will take up biogas investments after this project, the project will seek their active engagement in the demonstration projects so as to build their confidence and eliminate any uncertainties that financiers currently have. The project will promote linkages between existing public financing initiatives like the Green Fund and commercial financiers to promote risk sharing and evidence on which future investment decisions can be made.
Financial Risks	Industries' lack of resources to repay loans	L	Stringent selection of borrowers through assessment and due diligence of each borrower's historic and future financial management capacity.
	Lack of co-finance	L	Demonstration projects only selected on evidence of co-finance for the project

<b>Risk Factors</b>	<b>Description of risk</b>	<b>Risk Level</b>	<b>Mitigation measures</b>
	Lack of interest among banks and other FIs for large scale uptake.	M	Banking sector was closely involved during the PPG phase and has shown their support of the project and technologies. Letters of commitment to invest have been provided by three banks. Dissemination of the results will be organized to raise awareness among banking sector and other financial institutions.
Market risks	Low international oil and gas prices could make investments in biogas project unattractive	L	The principal focus of the project is “integrated biogas systems” where the focus and justification of investing in biogas systems is not only based on the economic benefits of offsetting the cost and unreliability of grid based power, but equally consider the additional benefits that include reduced disposal costs and environmental damage caused by the waste, the creation of local and green jobs through the use of the digestate as fertilizer. In addition, the use of this digestate as fertilizer has additional environmental benefits as it offsets the energy used to produce the chemical fertilizers. By systematically promoting this integrated approach, the project reduces the risk of investments in biogas being viewed only from the energy perspective that could be affected by low oil and gas prices. In addition, South African electricity is mainly based on domestic coal fired generation and that, along with current shortages, means any offset electricity is not going to reduce the price electricity in the short and medium term. In fact recent trends (despite low fossil fuel prices in international markets) shows increasing electricity tariffs by ESKOM as the utility moves towards charging cost-reflective tariffs. This trend is foreseen to continue in foreseeable future. Local heat generation is also coal dominated. Therefore, although there is a high risk that international oil and gas prices will remain low, it is unlikely to have a significant impact on the economics of South Africa biogas projects in the short to medium scale.
Environmental and social risk	Failure to mitigate environmental risks such as the disposal of waste water from biogas systems into water bodies. Gas leakage in biogas systems. Misuse of fertilizer due to lack of information. Failure to ensure social safeguards	M	Carry out Environmental Impact Assessments (where applicable) as part of preparation of the technology interventions, including sanitary management of organic and liquid waste, ways to address potential odour problems caused by the biochemical process to convert waste to energy, etc. Integrated solutions will be proposed to ensure that the liquid waste from biogas systems is used for agricultural purposes as a fertilizer. Risks associated with biogas leakage will be addressed right through from the project design to its operation and maintenance. The project will promote systems that operate at fixed flow rates to reduce the risk of biogas leakages and provide operation and maintenance manuals that encourage frequent gas leakage spot checks. In addition, the projects will focus on biogas systems that have on-site facilities to measure the quality of the fertilizers produced from the digestate to inform users appropriately and minimize high content of heavy metals, pathogens, antibiotics, high content of nitrogen, etc. Annual environment and social safeguards M&E reports will be provided for each project, which will be followed up with necessary actions and interventions.
Climate change risk	The technology or renewable resource is affected by climate change, for example water availability could result in variations in waste sources and quality.	L	Changing patterns in temperature and rainfall may affect the availability and quality of the waste feedstock. In turn this could impact the biodigestion and energy production. The majority of projects will use livestock waste feedstock with minimum water requirements and some will use industry waste which will be impacted less. In addition many of the projects aim to apply co-digestion meaning the risk is deemed low. The project will focus on well-established industries that have the resources to mitigate shortages of feedstock due to climate variability. The biogas technology itself is little impacted by climate change.
Social and Gender Risk	Risk of resistance against, or lack of interest in, the project activities from	L	This Project will pursue thorough and gender responsive communication and will ensure stakeholders’ involvement at all levels, with special attention to involving women and men, as well as, CSOs and NGOs promoting GEEW, and a gender expert. This shall mitigate social and gender related risks, promote gender

Risk Factors	Description of risk	Risk Level	Mitigation measures
	stakeholders, especially with regard to the active promotion of gender equality. Low participation rates of suitable female candidates due to lack of interest, inadequate project activity or missing qualified female population within engineering sector.		equality, and maximize the potential contribution of the project to improving gender equality in the energy field.

### A.7. Coordination with other relevant GEF financed initiatives

The GEF Project will seek to realize mutual impact, enable synergies and avoid duplication. Therefore UNIDO has already, and will continue to coordinate its efforts with initiatives undertaken by a range of non-governmental initiatives, including sector-specific organizations, FIs and other GEF projects. The following GEF projects are considered below for direct coordination:

The “**Equity Fund for the Small Projects Independent Power Producer Procurement Programme**” (GEF ID 9085), which is currently under development, will provide funding for 20 small scale (1-5MW) renewable energy projects. In their initial design it is intended that two of these projects will be biogas. There will be direct coordination with this project, in particular in helping to identify potential projects under Component 4 where a pipeline of projects is proposed. Further co-ordination is likely through consultation with DBSA to gain insights when developing the biogas investment strategy under Component 4.

The GEF Project will also seek to integrate aspects of the GEF/UNIDO “**Industrial Energy Efficiency Improvement in South Africa through Mainstreaming the Introduction of Energy Management Systems (EnMS) and Energy Systems Optimization**” (GEF ID: 5379) project which aims to accelerate and expand the introduction of EnMS, Industrial Energy Systems Optimization (ESO), and the Energy Management Standard ISO 50001 within the South African industry. As EnMS and the SANS/ISO50001 standard require continual improvement, ultimately enterprises must consider the application of renewable energy solutions with this being explicitly stated in the standard. Therefore, it is possible that, since the project also focuses on agro-processing as one of its sectors, there are opportunities to develop joint industry-biogas pilot installations through the GEF projects demonstration activities under Component 4.

The GEF Project will further seek to exchange relevant aspects of capacity building and project development, with the existing GEF/UNIDO ‘**CleanTech Programme for SMEs in South Africa**’ GEF ID : 5515 (CTSA) (as well as any additional follow up phases of this project that be subsequently funded by the GEF). Specifically, one of the main focus areas of the CTSA is to enhance the entrepreneurial skill base in the SME sector regarding low-carbon technologies through professional mentoring. Where possible, this inter-project cooperation will aim to build the skills base of female participants as well as to provide female role models and mentors.

In addition the GEF funded project on ‘**Renewable Energy Market Transformation**’ (REMT)(GEF ID 1894) built significant capacity in terms of supporting project identification and development i.e. feasibility studies through a pool of specialist. This pool will also be approached to be part of the framework of consultants for work in Components 3 and 4. In addition, the capacity development component of this project will build on the activities of the REMT project. Under Component 4, it is foreseen that the experience of funding some of the projects under the REMT will be useful in supporting investment projects under this project.

At a regional level and through the SACREEE coordination mechanism, it is envisaged that this project will be coordinated with GEF Project ID 5628 “**Promoting the production and utilization of bio-methane from agro-waste in South-Eastern Botswana**”, especially on standards and capacity building.

Within UNIDO, the project will closely link with programmes and projects on agri-business development, investment and trade promotion, and youth employment departments to build on their already ongoing activities in South Africa. In particular the project will complement UNIDO’s “**Promoting market-based deployment of clean energy technologies and services in municipality waterworks in South Africa**” which aims to catalyze market-based approaches to reducing GHG emissions in municipal waterworks in developing countries and emerging economies of Sub-Sahara Africa. In particular this project is looking at increased energy efficiency and renewable energy production in municipal waterworks for three selected municipalities in South Africa (small and medium cities with about 100,000 inhabitants). The project will combine carefully selected demonstration projects with capacity building, knowledge management and policy recommendations, that seen together, will support market-based scaling up and replication of the use of renewable energy and energy efficient technologies and services in municipal waterworks in South Africa and ultimately the SADC region as a whole. There will be complementarity in the development of knowledge management in particular but the demonstration projects from the two projects will be in different sectors; waste water treatment and biogas and agro-processing.

In addition to GEF financed initiatives it is important to note that GIZ has a renewable energy programme in South Africa which includes support for biogas. During the PPG the project development team worked with GIZ to ensure that there is no duplication and that synergies are developed from the joint effort. Annex T4 provides an overview of the GIZ activities and how this project interacts or builds upon it.

## **B. ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE:**

### **B.1 Describe how the stakeholders will be engaged in project implementation**

To achieve the objectives of this project a large number of stakeholders from Government, Industry, Research institutions and Financial Institutions need to be engaged in the project. Primary target beneficiaries of the project are energy and environmental policy-making and implementing institutions, primarily DEA and DoE, industrial unit owners (end beneficiaries), designers, installers, training institutions, energy professionals, service providers and the financial sector. Importantly, to create a biogas market, the national industrial associations will be stakeholders in helping industries opt to invest in projects during and post project. The outcomes of the planned project activities and potential recommendations for bridging the gaps have been discussed with all the potential stakeholders during the PPG stage. A list and summary of their intended roles is provided in the following table.

**Table 6: Stakeholder engagement in project**

<b>Stakeholder</b>	<b>Role in Project</b>
Department for Environmental Affairs (DEA)	DEA as the executing partner for the project is the main Government counterpart for UNIDO and will help staff the PMU. DEA will chair the Project Steering Committee (PSC). Specifically on project activities. DEA will be involved in the streamlining of licensing of biogas projects, in the development of guidelines for the use of digestate and will have a role in oversight of the demonstration projects.
Department of Energy (DoE)	DoE will sit on the PSC and will work with consultants on reviewing and developing a regulatory framework for sale and wheeling of electricity for small scale projects. DoE will also be involved in the investment strategy to be developed in Component 4 and in the development of biogas standards. Under DoE, SANEDI (South African National Energy Development Institute) is responsible for many projects promoting renewable energy and energy efficiency. SANEDI will be involved in the project through the technician and household biogas training.
Department of Trade and Industry ( <b>the dti</b> )	The <b>dti</b> , with its mandate to promote industrial development, increased investment and employment creation, is a key stakeholder. The <b>dti</b> will sit on the PSC and partake in the identification of projects

