

CASE STUDY

BRONKHORSTSPRUIT BIOGAS PLANT

Investment year: 2012

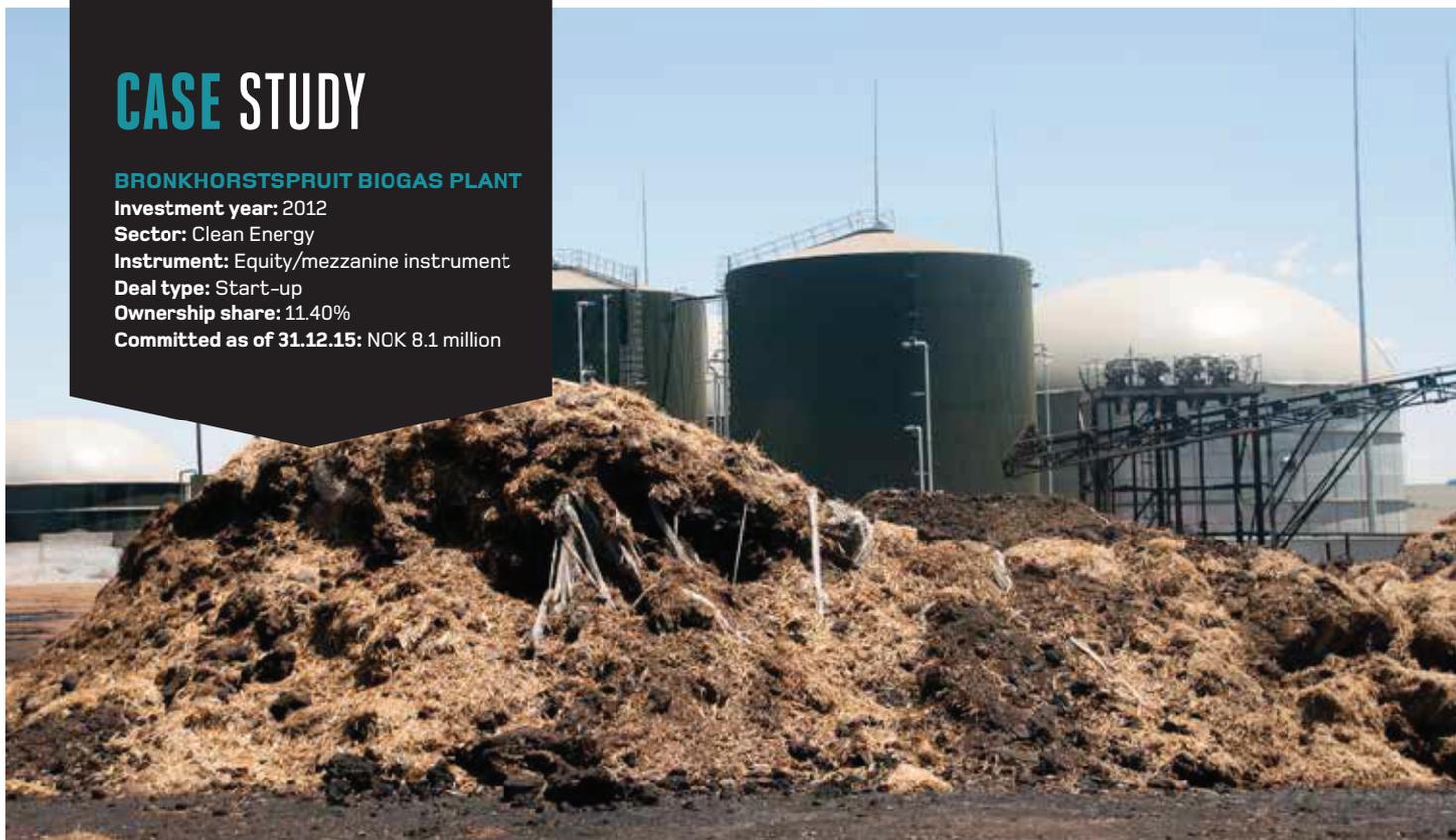
Sector: Clean Energy

Instrument: Equity/mezzanine instrument

Deal type: Start-up

Ownership share: 11.40%

Committed as of 31.12.15: NOK 8.1 million



ELECTRICITY FROM ORGANIC WASTE

Energy constraints are impeding South Africa's economic growth. The new Bio2Watt biogas plant produces electricity from organic waste, and is helping to reduce both the nation's electricity deficit and the amount of landfill waste.

