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Development (VCD) Component:**

**Supplementary Report
Renewable Energy**

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SECO Local Economic Development Assistance Programme in iLembe –
Value Chain and Cluster Development (VCD) Component

Renewable Energy Supplementary Report prepared for UNIDO

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Table of Contents

Abbreviations and acronyms	1
1 Introduction	2
2 The Policy Environment	3
3 Opportunities for Renewable Energy in iLembe.....	6
3.1 District and provincial policy and planning.....	6
3.2.2 Ethanol and biofuel production	13
3.2.3 Small scale biogas	16
3.2.4 Waste to Energy Conversion.....	18
3.3 Opportunities in the timber value chain.....	19
3.3.1 Woodchips and pellets as biofuel	19
4 Recommendations for Support	20
4.2 Promote green harvesting practices.....	23
4.3 Enable cogeneration expansion.....	23
4.4 Establish readiness for ethanol diversification	24
4.5 Explore the viability of biogas systems for co-operatives	24
4.6 Monitoring and Evaluation	24
5 Conclusion.....	24
References	26
Annex I – Interview Schedule.....	29
Annex II – Summaries of Stakeholder Interviews	30

Abbreviations and acronyms

CHP	Combines Heat and Power
CIPPP	Cogeneration Independent Power Procurement Programme
DoE	Department of Energy
DM	District Municipality
ICLEI	International Council for Local Environmental Initiatives
IDP	Integrated Development Plan
IPPP	Independent Power Procurement Programme
LSGs	Large Scale Growers
NCT	NCT Forestry Co-operative Limited
RE	Renewable Energy
RECORD	Renewable Energy Centre of Research and Development
SASA	South African Sugar Industry Association
KZN	KwaZulu-Natal
NERSA	National Energy Regulator of South Africa
NPC	National Planning Commission
SEA	Sustainable Energy Africa
SSGs	Small Scale Growers



1 Introduction

The State Secretariat for Economic Affairs (SECO) of the Swiss Confederation developed a Programmatic Approach for Local Economic Development in the iLembe District of South Africa, with a view to improving the socio-economic future of the area and its population. The programme consists of a series of interventions for stimulating economic activity and creating jobs by building related capacities in the iLembe District Municipality (DM), and specifically, in two of district's four local municipalities, KwaDukuza and Mandeni.

UNIDO has been mandated by SECO to develop and implement the Value Chain and Cluster Development (VCD) Component with a focus on the Sugar, Wood and Horticultural value chains. Included in the mandate is the evaluation of opportunities to develop renewable energy (RE) as a viable output of one or more of these value chains.

Opportunities for value addition and stimulation of local economic development through RE projects have already been identified by industry and other key stakeholders in the sugar and timber value chains in iLembe. Sugarcane farming is the dominant agricultural business in the district, with KwaDukuza being at the centre of an extensive sugarcane growing area. Subsistence farming prevails on higher lying ground, primarily within tribal authority areas. Tongaat-Hulett, a world leader in sugar milling, is the area's major industry player, including the Darnall Mill in KwaDukuza. The iLembe District is also home to the Sappi Paper Mill, located in Mandeni and supported by small patches of forestry plantations along the coast and inland.

In addition to sugar and wood, supporting agricultural activities in the area include paper production, fruit and vegetable farming (chillies), tunnel farming, flowers (rose, geranium and lavender), nurseries, herbs and spices and medical plants (Enterprise iLembe, 2008).

The purpose of this report is to summarize the findings from fieldwork, conducted at the end of April – beginning of May 2017, and make recommendations for support. Desk research supplemented interviews which were conducted with key stakeholders in the sugar and timber industry – from representative of lead sugar milling companies and timber grower cooperatives to small scale sugarcane growers (SSGs) - in the iLembe District, as well as local government officials. A complete list of the interviews conducted is available in Annex I and summaries of the interviews is available in Annex II of this report.

The findings from this fieldwork form the basis of a pre-feasibility study of the potential for RE within the sugar and timber sector value chains in the area. The focus of the study has been on exploring the feasibility – in the context of the existing policy environment - of expanded cogeneration in existing sugar mills, small and large scale ethanol production, and potential for grower Cooperative level biogas energy projects. The primary objective of this study has been to

assess the opportunities for stimulating job creation and local enterprise development for SSGs in the iLembe District and make recommendations for possible support interventions.

Depending on the scale and entry points of these initiatives, growth of the growers and SSGs in the sugar value chain is a sought-after result, along with increased revenues for the farmers. Research and stakeholder consultations have demonstrated clear alignment of these objectives with local, provincial and national Government policies that seek to resolve South Africa's triple challenges of poverty, equality and employment. The research and consultation processes are simultaneously validating the underpinning assumption that decentralised energy models in South Africa have the potential to add value and enhance the sustainability of existing industries, as well as create exponential jobs on the back of structural economic change.

2 The Policy Environment

Understanding the overarching national, provincial and local policy with regards to RE development has been a fundamental part of this study. An enabling policy environment is key to achieving the objectives of the broad programme and thus has the potential to become a key focus support area.

iLembe has been identified in various policy documents as the RE hub in the province of KwaZulu Natal (KZN), where each district is targeted to house an industrial hub to support the provincial industrial development zones based on its comparative advantage. iLembe does not currently have a policy or strategy on place to support RE developments on a district level. However, RE and the diversification of the energy mix has been recognised as a priority by the district (M. Mathenjwa, personal communication, 26 April 2017). The iLembe 2015 Growth and Development plan mainly focuses on stimulating the manufacturing side of the RE industry, given that the development of a RE Hub is envisaged in the Isithebe Industrial Estate in Mandeni (iLembe DM, 2015 and M. Mathenjwa, personal communication, 26 April 2017).

Target markets for the RE Hub include green industry project developers, manufacturers, energy services companies, consultancies, SMMEs, cooperatives, youth enterprises, research institutions, test laboratories, training providers and engineering companies. It is therefore intended that related investments will be informed by the targeted markets (Enterprise iLembe, 2014). Renewable energy generation initiatives, such as cogeneration, bioethanol, solar and wind, however are still seen as the "objectives of various private and public sector players in the district" (iLembe DM).

In 2015, Enterprise iLembe - the Development Agency of the iLembe DM - published Terms of Reference, "RE: biomass alternative energy feasibility study and business plan" in a call for tenders with a submission date of 10 August 2015. The results of this study have still to be made public. RE opportunities are also mentioned in the iLembe Environmental Management

Framework and Strategic Environmental Management Plan, launched in March 2013. Specifically, biofuel production based on biofuel crops is mentioned as being a feasible opportunity, although the report highlights related impacts, for example loss of crop land otherwise used for food production as a management consideration.

On a local government level, electricity generation has been the main source of revenue for KwaDukuza Local Municipality. Therefore, there has been a reluctance towards the development of RE and energy efficiency projects, which affect the revenue stream of the municipality (S. Hlongwane, personal communication, 26 April 2017). This is reinforced by the fact that KwaDukuza owns most of the electricity distribution infrastructure in its jurisdiction. However, the Economic Development Unit has been making efforts to influence municipal thinking with regards to the energy mix in the direction of RE and the new Ward Councillors adopted an energy diversification strategy late 2016 (S. Hlongwane, personal communication, 26 April 2017).

A Municipal Energy Master Plan was developed for KwaDukuza in 2015, mainly driven by the electricity supply shortages the municipality was experiencing on the background of rapid economic growth and levels of urbanisation. The Energy Plan, however, did not make any provisions for the development of RE or the promotion of energy efficiency (S. Hlongwane, personal communication, 26 April 2017). It is through the 2016-2017 Integrated Development Plan (IDP) that the KwaDukuza Municipality is making a commitment to promote “progressive strategies that will improve energy efficiency, promote the roll-out of renewable energy, and reduce climate change-inducing carbon emissions” (KwaDukuza Local Municipality, 2016).

The priorities outlined in the IDP with regards to energy are mainly centred around the development of new infrastructure, aimed at addressing electricity supply challenges (KwaDukuza Local Municipality, 2016). The plan also envisages the implementation of “catalytic projects”, among which the development of 250MW of RE generation (KwaDukuza Local Municipality, 2016). Stakeholder interviews revealed that KwaDukuza Municipality has made a clear decision to go into low-carbon development, but there currently no policies developed to foster that, such as feed-in tariffs for surplus electricity from cogeneration and other RE projects (S. Hlongwane, personal communication, 26 April 2017).

As part of the Urban Low Emission Development Strategies (LEDS) project, the Municipality is developing a new low-carbon vision. The strategy envisages that by 2030 KwaDukuza will have successfully managed its transition to low carbon development and will be a hub for green manufacturing and renewable energy activities, as well as a model municipality in terms of integrated resource management and climate change adaptation, among others (Urban LEDs, n.d.). Under this project, the municipality is also considering a commitment to 10-15% RE generation by 2020, as a way of reducing its per capita carbon emissions by 10% (Urban LEDs, n.d.).

The Mandeni Integrated Development Plan 2016-2017 envisions the isiThebe Industrial Park and the potential developments around it, as the main industrial centre within the municipality (Mandeni Municipality, 2016). As such, the Industrial Park has also been identified as a RE Hub within the iLembe DM. The Municipal Electricity Master Plan 2009/10 is expected to be updated during the 2016-2017 period, and RE is anticipated to be integral to this update. The majority of the electricity distribution infrastructure of Mandeni falls under the Eskom Grid Network, but the Municipality has a licence to distribute electricity to 1000 customers within the Mandeni Suburb (Mandeni Municipality, 2016).

On a national level, South Africa's National Development Plan (NDP) prescribes at least 20GW installed capacity of renewable energy to be procured by 2030 (NPC, 2013). The country's Independent Power Procurement Programme (IPPP), which has been deemed a success internationally, is intended to foster the development of RE projects by the private sector, towards achieving this goal. Since its inception in 2013, the Programme has become the primary driver of renewable energy development in South Africa. Ministerial determinations were issued for the IPPP programme by the Department of Energy (DoE) for 14.7GW of renewable energy, out of which 210MW of biomass, 110MW of biogas, and 1.8GW of cogeneration installed energy capacity (DoE, 2016). The Cogeneration Independent Power Procurement Programme (CIPPP), specifically was designed for the procurement of energy through three technologies - Waste to Energy, Combined Heat and Power (CHP), and Industrial Biomass.

The development of biofuels has also been on the national government agenda in South Africa. Following a comprehensive public consultation process at national and provincial level, involving stakeholders from industry, communities and non-governmental organizations, a National Biofuels Industrial Strategy was approved by Cabinet in December 2007 (DoE, n.d.b). The Strategy envisaged a 2% penetration of biofuels in the country's fuel pool by 2013. The approved Strategy suggests a 2% biofuels penetration to the current fuel pool and proposes interventions to achieve this, estimating that these will contribute to overall energy security and create 25,000 jobs in farming (DoE, n.d.b). Several updates to this strategy have been proposed but not adopted, and a national biofuel policy has also been drafted but not adopted. A financial incentive was however introduced in the 2008 national budget speech, with then Minister of Finance, Trevor Manuel, announcing a tax rebate for industries using biofuels.

