BIOGAS

SECOND NATIONAL BIOGAS CONFERENCE 2015

Navigating the Path to Biogas Implementation

Industrial Development Corporation Auditorium, Sandton, Gauteng

5–6 March 2015

Joburg Water Northern Works Waste Water Treatment plant Combined Heat and Power biogas installation.

energy
Department:
Energy
REPUBLIC OF SOUTH AFRICA

SABIA
SOUTHERN AFRICAN BIOGAS INDUSTRY ASSOCIATION

CONTENTS

FOREWORD

Tina Joemat-Pettersson, MP

Minister of Energy

I am proud to present this detailed report on the 2nd National Biogas Conference that the Department of Energy (DoE) in partnership with the Southern African Biogas Industry Association (SABIA) hosted on 5-6 March 2015 at the Industrial Development Corporation (IDC) Auditorium in Sandton.

This report synthesises the invaluable contributions made by over 220 conference delegates across the spectrum of our society including international experts from other parts of the African continent, Europe and South America.

The 2nd National Biogas Conference was aptly entitled "Navigating the Path towards biogas implementation" because the Department sees biogas as a critical component of our growing economy.

This growth begins with the energy sector, which is a central component in economic growth and sustainable development. We all know there can be no prosperity without energy, hence security of energy supply underpins many major decisions that we make as government.

In our quest to meet societal energy needs, we also need to rethink how we produce and consume energy. We need to be conscious of the impact of energy production on the environment and as such promote options that help us mitigate climate change.

Biogas is a methane-based fuel considered to be twenty-one times more harmful than carbon dioxide, and helps us convert our waste to energy while reducing our greenhouse gas emissions. Biogas was identified and prioritised in the 2003 White Paper on Renewable Energy Policy to contribute to the 2013 target of 10 000 GWh alongside solar, wind, small scale hydro and other biomass technologies.

Today, we are proud to say that through our efforts, the wind and solar energy sector is being firmly mainstreamed into the national electricity supply. However, small scale technologies such as biogas and small scale hydro have not yet taken off on a significant scale.

It is of concern that the adoption of biogas projects even for commercial purposes in South Africa has been very slow, even though the Renewable Energy Independent Power Producer Procurement (REIPPPP) programme allocated 12.5 MW to small- scale biogas and 5 MW to small-scale hydro technology. We have therefore

realised this as an area that requires a policy intervention.

This conference report provides critical information on the areas that we need to pay particular attention to.

Unimpeded by the past, the variety of renewable energy supply options enables government and the people of South Africa to implement a diversified energy mix as envisaged in the 1998 White Paper on Energy Policy of South Africa.

Through the REIPPPP programme that the Department of Energy is leading, government has been able to accelerate the transformation of the energy sector by bringing in the private sector and introducing the compulsory local content requirements.

In so doing, we have deliberately reinforced the centrality of energy to the economy and the development of our people.

Since 2011 we have introduced opportunities for Independent Power Producers (IPPs) to generate and supply electricity to the national grid.

Additionally, biogas technology offers significant opportunities for consumers to produce their own energy and therefore reduce the load on the electricity grid.

This is an area that requires refinement and the Department is looking into it alongside the issues of enabling arrangements to connect to the electricity grid (i.e. wheeling agreements).

To sum up, the Department working together with key stakeholders will focus on removing the policy and regulatory gaps which hinder the development of biogas and other small scale embedded generation opportunities.

Through this conference, we believe that we have started the conversation on how affected government departments and key stakeholders can engage on the development of a National Biogas Strategy including the identification of resources and tools that will be necessary to successfully implement a national biogas rollout.

The work that has already been done through the volunteers to the National Biogas Platform will simplify this task. We need to work together, as a collective, to build an efficient and vibrant biogas industry in South Africa.

From the REIPPPP we have observed that the increase in the deployment of renewable energy technologies globally has resulted in a constant and steady decline in prices which has benefitted the fledgling local renewable energy industry. Similar positive spinoffs are possible with a clear and implementable programme for biogas.

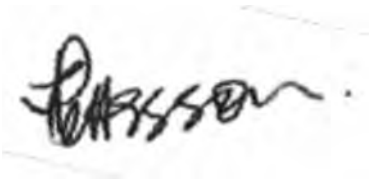
We recognise that many biogas projects are smaller than the minimum target of 1 MW set for the small scale IPP programme. Therefore to fully address the mainstreaming of this technology and the issues impacting its uptake requires everyone to take a more comprehensive and flexible view.

In light of this, our policy directive will focus on ensuring that energy from biogas can be used for transport, electricity and heat applications.

We need to replicate current biogas initiatives across municipalities' waste water treatment plants, the agro-processing sector, the abattoirs, residential sector and the like.

We strongly believe that biogas can make a significant contribution to filling the thermal energy gap which often confronts us in our off-grid solutions in marginalised communities. Consequently, biogas will assist us to reach our universal energy access goal faster.

In closing, I trust that this conference report and other related information that has been put together for general access by the public, will be invaluable in supporting the development and growth of the biogas sector.



Tina Joemat-Pettersson, MP
Minister of Energy

(Above) Attendance far exceeded expectations, with more than 300 delegates participating in the second National Biogas Conference.

EXECUTIVE SUMMARY

With solar and wind entering the mainstream of electricity generation in South Africa, biogas is emerging as a renewable energy source offering multiple benefits. They include agricultural, animal, food, human, landfill and plant waste management; round-the-clock generation of electricity and especially during peak periods; and production of lighting, heat and vehicle fuel.

Biogas also produces organic, nutrient-rich fertiliser, reduces odours from waste and abates greenhouse gas emissions, specifically of methane, which produces 21 times as much warming as carbon dioxide. In addition, the development, operation and maintenance of biogas plants generate more jobs than other renewable energy technologies.

Widely used in Europe and such countries as China and India, biogas has developed in fits and starts in South Africa, but the formation of the South African Biogas Industry Association (SABIA) three years ago coupled with acute shortages of electricity and rapidly inclining tariffs has given the industry strong impetus.

Rising interest in developing and using biogas was reflected at the 2nd National Biogas Conference in Sandton, Gauteng on 5 and 6 March 2015. Attendance exceeded expectations, with more than 200 participants from South Africa, several other African countries, Europe and South America. As conference programme director Nomawethu Qase of the Department of Energy (DoE) put it: "2015 is the year for biogas".

Biogas is produced through the natural biological decomposition of organic material in the absence of oxygen. It can be produced under controlled conditions in specially designed and enclosed biogas digesters which are fed with waste material. Methane gas released during the process can be used to drive turbines to generate electricity or utilised as a gas in households, commerce and industry. Organic fertiliser is produced from the digestate.

Biogas can be utilised for large and small-scale applications, and is widely used in rural areas, particularly in Asia where basic digesters produce heat for cooking in low income households.

Digesters are few and far between in South Africa, but a notable feature of the Conference was the participation of a number of rural farmers and community workers looking for information on biogas and guidance in its development. "People are struggling out there," said a participant from Limpopo.

Key biogas challenges

Until recently, development of a biogas industry has been hampered by a lack of awareness and understanding of the energy, environmental and social benefits of biogas technologies; complex administrative processes for project development and licensing authorisations, especially at national and municipal government levels; inadequate supportive legal and policy framework; absence of standards for safe and quality use of biogas; and a lack of dedicated financing mechanisms and skills.

Biogas breakthroughs

A number of developments are now opening the way for vigorous development of a biogas industry. They include:

- The establishment in late 2013 of the National Biogas Platform which has gone a long way towards unblocking many of the obstacles by bringing all interested parties together and working with government to simplify permitting and authorisation processes for the industry, identify and consolidate financing options, and collate available information on biogas projects. Ultimately, this work will go a long way towards helping government to create a policy and regulatory environment conducive to development of a sustainable industry.

- Rising electricity tariffs which are driving many companies and institutions to install alternative energy sources. This has seen a major breakthrough for the biogas industry with the development of two biogas combined heat and power plants in Johannesburg municipal waste water treatment works.

"These two projects have the potential to unlock the municipal biogas sector as they are the first of their kind in the country and all other municipalities now have a reference project to work from," Jason Gifford of WEC Projects, which developed the plants, told the Conference. "I am convinced that over the next three to five years there will be a massive roll out of biogas projects, starting with the big municipalities and then smaller ones."

The DoE's Xolile Mabusela added: "Since biogas cogeneration technology has improved, we believe there is a significant opportunity for municipalities to produce their own power at a cost below that of retail electricity."
Several abattoirs have installed biogas plants and many are considering similar projects.

- The award of a preferred bidder status to the 18 megawatt (MW) Johannesburg Landfill Gas-to-Electricity project under the third bidding window of the government's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). This plant will supply power to the national grid and as such has brought biogas into mainstream electricity generation.

PARTNERS: *(from left) Nomawethu Qase, Director: Renewable Energy Initiatives, Department of Energy; Mark Tiepelt, Chairperson of the SA Biogas Industry Association; and Sofja Giljova, Renewable Energy Advisor, South African-German Energy Programme.*

- The electricity supply challenge which has resulted in recurrent load shedding throughout South Africa.

Key points to emerge from the Conference included:

Biogas potential

In a Conference presentation, Willem du Preez of Johannesburg-based BBEnergy said a University of Cape Town Energy Research Centre study had estimated that total biogas-generated electricity potential in South Africa is about 2 300 Megawatt electricity (MWe continuous generation, 24/7).

He estimated that biogas generators could supply

peak period electricity to the national grid at a cost lower than Eskom's peaking diesel generators and Concentrated Solar Power plants with Thermal Energy Storage.

A delegate believed that biogas produced from unused grasslands could generate between 2 000MW and 3 000MW.

SABIA chairperson Mark Tiepelt told the Conference he believed the best potential for a rapid rollout of biogas plants lies in using waste produced on-site, such as in abattoirs, and generating electricity from biogas for use mainly on site.

This obviates the need to procure waste from elsewhere, and eliminates the need to sell electricity to other entities through complex wheeling and power purchase agreements. However, this would be possible if there are good incentives given to those who generate their own electricity, thereby reducing the strain on the national grid.

However, a number of delegates felt that too much emphasis is being placed on biogas as an electricity generator and not enough on its potential to produce good quality organic fertiliser, especially in rural areas where this can be used to improve food security.

National Biogas Strategy

Noting that the National Biogas Platform is already working to develop the critical elements of a national biogas strategy, Ms Qase told the conference: "We now need to work together to develop a framework that can contribute to a government-led strategy that assesses the resources, feedstock available for biogas production and the potential of biogas, and sets out support mechanisms, timelines as well as targets for development of the industry".

Drawing on his country's experience in supporting the growth of a biogas industry without a driving strategy behind it, a Brazilian delegate encouraged South Africa to forge ahead with the development of the biogas industry even without the strategy.

SABIA chairperson Mark Tiepelt added: "The biogas industry is in its infancy but has massive potential provided we continue to receive support from government to create a regulatory environment conducive to its development.

PLENARY SESSION : DAY 1

CONFERENCE AIM AND OUTLINE

Mark Tiepelt, chairperson, South African Biogas Industry Association (SABIA)

SABIA has made considerable progress over the past two years with strong support from its members, the Department of Energy, the Industrial Development Corporation (IDC) and the German development agency, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Biogas has been developed slowly over the years. Anaerobic digesters were installed in several municipal waste water treatment plants in the 1970s, though most of these have fallen into disuse. More recently, a world class 1.1MW plant has been built in a waste water treatment plant in Johannesburg; a few municipal landfill plants are now on-line; and the 18MW Johannesburg Landfill Gas-to-Energy project under government's

"We are working with government departments to develop a more efficient licencing process".