	<p>for the scale-up phase.</p> <p>The National Cleaner Production Centre (NCPC) is hosted by Council of Science and Industrial Research (CSIR) on behalf of <b>the dti</b>. The Manufacturing Competiveness Enhancement Programme (MCEP) is also under <b>the dti</b>. Staff from both these programmes will have their capacity built through training interventions to enable them to assess biogas projects for feasibility and to broaden their current knowledge base. SABS, the National Standards Body of South Africa, is the lead agency concerning standardization, certification and quality, was established by the dit. The project will consult with SABS regarding initiating/providing inputs in the process of formulation appropriate SABS biogas standards</p>
Department for Small Business Development (DBSD)	<p>DBSD has the responsibility for SMMEs and therefore is a key stakeholder within the project. DBSD will sit on the PSC and will be involved in the demonstration projects and in particular in the scaling up, helping to identify participants in the value chain – in line with one of its key objectives - to facilitate a process where SMMEs and co-operatives participate in the private sector value chains through enterprise and supplier development programmes. The department will utilize available policy instruments such as the Broad-Based Black Economic Empowerment policy and its revised Codes of Good Practice to facilitate the development of new enterprises and procuring of goods and services from SMMEs and co-operatives. The department aims to build the capacity and capability of SMMEs and co-operatives to run competitive, highly innovative and successful enterprises. This will be realized through capacity building, training and incubation in partnership with other relevant stakeholders</p>
Economic Development Department (EDD)	<p>EDD helps to coordinate government departments particularly linking the Project to existing government programmes. EDD will act as a ‘trouble-shooter’ for blocks to demonstration project development. EDD is also responsible for IDC who are likely to be the major financier of scaling up projects.</p>
Department of Science and Technology (DST)	<p>DST is responsible for research and development through the CSIR and National Research Foundation (NRF) both of which will be involved in the Project in specific capacities. DST currently supports the Fort Hare biogas project which is one of the selected demonstration projects.</p>
DAFF	<p>As well as sitting on the PSC, DAFF will be involved in the development of guidelines and regulations on the use of digestate as fertilizer. The Agricultural Research Council (ARC) under DAFF will be very involved in the project in particular in the characterization of agro-processing waste streams and in the characterization of the digestate. ARC has been involved during the PPG providing advice and in assessing the potential for biogas projects from organic waste in South Africa.</p>
SABIA	<p>SABIA is the most relevant biogas industry representative that will be capacitated to further support the growth of the biogas industry through development of biogas industry standards, introducing these standards and guidelines to members/stakeholders and acting as an extension agent for biogas operators. SABIA will have a key role in the development of knowledge products and their dissemination.</p>
Universities and Technical Colleges	<p>Four universities will be directly involved in the project (CPUT, UNIVEN, UFH and UFS) in terms of provision of training and developing the database of waste characterization. Further universities and technical colleges will be involved as satellites of CPUT’s courses and UNIVEN’s courses.</p>
Industrial associations	<p>These associations (SAPPO, SAPA, RMAA, etc.) have members from local agro-processing industries and would be included as project stakeholders for awareness workshops as well as for identification of sites interested in installation of biogas. All those associations consulted during the PPG expressed interest to be involved and to share information with their members.</p>
Financial institutions	<p>Financial institutions will be key in investing in the demonstration projects and scale-up projects. In particular IDC, ABSA, Nedbank, SEFA and DBSA have expressed their interest to enter this sector.</p>

Target agro-processing industry	During the PPG Phase, 5 pre-feasibility reports were prepared. Project developers and industry owners will be an integral part of the project as the key beneficiaries and have already formally expressed their wish to cooperate in this area. In addition to hosting demonstration projects and scale-up projects they will be involved in stakeholder consultation, in training and awareness activities.
Ethnic groups and organizations/ associations promoting ethnic people's rights	Through training project activities and the demonstration projects the project will engage with numerous local stakeholders some, which may include ethnic groups or organizations/ associations promoting ethnic rights. The GEF project will seek the full and effective participation of ethnic groups in all relevant project activities and will be guided by the Government of South Africa's policies relating to ethnic groups engagement.
GIZ	GIZ implements the South African – German Energy Programme (SAGEN) which includes energy efficiency and renewable energy. Under the Renewable Energy component there is a specific support programme for biogas projects. This includes activities relating to the following outcomes: Biogas resource assessment; Improving the national framework conditions for biogas; and Enhancing project development for biogas investment project. The PMU will liaise with GIZ throughout the project to ensure there is no duplication of effort and there is maximum impact.
Organizations/ associations promoting gender equality and advocating women's empowerment	<p>Relevant Civil Society Organizations (CSOs) and NGOs, including those focusing on gender equality issues and advocating women's empowerment, such as women's associations, will be invited to participate in stakeholder consultations, as well as during the implementation phase of the project.</p> <p>Regular consultations with both female and male stakeholders and local beneficiaries will ensure that the project's impact on and appropriation by the local communities can be assessed throughout project implementation.</p> <p>Equal participation of women will be encouraged as experts, conveners and consultants for training and capacity building activities, as well as in expert panels. Project stakeholders will be encouraged to nominate female employees to participate in the project.</p> <p>Efforts will also be made to include gender focal points from relevant ministries and other stakeholders where possible.</p>

## Project Management and Implementation Set-up

Figure 4 shows a diagram of the planned project implementation and execution arrangement

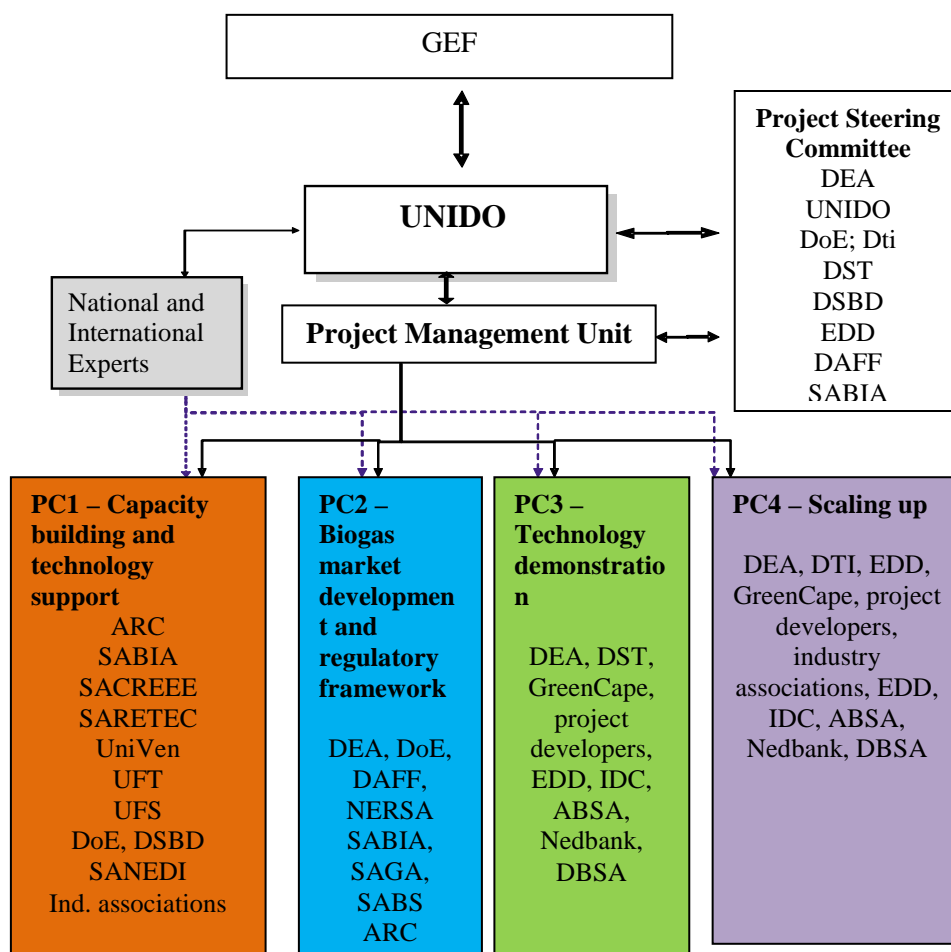


Figure 4: Diagram of planned project implementation structure

- **UNIDO:** as the GEF Implementing Agency holds the ultimate responsibility for the implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes; UNIDO will be responsible for monitoring of the project, and reporting on the project performance to the GEF. UNIDO field office in South Africa will provide day-to-day supervision of the project management Unit and provide linkages between the project and national departments and officials.
- **DEA:** acts as the local executing partner; a focal point to the project on behalf of DEA will be appointed; DEA will ensure that the activities on biogas are properly coordinated with the other activities which are on-going. DEA is responsible for the Green Fund which could fund biogas projects and could dedicate a window to biogas.
- **DoE:** acts as a co-implementation partner as part of the project is linked to their mandate. DoE will also ensure that the project activities are linked to other ongoing initiatives in the energy sector.
- **Project Management Unit (PMU):** will be responsible for the day-to-day planning and execution of project activities as in the agreed project work plan. The PMU will be headed by the National Project Manager (NPM), and

a project assistant. The PMU will be based at UNIDO's offices. Consultants will be drafted into the PMU when required. The PMU will coordinate all project activities and will report to UNIDO and DEA. The NPM will be recruited directly by UNIDO.

- *Project Steering Committee*: will be established for periodically reviewing and monitoring project implementation progress, provide strategic advice, facilitate co-ordination between project partners, provide transparency and guidance, and ensure ownership and sustainability of the project results, and is expected to be chaired by DEA and as a minimum will include representation from Government partners (DEA, DoE, DAFF, **the dti**, DBSD, DST and EDD) and SABIA

*Terms of Reference of the Project Steering Committee:(project execution)* will be established for supervising and guiding the project implementation, with the participation of DEA, DoE, DAFF, the dti, DBSD, EDD in-line with the existing Task Team plus SABIA. The Terms of Reference and final composition of the Steering Committee will be defined during the project implementation start-up phase. The responsibilities of the PSC are envisaged to consist of:

- Providing the necessary political support to the project implementation;
- Commenting on project work plans, progress reports and M&E reports;
- Mobilizing cost-sharing and follow-up financing;
- Assuring coordination between this project and other ongoing government activities and programmes;
- Assuring all stakeholders are appropriately involved in the project planning, execution and management;
- Facilitating linkages with high-level decision-making.

At the beginning of project implementation a detailed work plan for the first year of implementation will be developed by the PMU in collaboration with UNIDO and DEA, based on the overall work plan for the entire duration of the project. The yearly work plan will clearly define roles and responsibilities for the execution of project activities, including monitoring and evaluation; it will set milestones for deliverables and outputs. The overall and yearly work plans will be used as management and monitoring tool by PMU and UNIDO and the overall work plan will be reviewed and updated as appropriate on a biannual basis.

The mentioned stakeholders per component are indicative. The respective tasks to be carried out by organizations and experts will be made part of contractual arrangements with UNIDO and in line with UNIDO's rules and regulations. Any changes to the work program/project with the approved GEF CEO endorsement request will comply with GEF document C 39.Info 04.

## **B.2 Describe the socioeconomic benefits to be delivered by the Project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund/NPIF) or adaptation benefits (LDCF/SCCF):**

### **Gender mainstreaming at UNIDO**

UNIDO recognizes that gender equality and the empowerment of women have a significant positive impact on sustaining economic growth and inclusive industrial development, which are key drivers of poverty alleviation and social progress. In addition to the UNIDO Policy on Gender Equality and the Empowerment of Women (2015), which provides overall guidelines for establishing a gender mainstreaming strategy, UNIDO has also developed an operational energy-gender guide<sup>37</sup> to support gender mainstreaming of its sustainable energy initiatives and integrated a robust gender review as part of the project appraisal process both at technical and organizational level, as well as, established a Gender Team to support gender related efforts.

All *energy* interventions, including interventions related to *waste* management, are expected to have an impact on people and are, therefore, not gender-neutral. In fact, due to diverging needs and rights regarding energy and water consumption and generation, women and men are expected to be affected differently by the project (in terms of their rights, needs, roles, opportunities, etc.).