In spite of these and other initiatives, the general and widespread view of private sector stakeholders is that national policy instruments are inadequate to drive and regulate the development of the biogas sector (N. Bennett, personal communication, 9 May 2017, Petrie, 2014, Petrie et al, 2013). This hampers, rather than halts, private sector participation in the sector, including engagement in policy development. For instance, the National Biogas Platform was established as a result of the 2013 National Biogas Conference, as a public-private collaboration supported by the German government (DoE, n.d.a).

The main objectives included ensuring the creation of biogas regulations conducive to the development of a local industry, and identifying funding opportunities (DoE, n.d.a). The 2015 National Biogas Conference, saw a commitment from industry and government to using the Platform to foster cooperation in the development of a government-led biogas strategy (DoE, 2015). The strategy, which is still under development will assess the potential for biogas production and provide support mechanisms and objectives for development of the industry (DoE, 2015).

3 Opportunities for Renewable Energy in iLembe

This section considers the primary possibilities for RE in iLembe District, emphasising the most viable opportunities, which have also been the focus of the research and analysis conducted during the project research period. The sectors considered are sugar and timber wood with several RE opportunities identified for each. A high-level feasibility analysis of these opportunities is provided.

3.1 District and provincial policy and planning

The primary initiative in the District is the aforementioned RE Hub, to be developed at the Isithebe Industrial Park in Mandeni, which is expected to provide 250MW of RE generation capacity and more than 4000 jobs starting from 2020 (Enterprise iLembe, n.d.). The KZN Department of Economic Development, Tourism and Environmental Affairs has set out to develop an agency, which will oversee the efficient utilisation of the Industrial Park for manufacturing of RE components. The agency, which is expected to be established by 2018, will also ensure that the Hub will have linkages to the provincial level and will contribute to provincial development goals through establishing relationships with relevant industry clusters throughout KZN (Enterprise iLembe, n.d. and EDTEA, n.d.).

There are questions as to the efficacy of the RE Hub initiative and this research has highlighted a distinct lack of coherence in RE planning and implementation in iLembe as well as between the District and the Province. The focus on manufacturing (as opposed to the development of RE projects as value added opportunities) makes little sense given the severe competition from Chinese and other Asian imports. However, initiatives, some already underway, to develop RE projects within sector value chains as value added opportunities (increased income and jobs, reduced carbon emissions) show much more promise.

The South African Sugar Association (SASA) has begun to stimulate and support RE project development in the sugar value chain and provides a link to national RE policy developments. The Associations emphasis is on reducing input costs for small holders and on expanding jobs and smallholder participation in the sugar value chain through RE developments. For instance, biogas plants at a cooperative level could reduce energy and fertilisation costs for farmers, thus substantially reducing input costs. Similarly, large scale electricity generation facilities that

produce surplus electricity from sugar milling, could create an additional revenue stream for the sector, with job and income benefits across the value chain.

Thus, locating RE production within the sugar and timber value chains has the potential to effectively address coherence challenges and contribute to the success of the more viable of the RE potential considered under this programme. Heat to energy conversion, or cogeneration, biogas and biomass production potential from sugar and wood milling are opportunities, which have been explored in the two main industries in the iLembe District.

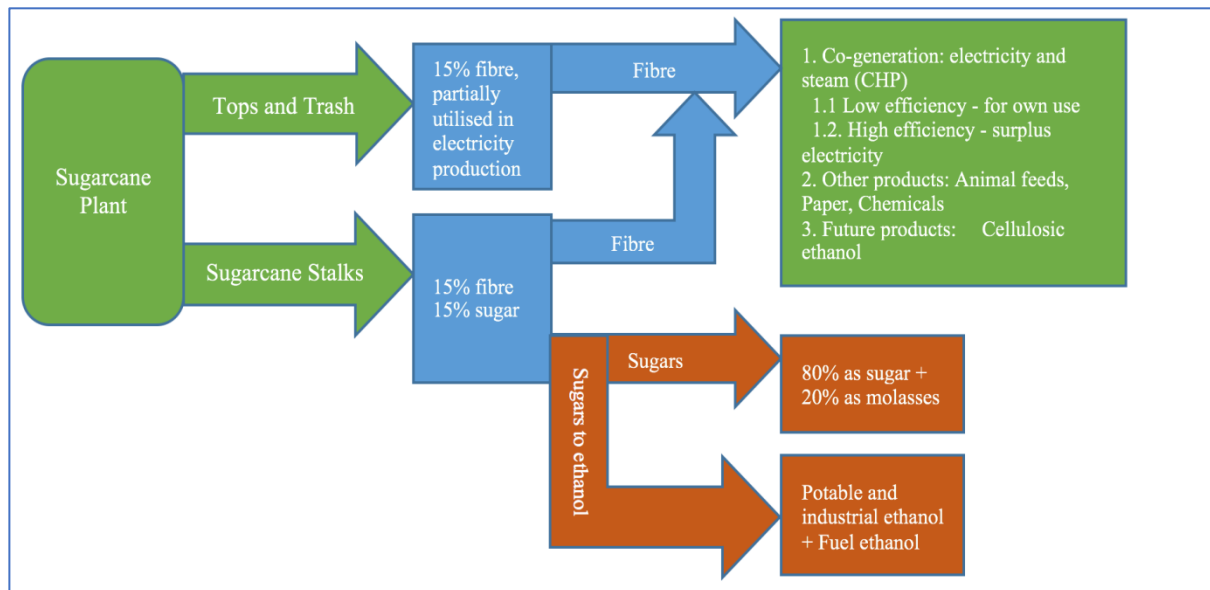
The assessment of the feasibility of these options for support is based on discussions with key stakeholders (listed in Annex I, interviews summarised in Annex II of this report). It has been particularly important to understand the barriers to investment and implementation and the arising opportunities. Barriers include the policy and regulatory environment, capacity, logistics, market access, the cost of capital investment and the risks of reduced rates of return. Opportunities presented by RE diversification include increased revenue streams, increased smallholder participation and income, job creation, reduced emissions and improved local air quality.

3.2 Opportunities in the sugar value chain

The South African sugar industry is one of the world leaders in the production of good quality and cost competitive sugar. In South Africa, especially in the province of KZN, the industry is also a major contributor to economic development and employment, through sugarcane farming opportunities specifically (SASA, 2013). The sugar industry is a diverse industry, which offers opportunities for agricultural activities, as well as manufacturing of various downstream and value-add products, such as raw and refined sugar, syrups ethanol, alcohol and paper. As seen from Figure 1, sugarcane can be used in the production of both sugar and energy in the form of either renewable electricity or ethanol for biofuels. As such, sugarcane is a “multipurpose” crop, which, when production streams are optimised and the plant is fully utilised, can be used in the production of various downstream products (SASA, 2015). As such, it is a major contributor to South Africa’s national sustainable development goals (SASA, 2013).

However, the total area under sugarcane has declined by about 10% in the last 10 years, whereas the number of Small Scale Growers (SSGs) has declined by 50% in the same period (SASA, 2016). This is important: sugarcane growers receive a share based on the industry revenue from sugar and molasses production. With the decline in SSG participation, the income streams for small growers and their dependents has reduced significantly. The distribution of revenue from other activities, such as cogeneration and bioethanol are negotiated additionally between growers and millers (SASA, 2015), creating an additional revenue stream and the ability to increase SSG participation in the sugar value chain.

Figure 1. Sugarcane Processing (adapted from SASA, 2011)



The number of SSGs and volume of sugarcane delivered by them has been in decline since the year 2000 due to several challenges and constraints, such as the lack of access to finance at competitive rates, infrastructure constraints (internal roads, fencing, and irrigation), and the negative impacts of climate change (drought and changes in rainfall patterns) (SASA, 2016). According to the SSGs, who were interviewed as part of this study, in the last three years, sugarcane harvest yields have not been good, primarily due to the prolonged effects of the drought in the area. The industry has implemented several interventions to support sugarcane SSGs. The industry actively supports cooperative farming models and provides extension services and financing opportunities for capital investments to ensure the sustainability of the SSGs. Additionally, the industry has also created a Supplementary Payment Fund, which serves as a tool for enhancement of the SSGs cane price (SASA, 2015).

Global trends indicate that to remain sustainable, sugar industries, need to diversify into production of energy through bioethanol and cogeneration (SASA, 2015). International leaders in sugar production, Brazil and India demonstrate successful models for energy diversification. One of the main factors behind their success has been the support of government through policy interventions, incentives and mandatory markets, aimed at creating an enabling environment for these developments (SASA, 2015). The South African sugar industry similarly holds potential for diversifying into energy projects, while at the same time it contributes to national objectives of fighting the triple challenges of poverty, inequality and unemployment (SASA, 2015).

In line with this, the development plan of the South African sugar industry envisions interventions, which foster the creation of new revenue streams and ensure the sustainability of the industry in the long term (SASA, 2015). Among others, these interventions include the

harmonisation of regional and trade sugar policies, preferential access to markets for maximisation of growth opportunities in RE, protection against low-cost sugar imports and a stable, comprehensive and coordinated approach to resolving outstanding land reform claims (SASA, 2015).

Outgrower sugar schemes, supported by lead firms, create significant numbers of jobs and stimulate enterprise development. Outgrower and industry diversification schemes, particularly through the water-food-energy nexus, produce energy from residues and waste matter, reducing input costs and creating additional revenue streams across the sector. This is happening to a limited extent in the iLembe District.

There are several possible, planned and existing RE initiatives in the sugar sector in the District of iLembe, ranging from localised biogas digesters to large scale ethanol for biofuel production and cogeneration at an industrial level.

Sugarcane is the main agricultural product in KZN and iLembe District (Enterprise iLembe, n.d.). Generally, the sugar mills across South Africa already use bagasse, the dry, pulpy residue remaining after the extraction of juice from sugar cane, for incineration in their boilers to create the heat energy that is essential to the sugar milling process. Within this central milling operation process, there are opportunities for expanded electricity generation and to on-sell the surplus electricity generated. This has the potential to simultaneously optimise milling operations and create additional revenue streams for across the sector value chain. SASA has developed RE generation plans, involving a cluster of projects, expected to yield 900MW of RE generation and a total of 34 406 jobs in the area (Enterprise iLembe, n.d.).

Bioethanol production provides an additional opportunity for diversification. Estimates are that between 600,000 and 1 million tons of surplus sugar has the potential to generate 360 to 600 million litres of bioethanol (Enterprise iLembe, n.d.). Illovo estimates that 4000 ha of expanded sugar cane agricultural production can stimulate a 25% plus growth of small holder participation in the value chain, noting that the sector has lost around 20,000 small holders in the last 20 years (M Cutts, personal communication, 24th April 2017). Tongaat Hullett's feasibility studies for ethanol production highlight that the job creation potential is "exponential" (W. Fechter, personal communication, 25 April 2017).

Ethanol production and electricity generation for sale via the national or municipal grids are large scale opportunities, and as discussed below, are, in the main, feasible at scale. Smaller scale opportunities exist for biogas and biomass production. Biogas plants, for example at the Cooperative level, can generate electricity for agricultural production and households, with the potential to significantly reduce inputs costs. These large and smaller scale opportunities are discussed in greater detail below. Waste to energy conversion opportunities are also briefly discussed.