Renewable Energy Independent Power Producer Procurement Programme (REIPPPPP) is being built.

The pig industry has shown great interest in biogas; a number of abattoir projects are underway; and several hundred digesters have been installed in rural areas, though countries like India and China have several million.

The biogas industry needs to meet numerous challenges if it is to realise its potential. SABIA members need to share information on their projects and the information needs to be disseminated to government and the business sector in order to create greater awareness of progress and the considerable commercial potential of biogas.

Biogas can also play a major role in providing electricity and clean household gas for the many rural communities who have no electricity and are

unlikely to have an Eskom connection within the next 10 to 20 years.

Among numerous challenges, the biggest is the licencing of projects, which require approvals from a number of government departments. One of our members had to wait for seven years before

Mark Tiepelt, Chairperson of the SA Biogas Industry Association

obtaining approval for a project, but we are now in a position where we are working with government departments to develop a more efficient process.

Another challenge is to promote the multiple benefits of biogas. In addition to the fact that biogas has the potential to contribute 3 gigawatt (GW) or 4GW to the national grid, including electricity during peak periods, biogas has a major role to play in waste management and can produce organic fertiliser and process heat.

It also has the greatest potential among renewable energy technologies for skills transfer and job creation. Solar projects under the REIPPPP are creating 0.9 job opportunities per MW whereas biogas projects can create five to 10 times that number.

A biogas industry can also support local manufacturing, contribute to reducing greenhouse gas emissions, support companies to move towards carbon neutrality and improve their prospects particularly in export markets, and reduce corporate exposure to carbon tax.

The biogas industry is in its infancy but has massive potential provided we continue to receive support from government to create a regulatory environment conducive to its development.

FEEDBACK

The National Biogas Platform

Overview

Presented by **Sofja Giljova,** Renewable Energy Advisor, South African-German Energy Programme (SAGEN) which is funded by the German government and implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

The National Biogas Platform was launched in 2013, with GIZ-SAGEN taking on the role of facilitator. Assistance provided by GIZ-SAGEN has included coordination, facilitation and documentation of regular meetings, and tracking of progress in the main work streams.

The Platform aims to:

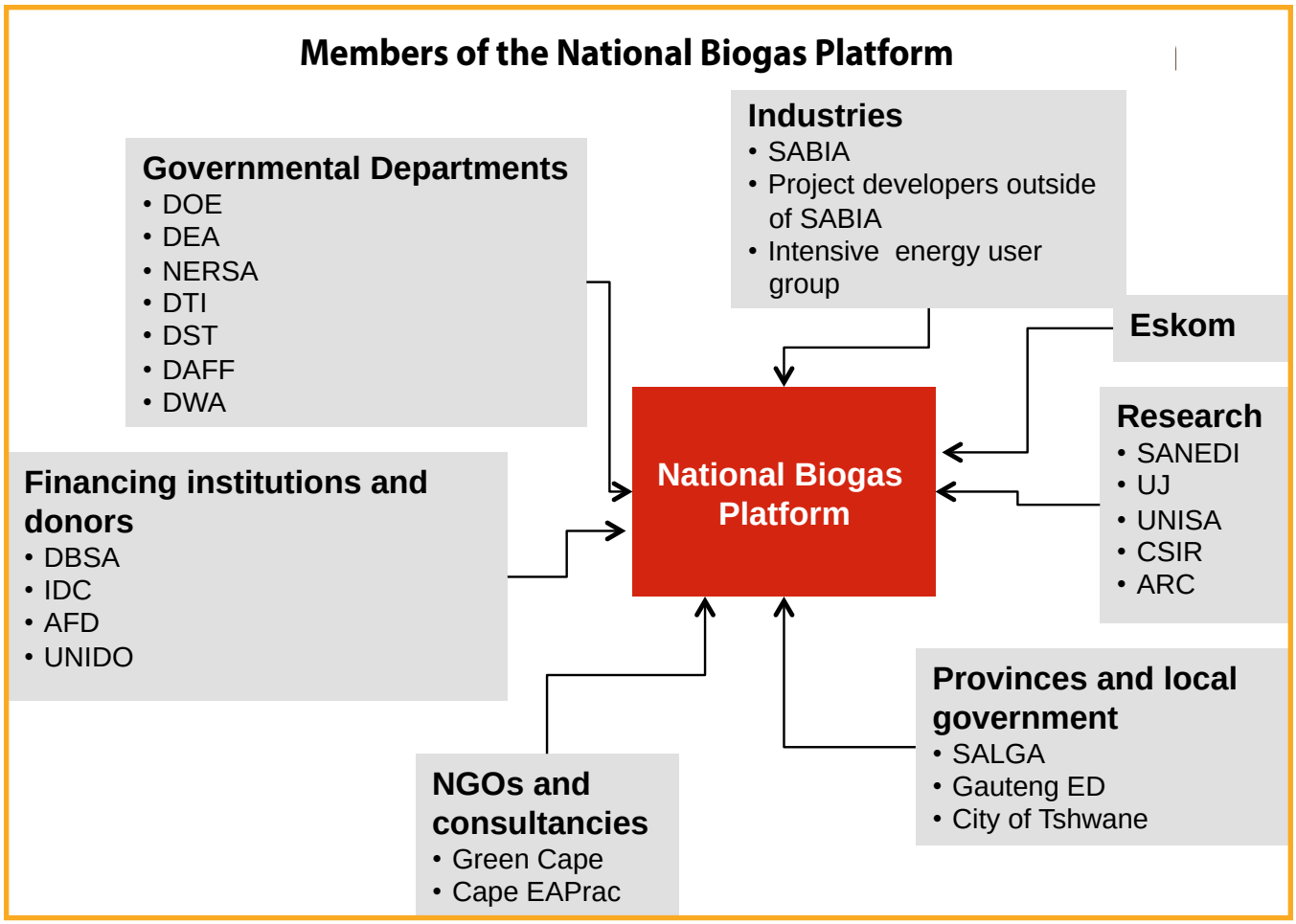
- facilitate the engagement of all related stakeholders on biogas issues;
- promote biogas industry development;
- address lessons learned from existing projects;
- assess current and future regulatory requirements in order to make regulations conducive for the development of the industry; and
- Identify and bundle existing financing options for biogas projects.

Since November 2013, nine bi-monthly platform meetings have been conducted, attended by 90 people from 35 institutions.

A total of 25 presentations were made by project developers, donors, researchers and financiers.

Three working groups based on the needs of the biogas industry have been established. They focus on:

- **Information gathering:** bundling information on existing projects and studies, with inputs from SABIA, Green Cape and universities;
- **Financing:** developing an overview of available project financing options at the different stages of project development, with inputs from the Industrial Development Corporation, the SA



Local Government Association SALGA), the SA National Energy Development Institute (SANEDI), the Council for Scientific and Industrial Research (CSIR), the Department of Trade and Industry (the dti), and AFD, the French Agency for Development; and

- **Licensing:** developing an overview of all required licenses for different types of projects, identifying bottlenecks and proposals for streamlining, with inputs from SABIA, Green Cape, Cape EAPrac, the Departments of Environmental Affairs (DEA), Water Affairs and Sanitation (DWAS), the Agricultural Research Council (ARC), the National Energy Regulator of SA (NERSA), and provinces.

Sofja Giljova, Renewable Energy Advisor, South African-German Energy Programme.

Information gathered by the Platform will be posted on the SABIA website.

New working areas identified by the Platform are:

- Development of a biogas information hub;
- Undertaking a biogas resource assessment;
- Development of a biogas policy framework;
- Setting of biogas technology parameters and standards;
- Research and Development (R&D) and skills development;
- Identifying socio-economic benefits of biogas, including rural electrification; and
- Publicity programmes.

Information Gathering On Biogas Projects

David Cornish, member of the National Biogas Platform and general manager of Ener-G Systems.

David Cornish.

The objective of the information gathering programme is to enable the learning and sharing of experiences among biogas developers and the development of informed decisions.

The process aims to identify sector-specific challenges and to enable the National Biogas Platform to respond to identified needs and motivate changes to support mechanisms and regulations. However, developers will not be expected to divulge commercially sensitive information about their projects.

Some information is already available on the SABIA website http://biogasassociation.co.za under Blogs but this will grow as the information gathering process develops. A list of 34 projects has already been compiled, and we have received 14 case studies and surveys.

Information can be sent to dcornish@gessa.co.za or gracia@green-cape.co.za

Financing Of Biogas Projects

Tony Nkuna, Coordinator of the National Biogas Platform Finance Working Group.

The working group's terms of reference are to:

- investigate financing options for the biogas industry and develop an Information tool as a guide for the industry. Local and international public and private funding is being investigated;
- define the key bankability criteria for biogas projects and develop some form of checklist to assist developers to assess their readiness before approaching lenders;
- explore appropriate means of adopting and making localisation beneficial to the growth of the industry instead of it being seen as a hindrance by developers;
- investigate funding sources for pre-feasibility studies with a view to overcoming challenges related to implementation funding;
- determine specific government and associated institutions' roles and interventions required for the growth and sustainability of the biogas industry; and
- assess project developers' concerns that the Municipal Finance Management Act is a stumbling block in the development of biogas projects.

Tony Nkuna.

The working group's approach is to split early-stage funding and implementation-stage funding requirements as the two require different criteria and therefore attract different funds.

Early-stage funding refers to financial support

required before the bankable stage is achieved. Implementation funding applies where the bankable stage has been reached. The information is comprehensive enough to cover energy efficiency projects as well.

The working group aims to launch the information tool on a website by the end of May, 2015.

Regulatory Processes For Biogas Projects

Louise-Mari van Zyl, member of the National Biogas Platform and Director of Cape EAPrac.

The National Environmental Management Act (NEMA) is the overarching environmental legislation, and provides for Special Environmental Management Acts (SEMA's) that include:

- The National Environmental Management Waste

Louise-Mari van Zyl.

  Act (NEM:WA) (Act No. 59 of 2008) which governs a Waste Management License;

- The National Environmental Management: Air Quality Act (NEM:AQA)(Act No. 39 of 2004) – Atmospheric Emissions License;

- The National Environmental Management: Biodiversity Act (NEM:BA) (Act No, 10 of 2004) – Permit; and

- The National Environmental Management: Protected Areas Amendment Act (NEM:PAA) (Act No. 31 of 2004) – Environmental Authorisation.

These SEMAs list 'activities' with thresholds that determine whether prior authorisations, such as environmental authorisation or a waste management license, may be required for a project. The enabling processes for obtaining most of the approvals are either a Basic Assessment or a Full Scoping and Impact Assessment.

Typically, a biogas facility, depending on its treatment capacity and the types of feedstock, will require a waste management license as a minimum requirement.

An important distinction is made between the treatment of 'general' and 'hazardous' waste products. In the event that 'general waste' is treated in a biogas digester, the process for obtaining approvals is normally that of a Basic Assessment process, whereas the introduction of 'hazardous' waste will upscale the process to a Full Scoping and Impact Assessment.

It is very important for prospective biogas operators to ensure that they categorise their feedstock correctly (as either 'general' or 'hazardous' waste) and obtain early input from the relevant authorities to determine whether or not their biogas facility must obtain prior approvals.