<sup>37</sup> UNIDO 2014: Guide on Gender Mainstreaming Energy and Climate Change Projects, [http://www.unido.org/fileadmin/user\\_media\\_upgrade/What\\_we\\_do/Topics/Women\\_and\\_Youth/Guide\\_on\\_Gender\\_Mainstreaming\\_ECC.pdf](http://www.unido.org/fileadmin/user_media_upgrade/What_we_do/Topics/Women_and_Youth/Guide_on_Gender_Mainstreaming_ECC.pdf)  
GEF5 CEO Endorsement Template-February 2013.doc



To ensure that men and women equally benefit from development projects and that gender inequalities in activities and outcomes are reduced or eliminated, gender dimensions need to be considered during the entire project cycle – from design and implementation to monitoring and evaluation. By systematically mainstreaming gender into its interventions, UNIDO’s Energy Branch (ENE) aims to ensure equal opportunities for both women and men, thus furthering UNIDO’s inclusive and sustainable industrial development agenda and contributing to the achievement of the Millennium Development Goals (MDGs), and the Post-2015 development framework, as well as the Sustainable Energy for All (SE4ALL) objectives.

### Gender dimensions of the project in South Africa

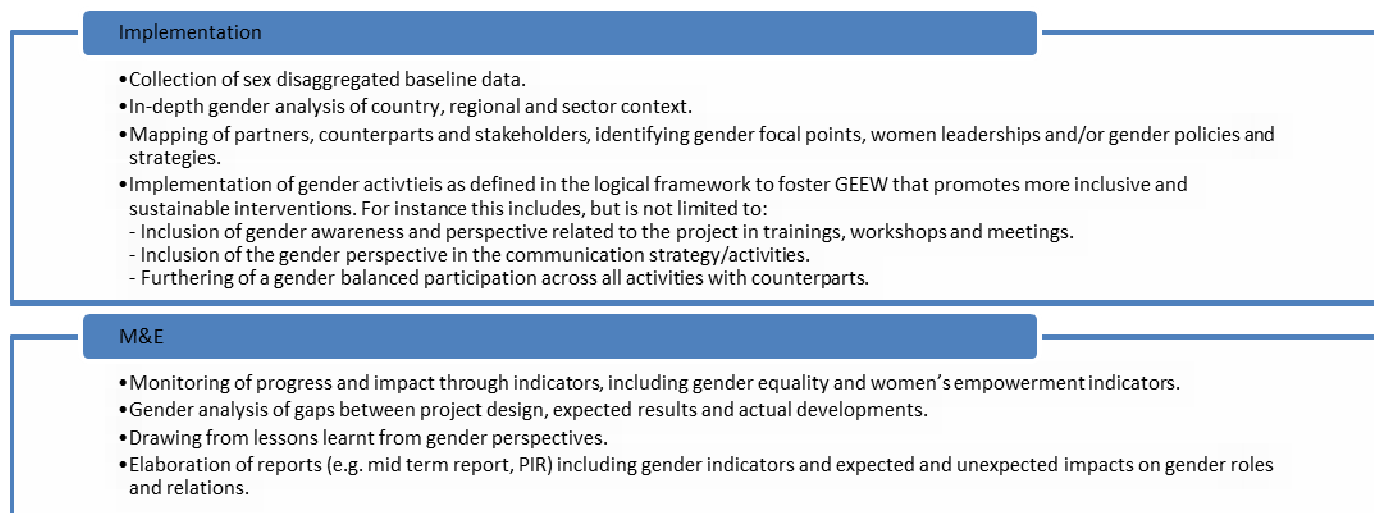
In South Africa, the Government is obliged, by both international and national legislative and policy frameworks, to integrate gender issues and engage women in all policies and processes, including renewable energy and waste matters. South Africa also requires skilled professionals in the field to create sustainable economic and social infrastructure. As such the increased participation and representation of women in the sector is considered as highly advantageous. Although women’s involvement at the energy and waste policy level is good, to date women’s involvement in the biogas industry and its implementation has been marginal, both at the institutional and enterprise level.

It is important, therefore, to advance women’s participation in, and influence on, the biogas market. There is need to build women’s knowledge and capacity on the subject, while ensuring support and mentorship structures to sustain women in the sector are put in place. It also calls for efforts aimed to remove the obstacles preventing the promotion of gender equality and women’s empowerment in the field. Finally, it is necessary to showcase and promote women as agents of change and to build the institutional capacity for gender sensitive governance and policy development and implementation.

### Gender Mainstreaming of the project

Therefore, this project aims to demonstrate good practices in mainstreaming gender aspects into this project dealing with *organic waste-to-energy energy* and *other low carbon technologies*, wherever possible, and avoid negative impacts on women or men due to their gender, ethnicity, social status or age. Consequently, it will be considered to include gender dimensions during the whole project cycle. Figure 1: Gender mainstreaming the project cycle below provides an overview of key issues that will be further considered during the gender mainstreaming of the next steps in the project cycle. Depending on the type of intervention and scope of activities, the degree of relevance of gender dimensions may vary.

**Figure 5: Key issues of gender mainstreaming the project cycle**



During the project preparatory phase, a preliminary gender analysis of the country context and the project has been conducted, based on which potential gender dimensions of project outcomes and outputs, as well as potential entry points for gender equality and women's empowerment (GEEW) were identified. Some gender-disaggregated indicators and targets have already been included while additional key gender dimensions of the project outcomes and outputs as well as potential gender-relevant indicators are provided in the logical framework. These identified gender dimensions will be verified during a detailed gender analysis during project inception as part of the capacity assessments of the project and used as a guide during the inception and implementation of the project as well as during M&E.

Guiding principle of the project will be to ensure that both women and men are provided equal opportunities to access, participate in, and benefit from the project, without compromising the technical quality of the project results.

In practical terms,

- **Gender-sensitive recruitment** will be practiced at all levels where possible, especially in selection of project staff, experts and consultants. Gender responsive TORs will be used to mainstream gender in the activities of consultants and experts. In cases where the project does not have direct influence, gender-sensitive recruitment will be encouraged. Furthermore, whenever possible existing staff will be trained and their awareness raised regarding gender issues.
- All **decision-making processes** will consider gender dimensions and consult, wherever feasible, representatives of CSOs and NGOs promoting gender equality and empowerment of women (providing them with equal voice). Regular consultations with stakeholders and local beneficiaries will ensure that the project's impact on and appropriation by the local communities can be assessed throughout project implementation. At project management level, Project Steering Committee will make efforts to be gender balanced and/ or during meetings will invite observers to ensure that gender dimensions are taken into consideration. Also at the level of project activity implementation, effort will be made to consult with stakeholders focusing on gender equality and women's empowerment issues. This is especially relevant in policy review and formulation.
- To the extent possible, efforts will be made to promote **equal participation of women in training activities**, both at managerial and technical levels, as participants and trainers. This can include advertising of the events to women's technical associations, encouraging companies to send female employees, provide childcare and safe transport, offer scholarships or reduced fees for women, adjusting TOR for selection of the trainers, etc. As such the GEF Project has potential to contribute to reversing gender inequalities and the project's partners and stakeholders have supported the integration of realistic and achievable gender equality and women's empowerment related targets within the project's components, with clear and measurable key performance indicators being set. In line with this, efforts will be made to make the training programmes available to equally qualified female candidates and will set a minimum target for the training (30%). To increase the share of female participants for example, adequate day times for women participation and locations which are easily accessible will be chosen.
- When **data-collection** or **assessments** are conducted as part of project implementation, gender dimensions will be considered particularly with reference to the impact of low carbon technologies on the livelihood of communities. This can include sex-disaggregated data collection, performing gender analysis as part of ESIA's, etc.
- Similarly, **participating female-led SMMEs** (waste industry, energy industry, fertilizer industry) or **female entrepreneurs/business women** will be selected on priority basis (until gender balance has been reached).
- Finally, efforts will also be made to include **gender focal points** from relevant ministries and/ or women's associations advocating GEEW, where possible.
- All **communication and outreach material**, as well as training material will be gender mainstreamed also communicating on gender equality and women's roles in the energy sector.
- **Cooperation with women's associations, women's advocacy and professional groups**, such as the Women, Energy and Climate Change Forum and the South African Women in Energy Network (SAWEIN), will be thought for example to assure actively promotion of trainings and gender mainstreaming of outreach and training material highlighting positive female roles and the agent of change role that women can play. In any awareness and communication the GEF project will adapt its functions to actively include gender equality considerations to ensure that the maximum level of female participation in the project's different training courses is achieved and that the project contributes to national efforts to promote gender equality in the industrial, waste, agricultural and engineering sectors.

- At the beginning of the project, a *gender expert* will be hired to conduct a thorough gender analysis of the project so as to verify the preliminary gender analysis, review the adequateness of the gender mainstreaming proposed in the project. The expert will also develop a plan on how to monitor the gender-specific dimensions of the project and provide guidance to maximize the impact. As part of their role the Gender Mainstreaming design process will be validated and completed under an additional UNIDO Gender Mainstreaming exercise within the Inception Phase process, when an action plan will be developed allocating the required resources and responsibilities to reach the defined gender outputs and targets.

### Socio-economic benefits

The project will catalyse social and economic benefits at the local and national level by increasing employment opportunities, helping to develop the local economy and strengthening local capacity by increasing technical knowledge and capabilities. The biogas projects will replace fossil fuels and electricity based on fossil fuels and as such will hedge the risks against increasing prices.

The results from the PPG phase suggest promising cost effectiveness especially if the benefits of latest innovation are introduced (e.g. through diversified marketable end-products at the downstream level). While these figures will need to be verified on a case-by-case basis, it is clear that the introduction of innovative and cost-effective technologies will save energy costs, strengthen the competitiveness of the individual enterprises and put the local economy on the path to low-carbon and sustainable industrial development. These projects will generate new ventures for entrepreneurs in consulting, designing, project implementation, manufacturing, operation and maintenance; hence will improve the social status through creating employment opportunities.

In addition the Project is expected to produce a number of other environmental benefits besides the reduction of GHG emissions: non-point source pollution abatement, water and air pollution reductions and public health improvement.

**Non-point source pollution:** In recent years, non-point source loadings, particularly wastes from livestock and food processing operations, have grown to become a major source of water pollution for South Africa's water environment. By targeting these SMME operations, the Project will greatly reduce pollution and improve the quality of the water environment. Additionally anaerobic digestion is estimated to reduce chemical oxygen demand by 87% to 90% and biochemical oxygen demand by 88%.

**Air pollution:** Studies have shown that livestock feeding operations are a source of air pollutants, including NH<sub>3</sub>, H<sub>2</sub>S, particulate matter PM<sub>10</sub> and PM<sub>2.5</sub>, odour and volatile organic compounds (VOCs). These contaminants cause respiratory, cardiovascular and immune illnesses, and spread infectious diseases. The biogas plants will significantly reduce the generation of these air pollutants, thus reducing the risk to public health. Meanwhile the biogas and electricity produced under the Project will replace the use of coal or other fossil fuels which is a major source of air pollution in South Africa. The health benefits of the emission reductions are difficult to quantify as they depend on population density and distribution and a variety of other factors, but the health and social economic benefits are believed to be significant.