3.2.1 Cogeneration and sales of surplus electricity through the grid

Cogeneration is a highly efficient form of heat to energy conversion, otherwise known as Combined Heat and Power (CHP). As such, it sees the simultaneous production of electricity and heat, both of which are used by the mills. Cogeneration affords greater efficiencies to sugar milling processes, through significantly optimising production capacities. In some mills, expanded cogeneration requires additional waste material from the sugar cane plant, obtained through “green harvesting” (as opposed to post-harvest burning of fields), which in turn greatly improves local air quality, otherwise compromised by post-harvest burning of sugar cane fields. Burning gets rid of the waste matter left from the tops and trash (see Figure 1) left over from the current practice of only harvesting the sugar cane stalk.

Cogeneration, has been seriously considered in the sugar industry. The lead milling firms all have cogeneration facilities, at a minimum to generate their own electricity supply. The stakeholder engagement process has revealed that the industry players have developed comprehensive and progressive feasibility studies and some have developed state of the art engineering plans for expanded cogeneration with a view to selling surplus electricity into the national grid. SASA has supported the lead firms in many of these endeavours. In particular, SASA has stimulated the participation of the sugar industry in the national RE IPPP by facilitating participation in the competitive bidding window for developing and implementing RE bioenergy projects.

According to SASA, in 2013 there were a total of 15 cogeneration projects under development (at 14 existing sugar mills and one new development), in KwaZulu-Natal (KZN) with a total installed capacity of 780.5MW, expected to come online between 2015 and 2019 (SASA, 2013). Two of these sugar mills, fall within the administrative borders of the iLembe District - Darnall and Gledhow – both of which are situated within the jurisdiction of KwaDukuza local municipality. Amatikulu and Maidstone sugar mills are included in these cogeneration projects, and are located very near the iLembe District border (SASA, 2016).

As a result, all 14 existing sugar mills have become energy self-sufficient, as they use the generated electricity for their own consumption. The mills use bagasse as a fuel source to generate steam and electricity. Given the fact that sugar cane is only harvested for 35-40 weeks of the year, cogeneration facilities are also fuelled with bagasse in the same period, allowing energy supply to completely match energy use at the sugar mill.

This level of self-sufficiency is achieved through the development of small scale cogeneration facilities. However, if the technology in the cogeneration facilities are upgraded to a higher efficiency level, together with an increase in sugarcane yields, sugar mills have the potential to produce 2-7 times more electricity (SASA, 2013). Once the electricity requirements for own consumption of the mill are met, the surplus electricity can be exported into the national grid,

generating additional revenue for the sugar company. Tongaat-Hulett are currently exporting surplus electricity into the grid at two of their sugar mills: Maidstone and Felixton, under Power Purchase Agreements (PPAs) with Eskom (W. Fechter, personal communication, 25 April 2017).

The dominant agricultural component is a unique feature of both the sugar industry and biomass energy sectors. Sugarcane farming, a highly labour intensive activity, provides the main input not only for the production of sugar, but also the fuel for cogeneration facilities. On this basis, it is estimated that the stimulation of RE developments in the sugar industry has serious job creation potential. The upgrading of cogeneration facilities to a higher level of efficiency will require an expansion of agricultural activities, particularly through the manner in which sugar cane is harvested; more waste matter is needed for expanded cogeneration meaning that the tops and trash also need to be harvested rather than burned. This process is known as green harvesting and is promoted by the Department of Environmental Affairs as a critical approach to improving local air quality and therefore human health (DEA, 2014).

Industry has identified several different pathways through which this expansion could be achieved (SASA, 2015):

- Vertical expansion - increasing the volume of sugarcane production per unit of land
- Horizontal expansion - increasing the area of land under sugarcane production
- Seasonal expansion - increasing the length of season from 36 to 40 weeks per year
- Greencane harvesting – shifting from cane burning techniques to labour intensive green harvesting techniques, where cane leaves and tops are cut and collected and provided to mills to fuel electricity production

It was estimated that such expansions of cogeneration projects at sugar mills have the potential to create a total of 34 106 jobs through the construction, operation and fuel phases (SASA, 2013). On average, the total job creation per MW installed operational cogeneration capacity was estimated at 44.1 jobs (SASA, 2013). Most these jobs were expected to be created in the “fuel phase” of plant development – 26.8 jobs or 60% of total jobs – and are related to downstream farming operations, supplying fuel for the plant (SASA, 2013).

The potential for expanded co-generation, although understood to attract a higher cost of investment for lead firms than ethanol, is substantial. Tongaat submitted a bid to the Renewable Energy Independent Power Producer Procurement Programme (RE IPPPP) for a 100 MW facility, whereas most of the existing facilities generate between 2-5MW on average. Co-generation at scale and ethanol production will increase the revenue stream for growers. It is also likely to increase the value of the sugar cane plant, in particular the waste matter.

In present terms, green harvesting attracts on average, an additional R3 per tonne to the price for cane that is harvested through a top and trash process (R34-35/tonne). This is because the green harvesting process is more labour intensive, noting that there are also higher associated transportation costs (more of the plant is being transported to the mill).

According to some interviewees, farmers keep and utilise close to 70% of the cane leaves and tops to cover the soil and to contain the moisture and protect against drought and weed growth (N. Bennett, personal communication, 9 May 2017). This is essential for replanting and thus part of the waste matter is retained (SSG Focus Group Discussion, 25th April 2017).

There are instances, as mentioned, of upgraded Cogeneration facilities, which are feeding into the national grid. The costs of cogeneration are around R37 million/MW installed capacity. External funding is a critical success factor and the transport and investment costs are generally high for such a project (P. Robillard, personal communication, 25 April 2017). Small scale expanded cogeneration facilities are not considered to be viable, hence Tongaat's submission of a 100MW plant as an RE IPPPP project.

A certain level of revenue through guaranteed tariff guaranteed, through secured, long term contracts is considered to be critical by investors such as Gledhow and Tongaat. The minimum tariff required for selling the electricity from cogeneration projects is at least 1.10-1.15R/kWh. This is because the mills are buying electricity at R0.97 without having to secure a 20-year contract (P. Robillard, personal communication, 25 April 2017). Thus, cogeneration is usually a side business to the main business of sugar production, and although it can be uncoupled to some degree, it would be too expensive to separate out completely. A 20-year PPA is a long-term commitment which means committing that the mainstream business will also be around for that period. A further issue highlighted is that balance sheet structures of power stations and sugar milling operations are very different (W. Fechter, personal communication, 25 April 2017).

Moreover, ESKOM, currently the primary off-taker of surplus electricity in South Africa, is not signing new PPAs and is attempting to cancel its existing PPAs with the sugar mills, citing electricity surplus as justification. This coupled with Eskom's related attempts to stymie further RE IPPPP developments, including the recent bidding window for bioenergy projects (under which Tongaat submitted its 1000MW facility bid), has resulted in a growing reluctance among the sugar companies to invest further in cogeneration. The policy environment is too uncertain.

However, there are customers other than Eskom and these opportunities are well worth developing. Municipalities, industries and households around South Africa have been seeking energy independence from Eskom since the 2008, and subsequent, national electricity crisis. Wheeling electricity from cogeneration through municipal grids to local customers such as Toyota, is a serious option. Municipalities such as Kwadakuza who own most of their grid

infrastructure, can facilitate this, either by buying and on-selling the electricity through a PPA, or by wheeling the electricity to customers, under licence through a PPA concluded directly between the generator and the customer. SASA has been in talks with relevant government institutions, such as the National Energy Regulator (NERSA), who will need to adjust the regulatory environment to facilitate such arrangements.

In the main, the municipalities such as Kwadakuza do not have the capacity to institute or manage wheeling agreements that feed electricity through their distribution network, and most do not have the financial security to underpin or guarantee a 20-year PPA with a generator. The neighbouring municipality of eThekweni however does have the requisite financial security and is better capacitated. It is also among the larger metropolitan municipalities that are seeking energy security, and has a large customer base.

There are interested private off-takers of electricity in the area. Illovo has been in talks with Woolworths, who are interested in green energy, in order to maintain and enhance their sustainable profile. However, their consumption is inadequate to underpin a PPA and bigger consumers, such as Toyota are necessary (M. Cutts, personal communication, 24 April 2017).

However, it is unlikely that a single consumer can buy all the electricity from, for example Tongaat's proposed 100MW facility at higher than the wholesale price. It is more likely that a cluster of private off-takers, who are also looking to buy green energy for their portfolios will constitute a feasible consumer base.

3.2.2 Ethanol and biofuel production

Ethanol is a renewable, domestically produced alcohol fuel made from plant material - sugar cane, corn or grasses. In the sugar value chain, it is produced by the fermentation of sugar cane juice and molasses. Ethanol is a low carbon fuel that can reduce oil dependence and can be blended with petrol in vehicles that have flexible fuel engines.

Bioethanol is produced from the surplus sugar of the industry. On average, the South African industry produces and exports sugar in excess of local demand (SASA, 2016). Therefore, according to industry, there is potential for some of this export sugar to be diverted to the local market for fuel ethanol production. It is estimated that the stimulation of the domestic biofuels market through affordable fuel ethanol subsidies, can bring more than R3 billion in investments to South Africa and enhance sustainable rural development (SASA, 2016). Bioethanol development projects, envisaged by the sugar industry, are expected to create 21,078 full-time jobs, 73% of which (15,369) are expected to be in the agricultural sector (SASA, 2016).



Within the iLembe District, there are currently ethanol production facilities at the Illovo Glendale Distillery and the NCP Merebank Distillery. Stakeholder consultations revealed that the lead sugar industry companies, such as Tongaat-Hullet and Illovo have also conducted feasibility studies on larger scale ethanol production.

Contradictions between the sugar companies on the feasibility of ethanol production suggest that scale, coupled with securing a local market, is the critical success factor. Illovo Sugar indicated that ethanol production is not viable, citing SASA studies which demonstrate that the price of ethanol produced from molasses is not viable. Illovo further indicated that large scale ethanol production is not viable due to the currently substantial sugar-oil price gap. Illovo's analysis, which dates to 3 years ago, has highlighted the need for locating an ethanol facility next to a sugar mill in order to supplement the supply of molasses. A further logistical issue is that the reliance on SSGs is dependent on the location of these milling operations. This is variable that results from the old historical communal areas (M. Cutts, personal communication, 24 April 2017).

Tongaat present a different view. Their feasibility studies (unseen by the authors to this report) reportedly demonstrate that ethanol production at scale is viable assuming a local market is created and/or government support is available to stimulate the industry's development. They assume that the oil price will not be sustained at current levels, citing the usual global commodity cycles and indicating that a realistic price for oil in the not too distant future is at around 80 USD/barrel (W. Fechter, personal communications, 25th April 2017). They further indicate that ethanol production will require less capital investment than cogeneration, having done extensive feasibility studies on both.

Government support and stimulation is presently a strong possibility because of the proposed Sugar Tax, although the issue is controversial. A tax on sugar was announced in the 2016 Budget Speech in an attempt to deal with South Africa's shockingly high obesity figures. Minister Gordhan confirmed that the government wishes to go ahead with the Sugar Tax in his 2017 Budget Speech, although a reduced rate (e.g. 20% to 11% on a can of Coca Cola). Parliamentary hearings on the matter are delaying implementation and it is likely that the Sugar Tax will not be implemented until late this year, or early next year. Yunus Carrim, the chair of the standing committee on finance, has warned that the debate cannot continue endlessly and has indicated that the debate will resume in August 2017, urging the National Economic Development and Labour Council (NEDLAC) to speed up its associated process (FIN 24, 4th June 2017).