Other legislation that must be complied with includes the National Water Act (Act No. 36 of 1998), the National Heritage Resources Act (Act No. 25 of 1999), various acts related to agriculture and planning, and the National Gas Act (Act No. 48 of 2001) and associated municipal bylaws.

Not all legislative requirements may be necessary to establish a biogas plant. Each facility needs to be evaluated on a case by case basis to determine the required processes.

The National Biogas Platform has developed a regulatory tool to guide developers and decision-making authorities through the legislative processes and to enable them to determine the requirements they must meet.

The tool is available on the Department of Energy website **http://www.energy.gov.za/** but the information will need to be updated from time to time because legislation is constantly being changed. Delegates were also given a summarised hard copy of the tool for quick reference.

Due to the fact that the biogas industry is regulated by so many different sets of legislation, there are challenges regarding the application and interpretation of legislation. This results in inconsistencies between different provinces.

The key to the advancement of the biogas industry therefore involves proactive cooperation between SABIA and government departments, in particular the national Department of Environmental Affairs and the national Department of Water Affairs, to help resolve inconsistencies and help streamline the regulatory framework within which the local biogas industry must operate.

A PROPOSED INDEPENDENT POWER PRODUCERS' (IPP) PLATFORM

Sisa Njikelana.

Sisa Njikelana, Chairperson, SA Independent Power Producers' Association (SAIPPA).

SAIPPA is proposing the establishment of an Independent Power Producers' (IPP) Platform to ensure that the IPP community speaks with one voice, harnesses its energies, and engages with government in a more coordinated way. An IPP Platform would also avoid as much duplication of effort as possible among the various IPP associations. SAIPPA hopes that SABIA will join this initiative.

TOWARDS A BIOGAS STRATEGY

Nomawethu Qase, Director: Renewable Energy Initiatives, Department of Energy.

Through the 2003 White Paper on Renewable Energy, government committed to strategically develop renewable energy resources in a systematic way. The 2010-2030 Integrated Resource Plan (IRP 2010) increased the modest 10 year target of about 1 600MW by 2013 to 17 800MW by 2030.

The key drivers of renewable energy are energy security, economic growth and combating climate change.

The concomitant benefits are the expansion of energy access, especially to poor and marginalised communities, economic growth and creation of job opportunities ranging from unskilled construction work to skilled professional services, improved air quality, reduction in greenhouse gas emissions, which moderates climate change, enhanced energy security, a diversified energy mix and sustainable development.

As a renewable energy technology, biogas therefore contributes towards the achievement of government objectives.

Biogas lends itself very well to small-scale household or community applications, particularly in rural areas where it can supply energy for cooking and heating, but it also has large- and utility-scale applications in electricity generation, providing process heat, co-generation and transportation.

In addition, biogas can be used for responsible waste disposal, producing nutrient-rich organic fertiliser and enabling rural communities to switch from fuelwood and paraffin, with health and safety benefits due to reduced indoor air pollution and risk of fires.

The Department of Energy now wants to ensure that biogas makes a positive contribution towards the achievement of government objectives. Targeted policy interventions are therefore required to ensure systematic development of a sustainable biogas market.

The National Biogas Platform will be working towards developing the critical elements of

such a strategy. "We now need to work together to develop a framework that can contribute to a government-led strategy that assesses the resources and feedstock available for biogas production and the potential of biogas, and sets out support mechanisms, timelines and targets for development of the industry," said Ms Qase.

Typical sources of feedstock that would need to be evaluated to assess the potential of biogas include:

- Sewerage: domestic, municipal, schools, hotels etc.
- Food waste: domestic, commercial and industrial, including fats and oils.
- Manure: pigs, cattle, chicken etc.

Nomawethu Qase.

- Agricultural: vegetables, fruit, maize, sugar cane, sugar beet etc.
- Commercial: abattoirs, cheese factories, breweries, wine estates, processing plants, fruit and vegetables, packaging plants, etc.

A biogas strategy will enhance efforts to promote biogas; determine the direct and indirect benefits of biogas and appropriate support mechanisms; establish the ability of biogas plants to deliver power to the grid at peak times; assess the potential for biogas in job creation, particularly in rural areas, and in local manufacturing; and the role that biogas can play in agricultural waste management.

Comment

Invited to comment on Ms Qase's presentation, a number of delegates voiced concern that too much emphasis was being placed on biogas as an electricity generator. Biogas may have limited potential to generate electricity on a large-scale, and small-scale developers do not have the financial resources to meet the requirements needed to make bids under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). However, in subsequent discussions at the Conference, some delegates said they believed biogas had the potential to produce between 2GW and 3GW.

Delegates felt there should be greater emphasis on biogas as a fertiliser producer and generator of heat, especially for rural communities.

BIOGAS AS A PEAK PERIOD ELECTRICITY GENERATOR

Willem du Preez, Consultant, BBEnergy.

The biogas power generation industry is currently developing at such a slow pace, that it is unlikely that the potential of the resource will be exploited to a meaningful extent in the foreseeable future.

The current electricity pricing levels for biogas do not reflect its most valuable component, which is the fact that biogas-generated power is fully dispatchable. This inherently higher value should be exploited by allowing biogas to compete for applications where its full dispatchability is a definite requirement, such as the supply of morning and evening peaking power. Biogas could be used to generate a large portion of peaking power, with substantial cost savings for the country.

A Time-of-Day (TOD) tariff for biogas-generated electricity is required with a rate for peaking hours that is sufficient to attract investors and which would be substantially lower than the current rates during peaking hours for Concentrated Solar Power (CSP) with storage and Open Cycle Gas Turbines (OCGTs).

CSP combined with Thermal Energy Storage enables CSP power stations to supply electricity even when there is no sun. However, for technological and cost reasons, this ability is limited to the supply

of electricity during the evening peak period. In contrast, biogas-generated electricity is truly dispatchable and can supply electricity on demand at any time of the night or day. Biogas-generated energy is stored in the form of chemical energy of the biogas produced by anaerobic digesters and stored in gas holders, from where the gas is fed to engine-alternators according to the load electricity demand.

The average cost of diesel used by OCGTs is about R3.00/kWh. This is only the cost of the diesel. It does not include other production cost elements such as operating and maintenance costs, amortisation and corporate overheads. Diesel-fuelled power plants cost Eskom more than R10-billion to operate in 2013 and were run at costs between 16 and 18 times higher than its coal plants, according to former Eskom CEO Brian Dames.

To encourage CSP with storage to generate energy during peak time, the Department of Energy introduced an incentive in the form of a TOD tariff. A base tariff applies during the day and a higher tariff will be applied for supplying energy during peak. Fully indexed to October 2014, a CSP plant will receive about R1.80/kWh for electricity delivered during the day and R4.85/kWh during peak period.

Potential for biogas electricity generation in South Africa.

According to a recent study by the Energy Research Group at the University of Cape Town (UCT), the total biogas-generated electricity potential of the country is about 2 300 MWe (continuous generation, 24/7). The combined total nominal capacity of Eskom's Ankerlig and Gourikwa open cycle gas turbine power plants is 2 067 MWe.

If the biogas industry has to deliver 2 000 MWe only during the morning (07h00–10h00) and evening (17h30-21h30) peak demand hours, i.e. 35 hours per week, the equivalent continuous generating capacity required would be 417 MWe, which is only 18.1% of the 2 300 MWe available. If the 2 000 MW had to be delivered only during the morning peak hours (15 hours per week), the equivalent continuous generation capacity required will be 179 MW or 7.8% of the available potential.

Distributed generation and grid stability

Large-scale biogas power generation is a very good example of distributed generation. It has the advantage of lower transmission costs compared to CSP generation in a few remote locations.

The distributed generation factor coupled with the truly dispatchable nature of biogas electricity will also help to improve network stability. With fluctuating capacity, inherent to most renewable energy technologies, addressing grid stability will become a high priority concern.

Willem du Preez.

The TOD tariff for CSP recognises the intrinsic value of storage for shifting generation in order to meet demand. The fact that biogas electricity generation, in contrast to CSP, is fully dispatchable, gives it a higher intrinsic value than that of CSP generation.

Cost of peak-period biogas-generated electricity

Depending on the size of disgesters, biogas plants will be able to supply peak-period electricity at between R2.80 and R3.80/kWh or possibly lower in a competitive bidding tender. This is substantially lower than CSP with storage (R4.85/kWh) and probably lower than diesel-fuelled OCGT (R3.00/kWh plus operating and maintenance costs, amortisation and corporate overheads plus cost of carbon emissions).

Fully dispatchable biogas power generation will also provide back-up to intermittent solar and wind generators and therefore greater grid stability.

HOW RENEWABLE ENERGY TECHNOLOGIES CAN SUPPORT ENERGY EFFICIENCY DEMAND SIDE MANAGEMENT INITIATIVES (EEDSM)

Xolile Mabusela, Director: Energy Efficiency, Department of Energy.

Since the 2009/2010 financial year, more than 60 municipalities have participated in an EEDSM programme funded through a grant under the

Xolile Mabusela.

Division of Revenue Act and supported by the German and Danish governments.

The focus has been on retrofitting energy efficient electrical equipment rather than introducing alternative energy sources. However, the departments of Energy, Environmental Affairs and Public Works are working together to drive energy savings and climate change mitigation in public buildings and facilities. Electricity consumption in municipal buildings and waste water treatment plants account for the major share of total municipal usage.

Biogas recovery for cogeneration in municipal waste water treatment (WWT) plants is another EEDSM option that is being seriously considered. The Department of Energy is working with three EEDSM participating municipalities that have identified biogas potential to generate renewable power via co-generation in the form of electricity and heat.

A feasibility study on the potential for biogas co-generation in WWT plants will form part of the energy consumption baseline assessment, and will be completed by June 2015 at three municipalities. Although detailed feasibility will be completed within three to four months, the commissioning of WWT Biogas Combined Heat and Power (CHP) (co-generation) plants will require investments from the municipalities or the private sector.

Since biogas co-generation technology has improved, the Department of Energy believes there is a significant opportunity for municipalities to produce power at a cost below that of retail electricity, thereby reducing their own electricity consumption. The plan is to encourage municipalities to generate own electricity to be used to power WWT plant equipment. Some heat generated will be used to heat digester tanks to optimum temperature.

Delegates networking during breaks in the conference.

PANEL DISCUSSION

Why do we not see more biogas projects developing in SA?

Moderator: Mark Tiepelt, Chairperson, SABIA.

Panelists: Sean Thomas (Bio2Watt), Jason Gifford (WEC Projects), Raoul Goosen (IDC), Moroasereme Ntsoane (Khumba Energy), David Oldfield (Finishes of Nature).

Issues covered by panelists and raised by delegates included:

Waste Water Treatment

Jason Gifford noted that numerous municipal waste water treatment plants have potential to produce biogas for heat and power applications. The development of these could unlock the biogas industry and take considerable pressure off the grid. However, while waste water treatment is part of municipalities' core business, generating biogas is not within their field of expertise.

Referring to his company's implementation of biogas projects for Joburg Water, Gifford noted that this was encouraging other municipalities to outsource similar projects.

"I am convinced that over the next three to five years there will be a massive roll out of biogas projects, starting with the big municipalities and then smaller ones," said Gifford.

Responding to a delegate who said he had met only with blank faces when discussing biogas with municipalities, Louise-Mari van Zyl from Cape EAPrac urged biogas developers to engage with municipalities to discuss the benefits of biogas and raise with them the consequences for failure to act more decisively to manage waste. Mr Tiepelt pointed out the South African Local Government Association is already engaging municipalities on this issue.