**Public health:** In addition to the public health benefits derived from the reduced water and air pollution, the anaerobic digestion process is known to reduce disease-causing pathogens and viruses by 90.6% to 99.9%, the removal rate by anaerobic digestion for coliforms by up to 99.9% and ascarid eggs by up to 93.3%. The anaerobic digestion technology will greatly reduce the risk of water-borne and infectious diseases for animals and local residents. If an additional hygiene process step is operated, as required in South Africa, i.e. pasteurisation, all pathogens will be removed.

**Eco-farming expansion:** The digestate generated from the biogas plants contains nitrogen, phosphorus, potassium and humus, which has been proven to be a valuable replacement of chemical fertilizers to provide nutrients to crops and improve soil fertility and contributes by carbon sequestration to GHG emission mitigation (CH<sub>4</sub> and N<sub>2</sub>O emission reduced and carbon stored in the soil). On-farm management will further reduce emissions, in particular GHG from manure and fertilizer handling. The use of organic fertilizer rather than chemical fertilizers can also reduce the amount of nitrogen, phosphorus and potassium entering water courses.

### B.3. Explain how cost-effectiveness is reflected in the project design:

The project takes a comprehensive approach to address many of the barriers that are preventing biogas being taken

up by SMMEs, in particular those related to awareness and capacity as well as a supportive regulatory framework. The strategy for the project to achieve good cost-effectiveness is based on a number of principles: 1) build on and maximize leverage of national public and private resources; 2) training-the-trainers approach for industry-wide awareness raising of and capacity building in renewable energy; 3) select demonstration projects primarily on the basis of their replication potential (and therefore direct and indirect avoided GHG emissions); and 4) searching and maximizing synergies with institutions for investment.

Given its focus on addressing policy and technical capacity barriers, this project will generate the biggest share of GHG emission savings after the project implementation period, when the new guidelines would be in place, capacity built and the training programmes established that will deploy their full impact in terms of new biogas projects. This project will result in:

- Direct emission reductions of 341,000 tonnes of CO<sub>2</sub>eq through its demonstration activities and 680,000 tonnes CO<sub>2</sub>eq through scale up projects.
- Target investment levels of 4 million USD by the end of the project in 2019 (leveraging at least 24 million USD for a 6:1 leverage ratio)
- Direct energy generation from demonstration projects totalling 3.7 MW and almost 8 MW through scale-up projects.
- Post-project indirect emission reductions estimated at a range of 1.8m-4m tonnes of CO<sub>2</sub>eq due to increased awareness and capacity to develop and finance biogas projects.

Calculating the cost per tonne of direct reduction of emissions for GEF, the cost per tonne of abatement would then be 4.2 USD/tonne CO<sub>2</sub>eq (depending on the use of biogas and mix of fuel being replaced). Incorporating the post-project indirect reduction of emissions, the cost per tonne of abatement would reduce to as low as 1.1-2.3 USD/tonne CO<sub>2</sub>eq.

### **C. DESCRIBE THE BUDGETED M & E PLAN:**

Formal monitoring and evaluation (M&E) of the project will follow the principles, criteria and minimum requirements set out in the GEF Monitoring and Evaluation policy in its current version and the respective guidelines and procedures issued by the GEF Evaluation Office and/or the GEF Secretariat. At the same time, M&E will comply with the rules and regulations governing the M&E of UNIDO technical cooperation projects, in particular the UNIDO Evaluation Policy and the Guidelines for Technical Cooperation, both in their respective current versions.

The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by:

- i) Tracking and reviewing project activities execution and actual accomplishments;
- ii) Leading the project processes so that the implementation team can take early corrective action if performance deviates significantly from original plans;
- iii) Adjust and update project strategy and implementation plan to reflect possible changes on the ground, results achieved and corrective actions taken; and
- iv) Ensure linkages and harmonisation of project activities with that of other related projects at national, regional and global levels.

A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments will be prepared by UNIDO in collaboration with the PMU and project partners at the beginning of project implementation and then periodically updated.

By making reference to the impact and performance indicators defined in the Project Results Framework, the monitoring plan will track, report on and review project activities and accomplishments in relation to:

- a. Renewable energy heat/power/CNG delivered and GHGs emission reductions directly generated by the UNIDO/GEF project. These will include the type and the number of projects developed and implemented.

- b. Renewable energy heat/power generation/CNG delivered and GHGs emission reductions in-directly generated by the UNIDO/GEF project. These will include type and the number of projects developed and implemented due to the increased capacity and conducive environment for the renewable energy projects.
- c. Renewable energy investment generated by the UNIDO/GEF project, directly and indirectly
- d. Development and amendments of policy, legislative and regulatory frameworks aimed to promote and support the SME bio-methanation market
- e. Level of awareness and technical capacity for the use of organic waste for energy within relevant institutions, in the market and within enterprises.
- f. Overall and specific socio-economic impacts of the project, including the increase in productive capacities, access to modern energy services, job creation for women and men, and gender related aspects (such as gender balance of beneficiaries, budget spent on activities actively promoting GEEW).

The National Project Manager will be responsible for day-to-day and local management of project activities execution, performance and the tracking of progress towards the achievement of milestones. However, monitoring and evaluation of the demonstration projects with respect to energy generation, technical performance, commercial viability and GHGs emission reduction will be integral part of the evaluation component of Project Component 3.

UNIDO will be responsible for oversight and tracking overall project milestones and progress towards the attainment of the set project outputs. UNIDO will be responsible for narrative reporting to the GEF. The UNIDO project manager will be responsible for the preparation of Annual Project Implementation Reviews (PIR) and mid-term evaluations as established in the M&E Plan.

One mid-term review will be carried out and a final external terminal evaluation at least one month before the completion of the project. UNIDO will make arrangements for the independent terminal evaluation of the project. The UNIDO project manager will inform UNIDO Evaluation Group at least 6 months before project completion about the expected timing for the Terminal Evaluation (TE). The UNIDO Evaluation Group will then manage the terminal evaluation in close consultation with the project manager.

All monitoring and evaluation documents, such as progress reports, final evaluation report, and thematic evaluations (such as capacity needs assessment), as well as publications reporting on the project, will include gender dimensions wherever adequate. Table 7 provides the tentative budget for the two evaluations, which has been included in Project Component 5. UNIDO as the Implementing Agency will involve the GEF Operational Focal Point and project stakeholders in order to ensure the use of the evaluation results for further planning and implementation.

**Table 7: Project’s Indicative Monitoring and Evaluation Work plan**

Type of M&E Activity	Responsible partners	Budget (USD)	Timeframe
Inception Workshop (IW) and inception report	UNIDO PM; PMU	0**	Within first two months of project start up
M&E design and tools to collect and record data (performance indicators) including a survey to confirm baseline values for industry, manufacturers, policy makers, gender, etc.	UNIDO PM; PMU and M&E specialists as required	5,000	Within first two months of project start up and mid project
Regular monitoring and analysis of performance indicators (technical, social, policy, environmental, gender)	UNIDO PM; PMU and M&E specialists as required	0**	Regularly to feed into project management and Annual Project Review
Annual Progress Reports (APRs) and Project Implementation Reviews (PIRs)	PMU to prepare prior to the annual project review UNIDO PM to validate and finalize to submit	0**	Annually

Type of M&E Activity	Responsible partners	Budget (USD)	Timeframe
	to GEF		
Annual Project Review to assess project progress and performance	PMU, PM, UNIDO headquarters and Project Steering Committee to review the project performance and take corrective actions	0**	Annually prior to the finalization of APR/PIR and to the definition of annual work plans
Steering Committee (SC) Meeting	PMU, PM UNIDO HQ and Project Steering Committee	0**	Annually to coincide with the Annual Project Review and ad hoc when urgent and important decisions need approval of SC
Mid-term review including survey to measure progress against baseline for SMMEs and policy makers	PMU, external consultants, UNIDO PM, UNIDO Evaluation Unit (ECA) in advising on TOR and selection of evaluators, Steering Committee and M&E specialists as required	20,000	Mid project
Final survey to measure progress against baseline for projects	UNIDO PM; PMU and M&E specialists as required	7,000	At least two months prior to end of the project
Project Terminal Evaluation	UNIDO Evaluation Unit (ECA), PMU, PM UNIDO HQ and Project Steering Committee, independent external evaluators	38,000	Evaluation at least one month before the end of the project; report at the end of project implementation
Lessons learned (in annual project review and PIRs)	PMU, external consultants, UNIDO PM	0**	By the end of project implementation; annual as part of PIR
Visits to field sites	UNIDO PM	0	Six monthly (and on project completion)
TOTAL indicative cost		70,000	

\* Excludes project team staff time and UNIDO staff

\*\* The costs are covered under Project Management Costs

According to the Monitoring and Evaluation policy of GEF and UNIDO, follow-up studies like Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, reports and other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities.

#### **Legal Context:**

The Government of the Republic of South Africa agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed on 03 October 1994.



**PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)**

**A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S) :**  
(Please attach the [Operational Focal Point endorsement letter\(s\)](#) with this form. For SGP, use this [OFP endorsement letter](#)).

NAME	POSITION	MINISTRY	DATE (MM/dd/yyyy)
Mr Zaheer Fakir (Operational Focal Point)	Chief Director, International Relations and Governance	Ministry Of Water And Environmental Affairs (Department Of Environmental Affairs); Tel: 012 3103828; Email: Zfakir@Environment.Gov.Za	12/18/2013

**B. GEF AGENCY(IES) CERTIFICATION**

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for CEO endorsement/approval of project.

