Briefing

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## Policy pointers

**South Africa's high per** capita energy consumption requires a more coherent enabling environment for the development of renewable energy capacity.

**Incentives to develop** domestic markets for biomass energy — both more efficient wood-pellet stove technologies and modern biomass electricity generation — are urgently needed.

**Creating a secure local** market for biomass energy and encouraging Eskom to sign purchase agreements could add much needed capacity to the network.

**A formal network of** biomass actors, equivalent to the Solar Energy Society for South Africa (SESSA) and South African Wind Energy Association (SAWEA), needs to be established with government support.

# South African biomass energy: little heeded but much needed

South Africa badly needs more energy. Heavy reliance on large-scale coal and a centralised grid is no solution, especially given agreed Long Term Mitigation Scenarios. The largest renewable energy source is biomass energy but mostly in the form of wood fuel for cooking and heating. Two modern attempts to develop South Africa's biomass energy potential — the Howick wood pellet plant, and the Tstsikamma biomass plant — failed. But only just, and this was mostly due to local market conditions and stand-offs in agreeing purchase agreements with Eskom (the public energy provider), not insuperable technological difficulties. More coherent incentives for domestic biomass energy market development within South Africa are needed, both for more efficient wood pellet stoves and also for biomass electricity, if South African citizens, and particularly its poorer communities, are to have secure access to energy.

## South Africa needs energy

South Africa has by some margin Africa's largest gross domestic product (GDP). Moreover, the Department of Energy[1] in its Integrated Resource Plan (IRP) for electricity provision 2010–30 predicts that it will increase by an average of 4.6 per cent over the next 20 years. This will inflate what is already by far the largest per capita energy consumption in Africa. The challenge of meeting growing demands for energy shows no sign of abating since the temporary rolling outages in 2008 cost the South African economy an estimated US$ 5 billion.

In response to what are widely regarded as 'thin' energy reserves, the public energy provider Eskom has begun a US$30 billion build

### How was primary energy supply met within South Africa in 2010?

- By domestic coal (67%)
- From oil (19%), much of which is imported.
- From solid biomass and waste (10%), critical to 80 per cent of rural households who use fuelwood and charcoal as their primary energy source.
- From natural gas (2%), nuclear (2%) and hydro (less than 1%).

The IRP for electricity provision takes a middle road between low cost and low carbon solutions to 2030 and opts for a balanced scenario which favours a strong emphasis in new production allocations for renewables (33%) and nuclear (25%).

programme, with about 20,000MW of additional capacity due to be online by 2025. Quite how South Africa procures this additional capacity in practice will set a precedent for other African countries in transition to energy intense economies.

There are significant inequities in South African energy use. Roughly 20 per cent of urban households and half of rural households are still unconnected to grid or off-grid electrification programmes. Recent free basic electricity entitlements to a maximum limit of 50kW hours per month have helped the poorest households to access electricity where it exists. But delivering on or off-grid electricity is still a major challenge — as is the sustainable supply of fuel for cooking and space heating.

*Local market development needs to be encouraged through coherent, reliable policy incentives*

In terms of renewables, solid biomass and waste is the main component of South African primary energy supply. Given its importance to the rural poor, it is understandable that the 2003 White Paper on Renewable Energy[2] identified biomass as an important source of low-carbon renewable energy (alongside wind, solar and hydro). A recent study by Banks and Schäffler suggests that South Africa has the highest potential for further developing industrial uses of biomass energy.[3]

## Biomass energy is integral to the renewable energy mix

Much of South Africa's existing biomass involves inefficient household use based on questionably sustainable harvesting, primarily from natural woodlands (60%) although also from plantation off-take and woodlots. Nevertheless, South Africa does have established experience in more commercial options, primarily using bagasse (waste fibre from sugar cane processing) for electricity generation in the sugar industry, and using waste wood and sawdust in the plantation based pulp industry.

To date, negative perceptions have hampered biomass energy development in South Africa and beyond. Several consultancy reports on South African renewables — from Haw and Hughes[4] and the report by Banks and Schäffler for example — point to concerns that increasing biomass energy use might threaten water availability, food security, biodiversity conservation and domestic health, and question its 'carbon-neutrality' in household situations where inefficient combustion is commonplace. Such concerns, while legitimate, can be easily addressed through careful land use planning and the introduction of more efficient biomass energy technologies. They form no grounds for dismissing biomass out of hand. Indeed, given the fact that many South Africans will depend on biomass energy for the foreseeable future, improving the sustainability, efficiency and health