Meeting Rural Energy Needs

Developing a national off-grid strategy: Moroasereme Ntsoane urged consideration for development of a national off-grid energy strategy in which biogas will have an important role to play through the supply of thermal energy, particularly in rural areas.

The strategy should include the establishment of a national agency to oversee its implementation in much the same way as the Renewable Energy Independent Power Producer Programme was innovatively and efficiently governing generation of grid-tied electricity.

The proposed agency could also look into the issue of how projects could be funded. "We need to go beyond pilot and demonstration biogas projects and move to mass implementation focused on rural areas," he said.

Fertiliser production: David Oldfield expressed concern that the conference was too heavily focused on a 1st World approach to biogas. "I come from Transkei which is 3rd World and where there is a need for small, do-able projects," he said. As an example, he said more emphasis should be placed on biogas' ability to produce fertiliser which would, in turn, help to secure greater food security in rural areas.

Sean Thomas responded that fertiliser in fact makes up 5% to 10% of the income from one of his company's projects. Farmers in the vicinity of another project are enthusiastic about being able to obtain fertiliser, he added.

Innovative rural applications: Responding to a delegate who wanted to know how schools in disadvantaged areas could benefit from biogas, David Oldfield offered the example of the Integrated Biogas and Algae Sanitation System developed by his company at six schools in the Eastern Cape.

The system has won several awards and provided sanitation to replace pit latrines, biogas generated from on-site food gardens and used instead of expensive liquefied petroleum gas (LPG) to cook school meals and fertiliser. In addition, the system provides a practical life science laboratory for the demonstration to pupils of environmental biotechnology and a platform to demonstrate renewable energy to local communities.

Connecting With Off-Takers

A delegate referred to a KwaZulu-Natal midlands piggery which he said was the biggest in the southern hemisphere. He wanted to know how biogas could be produced there on large-scale and delivered to a number of potential off-takers.

Mark Tiepelt suggested two possibilities. If the biogas was used to generate electricity, this could be sold through a wheeling agreement. An example was a Bronkhorstspruit project in which Bio2Watt was generating electricity at a feedlot and selling it to the BMW plant through a wheeling agreement with Tshwane metropolitan municipality and Eskom.

However, the project had taken seven years to implement because of the regulatory processes involved, though Bio2Watt's Sean Thomas told the conference he believed similar future projects could be implemented quicker as government regulators become more familiar with biogas .

If the piggery produced only biogas, this could cost-efficiently be compressed and bottled and transported to off-takers.

PANEL DISCUSSION

Connecting to the Grid

Moderator: David Cornish, SABIA.

Panelists: Thabang Audat and Mokgadi Modise (Department of Energy); Seetsele Seetswane (Eskom, Grid Access Unit); Mbulelo Ncetezo (National Energy Regulator of SA); Peter Neilson (Nelson Mandela Bay Metropolitan Municipality).

Thabang Audat noted that the nature of electricity generation and distribution is changing. Until recently, virtually all of South Africa's electricity has been generated by Eskom's coal-fuelled power stations situated mainly in the Mpumulanga coal fields and distributed from there to the rest of the country. However, independent renewable energy developers are now supplying electricity to the national grid from plants in many other areas of the country.

This development has led to a number of challenges. Renewable energy developers obtain an initial, provisional quotation from Eskom or municipalities for the cost to connect to the nearest sub-station

on the grid, and this becomes an additional cost for developers. However, final quotations are often two or three times more than the initial quotation. A way therefore needs to be found to make initial quotations as accurate as possible.

A second problem occurs when construction of a plant is completed before Eskom finalises the connecting infrastructure. This necessitates the payment to developers of a fee to compensate them for not being able to supply electricity to the grid. These two problems have created an urgent need for coordinated grid planning across the country in order to connect electricity from different generation centres.

Summarising Eskom's progress in connecting renewable energy plants to the grid, Seetsele Seetswane said the utility has to date connected 39 plants with combined capacity of 2 050MW. Plants with combined capacity of about 1 800MW have reached full commercial operation.

Responding to a question on wheeling renewable energy through Eskom, Mr Seetswane said Eskom has a well established process for grid connection

and wheeling electricity from plants above 1MW. For plants smaller than 1MW, Eskom has developed a small and micro generation framework and is awaiting policy directions from NERSA on a number of issues. Mr Ncetezo said NERSA has issued a document inviting public comment.

Presenting a municipal perspective on grid access for independent renewable energy generators, Peter Neilson said Nelson Mandela Bay Metro has developed a simple policy based on the fact that small-scale generation will not destablise the grid.

Embedded plants with capacity of less than 100kW do not require a generation license and can connect to the grid. Plants with capacity above 100kW are welcome to connect to the municipal grid provided they comply with legislative requirements such as a generation license and pay the costs of connecting to the grid.

BIOGAS STANDARDS AND NORMS

Two presentations were made on biogas standards and norms, the first by Roy Roos, Sector Specialist, South African Bureau of Standards (SABS), followed by Eddie Cooke of SABIA.

Roy Roos

The SABS develops and maintains standards and other normative documents and provides current and accurate information on international, regional and national standards.

National standards are developed through the work of technical committees representing major role players in a particular field to achieve maximum buy-in. Development of standards can be initiated by an individual, an organisation or institution or a government department by submitting a proposal form available on the SABS website.

This is a market-driven process and therefore based on voluntary involvement of all interested parties in the market.

National standards are developed by consensus. Compliance with a standard is voluntary.

The SABS is a member of the International Organisation for Standardisation (ISO). National Standards are prepared and maintained to align with international standards.

Types of standards include voluntary standards, standards referenced in legislation, and compulsory specifications, product standards, system standards, standard test methods and codes of practice.

Standards are subject to five-yearly reviews. They can be amended, revised at any time to keep abreast with technology and the market, or withdrawn.

Information regarding specific standards can be obtained from Standards Information Services at info@sabs.co.za or tel: (012) 428 6666 or from the SABS website at www.sabs.co.za by going to "Standards" under "SABS Products and Services".

Eddie Cooke

SABIA's mandate includes engaging with government at all levels to develop and enforce appropriate standards and regulations.

There are currently no effective standards for the installation of pipes and appliances for use with biogas in South Africa.

The SA biogas industry needs standards that demonstrate that biogas technologies are safe and secure. Standards are required to support biogas practitioners to build a qualified and trusted community of biogas professionals. Registered qualified biogas professionals are needed so that clients can be assured that they offer services and products of the highest quality.

To promote the safe and efficient use and supply

of bio-methane-based gas in South Africa, the following factors need to be considered: the safety environment; the industry focus; development of a win-win relationship between supplier and client; integrity; pursuit of continuous improvement; and development of industry standards.

As the biogas industry works with a flammable substance, standards must be included in regulations and made compulsory. According to regulation R735 gazetted in October 2009, all flammable gas systems should be installed

Eddie Cooke.

by registered practitioners and a Certificate of Compliance must be issued.
Pressure equipment guidelines under the Occupational Health and Safety Act (Act No. 85 of 1993) were gazetted on 27 February 2015.

> *"The South African biogas industry needs standards that demonstrate that biogas technologies are safe and secure."*

The biogas regulatory framework which has been proposed to the SABS covers domestic appliances, equipment and installations with a capacity of less than 0.5 gigajoule per hour (GJ/h); commercial and industrial applications (>0.5GJ/h); and Operating Pressure of Systems (<50 kPa (PER).

All equipment involving the use of flammable substances must be registered under the Safe Gas Equipment Scheme covering all commercial and industrial biogas equipment (> 0.5 GJ/h), domestic and commercial equipment using methane gas (< 0.5 GJ/h), gas ovens, burners, furnaces and boilers, bio-digesters, hot water geysers, heaters and gas generators, and engines.

Biogas has now been included under the Gas Act (Act No. 48 of 2001) and, depending on volumes and size of projects, biogas practitioners will need to comply with storage and construction licenses, register production activity, and have a trading license from NERSA if gas is sold.

Biogas practitioners also need to comply with the National Environmental Management Act covering air quality, water usage, waste management and environmental assessments.

SABIA has already submitted six standards to the SABS, which has asked us to focus on an initial two. The scope of these proposed standards have been changed to cover a wider spectrum of issues. We will not at this stage look at equipment standards but will adopt international standards to cover this.

Discussion

Mr Cooke agreed with a delegate who suggested that guidelines for biogas developers should be developed as an interim measure while standards are being set. He pointed out that guidelines have already been developed to assist bio-digester developers.

Responding to a delegate's concern that the biogas industry could become over-regulated, Mr Cooke said standards are vital in order to prevent accidents and fatalities. However, standards should not be so strict that they inhibit development of rural and domestic installations and make them unaffordable.

In cases where biogas standards do not exist for certain industrial applications, Mr Cooke suggested that standards covering natural gas could be used as an interim measure.

BIOGAS TRAINING AND JOB CREATION

Prof Sampson Mamphweli, Associate Professor, Institute of Technology, University of Fort Hare.

The Institute of Technology skills development programme aims to address challenges ranging from high unemployment especially among the youth to energy poverty in rural areas, and skills shortages among communities in the country. The programme covers solar and wind energy technologies, energy efficiency and biogas digesters.

The programme targets unemployed graduates, grade 10 to 12 school leavers, semi-skilled and self-taught plumbers and builders from the rural areas. At least 70% of the trainees will be women and most of the trainees will be youth.

The content of the training programme includes the theory behind biogas digesters, designs of biogas digesters, construction, installation and maintenance of digesters, the use of biogas and effluent, environmental benefits of using digesters, and business development in the biogas industry.

This includes the establishment and management of biogas cooperatives and health and safety issues. Training will involve both theory and practice with practice taking 90% of training.

Trainees will be divided into various teams and in the end encouraged to register cooperatives that will participate in the roll out of digesters under close supervision.

A two-year period of incubation under the University for "selected" cooperatives will be set aside. Linkages will be created between the newly formed cooperatives and established companies.

Envisaged impact of training

- Establishment of a number of cooperatives that will assist with a mass roll out of household digesters.
- Digesters will be built using low-cost and locally available materials that are accessible to most households in rural areas and local labour will come from the training.
- Bridging of the energy divide between areas that do not have access to clean energy and those that do have access.
- Easing pressure on the national electricity grid.

"It is anticipated that at least 30 people will be trained during the initial training and all of them will participate in the Expanded Public Works Programme."

As an example of potential electricity savings, most rural households use two plate electric stoves for cooking with each plate having a 1kW element.

At peak energy demand the stove would consume 2kWh over a one hour cooking period. Assuming that 5 000 households use the two plate stove at peak energy demand for one hour, this translates to 10 000kWh used over a one hour cooking period.

Rural households with electricity currently pay about R90c/kWh. This translates to a collective saving of R9000 per cooking hour, bearing in mind that households normally cook twice a day. The households that will use the trainees to install digesters will save this money.

It is anticipated that at least 30 people will be trained during the initial training and all of them will participate in the Expanded Public Works Programme currently funded by the Department of Energy (DoE) through the SA National Energy Development Institute (SANEDI).

An additional 10 people trained at Ikwezi municipality will participate in the project funded by the Energy and Water SETA. They will be organised under a cooperative and absorbed into the University incubation programme.

Indications are that the training model works. The University of Fort Hare has been mentoring a cooperative, the UHURU Development Projects Cooperative, which has been established by young people who participated in the DoE/SANEDI biogas project.