Agency Coordinator, Agency Name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Address
Mr. Philippe R. Scholtès, Managing Director, Programme Development and Technical Cooperation Division - PTC, UNIDO-GEF Focal Point		11/17/2015	Alois Posekufa Mhlanga, Industrial Development Officer, Energy Branch, UNIDO	+431260265169 	a.mhlanga@unido.org

## ANNEX A: PROJECT RESULTS FRAMEWORK.

Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
<b>Objective of the project</b>	<b>Promote market based adoption of integrated biogas technology in small and medium and micro-scale enterprises (SMMEs) in South Africa</b>	CO <sub>2</sub> emission reduced (tonnes of CO <sub>2</sub> eq) due to new biogas projects [direct and indirect] Energy generated from biogas technologies supported or promoted by project (in MWh) No of new SMME-based biogas projects	0 Direct CO <sub>2</sub> eq emission reductions associated with new projects 0 Indirect CO <sub>2</sub> eq emission reductions associated with new projects 0 MWh generated from biogas technologies supported or promoted by project No new agro SMME biogas projects	Cumulative reduction of GHG emissions by about 1 million tCO <sub>2</sub> eq over the period 2015-2035 Indirect emission reduction greater than 1.8m tCO <sub>2</sub> eq 55,000 MWh energy generated annually from biogas through projects installed over the period 2015-2035 related to project 13 new biogas projects at SMMEs installed between 2015 and 2019	GEF project tracking tool Project documents	The Government remains committed to the development of RE Implementation of project activities will foster investment in biogas technologies Adequate resources mobilized
<b>Project Component 1 – Capacity building and technology support system</b>						
<b>OUTCOME 1.1</b>	Capacity of market players and enablers strengthened and technology support systems established.	No. of trained personnel (gender disaggregated) Waste characterisation database developed and available Biogas guidelines developed and available Full time staff at SABIA able to support members	Few trained personnel No national waste characterisation database No S.A biogas guidelines No full time staff and SABIA not able to support members	300 personnel trained (30% female personnel) Waste characterisation database developed and available S.A biogas guidelines developed and available 1.5 full time staff at SABIA able to support biogas market (e.g. advice and	Project documents Participant logs and evaluation forms Training material SABIA website Waste characterisation database	Targeted stakeholders show willingness for training. Growth in industry leading to growth in training demand Training programme successfully implemented



Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
				information)		
<b>Output 1.1</b>	Detailed assessment and characterization of waste streams from agro-processing SMMEs conducted and centre for waste characterization established	No. of waste streams characterised	Limited South African waste streams characterised	150 waste streams characterised	Project documents Waste characterisation database	Waste streams available for testing.
		National waste characterisation database developed	No national waste characterisation database	Database developed and updated		
<b>Output 1.2</b>	Biogas support centre created	No. of full-time staff	No full-time members of staff	1.5 full time staff members (gender disaggregated)	Interviews with members SABIA annual reports Project documents SABIA website	Core funding for SABIA used for staffing and to support members
		Up to date website	Out of date website	Up to date website		
<b>Output 1.3</b>	Biogas guidelines and decision support tools, operation and manuals for integrated biogas systems in agro-processing SMMEs are developed and disseminated	Biogas guidelines developed	No South African biogas guidelines	1 set of biogas guidelines developed	Project documents SABIA website and records	
		No. of downloads of document	No downloads	>200 downloads (gender disaggregated user statistics)		
<b>Output 1.4</b>	Professionals and technicians in biogas technology trained	SETA accredited HH biogas training available	No SETA accredited HH biogas training	2 SETA accredited HH biogas training courses available	Participant logs and evaluation forms Copies of training material Training records and photos SAQA accreditation material	Targeted stakeholders show willingness for training. Growth in industry leading to growth in training demand Training programme successfully implemented
		No. of youth trained in HH biogas	9	80		
		% of female youth trainees	10%	30%		
		No. of household digesters built as part of training	0	30		

Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
		No. of SAQA accredited biogas technician courses	No SAQA accredited biogas course	1 SAQA accredited course available at SARETEC and satellites		
		No. short (1 week) biogas courses developed	No short biogas courses	3 short biogas courses developed		
		No. of biogas training sessions for Government Officials	1 training on biogas for Government Officials	2 training sessions on biogas for Government Officials		
		No. of trained Government Officials	No trained Government Officials	20 trained staff		
		% of female trained Government Officials	No biogas trained female Government Officials	30%		
		No. of biogas training sessions for MCEP/NCPC staff	No training on biogas for MCEP/NCPC staff	2 training sessions on biogas for MCEP/NCPC staff		
		No. of trained MCEP/NCPC staff	No trained MCEP/NCPC staff	20 trained staff		
		% of female trained MCEP/NCPC staff	No biogas trained female MCEP/NCPC staff	30%		
		No. of digestate use training sessions	None	5		
		No. of trained personnel in digestate use	None	100		
		% of female trainees in digestate use	None	30%		
<b>Output 1.5</b>	Targeted training workshops (10) for market players (project developers,	No. of training workshops for market players	None	Ten (10)	Participant logs and evaluation forms	Targeted stakeholders show willingness for training.
		No. of market players	None	200	Copies of training	Growth in industry leading to

Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
	enterprise executives, farmers and operators, current users of waste ) on integrated biogas systems conducted	trained			material	growth in training demand Training programme successfully implemented
		% of female trainees	None	30%		
<b>Output 1.6</b>	Two Regional training workshops conducted to train experts from SADC counties on biogas technologies in SMMEs	No. of regional biogas workshops	No regional workshops	2 regional training workshops (at least 30% female participants)	Participant logs and evaluation forms	Support from SACREEE and SADC countries is forthcoming.
<b>Project Component 2 – Biogas market development and regulatory framework</b>						
<b>Outcome 2</b>	Market environment for biogas strengthened and regulatory framework for grid-connected small to medium scale waste-to-energy projects developed	No. of quality standards for biogas Guidelines on use of digester effluent and digestate Norms and standards developed for biogas at DEA Regulatory framework developed for < 1MW biogas projects	No S.A standards for biogas projects No guidelines on use No norms and standards for biogas No clear policy or regulation on grid connection < 1MW	Two S.A standards for biogas projects adopted Guidelines issued on use of digester effluent and digestate 1 set of norms and standards for biogas Clear policy on grid connection < 1MW	Project documents SABS standards DEA norms and standards DAFF guidelines on digestate DoE regulatory framework	Government commitment to biogas and connection of small scale RE to grid
<b>Output 2.1</b>	Quality standards for integrated biogas plants in SMMEs developed, adopted and widely disseminated	No. of quality standards for biogas	No S.A standards for biogas projects	Two S.A standards for biogas projects adopted by SABS	Project documents SABS standards	Cooperation between users and experts to develop standards and training materials
		Integration of the standards within PER R719	Biogas not integrated in PER R719	Integration of the standards within PER R719	PER R719 Project documents	
		SETA certified training materials for the standards	No certified training materials	SETA certified training materials for the two standards	Project documents SETA	

Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
		Training modules designed	No training modules for standards	Training modules for the two standards	Training materials and modules	
<b>Output 2.2</b>	Guidelines and regulations (environmental, technical and legal) on the valorization of digestate and effluent developed and adopted	Characterisation of effluent and digestate from different biogas feedstocks	No characterisation of effluent and digestate	Characterisation of effluent and digestate from at least 180 different biogas feedstocks	Project documents DAFF guidelines	Cooperation between biogas projects and ARC
		Testing of effluent use on crops and record results	No data available of testing effluent on crops	Testing carried out over two agricultural seasons on maize and drybean at two sites and data recorded		
		Guidelines on use of digester effluent and digestate	No guidelines on use	Guidelines issued on use of digester effluent and digestate		
		Inclusion of digestate in the Draft Norms and Standards for the manufacture and applicability of organic compost	Not included	Inclusion of digestate in the Draft Norms and Standards for the manufacture and applicability of organic compost		
<b>Output 2.3</b>	Biogas license process streamlined	Norms and standards developed for biogas at DEA	No norms and standards for biogas	1 set of norms and standards for biogas	Project documents DEA website	DEA committed to streamlining licensing process
<b>Output 2.4</b>	Regulatory framework on access to the grid by small to medium scale biogas projects developed	Regulatory framework developed for < 1MW biogas projects	No clear policy or regulatory framework on grid connection < 1MW	Clear policy and regulatory framework on grid connection < 1MW	DoE website Project documents	Government committed to small scale RE and grid connection
<b>Project Component 3 – Technology demonstration</b>						
<b>Outcome 3</b>	Technical feasibility and commercial viability of waste-to-	No. of new biogas projects supported by GEF project at SMMEs	No new SMME biogas projects	5 new projects 3.7 MW installed	GEF project tracking tool Financing partner	Beneficiary industries have co-finance to implement projects and there is the technical capacity to

Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
	energy technologies demonstrated	Amount of MW installed Volume of investment mobilised for biogas projects Tonnes of CO <sub>2</sub> eq avoided	0 MW No co-finance No avoided emissions related to projects	18m USD 1m tCO <sub>2</sub> eq avoided	data Independent evaluation reports Project reports Project website	install the project.
<b>Output 3.1</b>	Detailed feasibility studies of selected 5 demonstration projects are conducted	No. of bankable feasibility studies completed	0	5 (including gender dimensions)	Project documents	
<b>Output 3.2</b>	Five (5) integrated biogas demonstration projects implemented to achieve at least 3MW installed capacity	Number of biogas projects implemented with support from GEF	No biogas projects implemented	5 projects implemented with direct support from GEF.	GEF project tracking tool Project implementers' records.	Co-finance is available for each project and there is the technical capacity to install the project. Data available for monitoring and evaluation
		Number of systems providing bio-CNG	No bio-CNG projects	2 bio-CNG projects developed	Independent evaluation reports Project reports Copies of case studies	
		Installed capacity of new organic waste to energy projects (MW)	0 installed	Installed capacity of 3.7 MW (eq)		
		Annual energy generated (MWh)	0 MWh	22,500 MWh (eq)		
		Tonnes of bio-CNG produced	0 tonnes/day	4 tonnes per day		
<b>Output 3.3</b>	Demonstration projects monitored, evaluated and showcased	Performance monitoring, evaluation reports on supported project	No dissemination material on biogas for SMMEs	5 performance monitoring evaluation reports	Project documents Evaluation reports	Copies of case studies
		Case studies on each GEF	No case studies	5 case studies		
<b>Output 3.4</b>	Best practice manual developed and widely disseminated	Best practice manual developed	No best practice manual	1 best practice manual	Project documents	
<b>Project Component 4 – Scaling up</b>						

Project Strategy	Objectively verifiable indicators	Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and Assumptions
<b>Outcome 4</b>	Investment in waste-to-energy technologies promoted	Investment strategy developed No. of new projects implemented Portfolio of investment projects compiled and available to financiers and developers Financial support for biogas identified	No investment strategy developed No scale-up projects No portfolio of potential biogas projects No dedicated funding for biogas projects	Biogas investment strategy At least 4 projects installed and commissioned. Portfolio of at least 25 investment projects compiled and available to financiers and developers Dedicated financial support for biogas identified	Project documents DoE website	Government committed to biogas scale-up
<b>Output 4.1</b>	Investment strategy for integrated biogas developed and disseminated	Investment strategy developed	No investment strategy developed	Biogas investment strategy developed	Project documents DoE website	Government committed to biogas scale-up
<b>Output 4.2</b>	TA provided to realize at least 4 more investment projects (at least 6 MW)	No. of bankable feasibility studies	No bankable feasibility studies	4 bankable feasibility studies (including gender dimensions)	Project documents	Co-finance is available for each project and there is the technical capacity to install the project
		Standardized long term feedstock supply agreement available	Informal/non-standardised feedstock supply agreements	Standardized long term feedstock supply agreement developed		
		No. of new scale-up biogas projects implemented	No scale-up projects implemented	At least 4 projects installed and commissioned.		
		Amount of MW installed	0 MW installed	At least 6 MW installed		
<b>Output 4.3</b>	Portfolio of at least 25 investment projects compiled and disseminated	Portfolio of investment projects compiled and available to financiers and developers	No portfolio of potential biogas projects	Portfolio of at least 25 investment projects compiled and available to financiers and developers	Project documents	Continued interest from potential project owners in being involved in biogas market.