NEDLAC is considering a sugar production diversification strategy as a job mitigation proposal directly in response to the job loss implications of the proposed sugar tax. This process arose as a result of South Africa's labour federation, the Congress of South African Trade Unions (COSATU), raising concerns that thousands of jobs will be lost if the sugar tax goes ahead. The federation



called for implementation to be delayed until jobs are secured. Cosatu's Matthews Parks told Engineering News on the 30th May 2017, that "the entire sugar industry is in decline and we've lost 15 000 jobs in the last few years".

NEDLAC's process brings business and government together to find solutions through a coherent job mitigation strategy. The estimates for job losses across the sugar value chain vary, with Treasury generally differing to COSATU and industry. The Beverage Association of South Africa (BevSA) estimates that around 70,000 jobs are in danger whereas Treasury representatives claim that these are 'scare tactics', stating that the job losses will be negligible (Engineering News, May 2017).

Nonetheless, NEDLAC's process recognises the necessity for a coherent job mitigation strategy. Ethanol production is a potential cornerstone to the Sugar Tax job mitigation strategy. It is a viable investment strategy if the lead sugar firms partner with the automotive industry, securing consistent ethanol supply and a market. Their resultant requirements for increased participation across the value chain will exponentially increase jobs and value for small growers (W. Fechter, personal communications, 25th April 2017; M. Govender, personal communications, 25th April 2017).

Discussions between the sugar industry and automotive sector have begun. Toyota has expressed interest in discussion facilitated by Provincial Government in KZN, in producing a flexi fuel engine vehicle (designed to run on ethanol and/or petrol), thus potentially creating a viable market for ethanol while diversifying their own business model. This would be a strategic project that requires government facilitation, as happened in Brazil. Clear policy direction is required in terms of the fuel blend, or percentage of ethanol mix in fuel consumption (R. Persad, personal communication, 25 April 2017; W. Fechter, personal communication, 25 April 2017). Industry believes that the kind of partnership with Toyota could work and flex fuel engines, as developed in Brazil, could also be an option for SA (W. Fechter, personal communication, 25 April 2017).

Political support for this project has been well articulated at the KZN provincial level. Indications from the political players are that the agriculture issues must be addressed to ensure that jobs are created and yields are reliable and sustainable to support ethanol production. KZN provincial government has committed its support to this process, placing high importance on value added. This can be achieved either through increasing the value of stock (better) or increase in the area under cultivation.

As discussed, the small holder perspective will need to be thought through. Cane is more cost-effective and labour-intensive than many other crops, such as maize and sorghum. Tongaat believes though that ethanol production at scale can only be viable with greater levels of

mechanisation (W. Fechter, personal communication, 25 April 2017). This may impact the value add for the SSG.

In conclusion, it is evident that the sugar market is dropping, and although there are alternatives, their viability comes down to pricing. SASA and industry players have explored different models, including for distilleries, for potential inclusion under the national job mitigation strategy. Mostly these have been shelved because: i) the oil price dropped, affecting competitiveness of pricing; and, ii) because the national regulatory environment is not supportive (M. Govender, personal communication, 26 April 2017).

3.2.3 Small scale biogas

In addition to the diversification opportunities outlined above, there is the potential for Co-operatives to install biogas systems, which make use of relatively simple and well known or mature technology to generate energy for local use. Fertiliser is a useful by-product of these systems, for the benefit of the farming enterprise.

The main part of a biogas system is a large tank, or digester, inside which bacteria convert organic waste into methane gas through an anaerobic digestion process. The methane gas can be used directly as an energy source, or converted, through a generator, into electricity. The energy and fertiliser produced reduces input costs for co-operatives and farmers that effectively install and optimise the management of these systems. For instance, the energy produced can power irrigation systems or borehole pumps, in addition to providing energy for houses, cooking and heating.

The iLembe Biogas project is one of the Working for Energy flagship projects situated in Ndwedwe in the iLembe district, KwaZulu Natal. 26 Biodigesters were constructed by Khanyisa Projects and are now operational producing gas used for cooking, under support from GIZ and the South African National Energy Development Institution (SANEDI). The project was designed and implemented as a pilot to test biogas as a possible energy solution for rural areas. The biogas is created through anaerobic (oxygen free) decomposition of the manure that takes place within the digester and the energy (methane) is piped to a stove inside the house where it is used for cooking and heating water.

Each household concerned owns a few cows, kept near the house and allowing for easy transport of manure by bucket to the digester. The digester needs 20-30 kgs of manure daily to allow households to cook on the biogas for between two and three hours a day. A reliable source of water is another prerequisite as between 30 and 50 litres of water is required per day to operate the digester. Households dispose of their grey water into the digester, and thus water is recycled.

There are a few initiatives underway at the Cooperative level. Glendale Valley has small scale biogas projects, installed at infancy stages. A prefeasibility study has been done for the Qwabe Cooperative. The Cooperative has 731ha under sugarcane production and a further approximately 300ha available for planting sugar or other crops. With 892 beneficiaries, the prefeasibility study highlights the opportunity for small scale growers to offset their electricity consumption and input costs. Animal waste feedstock can be used to supplement the biogas plant which assists with economic viability. Any surplus gas produced could be as LPG gas to the local community (M. Govender, personal communication, 24 April 2017).

Sucropower designed a demonstration biogas project at 30kW to offset the cost of electricity for irrigation. Raising funds for this project became an impediment and it was eventually relocated to the Thorni Park area, just outside Mandeni. Installation of a 50kW plant has since commenced and this project, aimed to demonstrate a viable business model, is expected to be up and running in the next month (N. Bennett, personal communication, 9 May 2017).

This pilot project is primarily about documenting and sharing learning experiences. Sucropower brought in business development agents from Sweden and Denmark, to examine the project and the potential for scaling these up across the iLembe District and KZN. (N. Bennett, personal communication, 9 May 2017).

Job opportunities are expected downstream of these biogas projects. Once the plant is in place, reliable and regular supplies of feedstock must be available to feed into it 365 days a year. However, sugar cane is not being cut for 3-4 months per year. While this feedstock could be stockpiled a 50kW plant requires 5 tons of feedstock per day, necessitating a lot of storage space. Moreover, the quality of the cane waste is sustained if stored for too long (N. Bennett, personal communication, 9 May 2017).

The learning experiences from projects such as the demonstration biogas project outlined above are critical. Biogas technology may be mature and accessible, but viable business and operational models for the local operators are not. Improved knowledge is needed as to how to optimise biogas operations to secure steady supplies of electricity and agricultural fertiliser. If this balance is not achieved and maintained, Cooperatives will not have a reliable flow of electricity with fluctuating rather than reduced input costs for example.

A biogas project visited by the project team in Mandeni is instructive. The farmer and land owner is a part time farmer, who is otherwise an Oil and Gas Engineer (PhD) on international oil rigs. He grows a variety of small crops and installed a biogas digester around two years ago as a project. It is a gravity fed 600 kW system, which according the farmer could provide electricity to five farms, requiring around 30 tons of biomass as feedstock, and producing around 30 tones of fertiliser. The feedstock comes from a mix of sugar cane tops (although the farmer has learned from experience that the problem with cane is its fibrous nature – the fibre floats to the top and is not

easy to digest in an anaerobic process) and maize and sorghum waste as the baseload in that these crops provide a steady feed of waste matter.

Over the past two years, the project has taught the farmer important lessons about optimisation and operational aspects of running a digester: i) feedstock must be steady and constant, although a digester can accommodate a variety of feedstock; ii) the farmer has a square mixing tank whereas a round tank is better for mixing waste; iii) the bacteria content is the key factor and the right heat is needed to maintain the bacteria that convert waste to methane in the digester; iv) 600kW to 1MW is the optimal sized plant in terms of management, feedstock supply, and energy and fertiliser outputs; and, v) it is cheaper to digest waste than to dump it.

Notwithstanding the last learning point and the high level of skills and education of the farmer, the digester is not yet running at optimal capacity and the farmer relies on Eskom power for around 80% of the time, after two years of operating the digester. A long lead in time needs to be factored into payback periods and cost benefit analyses. Farmer/cooperative expectations need to be managed carefully.

3.2.4 Waste to Energy Conversion

Waste to energy conversion opportunities also exist in municipal landfill sites, particularly in areas where population growth, urbanisation, and urban development is significant and where urban settlements are dense. Although less than 10% of South African municipalities presently convert their waste to energy (mainly for capacity and policy support reasons), iLembe is in the fortunate position of having one South Africa's landmark waste to energy projects as a neighbour – the Mariannhill landfill site project in eThekweni.

The Durban Municipal Solid Waste Project is a gas collection system at the Mariannhill landfill site in Durban. The project utilises some of the methane gas recovered to generate RE which is fed into the municipal grid. Fossil fuel based electricity is displaced in the process, and it is for this reason that the project became the first Clean Development Mechanism (CDM) project registered in South Africa, yielding additional project cash flow from the sale of carbon credits to the international community.

A report prepared for the Netherlands Embassy in Pretoria on the potential for waste to energy conversion in South Africa, considers iLembe as a densely-populated DM and estimates that the available waste is 29,082 tonnes per annum (presumably across all four municipalities), with the potential to generate 42,100 GJ of energy per annum (Urban Econ 2013). Importantly, there is a market for this energy in KwaDukuza and Mandeni. Sugar mills and pulp and paper mills are becoming increasingly inclined to reduce operational costs through cheaper and alternative

energy processes. Waste to energy technologies that process their and other waste products to generate electricity can achieve this.

In iLembe, these waste to energy conversions options are under consideration. KwaDukuza does not own their landfill sites and outsource this function to private waste management companies. The municipality has been engaging with private companies to see how the sugar waste can fit into a waste to energy project (S. Hlongwane, personal communication, 26 April 2017).

3.3 Opportunities in the timber value chain

Sappi, with their oldest paper mill in South Africa being the Tugela Paper Mill in Mandeni, is a significant industrial player employer in the iLembe District. Notably, the Mill operates its own landfill site, which is operated commercially under a ten-year waste management licence obtained in 2011. This raises waste to energy conversion as an additional opportunity to biomass production from wood waste. Globally and in South Africa, Sappi is already a RE player, having constructed RE plants on seven of their 14 sites around the world, that generate around 800MW of electricity.

In South Africa, the Group's capacity is around 150MW. This will increase to 175MW with the construction of the first biomass plant by Sappi in Mpumalanga in its capacity as a preferred bidder under the national RE Independent Power Producer Procurement Programme (RE IPPP) in 2015. The biomass will be supplied from the Group's plantations and from the mill, and the intention is that the plant incorporate technology comprising a boiler that generates steam and is passed through a steam turbine generator.

3.3.1 Woodchips and pellets as biofuel

Numerous attempts at establishing biomass plants for wood pellet and wood chip production, in the private sector, have ended up in closure and/or liquidation. Few plants have been able to sustain exports in a highly competitive market and South African plants have suffered from uncompetitive labour and logistical costs, affecting pricing structures (Petrie 2014, Petrie et al, 2013). However, the international market for wood pellets and wood chips is well established, with these products often being used as source of green energy, for example in Europe. Thus, there are a few viable options to consider in KZN.

NCT Forestry Co-operative Limited (NCT) was established in 1949 as a marketing co-operative for private and independent timber growers from the province of KZN (NCT, n.d.). Today the co-operative represents 2,500 growers and suppliers of timber, encompassing a total growing area of 300,000 ha (J. van Zyl, personal communication, 8 May 2017). Members of NCT are also



shareholders, who not only benefit from the support services offered by the co-operative but also share the revenue from sales (NCT, n.d.).