They have succeeded in sourcing funding for installation of a digester in a school in Kwazulu-Natal in partnership with a KZN-based company, TSAZ Renewable Energy.

The cooperative has established collaboration with Finishes of Nature Global (Pty)ltd, an established company in the biogas industry currently involved in the University of Fort Hare/DoE/SANEDI project under a joint venture with the cooperative.

They have participated in other renewable energy projects and established collaboration with International companies for development of biogas and other renewable energy projects.

Other University biogas projects

The University of Fort Hare is developing a 180kWe biogas digester funded by the national Department of Science and Technology (DST). The project will assist with the training of Masters and Doctoral candidates.

DST has also funded a school digester at Cofimvaba in the Eastern Cape. This digester will assist with the community outreach and training of individuals in that area in anticipation of a roll out of digesters.

Responding to a question by a delegate from Jane Furse in Limpopo, Prof Mamphweli said it is possible that the next phase of the skills development programme will take place in her province.

Programme Director Nomawethu Qase noted that a number of universities, including the University of Venda in Limpopo, are undertaking biogas projects and offered to put the delegate in touch with them. She added that a SA Renewble Energy Training Centre will soon open at Cape Peninsula University of Technology and that satellite branches will be established at other universities.

Delegates networking during breaks in the conference.

PROMOTING ORGANIC WASTE-TO-ENERGY AND OTHER LOW-CARBON TECHNOLOGIES IN SMMES: ACCELERATING BIOGAS MARKET DEVELOPMENT

Alois P Mhlanga, Industrial Development Officer, Energy and Climate Change Branch UN Industrial Development Organisation (UNIDO).
UNIDO is undertaking a project to promote waste-to-energy and other low-carbon technologies

among small to medium enterprises in the agriculture sector in South Africa .

Reasons for this include:

- The availability of waste feedstock from agricultural operations;
- Enterprises are being heavily affected by blackouts and are facing increasing electricity tariffs;
- Biogas is ideal for enterprises in off-grid and remote areas;
- Biogas is more storable and dispatchable than other renewable energy resources;
- Biogas has a high conversion efficiency if used directly for heat and transport;
- Revenue streams can be improved through the generation of heat and power at the local level;
- Increased productivity through technology and skills upgrading;
- Reduction in environmental challenges through organic waste management;
- Lowering costs associated with transporting organic waste to landfill;
- Creation of local jobs through waste sorting and collection schemes as well as fertiliser distribution; and
- The use of digestate and effluent for fertiliser and irrigation.

UNIDO is looking to support projects with capacity of 500kW to 3MW. They should be in the prefeasibility or feasibility stage but need some catalytic support and have high prospects for growth. They can be located in rural, peri-urban or urban areas and can be aimed at applications ranging from gas-for-heat, electricity, gas for vehicles and industry and/or fertiliser production.

The project will support capacity building, development of the market and regulatory environment, technology demonstration, and scaling up of developments.

UNIDO aims to soon make a final selection of projects to support, and to launch projects towards the end of this year.

WORKING SESSIONS

Three parallel sessions on six key biogas themes were held, with delegates free to choose which sessions to attend.

MUNICIPAL WASTE-TO-ELECTRICITY AND LANDFILLS

Moderator: Aurelie Ferry, Renewable Energy Technical Advisor, SA Local Government Association (SALGA).

Panelists: Jason Gifford (WEC Projects); David Cornish (SABIA); Xolile Mabusela (Department of Energy); Christopher Platzer (GIZ Consultant), Barry Coetzee (Manager Technical Strategic Support, Utility Services Directorate, City of Cape Town).
Issues covered by panelists and raised by delegates included:

The need for municipal champions

David Cornish noted that legislation and limits to funding constrain municipalities from developing projects, and that biogas generation is not a core municipal function.

What could drive more biogas projects is the development by senior municipal management of a clear vision of what they want to achieve in their municipalities.

This commitment will in turn flow into the rest of the organisation and the community that it serves.

In developing projects, municipalities will need to adhere strictly to the Municipal Finance and Management Act (MFMA), and independent developers of projects will need to follow the MFMA to the letter.

Echoing his view, a number of delegates said that without a municipal "champion", projects will not get off the ground.

Increasing municipal interest in biogas

"What could drive more biogas projects is the development by senior municipal management of a clear vision of what they want to achieve in their municipalities."

Jason Gifford noted that changes in legislation governing how municipalities deal with their waste water and sludge combined with the fact that electricity tariffs have more than doubled over the past six years have made it possible for his company to undertake highly successful waste-to-electricity projects for Joburg Water.

This is encouraging other municipalities to consider biogas projects. "We believe there will be a significant roll out of these kinds of projects over the next few years," he said.

David Cornish added that 10 WtE projects have been implemented since 2006 and that municipalities throughout the country are considering WtE projects.

Barry Coetzee reported that the City of Cape Town is likely to implement four to five projects that could possibly be developed through public-private-partnerships. The outcome of the procurement process is subject to finalising transaction advice in line with Municipal PPP Regulations. Potential projects include:

- A landfill gas project which has been registered as a Programme of Activity under the UN Framework Convention on Climate Change Clean Development Mechanism. An initial WtE generation project is envisaged at the Coastal Park landfill site and this will hopefully be followed by installations at two other locations.

- A landfill project at the Bellville South landfill to sell biogas extracted from the landfill. A tender has already been evaluated and a preferred bidder identified. This will involve methane gas being extracted for reticulation to an industrial user who is dependent on heating in their manufacturing processes. The project has potential to also be expanded to link with a wastewater treatment works adjacent to where the new WtE plant will be established. Further feasibility work will be required before decisions are made. An anaerobic biodigester project, which will be used to treat the city's northern area sewage sludges in a central location with capacity of about 10MWe, is at the detailed design stage. The design is based on the combined heat and power concept, which is also meant to reduce energy consumption and electricity bulk purchases, while selling power into the national grid.

Other potential anaerobic biodigester projects involving organic solid waste are also being contemplated, but the number and the procurement mechanism still need to be assessed.

Regarding small-scale biogas projects involving landfills, Mr Coetzee said the City has put forward a proposal via the SA Local Government Association (SALGA) on how these can be funded.

Small-scale developers, he explained, are unable to cover the high costs of making bids under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).
The capital cost and interest for such projects, even at small scale require additional returns, usually

in the formof a higher tariff payable on a Power Purchase Agreement. Current legislation does not allow for this unless a special dispensation can be made through the Department of Energy and the regulator, NERSA. The legislation does allow for the Minister of Energy to make such as dispensation in consultation with the National Treasury.

The City's proposal suggests that these projects should qualify for the REIPPPP tariff, with the municipality paying the ESKOM megaflex portion of the REIPPPP tariff for electricity produced and the balance coming from the REIPPPP budget, which is ring-fenced for renewable energy-type projects. This balance is the difference between a bankable project or not.

The National Treasury is looking at the proposal but has requested more information that needs to quantify the impact of this proposal on the ring-fenced funds. SALGA should appoint a service provider to establish the number of landfills and possible size of projects to provide this information to National Treasury.

Xolile Mabusela of the Department of Energy noted that with support from GIZ, the department is working with four municipalities to assess biogas potential in their waste water works.

Christoph Platzer, a GIZ biogas specialist from Brazil, pointed to "great similarities" in biogas development between that country and South Africa. This creates an opportunity to establish exchanges between the two countries on biogas issues at national and municipal levels. It is also essential, he added, for biogas developers to engage municipalities and illustrate to decision makers the potential and benefits of biogas.

Municipal Capacity Building

Setting the scene for discussion on this issue, Aurelie Ferry said municipalities often complain to her that they receive numerous proposals from developers who claim that their projects are "the best". However, municipalities have difficulty in evaluating proposals, raising the need for capacity building.
A Brazilian delegate said that municipalities in his country are also approached with "wonder solutions". A biogas matrix showing available technologies and their potential and costs has therefore been developed to assist municipalities. Guidelines for drawing up tenders have also been developed.

A participant urged SALGA to establish a panel of lawyers to which municipalities can refer legal issues, and to develop a standard tender template.
Mr Coetzee noted that the City of Cape Town has a waste forum in which information sharing takes place. However, platforms such as this need to be well structured to avoid them from becoming mere talk shops.

Developers and municipal officials should also have in-depth discussions before tenders are issued. Municipalities also tend to consider only price in evaluating tenders, rather than price and performance.
Mr Mabusela said consultants appointed by municipalities to assist them with projects are often not able to effectively transfer skills to officials.

Great similarities in biogas development between Brazil and South Africa create opportunities to establish exchanges between the two countries.

The Department of Energy holds quarterly sessions with 25 municipalities to share information but there is a need to expand the scope of these sessions and to include energy services companies (ESCOs). Workshops involving municipalities and ESCOs should also be held.

Health buffer zones

A delegate noted that health buffer zones have to be established around landfill gas recovery and biogas projects in sewage treatment plants. This restricts land use in those areas and the expansion of housing projects. Is there a way to motivate for a reduction in the extent of zones?

David Cornish pointed to the installation by his company of a gas collection system at Robinson Deep landfill site. Within a week of commissioning the plant, people in the area reported that for the first time in 30 years no smells were emanating

from the site.

He recommended that developers should build data bases of benefits from projects, which could be used to make a case for reducing buffer zones.

Assessing landfill potential

Responding to a question, Mr Cornish said a rule of thumb calculation is that landfills that receive about 25 000 tons of solid waste a month should produce about 1MW.

APPLIED RESEARCH AND DEVELOPMENT (R & D)

Moderator: Dr Martin Myer (Senior Lecturer and Research Coordinator, University of South Africa).

Panelists: Dr Karen Surridge-Talbot (Centre Manager for the Renewable Energy Centre of Research and Development (RECORD) at the SA National Energy Development Institute); Francois Cilliers (Biopower Corporation); Prof Sampson Mamphweli (University of Fort Hare); Rethabile Melamu (Green Cape).

Setting the scene, Dr Myer suggested issues that could be discussed include ways in which to improve the reliability and sustainability of bio-reactors, the possible establishment of a centralised biogas reactor feedstock testing facility, and training of newcomers to the biogas industry.

He said not enough attention is being paid to applied R & D, and specifically to microbiological aspects, with a view to attaching some kind of predictive value to when a given bio-digester installation is struggling, or likely to fail.

Issues covered by panelists and delegates included:

Research and its value

Dr Surridge-Talbot explained that RECORD has established a number of platforms to facilitate collaboration in meeting renewable energy challenges and objectives, among which is a Waste to Energy Platform. A WtE study was completed in November 2014 and the Platform was launched in December.
The study provides an overview of current national WtE research, identifies common themes, priorities and gaps, and makes recommendations. The study focuses on research undertaken on feedstock, technology and product, and on current initiatives, programmes and policies applicable to WtE.

More information on the study is available at **www.record.org.za**

Rethabile Melamu emphasised the high value of R & D and the need to support it not only during the formative years of biogas development but to ensure continuous improvement after the industry matures.

R & D supports policy development; builds capacity to innovate and adapt technology to African needs, with several hundred university graduates already having been trained in biogas; supports lobbying by providing credible information; assists in identifying gaps; and helps developers to overcome challenges.

"Because South Africa has a limited number of locally developed bio-digesters, Prof Mamphweli said his department at Fort Hare University is working on designs for small systems."

Because South Africa has a limited number of locally developed bio-digesters, Prof Mamphweli said his department at Fort Hare University is working on designs for small systems.