SOUTH AFRICA'S PRIORITIES IN ENERGY

- Improve operations and maintenance practices at Eskom
- Add more capacity through independent power producers (IPPs)
- Improve energy efficiency
- Target of 30 percent clean energy by 2025



¹ Eskom (2016)

² Goldstuck (2015)

³ The Shift Project Data Portal

⁴ Zuma (2015)

⁵ Department of Energy, South Africa (2015a)

South Africa's demand for electricity has increased substantially because of its rapid economic growth and its efforts to electrify rural areas. As a result, the margin between peak demand and available electricity supply has narrowed. To prevent the collapse of the country's power system, Eskom – the state power utility – has enforced rolling black-outs (or 'load shedding')¹.

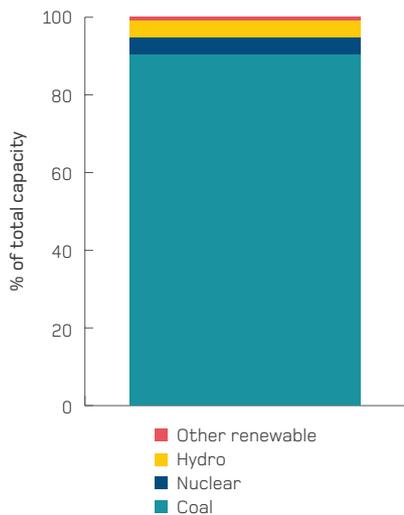
Increasing generating capacity is a key priority for the South African government. In 2014, economic growth in the country dropped to just 15 percent as a result of the ongoing power crisis – the slowest pace since the 2009 recession. Surveys show that outages have surpassed the problems of crime and competition as the most significant external threats to SMEs in South Africa². Many are losing income because of production outages and damage to equipment. While some

companies rely on back-up diesel generators as a source of energy, these are expensive and polluting.

To date, the energy mix in South Africa has been dominated by coal, and the country's total carbon dioxide (CO₂) emission from energy use is the 13th highest in the world³. But, according to South Africa's President, Jacob Zuma, the government plans to broaden its energy sources: "with regards to the long-term energy master plan," he says, South Africa "will pursue gas, petroleum, nuclear, hydropower and other sources."⁴

South Africa's renewable energy potential is substantial. A successful renewables programme has already added more than 4,000 MWs of renewable energy capacity in less than four years, and aims to generate 10,000 GWhs from renewable sources.⁵

Figure
South Africa's energy mix is coal dominated
 Installed energy generation capacity in South Africa (2013)



Source: CIA World Factbook

Renewable technologies such as wind and solar, however, are variable and require stabilising power and frequency regulation from other energy sources. The Minister of Energy, Tina Joemat-Pettersson, notes that South Africa must secure a reliable baseload supply while also reducing its greenhouse gas emissions. Achieving both objectives, she says, requires “a very fine balance.”⁶

Biogas is a renewable source of energy which is already contributing stable baseload power to the country’s electricity grid, and the Southern African Biogas Industry Association estimates that biogas can contribute up to 2.5 GWs of generation capacity.⁷

NORFUND’S INVESTMENT IN BRONKHORSTSPRUIT BIOGAS PLANT

Bio2Watt’s 4.4 MW Bronkhorstspuit plant is the first industrial scale biogas waste-to-energy operation in South Africa.

The project began in 2007, but it would take eight years before the plant could start operating. Both the biogas technology and the business model used in the Bio2Watt project were new to South Africa, and

meeting the government’s regulatory and environmental licensing requirements was therefore time-consuming.

Through its Project Development Facility, Norfund committed a convertible loan to fund the last part of Bio2Watt’s project development up to its financial closure stage, which was reached in early 2014. According to entrepreneur and founder Sean Thomas, having Norfund as a patient investor gave the greenfield project credibility, and catalysed investments from others. Norfund also provided around one third of the equity capital required for the project, and played an instrumental role in structuring the deal, defining the composition of the loan and equity provided, and the financing terms.

CONTRIBUTING TO DEVELOPMENT

The investment in the biogas plant complements Norfund’s energy portfolio and fits well with our strategy of investing in clean energy in developing countries that have large energy deficits. The capacity of the Bio2Watt plant is smaller in scale to other projects in which we usually invest, but the investment gave Norfund the opportunity to contribute to technology transfer to South Africa and to introduce a new business model. On October 10, 2015, the plant began operating – eight years after the project started, and is now contributing to increasing electricity supply and reducing landfill waste.

Generating stable electricity with an innovative business model

The biogas plant processes 200-300 tonnes of waste every day. This waste includes manure from 25,000 cattle (the plant is located on the premises of one of the country’s largest feedlots), as well as organic waste from the local municipality and nearby industries. When organic waste degrades, methane and CO₂ are produced. At biogas plants, this natural process is accelerated, the methane is captured, and electricity is generated by engines fuelled by the gas. While the technology is new to South Africa, biogas plants in Asia, Europe and the Americas have already been

commercial successes. The capacity of the Bio2Watt plant is relatively small (4.4 MW). However, unlike many other sources of renewable energy, the plant is able to generate electricity continuously and is therefore a stabilising source of energy for the grid.