There is an opportunity for biomass production from waste matter in the paper mill and sawmills in the wood value chain involving producing wood pellets and chips for the export market. Securing fibre for energy however is a critical success factor. NCT believes that the market is starting to value waste matter as fibre for the energy sector. This value still has to be recognised in a national biofuel policy, and as indicated, the national policy on biomass and biofuels has yet to be finalised, even stagnating in development over the past five years.

Natal Co-operative Timber (NCT), the 3rd largest timber trader in South Africa and located in KZN, is exporting wood chips, a by-product from their pulp and paper production, to Japan, and has been doing so consistently for approximately 10 years. These exports provide an additional revenue stream, indicative of a model that could be replicated elsewhere.

NCT's turnover for last year was R2bn and 70% of their produce was exported to Japan, Taiwan and India and China, with 30% sold locally, mainly to paper producers (Sappi, Mondi). All timber growers, formal and informal, become part of the same pool, without distinction. The business is currently 99% paper oriented, with room for diversification.

Over the last 5 years, the national policy environment has become decreasingly conducive. A consequence is that industry does not see the possibility to compete in the biofuels sector, even though there is potential. (J. van Zyl, personal communication, 8 May 2017).

There is an opportunity for NCT to act as a wood chip production centre and act as an export agent for increased wood chip production, thus increasing SSG participation. However, the absence of an enabling policy environment is likely to impede such a development, as has repeatedly happened in the past.

4 Recommendations for Support

There is little direct opportunity for external intervention to develop small farmers in the sugar and timber value chains in their current form. In this context, the advanced nature of the extension and development program run by the lead mills leaves little opportunity for a direct SECO/UNIDO program. Expanded diversification into the energy sector is value added and therefore different.

Both ethanol and cogeneration are understood to be important opportunities for diversification from sugar production as the trend toward declining sugar consumption accelerates. Both

expanded cogeneration and ethanol production will rely on the expansion of sugarcane growers' participation in the sugar value chain. This study has revealed that both cogeneration and biofuels have the potential to diversify the sugar industry of South Africa and stimulate the development of sugarcane SSGs through RE value added projects.

SECO/UNIDO external interventions can be effectively designed for both aspects of energy diversification - expanded co-generation and/or ethanol production. Support for establishing "green harvesting" practices and processing support is needed for lead firms and growers to increase feedstock and production, as is further development of the enabling policy environment. National by-laws for "green harvesting" (as an alternative to current practices of burning the waste matter in the field) are being proposed for adoption at the local government level with a view to greatly improving local air quality.

In addition to the diversification options, support is required for increasing the installations of small scale biogas systems at the co-operative (or farm) level. Farmers and co-operatives, as well as enterprises established to enable and maintain biogas systems, require support in determining the associated costs and benefits to decide the feasibility of the investment and size of the system. Support is also needed in developing the skills and training co-operatives/enterprises in installing, maintaining and optimising biogas system installations.

Diversifying into energy production and establishing small scale renewable energy plants that reduce localised input costs requires support and stimulation. Initial support for awareness raising, training, capacity building, partnership building and stimulation of outgrower and farmer participation could establish the traction needed for outgrower schemes, industry associations and government to continue to entrench these opportunities in the longer term. Evidence of this is available in Mpumalanga Province, another South Africa sugar cane and timber growing region, where the establishment of a bio-energy cluster has facilitated diversification of timber and sugar industries into energy production (biomass).

For expanded co-generation, specific support is needed to enable municipalities and lead firms to navigate the regulatory environment to establish appropriate licences, wheeling agreements and power purchase agreements. This will unlock increased participation for growers.

Additionally, the shift in the development/drive of value-add projects from national to local levels has given rise to the need for national government to support and build capacity of local government to drive and manage such projects.

It has become evident that the presence of a conducive policy environment is key to achieving this potential. SASA has been advocating for a policy approach, which optimises the sugar value chain through the inclusion of RE products. As such, they have been actively involved and

cooperating with key government institutions, such as the National Energy Regulator of South Africa (NERSA), DoE and IPPP Office in the development of a national biofuels and cogeneration policy framework (SASA, 2015).

As discussed, the proposed, controversial Sugar Tax, aimed at curbing the country's growing obesity epidemic, has given cause for an employment-loss mitigation plan, called for by the trade union movement. The resultant NEDLAC process is currently examining a job mitigation programme, to which energy-generation as a sugar production diversification strategy is central. Should implementation be agreed, ethanol will become a viable investment strategy for the lead sugar mill firms who intend to partner with the automotive industry. Their resultant requirements for small holder contributions will "exponentially increase jobs and value for small growers" according to detailed feasibility assessments.

The potential for expanded cogeneration, although understood to attract a higher cost of investment for lead firms than ethanol, is substantial. Cogeneration at scale and ethanol production will increase the value of the sugarcane plant and waste matter and thus the revenue stream for growers.

Tongaat-Hulett, and Sappi are the primary employers and supporters of smallholders in the District and have the infrastructure in place necessary to support either or both cogeneration and biomass production. They also have the means of integrating the small holders they support into RE production, thus absorbing and/or mitigating the associated risks (high initial capital costs of production, market access, etc.), something few, if any, smallholders can afford to do alone.

SECO/UNIDO external interventions can be useful and effectively designed for both aspects of energy diversification. Alternate harvesting and processing support is needed for lead firms and growers to increase feedstock and production, as is further development of the enabling policy environment. In terms of cogeneration, lead firms need to firm up alternate customers to Eskom such as industry and metropolitan municipalities such as eThekweni. While there are known opportunities, support is needed to enable municipalities and lead firms to navigate the regulatory environment to establish appropriate licences, wheeling agreements and power purchase agreements. This will unlock increased participation for growers.

If an external SECO/UNIDO intervention program can be designed and implemented to assist small farmers in these value chains to produce fresh food products (e.g. tomatoes, peppers etc.) for the various supermarkets (and other markets) and meet production requirements for energy diversification, then this supplements the current supplier development programs within these chains, and we have a win-win result for all parties concerned.

The specific interventions that are required for such a programme are the following:

4.1 Establish a Bio-energy Cluster

- Facilitate Public Private Partnerships in the Bio-energy Cluster, convened by the Provincial Department of Economic Development, Tourism and Environmental Affairs, with co-convening responsibilities from iLembe District Municipality and local municipalities
- Agree a Bio-energy Cluster Terms of reference
- Design and implement renewable energy opportunity awareness raising workshops through Enterprise iLembe with SECO funding
- Design and develop a skills development programme, implemented through Enterprise iLembe or suitable organisations, with SECO funding

4.2 Promote green harvesting practices

- Conduct a cost/benefit analysis that weighs up the pros and cons of green harvesting and develop a cost mitigation strategy for implementation through outgrowers, primarily considering: i) costs of logistics (transport); ii) the need for and costs of mechanisation, and iii) the value of waste material
- Promote the adoption of the Provincial policy for green harvesting at the municipal level in the iLembe District Local Municipalities, as designed under the National Environmental Management Air Quality Act 2004 (Act 30 of 2004), promulgated in 2014.
- Co-operate with the Sugar Association South Africa (SASA) in promoting green harvesting and providing training/skills development among outgrowers.
- If mechanisation is a viable option, raise awareness with, and support co-operatives in leveraging finance for the green harvesting equipment

4.3 Enable cogeneration expansion

- Build the capacity of SASA and municipalities to understand the regulatory environment for licencing cogeneration facilities and establishing wheeling agreements
- Provide technical support for establishing power purchase and wheeling agreements that allow for several electricity buyers, including municipalities
- Provide capacity building and technical support to SASA and municipalities to negotiate guarantees for PPAs (e.g. from the International Finance Corporation)

4.4 Establish readiness for ethanol diversification

- Stimulate sub national government and industry to industry partnerships for ethanol production
- Design and implement a study tour to Brazil for local and provincial government, industry/SASA and co-operatives to examine the options for ethanol production linked to the auto industry
- Develop the capacity of local (and provincial) government, Enterprise iLembe, outgrowers and industry/SASA to monitor the Sugar Tax job mitigation strategy development process, and link into this as it evolves. A joined-up capacity development process will enable partnerships and scale when the time comes.

4.5 Explore the viability of biogas systems for co-operatives

- Use the technology pilot plant (near completed 50 kilowatt facility at Thorny Park, Mandeni) to analyse the costs and benefits of co-operative-level biogas plants, specifically to understand: i) extent of reduced input costs; ii) logistical costs; iii) optimal size of plant; iv) optimal financing and business models, and; v) potential for bottling and selling surplus gas as an alternative to Liquid Petroleum Gas (LPG), and identify/quantify other value add from biogas generation.
- Build the skills and capacity of co-operatives to install, operate and maintain biogas systems (through the Bio-energy Cluster and Enterprise iLembe)

4.6 Monitoring and Evaluation

- Establish a detailed and appropriate monitoring program measuring the relevant activities and outcomes to judge success

5 Conclusion

The recommendations for SECO support are predicated by the research findings for this study. Thus, they are largely informed by stakeholders. In some instances, validation discussions were held with stakeholders to test research findings and recommendations.

Common features of the research findings for promoting energy diversification in sector value chains are: i) the policy environment is wanting; ii) capacity and skills for diversifying value chains into energy production (large and small scale alike) are extremely low; and, iii) markets and



partnerships (business-to-business and government-to-business) are essential success factors. These common features are about readiness and not implementation.

Therefore, this package of support is designed to establish readiness among iLembe District stakeholders for renewable energy diversification, whether at large scale such as ethanol production, or at the small-scale implementation of biogas digesters. As evidenced, partnerships for implementation, scale and learning are among the critical success factors. Others include skills development, capacity building and the establishment of an enabling policy environment. Notably, creating the right enabling policy environment relies on experiences from Districts such as iLembe, meaning that the 'readiness support' outlined in these recommendations, is essential to building the capacities for influencing national, provincial and local policy.

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Annex I – Interview Schedule

Name	Role	Institution	Contact details	Date of Interview
Ms Michela Cutts	Commercial Director - Sugar and Syrup	Illovo Sugar	MCutts@illovo.co.za	24 April 2017
Dr Marilyn Govender	Natural Resource Manager: External Affairs	South African Sugar Association	marilyn.govender@sasa.org.za	24 April 2017 and 26 April 2017
Ms Thuthu Ngcobo	Head LED	Enterprise iLembe	Thuthu@enterpriseiLembe.co.za	24 April 2017
Ms Cheryl Peters	Manager: Marketing and Communications	Enterprise iLembe	Cheryl@enterpriseiLembe.co.za	24 April 2017
Mr Ranveer Persad	Chief Director: LED	KZN EDTEA	ranveer.persad@moseskotane.com	25 April 2017
Mr Paul de Robillard	Executive Board Vice-Chairman	Gledhow Sugar Company	pderobillard@gledhow.co.za	25 April 2017
Mr Ray Ninela	SSG/Land Reform Manager	Gledhow Sugar Company	rninela@gledhow.co.za	25 April 2017
Focus Group	Smallholder Sugarcane Growers	Gledhow Sugar Company		25 April 2017
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Annex II – Summaries of Stakeholder Interviews

Michela Cutts, Commercial Director - Sugar and Syrup, Illovo Sugar, 24 April 2017

About Womba Juicing Plant: they have not done a proper market study, it has potential for RE but is not viable as a retail business on its own. Local markets are brand loyal. The product can't be too cheap and unpleasant. With all the bad publicity sugar has received, can they pull off a sugarcane drink? Alcohol drinks are more likely to have a local market. In terms of export, could be a possibility to export to Europe if they put a good marketing twist to it, but generally exporting juice is expensive due to transport costs.