It is also monitoring the performance of existing systems, including systems from China and India, with a view to developing computer models that will enable developers to access a wide range of information on various systems in different areas.

In addition, the department is undertaking feedstock analysis to predict biogas potential, assessing bacterial activity in different types of digesters, and addressing public health issues.

Responding to a rural farmer who is keen to develop a biogas facility in her piggery, Prof Mamphweli said his department will be available to advise as it also has a piggery with an installed biogas digester.

Biogas Design and Operation Manual

Francois Cilliers provided an overview of his extensive experience in research on biogas as an energy source that replaces fossil fuels, candles and firewood for cooking, lighting, heating, cooling and generating electricity. He drew attention to a manual which he authored and which is used as a key reference source: "Biogas Design and Operation Manual" ISBN 1-919849-87-4 obtainable from Institute for Agricultural Engineering.

He highlighted the fact that most digesters commissioned in SA are below ground, which buffers microbial bio-reactors against variations in ambient temperature changes.

Overall, the technology, particularly in rural areas, needs to align with use in modified gas burners and stoves, and water scarcity issues.

More extensive research required on the quality of bio-fertiliser

Echoing frequent calls at the conference that greater emphasis needs to be placed on the value of biogas as a fertiliser producer, two participants urged more extensive research into quality issues relating to fertiliser.

RURAL DIGESTERS AND OFF–GRID

Moderator: Noma Qase, Director: Renewable Energy, Department of Energy.

Panelists: Sebastian Khoza (DoE); David Mahuma (SANEDI); Alistair McMaster (Senior Manager for Renewable Energy: Eastern Cape Department of Economic Development, Environmental Affairs and Tourism – DEDEAT); and Wim Jonker Klunne (Energy and Environment Programme for Southern and East Africa).

Issues raised by panelists and delegates included:

Need for government buy-in

Alistair McMaster , referred the Working Session to the Provincial Sustainable Energy Strategy in which a core aim is energy poverty alleviation through the roll out of biogas systems particularly in remote rural areas.

The Provincial Bio-Energy Implementation Support Plan under the Strategy includes the roll out of household biogas digesters and the establishment of bio-energy villages managed by service cooperatives and linked to rural enterprise development hubs and agri-parks.

The Strategy was published in 2012, but not much progress has been made since then, he said, adding that the province has no hard core answers to why a biogas rollout has taken so long and what is required to accelerate its uptake.

What is needed, he said, is to create awareness about biogas within provincial government departments and municipalities; provide technical support and capacity development to provincial and local government; link biogas to SMME development and local economic development; support projects and initiatives; seek co-funding for projects and assist in project packaging; and unblock decision making.

> *"3.3 million houses are still not electrified and that only 300 000 of these have potential to be electrified off-grid because the cost to connect them to the grid is too high."*

Challenges in bio-digester roll outs

David Mahuma listed numerous challenges facing government's Working for Energy programme in the installation and maintenance of bio-digesters in rural areas.

These include:

- Creating an environment in which beneficiaries could contribute to costs through soft loans. However, the cost benefits will need to be demonstrated to households and other potential biogas users, such as communal facilities, cooperatives, and emergent farmers. Overcoming cultural concerns, such as the notion of using waste to generate gas for cooking.
- Maintenance of digesters: Many rural households are occupied by elderly people living alone, and they will often have difficulty in regularly feeding bio-digesters, so a way to assist them needs

to be found. In addition, a system needs to be developed to ensure general maintenance of bio-digesters after installers have left an area.

- The need to develop a standardised bio-digester design that is cost-effective and easy to install.
- The containment of costs in cases where digesters need to be installed underground in cold areas.
- Training of builders and installers.

Off-grid challenges

Sebastian Khoza noted that 3.3 million houses are still not electrified and that only 300 000 of these have potential to be electrified off-grid because the cost to connect them to the grid is too high.

DoE has grid and off-grid electrification programmes. Considerable progress is being made in extending grid connections. Potential for off-grid connectivity is considerable even in urban areas such as Gauteng.

Government funding for biogas

Moderator Noma Qase posed the question: should government spend resources on biogas promotion in the residential sector and, if so, what is the most appropriate way in which to do so?

"Yes", responded David Mahuma. In cases where SANEDI has installed household demonstration projects, municipalities have shown immediate interest in larger scale installation, particularly where the multiple benefits of biogas become evident. However, delivery mechanisms need to be found to facilitate local development and installation of systems.

Wim Jonker Klunne said government should support biogas not only with funding but by endorsing off-grid energy provision.

Biogas should also be regarded as part of energy provision among basic services delivered by government, but more data needs to be collected to determine the value of biogas in relation to other energy sources, added Alistair McMaster.

Ms Qase pointed out that government has changed its policy from one of providing universal access to electricity to providing universal access to energy. What, therefore, was government thinking on the provision of thermal energy and the extent to which biogas could be included under the revised policy? Mr Khoza responded that government had still not developed a clear solution to provision of thermal energy.

However, he pointed out that under government's off-grid programme, service providers are appointed to cover specific areas where they install Solar PV systems and are required to ensure the establishment of service centres which include thermal solutions, such as distribution of LPG.

Biogas not only for the poor

Mr Khoza urged that biogas should not only be used in disadvantaged areas but that medium and high income households should be encouraged to install digesters, which would also save energy costs and provide fertiliser for their gardens.

"Biogas should not only be used in disadvantaged areas but medium and high income households should be encouraged to install digesters, which would also save energy costs and provide fertiliser for their gardens."

Cries for help to assist communities that are still living in poverty

A delegate from Jane Furse in Limpopo related that she has undertaken considerable research on the use of biogas in her area and believes she has a full understanding of what the community requires.

She appealed for support in developing projects. "People are struggling out there," she said. She explained she has started a community development project in which young people could be trained to install and maintain biogas systems.

A KwaZulu-Natal farmer referred to an initiative by sugar cane farmers to investigate utilisation of crop waste as an additional income generator.

Initial studies show that production of fertiliser in bio-digesters is the most viable option, not as an income generator but as a cost saver for farmers. He appealed for suggestions on how digester installations and maintenance could be funded.

A delegate who will soon go on pension said she had investigated conditions in the area where she plans to settle and has noticed that a number of government-funded projects there have fallen into disuse. She too appealed for support to develop community energy projects.

Don't make the same mistakes as with the Solar Water Heating Programme

A delegate referred to reports that some government-funded solar water heating systems are inoperarable because of poor installation and said that this has created lack of confidence in the technology. He urged government to ensure that the credibility of biogas will not be compromised in the same way.

Mr Khoza responded that the problem was often due not to poor installation but to badly built houses in which systems are installed.

Ms Qase added that compliance with norms and standards is not only the responsibility of government but also of the industry and it is important for all those who are committed to this technology to protect its reputation.

Opportunity for co-funding

Wim Jonker Klunne, Programme Director of the Energy and Environment Partnership (EEP), used the opportunity to announce the EEP 11th Call for Proposals which is open until 13 April 2015. He urged participants to apply as this is the last call before the programme shifts focus to monitoring and evaluation.

ABATTOIRS

Moderator: Mark Tiepelt, SABIA.

Panelists: Jan du Preez (WEC Projects); Horst Unterlechner (iBert); Michael Hansen (Xergi); Louise-Mari van Zyl (EAPrac); Dirk Groenewald (Morgan Abattoir).

Expanding on her presentation on Norms and Standards on Day 1 of the conference, Louise-Mari van Zyl urged developers planning biogas installations in abattoirs to liaise with the Red Meat Abattoir Association.

Following changes in legislation on waste disposal, the Association is doing "amazing work" in looking for alternatives in dealing with waste and making its members aware of, among other things, the use of biogas to treat waste.

The Association is working with government to establish waste management norms and standards for the abattoir industry.

Asked by Mark Tiepelt whether it is possible to develop a template that can be used by government departments to expedite approval of biogas projects, Ms van Zyl said the process involved in gaining approvals was either through a basic environmental assessment or a full environment impact assessment.

The Red Meat Abattoir Association is doing "amazing work" in looking for alternatives in dealing with waste.

This is already a well-structured process but it is unlikely that integrated decisions can be made because each biogas plant requires specific approvals from a number of government departments. However, government departments have committed themselves to trying to run all processes in parallel.

Horst Unterlechner, whose company installed the first abattoir biogas plant in South Africa – a combined power and heat facility at Jan Kempdorp in Northern Cape province – noted that few biogas plants in abattoirs run solely on abattoir waste.

Additional material, such as dung, needs to be used in order to achieve the right mix and quality of waste, which is a key requirement for a successful project.

Dirk Groenewald explained that Morgan Abattoir in Springs, Gauteng, began to consider establishing a

biogas plant because of constraints in the supply of electricity (from the national grid) and problems encountered in waste management some seven years ago. However, the company had to meet major challenges.

Obtaining regulatory approvals and licenses was a constant battle, with paperwork being left unattended on officials' desks for long periods.

Financial institutions were also reluctant to fund a technology with which they were not familiar. The biogas project only became possible after Morgan Abattoir secured an Eskom rebate for the amount of grid electricity that the plant would save.

Jan du Preez, whose company has designed the Morgan abattoir biogas plant, noted that about 1.2 million cattle, 2.5 million to 3 million pigs, and some 1 billion chickens are annually slaughtered in South Africa.

About 30% of the abattoir by-products can be collected in a controlled manner and used for gas-to-electricity projects. This equates to generation of about 10MW from abattoirs.

He urged that South Africa should in many cases apply and adapt European biogas regulations rather than spend considerable time developing its own regulatory system.

Michael Hansen, whose Denmark-based company has developed over 100 biogas plants world wide, endorsed the view that European standards and experience developed over many years should be adopted in South Africa.

Responding to questions on how to calculate biogas potential for electricity generation, Mr Unterlechner said waste from 250 cattle slaughtered per day five times a week will produce about 100 to 135kW.

Mr Tiepelt cautioned that it is problematic to make generic calculations of biogas potential because each plant differs.

Regarding fertilizer produced by abattoir biogas plants in South Africa, Mr Unterlechner said each facility requires a license to sell the product.

He said good quality fertiliser can fetch a price of about R500 per ton in South Africa.

AGRICULTURE AND FOOD PROCESSING

Moderator: Petrus Britz (Research Team Manager, Agricultural Research Council Institute for Agricultural Engineering).

Panelists: Mokhele Moeletsi (ARC); Dr Mary-Jane Thaela-Chimuka (ARC, Animal Production Institute); Jorgen Ballermann, Mananging Director of Xergi; Carsten Linnenburg, Senior Consultant, GIZ.

Dr Thaela-Chimuku, a Senior Researcher at the ARC, said the ARC Animal Production Institute is exploring biogas generation from pig waste on its farm in Irene, as well as the potential of biogas in managing animal waste in general and in reducing carbon emissions.

Saying she has become enthusiastic about biogas since becoming aware of the technology, she told the conference: "I am going to make sure that our Institute opens farmers' eyes to biogas and makes them aware of it."

"I am going to make sure that our Institute opens farmers' eyes to biogas and makes them aware of it."

Jorgen Ballermann, who works for a Danish biogas engineering company, said he believes there is scope for large-scale projects in agriculture and the food industry.

He cited as an example a Danish project that will use manure from 60 farms and waste from supermarkets and the food industry.

Biogas and the environment

Mr Britz noted that Norway digested virtually all of its solid and sewage waste and said South Africa should follow suit. The problem, though, is that too many people in South Africa are unaware of biogas.