<b>Project Strategy</b>	<b>Objectively verifiable indicators</b>	<b>Indicator (quantified and time-bound)</b>	<b>Baseline</b>	<b>Target</b>	<b>Source of verification</b>	<b>Risks and Assumptions</b>
<b>Output 4.4</b>	Technical support to design financial support	Financial support for biogas identified	No dedicated funding for biogas	Dedicated financial support for biogas identified	Project documents Government/FI websites	Interest from Government and FIs in being involved in biogas market
		Quantity (USD) of funding identified	No dedicated funds for biogas	USD 100m of funding identified		
<b>Output 4.5</b>	National biogas investment forum organized regularly	No. of national biogas investment fora	No national biogas investment fora	2 national biogas investment fora organised (including main event on gender dimensions of biogas; gender balance of speakers at the event)	Project documents Forum programmes, notes and list of participants	Continued interest from FIs, project developers and project owners in being involved in biogas market. Participants willing to pay entrance fee

**ANNEX B: RESPONSES TO PROJECT REVIEWS** (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

Based on the PIF Screening, STAP's advisory response to the GEF Secretariat and GEF Agency(ies): Consent

	<b>Comments from STAP</b>	<b>Response</b>
1	The aim of this project is to promote biogas plants using organic waste feedstocks in contrast to large-scale waste-to-energy plants that use incineration of MSW <sup>38</sup> , but not always with heat recovery. Capacity building is a key part as is developing market and regulatory frameworks, but the main component of the project is supporting demonstration power generation plants and then scaling up. The aim is to reduce organic wastes to landfills and to discourage fly tipping of rubbish.	
2	The baseline is described but not quantified.	<p>The amount of organic waste generated in the target industries has been quantified and is the national baseline for current waste disposal methods (lagoons, dumping and landfills). In addition the baseline for the waste generation for the demonstration projects has been quantified. The scale-up projects under component 4 have not all been selected at this stage so it is not possible to identify the baseline for these projects. However, this will be established during the second year of the project as part of the project monitoring and management.</p> <p>Energy consumption at different sites varies enormously in scale as well as in delivery (electricity, coal, diesel). Biogas projects will offset some or all of this energy depending on the site characteristics. The baseline energy consumption for the demonstration projects is quantified in the pre-feasibility studies in Annex T8.</p>
3	Component 1: For capacity building and technology support, the project will carry out a detailed inventory of waste streams from industry to establish volumes, characteristics, location of landfills, etc. that will be used to support the identification of potential sites for biogas energy projects. What tools will be used to carry out this analysis? It lends itself well to the use of geographic information systems (GIS) in support of multi-criteria decision making for spatial decisions (e.g. site location). Other data would be useful (and maybe even required) such as information about slope, proximity to roads, etc. (see Yal, G.P. and H. Akgün. 2013. Landfill site selection and landfill liner design for Ankara, Turkey. Environmental Earth Science, 70: 2729-2752; Kara, C. and Doratli, N. 2012. Application of GIS/AHP in siting sanitary	<p>During consultation during the PPG, stakeholders were specifically asked about the need for support for SAWIS, as foreseen in the PIF. Although still considered important for the National Waste Management Strategy and for planning rural renewable energy electrification, it was not considered to be a real barrier to uptake of biogas by the key stakeholders. As a result this activity has been omitted from the final design.</p> <p>The funds associated with it have been diverted to deliver a greater level of capacity building and training over and above the training workshops that had been proposed.</p>

<sup>38</sup> Municipal solid waste



	landfill: a case study in Northern Cyprus. Waste Management & Research, 30(9): 966-980.)	
4	<p>Component 2 talks of two demonstration plants totalling around 3 MW whereas in Table B of the PIF it states four plants as it does lower in the paragraph. Which is it a 2 or 4 demo plants? How much funding is to be allocated to each plant? Total funding sought for this component is around \$8M and, if for 3MW total plant, that equates to approximately \$2700/ kW. This seems high for biogas plants. Also what is learned from 1 MW scale plants may not be as relevant to small scale domestic plants as is implied.</p>	<p>Component 3 will be supporting five demonstration projects which were selected as part of the PPG process with the aim to be able to demonstrate both technical feasibility and commercial viability for as wide a range of projects as possible to allow for maximum replicability and maximum demonstration impact. Therefore, the projects were selected to cover a range of: location (cover a number of provinces); different capacities/sizes; different feedstocks and enterprises; different uses of gas; and on-grid and own use projects. The final capacity of these projects is 3.7 MW.</p> <p>The costs in the PIF were actually underestimated. Using the actual envisaged costs for the five projects a total of about USD19m is required for these projects. This works out at about USD 5.3 /MW. Although this seems high this is within the range estimated by IRENA at 2.6-6.1 USD/MW (<a href="https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-BIOMASS.pdf">https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-BIOMASS.pdf</a>). In addition some of these projects include innovative technology for South Africa for scrubbing and compressing gas and much equipment must be imported. Therefore these costs are considered reasonable in this case. The proposed grant per project is included in the document and is between 7.9% and 10% of the estimated costs.</p> <p>This project concentrates on biogas for SMMEs. Although the technologies used for household/domestic systems may be different there are a number of lessons from the enterprise scale systems in this project which can be transferred to the smaller systems, in particular with regard to managing the systems and its feedstocks and safety and security measures. In addition greater knowledge of the potential and advantages of biogas the greater the likely take-up will be at all scales.</p>
5	<p>The assessment of mitigation potential is OK but the main question is whether all the useful heat available will be utilised. This depends on the location of the plants and nearby heat loads. It is agreed that the co-value of the effluent is critical for project success, but no comment is given on the potential price and offset of total costs.</p>	<p>The heat produced by the projects will either be used to offset on-site heat demands currently met by coal fired boilers or will be used for heat for the digester. It is not envisaged that all the heat will be used. GHG mitigation calculations have included the actual amount of the heat that will off-set other heat sources. Emission calculations have also included a conservative estimate of GHG emissions saved from off-setting synthetic fertiliser.</p> <p>The economics of each project have identified the predicted heat and electricity savings as well as savings in waste disposal practices and where considered possible a value has been applied to the effluent (up to ZAR 100/tonne (USD8.5/tonne). It should be noted that the financiers currently value this potential revenue stream at zero.</p>
6	<p>The risks state the technologies "are relatively new" whereas it is a mature technology. Even so the skill of the plant operator is imperative. Maintenance is mentioned, but this can be a major cost for biogas plants due to managing the bacteria and over-coming corrosion problems due to the H2S gas.</p>	<p>The technologies are not new but are still relatively unknown in South Africa. Training is a key part of the project and in each case the project developer has included for training of O&amp;M staff including safety standards, risk management and operators training management of the digesters. Clean up equipment is included in some of the projects. The cost of maintenance is significant and has been included in the economics.</p>

7	There is already much experience and knowledge concerning 1 MW scale biogas plants as in Germany, Denmark, UK etc. It would pay for the proposers and developers to first learn from their long-term experiences. One way is through the IEA Bioenergy biogas task group – see <a href="http://www.iea-biogas.net/">http://www.iea-biogas.net/</a>	A number of the demonstration projects are learning directly from European projects and in some cases using European technology. It is proposed that South African Biogas Industry Association (SABIA) an association bringing together all stakeholders in biogas industry active in South Africa, as the biogas support centre, engage with IEA Biogenery biogas task group.
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### Responses to Questions from GEF Council Member(s): Germany

	Comment	Response
1	Regarding other initiatives, Germany suggests coordinating with the South African German Energy Programme (SAGEN) financed by the German Federal Ministry for Economic Cooperation and Development (BMZ). In collaboration with the Department of Energy (DoE) and the South African Association on Biogas, the project supports the national biogas platform which brings together all relevant stakeholders.	During the PPG there were detailed consultations with the SAGEN staff, the Department of Energy (DoE), the Southern African Biogas Association (SABIA) and the National Biogas Platform. Several meetings were held to develop an effective and coordinated approach so as to enhance the development impact of the two initiatives. As such, SAGEN staff delivered presentations on the programme at both the consultation and validation workshop. In addition, they also lead group discussions in areas where SAGEN is working to ensure that this UNIDO/GEF project will built on work that is already done under SAGEN, but also address areas that are not being attended to under SAGEN Programme. Annex T4 of the CEO Endorsement document includes a table showing the activities being supported under SAGEN programme and what this UNIDO-GEF programme will support and how these will be coordinated. In addition, the project steering committee will incorporate representatives of both the Department of Energy and Southern African Biogas Industry Association (SABIA). This will ensure that the activities by the two projects are effectively coordinated.
2	Coordinate with the Climate Support Programme (CSP) financed by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), which supports the implementation of the Waste to Energy Flagship Programme in collaboration with the Department of Environmental Affairs (DEA). It develops a guideline for the implementation of waste-to energy projects and supports the NAMA development.	The Department of Environmental Affairs (DEA) is the main government counterpart for the project and through them there is coordination with the Waste to Energy Flagship Programme. The work to date has included a guideline for all waste-to-energy technologies and under this project further guidebooks and knowledge tools will be developed which will focus just on the biogas element, especially in SMMEs.
3	A further coordination with CSIR as well as biogas project developers which are organized in the biogas association SABIA would also be beneficial.	CSIR, biogas project developers and SABIA were consulted during the project design and as a result there will be significant support from the project to SABIA (and project developers) in activities 1.2, 1.3 and 2.1, and CSIR will be involved in the pilot projects. Through this support it is anticipated that SABIA will become the biogas support centre for South Africa and the sub-region and will also be transformed into a more professional association.
4	Planned activities should avoid duplication of efforts and be linked with existing initiatives (e.g. Nersa, Eskom, the	During the project design there was consultation with NERSA, Eskom, and DoE to understand the current status of existing activities and initiatives and to discuss how the UNIDO-GEF

Department of Science and Technology (DST)).	project could help without duplicating any on-going efforts. As a result under Activity 2.4 support will be provided to these organizations in developing a regulatory framework to support biogas and small-scale renewable projects to connect to the grid. DST is supporting the waste roadmap for South Africa and also supporting work at Fort Hare University. Following discussions with them, this project will build on the work by DST at Fort Hare and develop this project further and make it a flagship project.
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## Response to GEF comments made at PIF stage