### Box 1. Howick wood pellet plant, Kwazulu Natal

The Howick wood pellet plant was established in 2006 in Kwazulu Natal by Biotech Fuels (Pty) Ltd — a South African-based energy company. Investment came from GAM UK. It reached a production capacity of 60,000 tonnes (at 85 per cent efficiency) by 2012, primarily exporting to the European wood energy market and employing 42 people. Three years of prior technical investment had allowed Biotech to align the plant with local conditions, come to grips with local raw material supply, and learn the vagaries of the export market. It passed the scrutiny of a European sustainability and production standards audit in 2011. Initial projections that raw material could come from within a 50km radius of the plant were adjusted as it proved only possible to source enough raw material from 36 separate sawmills, furniture and pallet producers in a 97km radius. While not paying suppliers for the raw material, Biotech did incur substantial costs for road haulage, cleaning and drying (equivalent to US$29 per pellet tonne). A major difficulty was encountered in cleaning, with metal contaminants creating high wear and tear and burning out equipment three times faster than in equivalent European plants.

Within the initial project design there was also a 5MW biomass electricity plant, both to supply the primary plant, and to sell surplus energy to neighbouring industries and Eskom. This power plant was never fully commissioned because Biotech could not secure a favourable power purchase agreement from Eskom for the surplus electricity. This was surprising, given Eskom's urgent need for increased energy capacity and a public call for industrial co-generation at the time. Biotech explored Clean Development Mechanisms (CDM) finance to subsidise the overall generation costs but was unable to find a solution and stalled the installation. The result was that they had to fall back on grid-supplied electricity, reducing profitability and eliminating a potential option for increased energy capacity in the region.

In this scenario, further investment to reach 72,000 tonnes production capacity was required to optimise economies of scale and break even. Unfortunately, the global economic recession squeezed prices. By 2012 the export price of US$165 per tonne brought straight losses to the Howick plant. A crucial problem was the lack of a local market to serve as a back up. High logistical and maintenance costs could not be reduced further. Biotech did explore supplying local pellet stoves for the domestic market, but time was against them. GAM UK became nervous and called in their investment, resulting in liquidation in 2013.

of their energy system is surely a priority irrespective of broader concerns over industrial energy expansion.

South Africa has substantial biomass energy potential. Its 42 million ha of natural woodland, 1.35 million ha of plantation and significant tree resources outside forest supply an existing 1.2 million tons of wood fuel. But none of this is currently used by Eskom for the production of electricity. In addition there are untapped links to currently unused agricultural waste and garden waste — which are regularly used for electricity production — either in co-firing or dedicated plants elsewhere.

A major advantage of biomass energy production, both in the conventional use of fuel wood and charcoal for cooking and space heating, and for commercial electrification is the high employment intensity of the industry. An additional advantage is the widespread availability of this energy source in remote areas that pose a challenge for conventional grid connection.

The South African cabinet's acceptance two years ago of the Long Term Mitigation Scenarios (LTMS) as a basis for the country's climate policy paves the way for an economic growth model in which carbon constraints are given serious consideration. Indeed a palatable compromise between low carbon and low cost energy provision is proposed in the Department of Energy's Integrated Resource Plan. Yet a concrete set of policies, subsidies and institutional support mechanisms have not yet materialised to drive the development of a stable internal market for biomass energy, to complement the growing but highly competitive export market for biomass pellets. Two attempts to create appropriate incentives — the Renewable Energy Feed in Tariff (REFIT) and its successor, the renewable energy bid programme (REBID) — have so far failed to establish institutional structures and alignment with other relevant legislation (such as the National Environmental Management Act) that might have allowed quicker progress.

## Past failures do not need to be nails in the biomass coffin

A recent report by OneWorld[5] looks in some depth at two examples of commercial biomass energy development: the Howick wood pellet plant (see Box 1) and the Tstsikamma Biomass plant (see Box 2). Both failed, but both came closer than other South African examples to sustainable commercial profitability. Understanding why they failed may help decision makers develop a package of incentives that will provide the foundation for future success.

### Box 2. Tstsikamma Biomass Plant, Western Cape

MTO Forestry (Pty) Ltd. acquired three sawmills in the Cape, including Tstsikamma, in the post 1994 democratic election period. Within their strong community and sustainable forestry model they diversified operations by opening a biomass electricity plant of 6MW operating capacity at Tstsikamma (to be operated by Associated Energy Service – AES). It used waste from adjacent sawmill and other operations. At the time when AES took over there was no Eskom connection line available, but this was installed a year later in 2006. The plant supplied both the sawmill and neighbouring communities with steam and electricity. But the Eskom line was never used as Eskom did not at the time believe they required additional capacity and did not facilitate the process. AES therefore decided not to invest the US$800,000 for the switchgear needed to supply the grid.