At Sezela, they have a downstream line for production of diacetyl, which is used as an ingredient in butter flavourings (popcorn butter flavour).

Production of alcohol: both potable and industrial, both exported, they don't sell consumer products.

Ethanol is not viable: SASA studies show that price of ethanol from molasses is not viable. Large scale not viable due to a large sugar-oil price gap. The production does not utilise any water as the water comes in with the cleaned cane. You would need two mills next to each other so they can supplement the supply of molasses. Have not looked at ethanol for 3 years. The reliance of small holders would depend on the location and it will be to different degrees depending on where the plant is situated. This is variable due to the old historical communal areas.

Famers are successful in cane because they have a guaranteed market for their product and there is no need for them to hedge.

They are developing a Fairtrade certified sugar area, specifically focused on small holder farmers. It is going to be rolled out in the Noodsberg and Sezela areas. The Jobs Fund will be contributing funding for the project. These will be seasonal jobs because sugar cutting goes on for 9 months of the year. It attracts a lot of migrant labour from Eastern Cape, as there is a belief that people in KZN are not physically as strong.

Energy potential: they are currently exporting electricity to the grid. ESKOM has decided that they are not going to buy anymore, so they are looking at wheeling opportunities. It requires a license and there will be charges involved so still have to see if it is financially viable. They have a coal to energy project but there is no PPA, as there is no point, ESKOM has not even announced the bid window 3 contracts for cogeneration.

If Eskom was willing to buy, a tariff of R1.2 would be viable. But also depends on the technology that is used. There is an opportunity to go large scale, talking up to 5MW for cogeneration. It is usually designed around efficiency. Large scale cogeneration is still a pie in the sky at the moment. It has been going nowhere so the board is now unwilling to invest more money into it. It will not be viable for as long as they always have a cancellation option in their contracts. They have already invested a lot and it has been thrown away. There is too much policy uncertainty.

Wheeling through the municipality: wheeling to themselves at Merebank and looking at other potential customers, who are looking to buy green energy, such as Woolworths. We have had conversations with them, but their consumption is not high enough, so we need to look for others. Navigating NERSA has not been an easy task.

In terms of waste material, small scale cogeneration uses only what comes out of their cane stock. In case of the large scale, there is a need to bring in more fibre as waste. There are crazy job numbers involved in the green cane harvesting option. Instead of burning the leaves, farmers need to cut them out, which is labour intensive and creates a lot more jobs. Then leaves also get transported and delivered to the mill as waste. Green cane harvesting requires training.

There is a pooled revenue system where the total revenue (from sugar and molasses) is distributed between growers and millers. 64% of total costs is with growers. So when miller has to spend more on buying waste, it becomes a zero-sum game. But not the case if they are buying leaves as that is an additional part of the plant, which is currently not being utilised.

There used to be 40000 thousand farmers and that has come down to half today. On the coast a lot of people went out of business because of a moth. Also, young people are not so interested in farming.

Dr Marilyn Govender, Natural Resource Manager: External Affairs, South African Sugar Association, 24 April 2017

The industry is currently working closely with the IPP office on the cogeneration side and with DoE on the electricity and biofuels side. Trying to influence procurement and policy support. NERSA is also very familiar with the sugar story.

Industry has moved forward despite the IPP, they are now looking at selling to private buyers. Looking at whether banks would provide some top-up financing.



SASA has done job creation numbers both for cogeneration and biofuels as well as a cost-benefit analysis for cogeneration and ethanol. These have not been made public.

SASA has a good LT relationship with IPP office, at one stage they mapped the entire REI4P RfP together with them.

In a perfect world, where policy was supportive, both cogeneration and ethanol would exist and would bring benefits (jobs). The market for ethanol is possibly a little more problematic, as the regulatory and subsidy framework is not there. There was a 2013/2014 biofuels framework, which targeted a certain potential manufacturer. There will be a need for a subsidy: globally nowhere biofuel production has been launched without subsidies.

Industry wanted to go national at first. Then when that fell apart, KZN started looking at provincial energy fund (Liesl). Industry has been tracking national developments, but has shifted focus to local government. However, municipalities are still struggling to drive the process, due to lack of capacity and funds.

Small scale biogas project in infancy: prefeasibility has been done, there could be an opportunity for small scale growers to offset their electricity consumption and input costs. Looking also at animal feedstock to supplement, so that plants can be set up at an economically viable cost. Any surplus can be sold as LPG gas to the local community.

There is a workshop about it on the 19th, where a biogas business plan will be mapped out. It will be done at a cooperative level (Glendale Valley Cooperative).

Dr Marilyn Govender, Natural Resource Manager: External Affairs, South African Sugar Association, 26 April 2017

Everyone is nervous about cogeneration, but industry is willing to upgrade and willing to sell surplus electricity. It all depends on how the wheeling will work, would it be through municipalities? SASA has been navigating NERSA on the wheeling side but there are still issues with municipal revenue, so there is a need to engage with National Treasury as well.

Small scale biogas can be a pilot project. But it needs studies: is it going to be cheaper than buying from ESKOM? Glendale Valley, Qwabe cooperative: 731ha under cane, 892 beneficiaries.

There has been work done on green harvesting regime (at the height of the cogeneration hype) from research institute and industry so a package of support would have to be very specific. Mpumalanga might have tested green harvest technologies, such as a chopper.

The regulations to stop cane burning are national level bylaws around air quality. They are being looked at by local government.

Ethanol: it is an alternative that we have proposed to government. The Toyota idea is an alternative to national level initiatives. There is a shift in thinking from the national to the local government level.

The sugar market is dropping, so what is the alternative for the sugar juice, when looking at the local market. It all comes down to pricing. They have explored different models, including for distilleries, for potential inclusion under the national strategy. They got shelved because the oil price went down and because of the national regulatory environment.

Opportunities for support: offering opportunities to black growers, supporting black growers to enter the space. There needs to be an off taker for the fuel. What would the costs be if the growers put up their own distillery? No one has done research on that.

Ms Thuthu Ngcobo, Head LED and Ms Cheryl Peters, Manager: Marketing and Communications, Enterprise iLembe, 24 April 2017

Mr Ranveer Persad, Chief Director: LED, KZN Economic Development, Tourism and Environmental Affairs, 25 April 2017

Liesl was responsible for RE and sugarcane energy, there was a KfW/AfDB iLembe cane energy project.

The province is divided into Tribal and Municipal Areas. Tribal areas are generally off-grid, which creates an opportunity for decentralised and off-grid solutions. A trust has been set up to look at these opportunities in the Qwabe area. It is cheaper to live in those areas and there is a different services delivery model.

Nicholas Bennet (CEO, P&CE): project for plant for processing cane tops in Glendale Valley. Products were energy, gas and fertilizer.

Ethanol potential: around Toyota, biofuel cars, it has been discussed briefly. It is a strategic project. In Brazil they have seen it happen. The issues are the percentage mix requirements and also that a special pump is required, so will need investment in infrastructure to work.



There would be political support of this project on a provincial level. Agriculture issues are key to be addressed and the new government is key to do so. They place high importance on value added. This can be achieved either through increasing the value of stock (better) or increase in the area under cultivation. The small holder perspective will need to be thought through.

The province has purchased land in the South for a new auto park (which is essentially for Toyota). Will be a big provincial investment, as well as a greenfields project.

Paul de Robillard, Executive Board Vice-Chairman, Gledhow Sugar, 25 April 2017

50% of the cane comes from black growers

Mauritius is a good example of a successful strategy: they have a partnership between the EU, government and the industry, it is a 50 year project

Agriculture is very fragile in the region, especially in tribal areas. Government is driven by the socioeconomic factors.

There is a 2MW cogeneration plant, which feeds into the grid. 25% invested by Gledhow, 25% by Dr Shukla(?).

The costs of cogeneration are at R37 million/MW installed capacity. There is the need for external funding. Transport and investment costs are generally very high for such a project.

The min tariff at which you have to be selling the electricity from brownfield projects like this is at least 1.10-1.15R/kWh, especially because you are buying electricity at R0.97 and you don't have a secure 20-year contract.

Unless you really understand the challenges that small holder farmers face, the project will not be sustainable and you cannot strategize.

Under a 5-year development plan they are working on a LT distillery project for potable alcohol, based on true vertical integration (using the whole cane plant, even the water used for irrigation). Trying to look for opportunities to maximise the value derived from cane, as the current situation is not sustainable for SH farmers if they don't have any protection.

If you decide to change and use a bypass turbine to change to higher efficiency, the amount of additional bagasse that you will need depends on a variety of factors.



Wheeling opportunities: afraid that municipalities would not be able to pay for the electricity that they receive.

Womba juice has proven to be a bad investment, would be better to invest in coconut juice. Sugarcane can be looked at as an energy source, food supplement for poor people.

Ray Ninela, SSG/Land Reform Manager, Gledhow Sugar Company, 25 April 2017

Most of the growers are still burning the cane. They also use cane leaves to conserve the moisture in the soil to prevent drought. There are land reform beneficiaries, contractors and growers. They could give us statistics for the different kinds of farmers and also for production estimates, as well as the costs per grower. These are the numbers they use to estimate the price of the cane. Most farmers have other sources of income, as government support is still a big issue.

Small holder farmers, Focus group at Gledhow Sugar Company Extension Services, 25 April 2017

Joseph: a grower and a contractor, he hires people to work for him, so he's getting a little bit of income from both. It still doesn't make much but is better than doing just one.

Mlambo: chairman and part of Maqumbi cooperative. It was split into two factions: one is 110 members and the other is 305 members. There are 216ha of land in the 305-member faction. They hire people on a broad spectrum, mostly BEE. Have some issues with white and Indian contractors.

Dumsandla, Shiga Family Trust – 35 members, 4x4 tractor was given to them this year by Gledhow and they use it for 110ha of land, for spraying.

Renu Kasamaru – farmer and contractor, 150ha, just sugarcane (100ha), planning to plant the rest with sugarcane as well, because it's what she knows.

Mhlongo – traditional housing area, land was given to them by the chief, has around 5ha on his name and he's also a contractor, helps with Maqumbi's 150 faction. Does transportation and cane cutting. Employing 15-20 people depending on the season. These are temporary jobs. He tries to promote employment of local people.

Nguna – contractor, hires cane cutters and stackers, provides transport for an area of 20km to work. Has no hiring limit, people come from Eastern Cape, Mozambique, Zimbabwe. They burn before they cut but also use other techniques (green harvesting). For the green

harvesting they pay more for labour, because it takes more effort: R34-35/tonne for burnt vs R38/tonne for green. The unburnt cane also goes for seed because you can't use burnt cane to replant. The trash also helps to keep the moisture into the soil. Also protects from the growth of weeds when you create a blanket of green leaves. Most of the mills do not want plant tops because they are finicky.

Tumbela – contractor for cane cutting, 15-20 people, work for all in the area and she manages them. Started in 1994 and has managed to buy a tractor with her savings. Also has a vegetable garden with other community members.