The transfer of the electricity from the Bio2Watt plant to the car manufacturer takes place through a process known as ‘wheeling’: after BMW purchases the electricity, it is then transported from the Bio2Watt plant through the grid network which is owned and operated by Eskom and the City of Tshwane Metropolitan Municipality. Billing is managed by the municipality. This agreement, in which an independent power producer is selling electricity directly to a private customer instead of the state-owned utility, Eskom, is the first of its kind in the country. The BMW factory receives 25-30 percent of its electricity from Bio2Watt. Ultimately, BMW hopes to source all its power from renewable energy sources.

The 10-year agreement provides BMW with a stable electricity price for the duration of the contract. Although this is higher than current grid prices, both BMW and Bio2Watt anticipate that the electricity supplied by Eskom will become more costly, and that this will make the biogas supply competitive within two to three years.

This assumption is supported by the NUS Consulting Group’s forecast that “electricity prices in South Africa will continue to rise despite a slowing economy, as supply challenges persist. The short and long term outlook for electricity is for prices to increase as Eskom continues to deal with generation and infrastructure costs.”⁸

This business agreement is just one of many that were negotiated before the construction of Bio2Watt could commence. The success of the first biogas business model means that it can now be used as blueprint for other biogas projects. The Bio2Watt scheme has also led to changes in South Africa’s regulatory framework. This, it is hoped, will make it easier and less time consuming to replicate similar projects.



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(1) The BMW factory receives 25-30 percent of its electricity from the biogas plant. **(2)** The biogas plant processes 200-300 tonnes of waste every day.

Avoiding greenhouse gas emissions

Bio2Watt is supplying extra electricity to the grid, but it is also having other positive impacts by helping, for example, to prevent climate change and reducing waste. Methane is a naturally occurring gas that is emitted during the breakdown of manure and other organic waste. At biogas plants, this natural process of decay is accelerated. Methane – a gas almost 30 times more potent than CO₂ – is captured and then used in gas engines to generate electricity. While the combustion of biogas produces CO₂, the carbon in the biogas originates from plant matter that has fixed the carbon from atmospheric CO₂. Biogas production is therefore carbon-neutral and does not add to greenhouse gas emissions⁶.

Reducing landfill waste

Reducing landfill waste, and organic landfill waste in particular, is a challenge for the government and local municipalities. Bio2Watt's biogas plant is a convenient and environmentally friendly way for companies to dispose of organic waste. The company's original business model did not include revenue for handling waste securely, but this may become a new income stream because waste regulations in South Africa are tightening: from 2016, organic waste will no longer be permitted in landfills. Several large multinational corporations have 'zero waste to landfill' policies. By sending their waste to

Bio2Watt, they will be able to fulfil these commitments, receive a certification of disposal, and may also be able to reduce their costs.

The more frequent removal of manure from the feedlot to the plant has environmental benefits, too, by reducing river pollution, and raising standards of animal welfare. Waste water from the biogas plant is recirculated and reused for the grazing land, thus returning nutrients to the soil.

Creating jobs

The energy sector in South Africa provides jobs through plant construction and operations, and by supplying electricity to businesses. During the building of the Bio2Watt plant, for example, 190 people were temporarily employed for seven months. Approximately 10 people are employed directly by the operating plant. The biogas plant has also contributed to indirect job creation in the waste management and handling sectors. More than 50 jobs, for instance, have been created on the feedlot and at the waste companies.

Although the direct and indirect job creation effects of Bio2Watt are important, it is normally the second-order growth effects that are the primary motivation for DFI investments in the energy sector. The creation of jobs through the removal of obstacles to enterprise growth (such as

a lack of access to reliable electricity) is an example of a second-order growth effect. The power purchase agreement between Bio2Watt and BMW provides the car company with a stable electricity price for the duration of its contract with Bio2Watt. This is important for BMW because it is in the process of expanding its manufacturing and export facilities in South Africa.

BIO2WATT: THE WAY FORWARD

Bio2Watt is exploring additional ways to generate income. These include installing two extra gas engines to expand its capacity to 6-7 MW, selling the heat generated commercially, and using CO₂ emissions from the plant to grow vegetables in greenhouses.

Norfund has given a project development loan for a second biogas plant project which Bio2Watt plans to build in the Western Cape Province of South Africa. Bio2Watt has entered its proposal for the development of this biogas plant in a new bidding round in South Africa's renewable energy programme, and is also looking at exporting the business model and developing further biogas projects in other African countries.



⁶ Buckhardt (2015)

⁷ Department of Energy, South Africa (2015b)

⁸ NUS Consulting Group (2014)

⁹ Wilkie (2015)