Mr Linnenburg referred to a biogas lifecyle study in which he had been involved and which showed that bio-digesters produce multiple benefits ranging from a reduction in smells from farms to generation of electricity and gas, production of fertiliser and reduction in greenhouse gas emissions.

Biogas and energy

How can we purify biogas by extracting its 40% content of CO2, asked Mr Britz, who suggested the CO2 could be used in the food and beverage industries. Mr Linnenberg responded that purification technology is expensive and that the cost can only be justified in large-scale biogas plants.

Biogas fertiliser

Responding to concerns that heavy metals and other harmful substances could accumulate over time in soil treated with biogas, a participant suggested that a study should be undertaken on this and other biogas issues and used to develop processes appropriate to South African conditions and requirements.

Dr Thaela-Chimuka suggested that the ARC, SABIA and government should possibly work together to raise funds to support local research which could also take into account international experience.

Optimising the use of biogas

Following discussion on the pros and cons of using energy and other crops for biogas generation, Mr Tiepelt said the greatest potential for a rapid rollout of biogas plants lies in using waste produced on-site, such as in abattoirs, and to generate electricity from biogas for use only on the site.

This obviates the need to procure waste from elsewhere, and eliminates the need to sell electricity to other entities through complex wheeling and power purchase agreements.

Another participant pointed to what he believes is South Africa's greatest potential for biogas. This lies in grasslands which are not used for pasture or food production, and in grasslands on contaminated soils around mines.

These unused grasslands have the potential to provide feedstock for bio-digesters that could produce sufficient biogas to generate between 2GW to 3GW for the national grid. The model would be particularly beneficial in rural areas where communities could benefit from being able to sell electricity and from using fertiliser from digestate to nourish arable land.

Conclusions

Summing up, Mr Britz said slow implementation of biogas in South Africa is due to lack of knowledge and awareness of the technology, a shortage of water needed to produce biogas, and the existence of alternatives, such as LPG. A major problem, added Mr Linnenburg, is long delays in regulatory approvals. What will boost the industry, he said, is to allow biogas plants of up to 1MW to supply the national grid.

VEHICULAR BIOGAS

Moderator: Dr Titus Mathe (Senior Manager: Power Plant, Eskom).

Panelists: Muzi Mkhize (Chief Director: Hydrocarbons, Department of Energy); Themba Tenza (Chief Director, Department of Transport); Carel Snyman (Programme Manager: Green Transport, SA National Energy Development Institute – SANEDI); Lovell Emslie (Industrial Development Corporation); Eddie Cooke (SABIA and SA Gas Association); Mac Makwarela (Director: Department of Environmental Affairs).

Government should provide certain basic infrastructure, but the private sector should establish refuelling infrastructure.

Issues raised and key points made by panelists and delegates included:

Vehicular biogas initiatives

- Dr Mathe related that in 2006 he became involved in a government-sponsored green transportation project implemented by SANEDI. As part of this, he converted his Mercedes Benz at a cost of about R10 000 to run on compressed natural gas (CNG) and petrol. He uses the vehicle to this day. The only challenge he has encountered is the lack of gas refuelling stations and the limited driving range when running on gas.

  Overall, he has enjoyed a smooth ride; the

warranty on his car has remained valid; and there have been no problems in servicing the car. "If I had easy access to refuelling stations, I would use the vehicle every day," he said.

What is needed now, he added, is dissemination of accurate information on gas-driven vehicles, development of refuelling infrastructure, and possibly tax incentives to encourage uptake of vehicles.

- The Department of Transport is developing a Green Transport Strategy and is engaged in a project to test the conversion of public transport vehicles powered by CNG and conventional fuel, said Mr Tenza. He added that the department is reviewing its 1996 national transport white paper to take into account new technologies, such as biogas, and that stakeholder workshops will be held.

- SANEDI has invested to establish a facility at the University of Johannesburg to train students interested in pursuing careers in biogas. It is also engaged in a project with the SA Cities Network to establish a bio-digester at the Johannesburg Zoo to enable the institution to use biogas.

Another project being undertaken involves the conversion of buses and taxis to run on gas. In addition, SANEDI is planning a facility to enable municipalities to buy fleets of green vehicles, with suppliers undertaking to sell vehicles at a cost on par with conventional equivalents.

- A study undertaken three years ago showed that if Gauteng used all biomass resources in the province to produce bioCNG, there would be sufficient gas to run Gauteng public transport vehicles, noted Mr Cooke who was part of a team which converted the first vehicles to run on CNG in South Africa. He said bioCNG can be cleaned to such a standard that it is the equivalent of pipeline gas and is the cleanest path to emissions reduction. He noted that the private sector is establishing CNG refuelling stations for converted taxis.

- The Department of Environmental Affairs has identified 18 carbon emissions reduction opportunities in the transport sector and established that CNG has attractive mitigation potential, reported Mr Makwarela. He added that the department is now studying the issue of gas infrastructure development.

- A study commissioned by the IDC to investigate the economic viability of using CNG in the transport industry indicates that a six month payback period for conversion of taxis to CNG is easily achievable, said Mr Emslie.

Dr Mathe described developments as "exciting", but asked: who is coordinating all these initiatives, and is there a single source of information on them? Mr Mkhize said the point of call is the DoE and SANEDI.

Vehicular biogas infrastructure

Should the City of Johannesburg establish gas scrubbing and refuelling infrastructure, or leave this to the private sector, asked a city official. A panelist suggested that the city could start the process on a small scale and then allow the market to drive further development. However, a regulatory framework still needs to be established, and the issue of taxing gas fuel needs to be considered.

What is needed now is dissemination of accurate information on gas-driven vehicles, development of refuelling infrastructure, and possibly tax incentives to encourage uptake of vehicles.

Mr Makwarela added that government should provide certain basic infrastructure, but the private sector should establish refuelling infrastructure, with government creating an enabling environment.

Standards

Mr Cooke reported that some ISO standards have been adopted in South Africa for CNG, but standards still need to be set for biogas production, scrubbing and storage.

Incentives

Responding to questions on incentives, Mr Makwarela suggested the biogas industry should

propose types of incentives that will support development of the technology. Mr Emslie said government should consider giving the biogas industry a tax holiday to enable it to develop. Endorsing Dr Mathe's views, a participant urged that buyers of gas-powered vehicles should receive a tax benefit.

Working outside silos

Responding to questions on the degree to which the various government departments involved in biogas development work together, panelists emphasised that the departments are not working in silos but frequently meet and also engage with provincial and local government. Government will also use the National Biogas Platform as a means of sharing information.

Conclusions

- Echoing conference programme director Nomawethu Qase's view, Mr Makwarela agreed that "2015 is the year for biogas".

- Referring to a proposal at the Natural Gas Conference last year that a Gas Vehicle Association should be formed, Mr Snyman said SANEDI is discussing this with industry. He said people interested in joining the initiative are welcome to call him. He added that a major reason why the country should develop CNG and biogas for transportation is that this will save the country a "fortune" by being able to reduce imports of diesel and petrol.

- Insufficient standards is the "big gap" in biogas development, but the industry is working with the SA Bureau of Standards to address this and hopefully full standards will be in place within a year, said Mr Cooke. However, he added, "we need to stop with proof of concepts and pilot projects and start putting down commercially viable projects that benefit everyone".

LIST OF ATTENDESS FOR 2ND NATIONAL BIOGAS CONFERENCE HELD ON 5-6 MARCH 2015

Name	Institution	Contact details
Akinwale Aboyade	Mangosuthu University of Technology	
Alistair McMaster	DEDEAT	Alistair.McMaster@dedea.gov.za
Alois Mhlanga	UNIDO	A.MHLANGA@unido.org
Andile Buthelezi	SA Canegrowers Association	abuthelezi@mweb.co.za
Andrew Taylor	CAE	andrewtaylor@cae.co.za
Anele Mtshemla	Ispg (Pty) Ltd	anele@ispg.co.za
Anes Moonsingh	Geener Alternative Solutions	
Angela Brown	RE-SA	angelab@re-sa.co.za
Aurelie Ferry	SALGA	aferry@salga.org.za
Barry Coetzee	City of Cape Town	barry.coetzee@capetown.gov.za
Benat Araucua	Selectra	benat@selectra.co.za
Boikhutso Oldbe	Green Tide	boikhutsoolobe@gmail.com
Bonile Jack-Pama	Ispg (Pty) Ltd	bonile@ispg.co.za
Bopang Khutsoane	DoT	KhutsoaB@dot.gov.za
Bruce Thandike	WCPS	bruce@wcpsolutions.co.za
Bertie Steyller	TB Proc Tech	bertregtler@we.com
Butch Carr	Bosch Projects	carrb@boschprojects.co.za
Carel Snyman	SANEDI	carels@sanedi.co.za
Carsten Linnenberg	AD Solution	linnenberg@ad-solutions.biz
Claren Chan	IDC	clarenc@idc.co.za
Chego Lefadi	IDC	lefadic@idc.co.za
Christopher Swart	BBEnergy	cswart @ bbe.co.za
Christian Olesen	Alistair.McMaster@dedea.gov.za	chrrolsn@gmail.com
Christian Borchard	GIZ	Christian.borchard@giz.de
Christopf Platzer	GIZ	
Clifford Ndlovu	GGDA	cliffordn@ggda.co.za

Cobs Pillay	DTI	cpillay@thedti.gov.za
Cynthia Sekgobela	Waste to Dollar	cynthia.Sekgobela@sasol.com
Danie Pienaar	Eskom	danie.pienaar@eskom.co.zaa
Daniel Itchu-Omoreebe	CPUT	milta@xergi.com
David Breitfield	GIZ	DAVID.BREITFIELD@GIZ.DE
David Cornish	EW-Gsynstems (Pty) Ltd	dcornish@gessa.co.za
David Modii	City of Tshwane	davidn@tshwane.gov.za
David Dewaltlas	Greke greesy	daviddewaltlos@dorke-energy.com
David Mahuma	SANEDI	dmahuma@sanedi.co.za
David Ntsowe	City of Tshwane	davidn@tshwane.gov.za
David Oldfield	Finishes of Nature	david@finishesofnature.co.za
Derek Meyer	RESSA	derek@ressa.co.za
Dirk Groenewald	Feedstock owner	dirk@morganabattoir.co.za
Dominic Milazi	DoE	domic.milazi@energy.gov.za
Dr David Tinarwo	University of Venda	david.tirarwo@univeven.ac.za
Dr Jenitha Badul	DEA	JBadul@environment.gov.za
Dr Karen Surridge-Talbot	sanedi	karenst@sanedi.org.za
Dr Manfred Dutschke	Green Cape Initiative WC Government	dutschke@mweb.co.za
Dr Martin Meyer	UNISA	myer.msm@gmail.com
Dr Mary-Jane Thaela-Chimuka	ARC	thaelamj@arc.agric.za
Dr Rethabile Melamu	Green Cape Initiative WC Government	rethabile.melamu@gauteng.gov.za
Dr Shauna Costley	DEA	scostley@enviornment.gov.za
Dr Titus Mathe	Eskom	titus.mathe@eskom.co.za
Dr Tobias Festauer	CSIR	tfeistaner@gmax.net
Dr Ulrich Averesch	GIZ	ulrich.averesche@giz.de
Dr Vincent Okudoh	Cape Peninsula University of Technology	okudohr@cput.ac.za
Dr W Fromme	DFIC	info@dfic.de
Doug Fetgher	DTOD	Uzfree@gmail.com
Dumisa Maliti	ECRDA	malitid@ecrda.co.za
Dwight Rosslee	Selectra	dwight@biogaspower.co.za
Eddie Cooke	SABIA	eddie@sagas.co.za
Eddy Moms	Ibert	eddy@ibert.co.za
Elrike Henning	Energidrop	elrike22@gmail.com
Emmanuel January	Barloworld Power	ejanuary@barloworldpower.com
Enitha Badul	DEA	JBadul@environment.gov.za
Esrom Mahlatsi Malatji	UJ	mahlatsi87@gmail.com
Fred Mostert	Elgin Fruit Juice	fred@efj.co.za
Gabriel Kgabo	Eskom	kgabotg@eskom.co.za
Gawin Latrebo	WSE	gawin@hmlatrobe
Gerald Zeederberg	Green-Tec	m2greentec@gmail.com
Giel Goosen	George LM	giel@george.org.za
Gordon Ayres	AGAMA (Biogas) Pty Ltd	gordon@biogaspro.com
Gordon Kernick	SAACKE	grant@saake.co.za
Gracia Munganga	Green-Cape	gracia@green-cpae.co.za
Grant Douglas	SAACKE	grant@saake.co.za
Grootboom Lunga Sincerely	ARC-ISCW	glunga@ymail.com
Hansie Maerumule		hansie.maerumule@gmail.com
Henli Sa	Eco Metrix Africa	Henli.SaCaEcoMetrix.co.za
Horst Unterlechner	Ibert	horst@ibert.co.za
Jan Willem Timmen	Eco Metrix Africa	jan-willem.timmen@ecommetrix.co.za
Jan Du Preez	WEC Projects	jan@wecprojects.co.za
Jan Willem Timmen	Eco Metrix Africa	jan-willem.timmen@ecommetrix.co.za
Jason Gifford	WEC Projects	Jason@wecprojects.co.za
J Ballweman	Xergi	jbaoxergi.com
Johan Victor	Private	vickies@telkomsa.net
John Kesi	DAFF	kesimj@yahoo.co.uk
Johan Parkin	eThekwini Metro	John.Parkin@durban.gov.za
John Roux	Western Cape Department of Agriculture	johanr@eisenburg.com