Yields are around 50-60 tonnes per ha for rainfed, but also depends on availability of water, could be 30 if there is a drought. Could go up to 100tonnes when irrigated. For the first 12 months you can't cut.

Funding for inputs – loans from Gledhow, only repay when you start cutting. They come and view the place, you get visits by an extension officer. What happens if they can't repay? It doesn't usually happen.

On average 10% of the cane is used for replanting.

Cane is not usually burnt on the field but in special zones, but that depends, it's not universal.

What support would be needed to transition to green harvesting? Depends on the money that will be paid for it. The procedures are the same, there are only extra charges for the contractors.

The last 3 years the harvest has not been good due to the effects of the drought.

Mr Wolfgang Fechter, Executive: Business Development and Bioenergy, Tongaat Hullet, 25 April 2017

They export electricity from 1 of 2 sugar mills, wanting to increase capacity and looking at wheeling agreements, but ESKOM is not being helpful. Trying to also avoid municipalities as that would be another obstacle. Mainly looking at Tongaat customers.

Selling to ESKOM but they haven't been ball, so they have had to make the process inefficient again, because there is more need for steam and less need for electricity now. Going back is difficult.

They try not to use coal at all, use woodchips, supplied from distressed forests (only left for burning). You need to have an alternative to the wood chips, because if they run short, we cannot get regular woodchips at the same price as rejects, so cost goes up.

4MW and 20MW (which is now being put in place); 20 = 8 + 12MW but looking for an off-taker. ESKOM is not working, as they provide an optimised tariff, close to the wholesale price, which is very close to the margin. For that sort of price you will not specifically invest in a cogeneration project.

Bagasse we have enough to supply the mill, because we have large scale operations, Maidstone and Felixton are where we export.

They just did studies and did not invest that much into the REI4P. Cogen is usually a side business to the main business, which can be uncoupled to some degree but would be too expensive to separate completely. The 20-year PPA is a long-term commitment and you are committing that the rest of the business will be around for just as long, as well.

IPP work: 100MW power station was designed, a lot of money was spent on the design and engineering. 50% of the fuel is leaves and woodchips. A sugar mill is limited by the level of fibre it can process, so they were always either short on leaves or short on bagasse.

Over the last 5 or so years they have spent more than R5 million on this. There needs to be a value for it, in order to be able to secure the cane supply for it.

One of the issues is that balance sheet structures of power stations and sugar industry are very different. In Mauritius, there is a model where growers own the mill but not in SA.

They should have brought in a power partner into the project, as they would be used to the kinds of contracts. 20 year PPA is a mismatch for the industry.

Mozambique: 2 sugar mills, which would be much more competitive in an area where energy demand and supply is lower. In SA to compete with coal is impossible.

Selling to eThekweni at Maidstone, it is a matter of debottlenecking in NERSA.

Other customers: finding one customer who would be willing to buy at a higher than wholesale price would be difficult. It is easier to find a few smaller ones who are prepared to buy at premium price.

The top markets to chase are Mozambique and Zimbabwe, where investments can be made without a subsidy. In Zimbabwe there are two mills, where they have had requests from mines for power. It works because there is power shortage and we are competing with diesel.

Co-management model with growers: we help them with management of big contractors, managing transactions, growing is sometimes outsourced in the local community. Provide extension services and often fund capital costs.

Irrigated portion is very small, it is mainly rainfed because it makes it simpler for SS farmers. Irrigated cane is largely corporate.

Ethanol and biofuel potential:

They have done a cost-benefit analysis, oil price gap becomes too big at some point. However, in the context of the sugar tax, the ethanol has come back on the table again. Job losses issue is real as a result of the sugar tax, so ethanol becomes an obvious mitigation strategy.

We would choose ethanol over cogeneration: investment is much more palatable and allows for a better optimisation of the sugar value chain. There is a big job component as well, as the obesity issue is a long-term debate. Have started only now talks with government and will know in the next 2-3 months what their stance is on this idea.

Large oil companies do not see ethanol as a threat, while when it comes to energy, ESKOM is not being rational. Cane is more cost-effective and labour-intensive than other crops, such as maize and sorghum (mechanised).

Flex fuel engines in Brazil, could also be an option for SA.

The kind of partnership with Toyota could work.

Dr Syd Kelly, Associate – Consultant, Amandla Resource Development, 25 April 2017

Projects are mostly hybrid. Working on biogas projects with some of the municipalities. Richards Bay biogas project has a learning curve.

Sappi are keen and want to make use of their waste, even thinking of biodiesel, but there are a number of constraints, such as safety concerns.



Have done wheeling through Eskom in 2008. Role is a little like Amatola but broader, also do facilitation and support of small scale enterprises.

There is a cogeneration project being built at the moment, 2MW installed capacity – expected output is heat and surplus electricity.

Biofuels are not entirely feasible.

Obstacles: the capacity of municipalities, cost of technology, lack of a reference site from a technology perspective.

They could provide help with: knowing where biomass is, have done a survey of the region, also have technical specs (calorific value, moisture content)

Mr Linda Mncube, IDP Manager and Mr Masupha Mathenjwa, Environmental Specialist, iLembe District Municipality, 26 April 2017

Linda: represents the district in the SECO programme, the Agriparts programme can also provide some support. There isn't a clear policy on the district side on RE, there is no strategy, but has been recognised as a priority. Provincial Growth and Development Plan focuses on manufacturing side of RE, because a RE Hub is envisaged in the Isithebe Industrial Estate in Mandeni. Enterprise iLembe is mandated to provide development and support to SMEs.

Masupha: with regards to RE, we have tried to get meetings with SASA, in order to get an understanding of what is happening in the industry. Worried about the resources for cogeneration and ethanol production. There are also issues related to food security. Solutions for this sector will be very welcome.

Currently they are looking at technological solutions for the RE sector, which can be manufactured locally. For example, with ethanol, sourcing of technologies is now from overseas and that has a negative effect on local industry. It's a technology needs assessment project to determine which technologies will be easier to manufacture within the district.

Challenge on the district level: energy infrastructure is with local municipalities. For example, KwaDukuza owns most of the grid in the area, while in Mandeni it is a combination between Eskom and municipality, but Eskom owns most of it.

The issue with resources for cogeneration is that mills are already utilising all the available resources. There will be a need to find additional resources. The issue with green harvesting

is that there is an extra cost of transporting it to the mill. We are trying to fully understand the implications of any intervention.

Linda: There needs to be a unit in place to coordinate between the 4 different components of the programme in order for a more holistic view and solutions to be achieved. There has to be an understanding of how one component affects the others. Such as the example of municipal finance.

Mr Sikhumbuzo Hlongwane, EDP Director, KwaDukuza Local Municipality, 26 April 2017

Has been on the SECO programme for 5 years.

Have been trying to influence municipal thinking on the energy mix. Electricity is currently their main source of revenue, as KwaDukuza owns most of its grid. So there is reluctance when it comes to RE and energy efficiency projects.

The municipal Energy Plan did not even have a page on RE or EE. Only now, the new development plan is starting to move into that direction. We support RE into the mix and we are open to it. But there is need for more exposure in order to build capacity.

The mill generates electricity and is supplying SAPPI.

We would like to see more institutionalisation of the measures under the programme. As a municipality, we are very sensitive about the job multiplier of the measures.

Cogeneration: the decision to go into low-carbon development is there but we don't have policies and tariffs in place for feeding back into the grid.

Tongaat: operation Vuselela, Ballito land was owned by Tongaat. Now the land use is changing from agri to property development, so concerns around land use have come up from that. Would there be enough land to supply the extra cane? Is it going to be sustainable under these circumstances to build more mills? There will be competition around land use. Tongaat is currently the only company, which has land management unit.

Ethanol: municipality has not been looking at it. There is a need to get National Treasury and National Government involved. Also, the private sector needs to be involved so that it is not only government driven.

Research needs to be useful for industry and government, so that the measures are justified. They also need to be linked back to NDP objectives. The objectives are often in



place, but we need the steps on how to get there. There is a need to balance the short-term outcomes and the long term ones, as we might not be able to see any ST benefits.

The municipality needs support in building the skills and capacity move such projects forward. Is there capacity to source the extra people that will be needed to drive the process forward?

Waste to energy: they don't currently own their landfill sites, we have private waste management companies. Have been engaging with private companies to see how the sugar waste can fit into a waste to energy project.

Ms Fezile Nzuza, LED Officer, Mandeni Local Municipality, 26 April 2017

Working on projects in forestry, vegetables, sugarcane.

A lot of SMEs are linked to the SAPPI mill. There are factories in the area and SMEs are supplying them with local produce. The factories are into clothing, plastic, scaffolds for construction.

Agricultural sector: development of local farmers, providing farmer support. Agriparks is a Presidential initiative, setting up of stalls for informal traders, helping them with licensing, capacity building, basic business skills training (outsourced).

Sugarcane is the biggest sector. The closest sugar mill is the Amatikulu mill, 30-40km, could be just outside the jurisdiction of Mandeni Municipality.

Nisaar Mahomed, Green Economy and Knowledge Economy, KZN Trade and Investment, 8 May 2017

Regarding the Toyota biofuels idea, has the private sector been involved in the discussion? Can put us in touch with the auto cluster in KZN (association of auto manufacturers), as no one seems to be talking about what a project like that means for the auto industry.

Also, from the municipal perspective, eThekweni have been considering using biofuels for their fleet of busses, for example. However, at the moment iLembe has a biofuel facility, which is not being used to its full capacity. Therefore, the question becomes whether there will be a buy in for the product, as well as who is going to own such facilities/projects, who is going to be willing to invest in it. Is it going to be the private sector or the government? Where is the market for such an initiative?

More can be done in terms of the overall policy enabling environment on a national level, however, at the end of the day there has to be indication from off-takers first.

For example, it took some time for the REI4P to take off and to come to a point where now costs of electricity have become lower than coal. It needed some government support initially but then it was the interest from the private sector that generated the scale and brought the cost of technology down. Government can only go so far, after a while it has to be market driver, because otherwise it becomes unsustainable after a while. If the project fails, that doesn't help the overall green economy much.

Sugar is a very big player in cogeneration. There is a lot of potential, some say about 1000MW installed capacity from cogeneration can be developed. They have just had an EU delegation, together with GreenCape, which looked at biofuels and cogeneration. So the province is working with them, as we know Western Cape also has similar initiatives, to make sure that efforts are not duplicated and all provinces are speaking the same language with regards to these projects.

Wheeling has been considered as a solution but they are aiming to make sure that regulation is up to speed with what the private sector needs. Right now, the tariff that private sector requires is higher than what the bid level is but that is considering that there are a lot of job creation opportunities from biofuel.

James van Zyl, Commercial Manager, NCT Forestry Cooperative, 8 May 2017

Third biggest company in timber after Sappi and Mondi, 2.5 thousand growers and suppliers, growing commercial timber on 30 thousand hectares of plantations. There are at least 800 and growing previously disadvantaged growers.

Last year turnover was R2bn, 70% of the produce went for export to Japan, Taiwan and India and China and 30% is sold locally, mainly to paper producers (Sappi, Mondi). All timber growers, formal and informal, become part of the same pool, we don't distinguish.