In 2012, Swartland, a private sector sawmill operator, cited the MTO operation as unfair competition and disputed the initial bid award to MTO. The competition board resolved the dispute in favour of Swartland and MTO passed the sawmill and biomass electricity plant to Swartland as part of the dispute settlement. Swartland's core business and profit orientation led them to mechanise the sawmill, shedding 2,000 jobs. The greater sawmill efficiency reduced sawdust, which then had to be trucked in from other areas. Swartlands disinterest in peripheral business options, and increasing raw material costs, led them to close the biomass electricity plant (but still keep the steam production unit). An additional factor was the low efficiency of the dated electricity generation plant, which would have cost significant investment to upgrade. Had Eskom seen fit to purchase electricity seven years before, the added profitability might have resulted in a different outcome.

Given the critical generation capacity challenge in the foreseeable future, an obvious lesson from both case study examples is that local market development needs to be encouraged through coherent, reliable policy incentives.

## Developing local biomass energy markets is a logical way forward

Over 80 per cent of rural households across South Africa use fuelwood as their primary source of energy, at an estimated value of just over US$200 per household per year according to a report by Damm and Triebel.[6] Biomass is determined both by the availability of energy alternatives (including electricity) and by the availability of the local raw material. There appears to be a high domestic market potential for more structured and sustainable production of biomass energy, linked to a clean and efficient stove distribution programme. Plants could also link to the export pellet markets.

From further local energy surveys conducted in the Blue Crane district and referred to in the OneWorld report it seems that community involvement in such projects would be possible in distribution channels from plants such as Howick to the local market, and in the distribution of appropriate stove technologies. Should a market for wood pellets develop domestically, it might

then also be possible to feed this market with smaller scale technologies based on either plantation or natural forest wood. A full feasibility study might shed important light on this potential. It is not primarily technological issues that are perceived to be problematic, rather it is the need to subsidise the early stages of wood pellet market development and distribution channels until the scale of the market can generate returns that no longer require subsidy.

In terms of domestic electricity markets, it is clear that even with the installation of the large coal fired Medupi and Kusile power plants in the pipeline, the public electricity provider Eskom is unlikely to be able to meet demand. It therefore makes great sense to support the development of community oriented biomass electricity plants in association with wood waste (or even dedicated woodlot production) in the near future. Such plants could serve either off-grid or on-grid networks. A key challenge will be the willingness of Eskom to facilitate acceptable purchase agreements — in line with the intention of the Draft Integrated Electricity Resource Plan for South Africa and the LTMS.

Beyond the questions of market development, serious thought also needs to be given to the development of the raw material base in ways that do not threaten water, food and biodiversity. Well managed natural woodlands could complement resources available from plantations. Oneworld's recommendations include the establishment of a network of biomass actors — including technology providers and research institutions, such as the Sustainable Energy Centre of the Western Cape, Energy Solutions and Technology Innovation at Stellenbosch and the Energy Research Centre at the University of Cape Town.[7] This would put biomass on an even footing with, say, the South African Wind Energy Association or the Solar Energy Society of South Africa and allow interested parties to build public awareness and push for better legislative support.

**Belynda Petrie and Duncan Macqueen**

Belynda Petrie is the chief executive officer of OneWorld Sustainable Investments.

Duncan Macqueen (www.iied.org/users/duncan-macqueen) is a principal researcher in the Forest Team in IIED's Natural Resources Group.

## Notes

[1] Department of Minerals and Energy. 2010. Draft Integrated Electricity Resource Plan for South Africa — 2010 to 2030. See: www.energy.gov.za/files/irp_frame.html / [2] Department of Minerals and Energy. 2003. White paper on renewable energy. See: http://unfccc.int/files/meetings/seminar/application/pdf/sem_sup1_south_africa.pdf/ [3] Banks, D., Schäffler, J. 2006. *The potential contribution of renewable energy in South Africa.* RAPS Consulting, Rondebosch, South Africa. / [4] Haw, M., Hughes, A. 2007. *Clean Energy and Development for South Africa: Background data.* Energy Research Centre, University of Cape Town, South Africa / [5] Petrie, B. 2013. *South Africa: a case for biomass?* OneWorld, Cape Town, South Africa / [6] Damm, O., Triebel, R. 2008. *A synthesis report on biomass energy consumption and availability in South Africa.* ProBEC and LHA Management Consultants, South Africa. / [7] Energy Research Centre, University of Cape Town: www.erc.uct.ac.za

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**Contact**

Correspondence to:
duncan.macqueen@iied.org
belynda@oneworldgroup.co.za

IIED
80–86 Gray's Inn Road
London, WC1X 8NH
United Kingdom

Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055

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