Jarred Roberts	Bosch	roberts@boschcapital.com
Karlos Txopitea	Selectra	Karlos@slectra.co.za
Karl Siegel	MBHE	karls@mbhenergy.com
Karth Siegel		karths@mbhenergy.com
Kedibone Chueu	DAFF	kediboneC@daff.gov.za
Kedibone Modiselle	City of Tshwane	kedibonemak@tshwane.gov.za
Kent Buchanana	DEA	kbuchanan@environment.gov.za
Khothatso Mpheqeke	SANEDI	khothatsom@sanedi.org.za
Kibii Komen	City of Tshwane	kibiikomen@tshwane.gov.za
Koos Moego	Public Works	koos.mosango@dpw.gov.za
Kukoyi Temitope Oladayo	UJ	kukoyitemitope@yahoo.com
Lebogang Mosenthal	DoE	lebogang.mosenthal@energy.gov.za
Leo Crisp	GIZ/DoE	crisp.leo@gmail.com
Lerato April	DoE	lerato.april@energy.gov.za
Li-Long Huang	DBSA Green fund	li-longh@dbsa.org
Linda Cele	Eyethu Engineers	lindac@eyethu.co.za
Li-Pei Huang	Gauteng Infrastructure Financing Agency	i.huang@gifa.co.za
Louise-Marie van Zyl	EAPrac	louise@cape-eaprac.co.za
Lufuno Mukwevho	DoE	lufuno.mukwevho@energy.gov.za
Maialen Rodriguez	Selectra	maialen@selectra.co.za

Makananisi Funzani	DAFF	FunzaniM@daff.gov.za
Makhosazana Baker	City of Johannesburg	MakhosazanaB@joburg.gov.za
Makwarela Azinipaleli	DEA	MAMakwarela@environment.gov.za
Maletlabo Handel	UNIDO	maletlaboh@sanedi.org.za
Mamodishe Sebati	UNIDO	m.sebati@unido.org
Marieta Buckle	AFRISAM	marieta.buckle@za.afrisam.com
Maryjane Mhabela-Chumuka	ARC-API	thaelamj@arc.agric.za
Mark Tiepelt	SABIA	mark@biogassa.co.za
Mary Vanderven	Simgas	marijn@simgas.com
Mashudu Mundalamo	DEA	mmundalamo@environment.gov.za
Mauritz Lindeque	Carbon Neutral Approach	mauritz@carbonneutralapproach.com
Mbulelo Ncetezo	NERSA	mbulelo.ncetezo@nersa.org.za
Michael Hansen	XErgi	milta@xergi.com
Moira Louw	RESSA	moira@ressa.co.za
Mokale Rasetlola	City of Tshwane	mokale@tshwane.gov.za
Mokgadi Modise	DoE	mokgadi.modise@energy.gov.za
Mokhele moeletsi	ARC	moeletsim@arc.agric.co.za
Moroasereme Ntsoane	Khumba Energy	mntsoane@khumbaenergy.co.za
Mpho Matsepe	MMISR Energy Consultants	mpho@mmsr.co.za
Mukhuba Mashudu	ARC-ISCW	mashudumukhuba@gmail.com
Muzi Mkhize	DoE	muzi.mkhize@energy.gov.za
Nalen Alwar	Barloworld Power	nalwar@barloworldpower.com
Namisha Muthraparsad	DWS	MuthraparsadN@dwa.gov.za
Ndiafhi Tuwani	DoE	ndiafhi.tuwani@energy.gov.za

Ndumiso Bhembe	Takhiwo Project Advisors	ndumiso@tprojectadvisors.com
Nita Ramlutchman	RE-SA	nitar@re-sa.co.za
Merley Morudu	SEWALETURBO PTY LTD	marleyinm@gmail.com
Nokwazi Moyo	UNIDO	n.moyo@unido.org
Noma Qase	DoE	Noma.Qase@energy.gov.za
Nosisa Garawe	SANEDI	Noma.Qase@energy.gov.za
Noxolo Mtemba	GGDA	noxolom@ggda.co.za
Nsindiso N Mchunu	Nyanda Biogas Systems (pty) Ltd	dub.z@hotmail.com
Ntuthuko Shezi	Rural Development Company	Shezi@ruralcities.co.za
Pieter Buys	WSE	pietebys@vodamail.com
Petrus Britz	ARC AGRIC ENG	britz@arc.agric.za
Pheladi Masipa	DoE	Pheladi.Masipa@energy.gov.za
Phillip Ninela	DTI	PNinela@thedti.gov.za
P Mashele	Blue Blanket	mashelp@gmail.com
Prakashma Somai	Gordon Carbon Solutions	psomai@gordoncsolutions.co.za
Prof Sampson Mamphweli	University of Fort Hare	SMamphweli@ufh.ac.za
Prof Wilson Parawira	Bindura University of Science Education	parawiradr@yahoo.co.uk
Pulane Lodi	DoT	LodiP@dot.gov.za
Ralph Muvhiiwa	UNISA	rmuvhiwa@gmail.com
Reemal Singh	DRDLR	Reemal.Sing@drdlr.gov.za

Reinhardt Barnard	Surya Power	enegineer@suryapower.co.za
Reoagile Monageng	Bosch Projects	Reoagile.Monageng@za.bosch.com
Riaz Hamid	SANEDI	Riazh@sanedi.org.za
Rob Cloete	Selectra	rob@selectra.co.za
Robert Aitken	Restio Energy (Pty) Ltd	robert@restio.co.za
Roger Macklilan	ECRDA	roger@ardasa.co.za
Randy Molosiwa	Green Tide	sunkingrandpoint@gmail.com
Rudzani Tshibalo	DoE	rudzani.tshibalo@energy.gov.za
Roy Roos	SABS	roy.roos@sabs.co.za
Sandile Martnimus	Wasig-Mart	sandiq@wasteumt.co.za
Sandile Tyatya	Itireleng Energy	sandile.tyatya@gmail.com
Sam Dugbartoy	Fahzacrest	sam@pay2acrest.co.za
Sarah Edwards	RWS Environmental services	sledwards@rws-environmental.co.uk
S Bernes	nwu.	23156359@nwu.ac.za
Sean Thomas	Bio2Watt	sean@bio2watt.com
Seetsele Seetswane	Eskom	Seetsws@eskom.co.za
Seneo Madikiza	DAFF	seneom@daff.gov.za
Simphiwe Molefe	Barloworld Power	Barloworld Power
Sisa Njikela	SAIPPA	sisanjikelama@gmail.com
Siyanda Boyana	Embo / Pickitup	siyanda@emboenenvirosol.co.za
Sofja Giljova	GiZ	sofja.giljova@giz.de
Solomon Mmiso	IDC	solomonm@idc.co.za
Stella Mamogale	DoE	stella.mamogale@energy.gov.za
Takalani Rambau	DoE	tarik.hoeppener@re-energise.co.za

Terrence Leluma	Lehalima Bussiness Enterprise	tpleluma@lehalimagroup.co.za
Thabang Audat	DoE	thabang.audat@energy.gov.za
Thabang Moagi	DoE	thabang.moagi@energy.gov.za
Thandiwe Maimane	DoE	thandiwe.maimane@energy.gov.za
Thandile Malmbuzi	ARC-ISCW	tmdlambuzi@gmail.com
Thebe Mamakoko	DoE	thebe.mamakoko@energy.gov.za
Themba Tenza	DoT	Tenzat@dot.gov.za
Thenjiwe Sebeya	DoE	thenjiwe.sebeya@energy.gov.za
Theuns Breytenboch	Western Cape Department of Agriculture	theunsbeelsenburg.com
Tony Cummines	Enerr-G Systems	tonyc@gessa.co.za
Tony Nkuna	IDC	TonyN@idc.co.za
Vonani Mabunda	ABSA	vonani.mabunda@absa.co.za
Willem Bos	CAE	wbos@coe.co.za
Willem du Preez	BB Energy	wdupreez@bbe.co.za
Wayne Elossop	Wartsila	wayne.glossop@witila.co.za
Wim Jonker Klunne	EEP	wim.jonkerklunne@kpmg.fi
Xolile Mabusela	DoE	xolile.mabusela@energy.gov.za
Yoav Shmulevich	Anaergia Africa	yoav.shmukvich@anaergia.com

ACKNOWLEDGEMENTS

The Department of Energy is grateful to the following individuals and organisations for their commitment to the establishment of a viable biogas industry in South Africa:

SABIA Members led by the Chairman, Mr Mark Tiepelt;
GIZ-SAGEN team particularly Dr Soeren David, Dr Sascha Thielmann and Ms Sofja Giljova;

The National Biogas Platform Members, particularly the working groups, who have volunteered their time since the Platform establishment in 2013 to support Government and SABIA in navigating the path towards biogas implementation;

IDC for sponsoring and supporting the logistics of the conference;

The Conference Planning Team – Ms Sofja Giljova, Ms Lebogang Mosenthal, Ms Nomawethu Qase, Ms Itumeleng Masenya, Mr Mark Tiepelt, Dr Martin Meyer, Mr Tony Nkuna and Mr Pheladi Masipa;

Speakers and moderators whose contributions added invaluable knowledge to the sector, making the conference a huge success;
The entire Renewable Energy Initiatives Team for their collective leadership in identifying technology areas that require government intervention and finding relevant partnerships to plug in the gaps;

Martin Schneider for putting together a comprehensive conference report.