Business is currently 99% paper oriented. In SA, there has been mainly development of pellet manufacturing, there have been 4 plants, all of them are now effectively bankrupt today. Due to high pricing of raw material and high freight cost were not competitive internationally.

Today we do our own biofuel exports to Japan, Summit Energy, export of chips, we estimate that we have 6-10 years of 100 tonnes/annum. The idea initially was for this to be an additional revenue stream. However, studies have been done on collecting chips specifically

for biofuel purposes and it does not pay, because when it comes to biofuel mass equals energy.

Over the last 5 years, policy has become less conducive. Industry does not see the possibility to compete in the biofuels sector, even though there is potential: biofuel is very much like coal, you can store it for long periods. We have to be incentivising the private sector to buy in and make sure that they will be making through biofuels at least as much as they would make in other sectors.

Years ago they had no change of entering the international biofuels market. Today we know that there are opportunities to compete, the trends from European markets will come to SA as well.

Benefits for growers: there would be increase in the number of growers as well as the volume due to higher off-take. Annual yields have gone up by almost 50%, the industry has also developed (through genetic improvements and technologies) to be able to grow more in the same area.

Support programme: Two main things: 1. Provide seedlings, loans; 2. Creating a point of sale for the growers, in order to reduce truck load costs, allow them to participate in the value chain without having trucks for transport. These are being subsidised at our own cost at the moment. They have immediate benefits for the growers.

Policy environment: currently we have a stable market, so they are not generally looking at other opportunities, such as energy generation. They act as a kind of grower cooperative. Not actively looking to start generating electricity. There are 30 thousand tonnes of bottom end chips from small growers, which have the potential to add 3MW installed capacity to the grid.

Secure supply of bottom end chips: there is a network in the Midlands area, where you can buy these from a selling point. In the winter months supply is much lower, but if you are large scale producer, you can stock up during summer and use in winter as well.

NCT has extensive information on what has gone wrong in the past. They like to cut to the chase when it comes to new opportunities: what is the price and is it high enough to swing product from current chain to a new direction. They would like to find ways to support local industry and are looking for partners. Even if it is just to do a feasibility study on some of these possibilities.



Nic Bennett, CEO, P&CE Services and Sucropower, 9 May 2017

Overseeing 5 different companies: two of which are P&CE Services (project implementation, has tested the viability of biogas for small scale farmers in KZN) and Sucropower (working with the sugar industry to develop biogas plants), at first set up as a social enterprise.

There was a workshop on the 6th of March, CSIR was there (Liesl) and they are currently looking at designing a biogas development plan for KZN.

Through Sucropower they have gained access to every single cane farmer in the area. We were surprised how many there were. Gledale Valley project is an interesting case because during Apartheid they tried setting up a sugar initiative there for black owners. We have been working with the Quabe Trust there, designed a demo biogas project (30kW) with the idea to scale it up. But it is important first to have something in place that farmers can see: see that it works and learn how to use it.

It was designed mainly to offset the cost of electricity for irrigation. Nic was found funding of the project, on the implementation side, through EEP Africa (grant). Farmers had to find funds on their end to fund the supply of feedstock, but they didn't come through. Sucropower then took the project to commercial farmers in the Thorni Park area, just outside Mandeni. So started putting up a 50kW plant there, which should be running in the next month or so.

This pilot project has been a lot about sharing the experience. They brought in business development agents from Sweden and Denmark, to see the developments, as they are willing to provide funding for similar projects.

On the downstream side is where the job opportunities lie, as once they have the plant in place and they see that it works, local people become very creative and come up with a lot of ideas about what to do with downstream products. There are hundreds of business opportunities coming out of each of those plants. This is a model, which has the potential to be replicated all over Africa.

OW seems like a suitable partner for getting public-private partnerships in place, which can make these projects happen. And SECO programme specifically seems like a good opportunity to find funding opportunities for these projects.

There is nothing that is stopping the Glendale Project but funding constraints. We have even set up networks for marketing the downstream products, such as organic fertiliser: Illovo distillery. At the last workshop it was concluded that some changes have occurred since the

last feasibility study was done and so a new one needs to be conducted at Glendale. This would be a 2 month job and if funding is available, the plant can be up 5-6 months later.

Adjacent to Thorny park (1.5km) is a piece of land (147ha), intended for housing development. There is an ESKOM power line running through it. The farmer is looking at developing a residential site, powered by biogas (needs a 250kW plant). The plant will be fuelled by sugarcane and napier grass (elephant grass). The energy will be used by the community for electricity and heating. The fertiliser will be brought back to the land to feed the agricultural activities. There are green spaces, schools and creches envisaged as well, students at the schools will be taught the skills to design and operate the biogas plants and farming. Study will be finished at the end of the month, 650 houses will be put in place, gap housing (250 thousand to 1 million Rand). Name of the development is Ezulwini (Heaven) and is about upgrading how people live to a more sustainable, green and environmentally friendly lifestyle.

Job opportunities, when it comes to biogas: once you have the plant in place, you have to have feedstock available to feed into it 365 days a year. However, sugarcane is not being cut for 3-4 months per year. You could stockpile it, but a 250kW plant requires 25 tons of feedstock per day. This requires a lot of storage space and also the quality of the cane waste is not the same if stored for too long.

Farmers need cane crop residue: the top of the plants are cut off and left on the ground, where they can stay for a long time, to preserve the moisture and prevent weeds. About 2/3 of the tops go for this purpose. At the same time, the cost of collecting it is huge and farmers often don't have the equipment for that so they would have to carry it.

KZN is subtropical and provides a variety of other options for feedstock, such as the napier grass, it is very easy to manage, as it is very hardy. We use mainly napier grass in our biogas projects, as sugarcane is not as viable, due to costs of collecting it.

Possible support options: providing logistical support for farmers in collecting, in order to ensure that they can provide consistent supply or helping them diversify into other feedstock options. Could be both: they could collectively create a biogas plant and also they can be helped to diversify in additional streams. There are many business opportunities from biogas: for example, gin production in one of the communities, from the grapefruit that used to be exported to Japan but is now left on the ground, due to fallout with Japanese buyer. The juice is used to make gin and the pulp is used as biogas feed (efficient, as has a little sugar in it, such as cane).

In two weeks we should have something to show on the ground. Thinking has gone mainly into securing dedicated livestock and opportunities for diversifying into other businesses.

There is the opportunity to create a network of gas stations from communities, however, the important thing is that once a biogas plant is set up, it has to be fed and the community has to take responsibility for that. Income would come from a variety of business opportunities: CO₂, gas, fertiliser, electricity).

Cogeneration: P&CE has worked on the costing of different designs for Illovo and Tongaat Hullet. They have not done any in ethanol yet, that is a question of finding the right engineer to do such designs.

Another possible package of support is the facilitation of wheeling/selling into the grid of surplus electricity from biogas plants.

Biogas plants (in some places they have done this through the development of mini grids) also have the potential to supply electricity to farmers so that it reduces the diesel costs for powering any equipment. In Brazil, the sugarcane industry is using gas vehicles and there is also a company in Johannesburg, which supplies 1300 buses and taxis with biogas.

There is currently no government act in place to regulate how these biogas plants are put in place and run. We voluntarily did an EIA for Ezulwini, although it is not required by law. There are also no legal mechanisms in place to facilitate the sale of by-products. Biogas Association has started talks with government, but SASA could possibly also be brought in on this. There is fear that if industries are not involved in such talks, once regulations are put in place, they will become an obstacle for plants that have already been developed or future developments.

Hamish Erskine, CEO, Dube TradePort, 12 May 2017

The KZN Autopark project: DTP bought the land from Illovo and now they are owner and implementing entity of the project.

Hamish has been involved in economic development since the early 90s and has been with DTP since the very beginning. Knows the sugar industry very well and is familiar with the ethanol potential. The key factor in the Brazil (flex fuel) success story has been the fuel % mix objective. That should be a national policy and not provincial, it is down to blending regulations.

Sugar production is ideally suited for the area but sugar as the primary product has been under pressure. Ethanol production requires capital investments in order to achieve scale. In



SA government and oil industry have not grasped the story completely. On a provincial level, the idea has been receiving a lot of support.

Role of DTP can be various: they are 10km away from Maidstone, a special economic zone and also provide a lot of transport/logistics services.

Adding to support story: the SA economy is often accused of being monopolistic and having many barriers to entry. Sugar industry is similar in some ways. There is a need to show that this project can bring down these barriers and offer an opportunity for new private sector players to get involved, who did not previously have a chance. If the project will be seen as transformative, this is an important element.

Tongaat have been trying to do this alone and that's the wrong approach, they need to involve a variety of players. The CEO has been making attempts to create such an environment, he's close to retirement now.

If you can demonstrate that there is a real opportunity, it will still be no breeze but will be a first step: getting the consensus right at provincial level, then investigating/anticipating what private sector and competition arguments for/against will be so you can out-lobby them.

Auto manufacturers: what does it cost to make the conversion?

Government (provincial) is a shareholder is DTP, although they operate very much as a private sector entity. Therefore, support from DTP will be there for this project.

At first he thought it was just an LED project, but had a SECO meeting and can see now that it is much bigger, more strategic.

Peta Wolpe, Managing Director and Mark Borchers, Director, Sustainable Energy Africa (SEA), 16 May 2017

Wheeling regulations have not been resolved in South Africa. There has been a draft wheeling provision suggested in the Electricity Regulation Act but it is only a few points and does not make it clear.

There is an inherent risk, associated with wheeling but that could also be an opportunity. The question is what will NERSA think of the idea to promote wheeling as a way of enabling cogeneration projects.

SEA (Meghan) has had meeting with IPP Office around getting municipalities involved in the REI4P process. They sent a proposal to them for feedback and adjustment a while ago but it has not been returned, which has left the project in a limbo.

The International Council for Local Environmental Initiatives (ICLEI) has done some LEDs work in KwaDukuza.

It feels like the nuclear project agenda has created bottlenecks all across these processes in the energy sector, driven by ESKOM.

Studies have been done for CT, for example that it can reduce its emissions through being able to generate and buy from IPPs, which is not excluding the national generation capacity but allowing for municipalities to come into the field.

Pressure is coming on the regulatory environment from many different angles. So this is something that could be worth looking at.

Municipalities revenue work: SEA has done work with GIZ on facilitating future business models. However, nothing specific has been done yet. So far it has been more about opening up the space for different opportunities and bringing people together to discuss these (Meghan).

Andrew has done some modelling on the revenue side with regards to EE, solar heaters and the impact of SSEG. These have all been short term solutions, playing around with tariffs. However, a long term revision of the business model of municipalities has not been done.

Now they are starting to put fixed charges in place, where tariffs = fixed + variable charge. In Cape Town there is a R250 fixed charge/month to be connected to the grid. This separation of fixed and per kWh charges makes sense for municipalities but knocks the business case for SSEG. Commercial SSEG have always had fixed charges so it doesn't affect them as much, but residential ones have been affected by this.

SEA has also done work with Tshwane and AMEU on SSEG.

They think support for resolving the regulatory process is very important, but there is a risk it could become a dead end. It is an uncertain environment but they would be happy to provide support.

SALGA has worked on RE and EE national municipal strategy policy document, which is available on their website and could be useful. They have also organised provincial



workshops where municipalities have come to discuss this strategy so they have had contact previously with these municipalities.

For SECO they are doing a feasibility study on a benchmarking system for energy awards for the energy sector in SA.