Comment	Response
Component 1	
<p>By CEO endorsement, the project is expected (i) to detail how the project will ensure supported data collection and management activities can be sustained beyond project completion with regular updating of data (reporting and characterizing waste, detailed inventory of waste streams from industry); and (ii) to detail how the associated costs will be covered beyond project completion.</p>	<p>The main on-going data collection envisaged at PIF was the inventory of waste in the South African Waste Information System (SAWIS). During consultation during the PPG, stakeholders were specifically asked about the need for support for SAWIS, as foreseen in the PIF. Although still considered important for the National Waste Management Strategy and for planning rural renewable energy electrification, it was not considered to be a real barrier to uptake of biogas by the key stakeholders. As a result this activity has been omitted from the final design.</p> <p>The characterisation of waste streams is expected to continue beyond the project end as the laboratory at UFS will offer analysis services to the private sector so ensuring its sustainability. The database will continue to be available via the SABIA and UFS websites.</p> <p>The project management unit (PMU) will close with the project, but during the project duration capacity would have been built up within SABIA and the government agencies allowing them to continue to promote biogas. How SABIA will be supported is detailed below.</p>
<p>By CEO endorsement, the project is expected to detail how the technology support center full cost recovery will be ensured.</p>	<p>The support foreseen for the biogas technology support centre at the PIF stage has now been identified as support for SABIA, the South African Biogas Industry Association. Support under the GEF project will be provided for SABIA in three ways: a) firstly core funding will be provided to SABIA to be able to support full time staff members to allow them to offer technology support services to their members; b) support will be provided for SABIA to develop South African biogas guidelines which will then be available from their website; and finally c) support will be provided to develop two South African quality standards for biogas and the associated SETA certified training materials and modules. The support under c) is the most important to ensure that SABIA will be self-financing beyond the project. Funding will come from the accreditation and registration of biogas practitioners once the standards have been integrated into the gas PER R719 regulations. In addition funding will continue from membership subscriptions and also from the organization of a regular fee-based biogas conference. SABIA's business plan shows how these revenues, calculated conservatively, will ensure that the organization will reach full cost recovery and will offer greater services to the biogas sector in South Africa.</p>
Component 2	
<p>Please clarify what policy or regulation the project will target to enable WtE projects in SMEs to access the grid. Please note that it is expected that the project will support the adoption and implementation of the supported regulations and policies.</p>	<p>NERSA is in the process of publishing a decision on embedded electricity (covering all technologies but with a focus on PV) which will identify gaps in policy. In line with this the Department of Energy (DoE) is currently reviewing the Electricity Regulation Act 4 of 2006 with a view to drafting legislation and regulatory rules associated with wheeling arrangements and small-scale embedded generation (&lt;1MW). With the provision of some international expertise this GEF-UNIDO project will assist the DoE (and NERSA and Eskom) in this review and in developments around the revision of the Act in particular in testing its applicability to biogas and in its adoption and implementation. A particular area that can be</p>

	<p>investigated is the provision of peak power since biogas can be stored. The regulatory adoption of a new framework is likely to catalyse the development of many other small to medium renewable energy projects that would be connected to the grid.</p>
<p>By CEO endorsement, details are expected on (i) how the potential methane leakage will be monitored, (ii) how this monitoring will be sustained beyond project completion, and (iii) how the project will monitor the impact it would have on agricultural fertilization (practices and quantities) especially for nitrogen input</p>	<p>i) Methane leakage will be monitored at each demonstration project. The main measure to minimize gas leakage is to ensure proper operation without major fluctuations of production/supply/fuelling of biogas and hence fluctuating gas pressures, regular controls and gas leakages checks. Accordingly, the training will include this and the toolkits, decision support tools and maintenance plan will be developed providing practical guide to how to check for methane leakage, the frequency of check and how to remedy the situation. SABIA would be equipped to carry out the checks for the demonstration projects.</p> <p>ii) The methane leakage monitoring will form part of the operation and maintenance procedures for the projects so is already included in the projects' on-going costs and designs.</p> <p>iii) A key part of the project is an investigation into the use of digestate and effluent as fertilizer. Support will be provided to develop guidelines on application rates, timing, limitations and monitoring for digestate use and how these can offset the use of synthetic fertilizer (N, P &amp; K). The guidelines will be based on characterization of the digestate from projects and testing it over two agricultural seasons. Should regulation be deemed necessary then the appropriate regulations based on the guidelines will be developed. At the same time the quantity of synthetic fertilizer saved at each site, and digestate applied will be monitored to allow calculation of the impact</p>
<p>By CEO endorsement, details are expected on how the project intends to tackle the potential variations in waste sources and quality and their consequences for energy production and bio-digestion sub products users.</p>	<p>In each case the demonstration projects have estimated the waste from their own farming or processing activities and have used a conservative figure for the number for the products and financial models. The selected projects have fixed operations throughout the year so seasonal variations will be minimal. Where crop waste is used it is in co-digestion plants so although overall output will vary it will not stop. Some confidence is provided in that the waste and its quality is within the control of the project owner. Sensitivity analysis has also included a 10% reduction in outputs.</p>
<p>By CEO endorsement, details are expected on the respective roles of (i) the proposed project, and of (i) NCPC and the REMT project.</p>	<p>The REMT project has already been completed. However this project built significant capacity in terms of supporting project identification and development i.e. feasibility studies through a pool of specialists. This pool will also be approached to be part of the framework of consultants for work in Components 3 and 4. . In addition, the capacity development component of this project will build on the activities of the REMT project. Under component 4, it is foreseen that the experience of funding some of the projects under the REMT will be useful in supporting investment projects under this project.</p> <p>The NCPC will be an important partner to the project and will receive targeted training to allow staff members to identify potential sites for biogas and to undertake adjudication of related project proposals in the future.</p>
<p>Please clarify how the project intends to support the transition from a heavily supported and subsidized demonstration phase to a scaling up phase with the involvement of the south African green fund and local banks. The financial sustainability of the proposed transition will be key since it is unlikely that subsidies</p>	<p>The demonstration phase will receive technical assistance and financial support to help get the projects implemented. The support is intended to be catalytic but is not substantial. The grants available will only be up to about 10% of the capital costs. The following scale-up phase includes the provision of technical assistance and transaction advice to help get the next group of projects implemented. No grant will be available for this second group of projects. There is therefore already a proposed transition between these two phases. It is anticipated that the demonstration and scale-up projects will build up the knowledge and</p>

<p>from the green fund may be sustained over a long period of time. One may consider supporting the design and implementation of a gradually decreasing project preparation and financing subsidy scheme. In parallel, a gradual increasing involvement of the local banks/financing institutions is expected.</p>	<p>capacity in South Africa for project developers to understand better and to take projects forward and reduce the cost of finance due to the FIs exposure to successful biogas projects.</p> <p>Subsidies outside of the UNIDO-GEF project are not envisaged for the demonstration or scale-up projects. However concessional finance from the Green Fund (through DBSA) and other green credit lines (through existing local banks IDC, Nedbank and ABSA) is included. This is in the form of debt at interest rates of prime minus 1-2%. Increased exposure to biogas for these four local banks is likely to increase their appetite for investment in such projects, with and without their concessional finance lines. The Green Fund and the green credit lines are expected to continue and specific windows for biogas will be negotiated as part of the project so ensuring that some concessional finance will be available in the short to medium term. Beyond that it will be possible to finance projects at commercial rates.</p>
<p>By CEO endorsement, details are expected on (i) how the Green Fund support is expected to be provided (through tenders as currently explained on the Fund website, or through a different process); (ii) how the project will make sure the tendering process, if it is used, will be attractive enough (number of tenders, frequency).</p>	<p>The Green Fund (details available at <a href="http://www.sagreenfund.org.za/Pages/default.aspx">http://www.sagreenfund.org.za/Pages/default.aspx</a>) offers concessional debt to green projects through a tendering process. Under this UNIDO-GEF project scale-up biogas projects will be identified and helped in preparing bankable plans which can then be proposed to the Green Fund (DBSA) for finance. Department of Environmental Affairs operates/runs the Green Fund and they have agreed<sup>39</sup> that a dedicated part of the fund will go towards biogas projects in the future rounds. One of the identified scale-up projects has already secured finance from the Green Fund and this is included in the DEA's co-finance for the overall project.</p> <p>The Green Fund will be replenished in 2016 and we already discussed and tentatively agreed that a special and dedicated window will be set up under the Green Fund for biogas in SMMEs projects. Further discussions with DEA re. the Green Fund and with other green credit lines in South Africa form one of the key activities in Component 2 to identify dedicated biogas windows within each. The government is commitment to fund WTE projects under the Green Fund. The Green Fund operates in two year cycles that are replenished by Treasury each cycle meaning that two cycles of call for tenders with a special window for WTE projects could be implemented during the lifetime of the project.</p>

<sup>39</sup> During PIF discussions with UNIDO

**ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS<sup>40</sup>**

A. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES FINANCING STATUS IN THE TABLE BELOW:

PPG Grant Approved at PIF: 90,000			
<i>Project Preparation Activities Implemented</i>	<i>GEF/LDCF/SCCF/NPIF Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
Baseline Data Collection	14,500.00	14,400.00	100,00
Stakeholders consultations: consultation and validation workshops	21,400.00	21,400.00	0
Project design and demonstration projects selection and review	40,000.00	40,000.00	0
Project strategy development and implementation detailing	14,100.00	13,914.00	186.00
Total	90,000.00	89,714.00	286.00

**ANNEX D: CALENDAR OF EXPECTED REFLows (IF NON-GRANT INSTRUMENT IS USED) N/A**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/NPIF Trust Fund or to your Agency (and/or revolving fund that will be set up)

No reflows are expected.

**ANNEX E: TRACKING TOOL FOR CLIMATE CHANGE MITIGATION PROJECTS**

See separate excel file with file name “GEF ID 5704 Annex E \_GEF CC Mitigation Tracking Tool.xls”

<sup>40</sup> If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities.

## ANNEX F: GEF GRANT PROJECT BUDGET

All figures in USD

Component 1. Capacity building and	Type of Expense	GEF Grant Budget Component 1				Output Total
		Yr 1	Yr 2	Yr 3	Yr 4	
1.1 Detailed assessment and characterization of waste streams from agro-processing SMMEs conducted	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	11,854	11,854	11,854	-	35,563
	Contractual Arrangement	16,935	16,935	16,935	-	50,804
	Training/Workshops	-	-	-	-	-
	International Meetings/Workshops	-	-	-	-	-
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>28,789</b>	<b>28,789</b>	<b>28,789</b>	<b>-</b>	<b>86,367</b>
1.2 Biogas support centre created - SAWEC	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	-	-	-	-	-
	Contractual Arrangement	25,000	25,000	25,000	25,000	100,000
	Training/Workshops	-	-	-	-	-
	International Meetings/Workshops	-	-	-	-	-
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>25,000</b>	<b>25,000</b>	<b>25,000</b>	<b>25,000</b>	<b>100,000</b>
1.3 Tool kits, decision support tools, operation and manuals for integrated biogas systems in agro-processing SMMEs are developed and disseminated	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	-	-	-	-	-
	Contractual Arrangement	120,000	-	-	-	120,000
	Training/Workshops	-	-	-	-	-
	International Meetings/Workshops	-	-	-	-	-
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>120,000</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>120,000</b>
1.4 Professionals and technicians i biogas technology trained	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	16,935	16,935	16,935	-	50,804
	Contractual Arrangement	66,667	66,667	66,667	-	200,000
	Training/Workshops	-	-	-	-	-
	International Meetings/Workshops	-	-	-	-	-
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>83,601</b>	<b>83,601</b>	<b>83,601</b>	<b>-</b>	<b>250,804</b>
1.5 Targeted training workshops for market players (project developers, enterprise executives, farmers and operators, current users of waste ) on integrated biogas systems conducted	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	20,322	20,322	20,322	-	60,965
	Contractual Arrangement	-	-	-	-	-
	Training/Workshops	-	-	-	-	-
	International Meetings/Workshops	-	-	-	-	-
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>20,322</b>	<b>20,322</b>	<b>20,322</b>	<b>-</b>	<b>60,965</b>
1.6 Two Regional training workshops conducted to train experts from SADC counties on biogas technologies in SMMEs	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	-	-	-	-	-
	Contractual Arrangement	-	-	-	-	-
	Training/Workshops	-	-	-	-	-
	International Meetings/Workshops	-	25,000	-	25,000	50,000
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>-</b>	<b>25,000</b>	<b>-</b>	<b>25,000</b>	<b>50,000</b>
<b>TOTAL Component 1</b>		<b>277,712</b>	<b>182,712</b>	<b>157,712</b>	<b>50,000</b>	<b>668,137</b>



Component 2	Type of Expense	GEF Grant Budget Component 2				Output Total
		Yr 1	Yr 2	Yr 3	Yr 4	
2.1 Quality standards for integrated biogas plants in SMMEs developed, adopted and widely disseminated	International Expertise	-				-
	Local Travel	-				-
	National Expertise	-				-
	Contractual Arrangement	65,000	65,000			130,000
	Training/Workshops	-	10,000			10,000
	International Meetings/Workshops	-				-
	Equipment	-				-
	Miscellaneous	-				-
	<b>Output sub-total</b>	<b>65,000</b>	<b>75,000</b>	<b>-</b>	<b>-</b>	<b>140,000</b>
2.2 Guidelines and regulations (environmental, technical and legal) on the valorization of digestate and effluent developed and adopted	International Expertise	-	-	-	-	-
	Local Travel	-	-	-	-	-
	National Expertise	2,540	2,540	2,540	2,540	10,161
	Contractual Arrangement	45,000	45,000	45,000	45,000	180,000
	Training/Workshops	-	3,000	-	-	3,000
	International Meetings/Workshops	-	-	-	-	-
	Equipment	-	-	-	-	-
	Miscellaneous	-	-	-	-	-
	<b>Output sub-total</b>	<b>47,540</b>	<b>50,540</b>	<b>47,540</b>	<b>47,540</b>	<b>193,161</b>
2.3 Biogas licence process streamlined	International Expertise	-	-			-
	Local Travel	-				-
	National Expertise	7,621	7,621			15,241
	Contractual Arrangement	-				-
	Training/Workshops	-	-			-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>7,621</b>	<b>7,621</b>	<b>-</b>	<b>-</b>	<b>15,241</b>
2.4 regulatory framework on access to the grid by small to medium scale biogas projects developed and presented to local authorities	International Expertise	7,500	7,500			15,000
	Local Travel	-				-
	National Expertise	22,862	22,862			45,724
	Contractual Arrangement	-	-			-
	Training/Workshops	-	-			-
	International Meetings/Workshops	-	-			-
	Equipment	-	-			-
	Miscellaneous	-	-			-
	<b>Output sub-total</b>	<b>30,362</b>	<b>30,362</b>	<b>-</b>	<b>-</b>	<b>60,724</b>
<b>TOTAL Component 2</b>		<b>150,523</b>	<b>163,523</b>	<b>47,540</b>	<b>47,540</b>	<b>409,126</b>

Component 3	Type of Expense	GEF Grant Budget Component 3				Output Total
		Yr 1	Yr 2	Yr 3	Yr 4	
3.1 Detailed feasibility studies of 5 selected demonstration projects are conducted	International Expertise					-
	Local Travel					-
	National Expertise	124,471				124,471
	Contractual Arrangement					-
	Training/Workshops					-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>124,471</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>124,471</b>
3.2 Five (5) integrated biogas demonstration projects implemented to achieve at least 3MW installed capacity	International Expertise					-
	Local Travel					-
	National Expertise	30,483	30,483			60,965
	Contractual Arrangement					-
	Training/Workshops					-
	International Meetings/Workshops					-
	Equipment	600,000	900,000	300,000		1,800,000
	Miscellaneous					-
	<b>Output sub-total</b>	<b>630,483</b>	<b>930,483</b>	<b>300,000</b>	<b>-</b>	<b>1,860,965</b>
3.3 Demonstration projects monitored, evaluated and showcased.	International Expertise		-			-
	Local Travel					-
	National Expertise			20,322	20,322	40,644
	Contractual Arrangement					-
	Training/Workshops					-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>-</b>	<b>-</b>	<b>20,322</b>	<b>20,322</b>	<b>40,644</b>
3.4 Best practice manual developed and widely disseminated	International Expertise					-
	Local Travel					-
	National Expertise			20,322	20,322	40,644
	Contractual Arrangement		-			-
	Training/Workshops		-			-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>-</b>	<b>-</b>	<b>20,322</b>	<b>20,322</b>	<b>40,644</b>
<b>TOTAL Component 3</b>		<b>754,953</b>	<b>930,483</b>	<b>340,644</b>	<b>40,644</b>	<b>2,066,723</b>

Component 4	Type of Expense	GEF Grant Budget Component 4				Output Total
		Yr 1	Yr 2	Yr 3	Yr 4	
4.1 Investment strategy for integrated biogas and low-carbon technologies developed and disseminated	International Expertise	-	-	-	-	-
	Local Travel					-
	National Expertise	45,724	45,724			91,448
	Contractual Arrangement					-
	Training/Workshops	5,000	5,000			10,000
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>50,724</b>	<b>50,724</b>	<b>-</b>	<b>-</b>	<b>101,448</b>
4.2 Technical assistance provided to realise at least 4 more investment projects (at least 6 MW)	International Expertise		45,000	45,000		90,000
	Local Travel					-
	National Expertise	101,609	101,609	101,609		304,826
	Contractual Arrangement	-	-	-		-
	Training/Workshops					-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>101,609</b>	<b>146,609</b>	<b>146,609</b>	<b>-</b>	<b>394,826</b>
4.3 Portfolio of at least 25 investment projects in integrated biogas systems are compiled and disseminated	International Expertise		15,000			15,000
	Local Travel					-
	National Expertise		91,448	91,448		182,896
	Contractual Arrangement					-
	Training/Workshops					-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>-</b>	<b>106,448</b>	<b>91,448</b>	<b>-</b>	<b>197,896</b>
4.4 Technical support provided to design financial support	International Expertise					-
	Local Travel					-
	National Expertise	30,483	30,483			60,965
	Contractual Arrangement					-
	Training/Workshops					-
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous					-
	<b>Output sub-total</b>	<b>30,483</b>	<b>30,483</b>	<b>-</b>	<b>-</b>	<b>60,965</b>
4.5 National biogas investment forum organised regularly	International Expertise					-
	Local Travel					-
	National Expertise					-
	Contractual Arrangement					-
	Training/Workshops		20,980		20,980	41,960
	International Meetings/Workshops					-
	Equipment					-
	Miscellaneous		4,988		4,988	9,976
	<b>Output sub-total</b>	<b>-</b>	<b>25,968</b>	<b>-</b>	<b>25,968</b>	<b>51,936</b>
<b>TOTAL Component 4</b>		<b>182,815</b>	<b>360,231</b>	<b>238,057</b>	<b>25,968</b>	<b>807,071</b>

## ANNEX G: ESTIMATE OF ENERGY SAVINGS AND GHG EMISSION REDUCTIONS

### Direct emission reductions

Direct emission reductions within this project result from the investment in a minimum of 5 demonstration projects and in direct assistance in further replication or scale-up projects. These projects will be installed and commissioned during the project's 4 year implementation phase resulting in direct GHG emission reductions. For each of these projects an economic lifetime of 15 years is assumed. For the 5 demonstration projects this results in total direct emission reductions of 341,000 tonnes of CO<sub>2</sub> equivalent (tCO<sub>2</sub>eq) over the lifetime of the investments, and for the replication projects this results in double this figure with a further 680,000 tCO<sub>2</sub>eq.

In the non-GEF base case the energy needs of each project would be met in a variety of ways. In all cases electricity is imported from Eskom from their coal dependent generation. In some cases heat demand is met by coal fired boilers which will be offset by the biogas. Where bio-CNG is to be produced gasoline or diesel will be displaced in vehicles and in one case bio-CNG will displace LPG used for heat processes. A conservative emission factor for the grid, of 0.912 tCO<sub>2</sub>/MWh, has been used and IPCC figures have been used for LPG, coal (non-bituminous), gasoline and LPG.

In addition there are emission reductions resulting from the displacement of synthetic fertiliser by using the digestate. A conservative figure of 20 kg CO<sub>2</sub>e/tonne digestate applied has been used based on the lower figure of 20-40kgCO<sub>2</sub>e/tonne (Parliamentary Office of Science and Technology, 2011). Further emission reductions are available from the avoidance of previous waste disposal methods. Again these differed between projects from open lagoons, open dumping, and landfill to disposal at sea. Conservatively the current calculations do not include for these emissions.

It must also be noted that despite measures to prevent it there could be methane leakage at the project sites. Since methane has a Global Warming Potential (GWP) of 21 these spills can be significant. Default CDM figures have been used based on the technology proposed, i.e. steel or concrete lined digesters have leakage of 2.8%, Upflow anaerobic sludge blanket (UASB) of 5% and other methods of 10%. In addition parasitic electricity use has also been included in the calculations.

In each case the most conservative figures have been used. Actual emission reductions could be higher. The following table summarises the emission reductions associated with the demonstration projects.

Table 8:

	Demonstration project	Biogas assumed use for conservative calculation	Digestate use assumed	Annual GHG reductions (tCO <sub>2</sub> eq)	GHG over Lifetime (tCO <sub>2</sub> eq)
1	Western cape abattoir	Electricity and heat	Crops	3243	48,643
2	Fort Hare project	Electricity	Crops	2731	41,000
3	Bela Bela and Uilenkraal	Electricity	Crops	3383	50,700
4	Portfolio of projects	Electricity, heat	Crops	5731	86,000
5	WEC food processor	Electricity	-	7653	114,700
	<b>Total</b>			<b>22,740</b>	<b>341,105</b>

### Direct post-project emission reductions

Although the project will facilitate the financing of new biogas projects beyond the implementation phase, this is not expected to use GEF funding which would be used during the project implementation phase only. Therefore as a conservative assumption, no direct post-project greenhouse gas emission reductions are claimed.

### Indirect emissions reductions

The project is expected to catalyze significant further investment in biomass to energy technologies due to its policy, technical and capacity building activities that are designed to address the current barriers to investment. These are likely not only in the agricultural industry but also in other industries, resulting in indirect emissions reductions. Using the GEF bottom-up methodology, indirect emission reductions attributable to the project are expected to be 4,000,000 tCO<sub>2</sub>eq. This figure assumes a conservative replication factor of 4 (GEF uses 3 for a market transformation initiative and 4 where a credit guarantee is introduced).

Using the GEF top-down methodology, indirect emission reductions attributable to the project are estimated at 1,800,000 tCO<sub>2</sub>eq. This figure assumes that total technological and economic potential for GHG emission reductions in this area over the

post-project 10 years is 3,000,000 tCO<sub>2</sub>eq, with a project causality factor of 60 %, which takes into account the influence of the related existing government initiatives<sup>41</sup>.

The range of indirect CO<sub>2</sub> emission reductions is 1,800,000 – 4,000,000 tCO<sub>2</sub>eq.

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<sup>41</sup> It is expected that post – project about 10 projects would be installed annually in South Africa . Current projections are only 2-3 a year. The emission reductions due to these installations would equal approximately 6400 tCO<sub>2</sub>eq per project.

