Bush Control and Biomass Utilisation Project

POLICY BRIEF
AUG 2021

© Colin Lindeque – Energy for Future biomass stockpile at Ohorongo Cement

Electricity generation utilising encroacher bush

Assessment of micro- and macroeconomic benefits of a 40-Megawatt Encroacher Bush Biomass Power Station near Tsumeb in Namibia

KEY MESSAGES

- NamPower proposes to develop a 40-Megawatt (MW) biomass power station near Tsumeb with an operational lifespan of 25 years. This study assessed the direct, indirect and induced impacts of the project on the Namibian economy, as well as endeavour to identify the broad beneficiaries of the project. This is an update of the 2018 study on an earlier proposed 20MWe power station, with the new study considering four different power station scenarios. The four options assessed included the following:
  1. A single 40MWe grate-fired biomass power station;
  2. A phased 2 x 20MWe phased biomass power station, with the second 20MWe coming online five years after the first;
  3. A 16MWe pilot biomass power station; and
  4. A 16MWe pilot biomass power station, to be followed by a separate 20MWe biomass power station on the same site reaching commercial operations five years after the pilot project.

- The study also modelled four distinct price points for the biomass feedstock and the adjustments to the capital cost per kW of installed capacity. The single 40MWe power station was selected as the base scenario, with a feedstock price of N$750/t and a capacity factor of 70%. The additional power stations and inputs were included in the updated study as addendums.

- Electricity generation utilising encroacher bush is in line with key national and local development priorities as outlined in key policies such as the Harambee Prosperity Plan II, Vision 2030, and the Fifth National Development Plan. This project will contribute towards providing employment opportunities, skills development, local economic growth and an improved agricultural carrying capacity of the farmland where encroacher bush has been harvested.

- The biomass power station project provides far-reaching economic benefits, from biomass harvesters, to farmers, to indirect and induced employment. Making use of an abundant resource such as encroacher bush has the potential for greater employment creation in Namibia than other sources of renewable energy.

- The assumed biomass-based power generation costs varied significantly according to the power station scenario, with the first scenario (single 40MWe power station) providing the most affordable tariff at an average N$1.97/kWh (nominal terms) over its lifespan. The tariffs are largely offset by the subsequent macro-economic benefits generated by the project, valued at N$2.67/ kWh generated in the 40MWe base case.

BACKGROUND

Namibia faces the challenge that its traditionally open savannah rangeland, characterised by a mixture of trees, thickets of bush and extensive grassland, is increasingly transforming into a dense, bush encroached landscape. Bush encroachment is defined as the densification and rapid spread of native shrub and tree species, resulting in an imbalance rangeland ecosystem. This phenomenon affects over 45 million hectares of land in Namibia. This imbalance of the woody species leads to a reduced biodiversity, a decreased carrying capacity of the rangelands, and in the medium term, a reduction of available groundwater, as a result of the increased water uptake by the encroacher bushes. Due to bush encroachment's detrimental effect on the grazing capacity of agriculturally productive land, productivity has declined. Restoring bush encroached areas by the sustainable removal (harvesting/thinning) of some of the woody plants to yield a more balanced rangeland ecosystem will result in an improvement in grass production and therefore also grazing capacity.

The proposed harvesting site is a radius of approximately 100km. The assumed sustainable harvesting yield of 12.65 tonnes of biomass per hectare, on a dry matter basis, means an estimated 46.7 million tonnes of biomass is available within the proposed harvesting area. The 40MWe power station has an annual fuel requirement of 201,369.67 tonnes (t) of biomass, which equates to a maximum 10.8% of the available encroacher bush being utilised over the full 25-year lifespan of the plant. The availability of biomass far exceeds the total anticipated demand and means competition for the resource itself is unlikely to be sufficiently large to jeopardise the viability of the project.

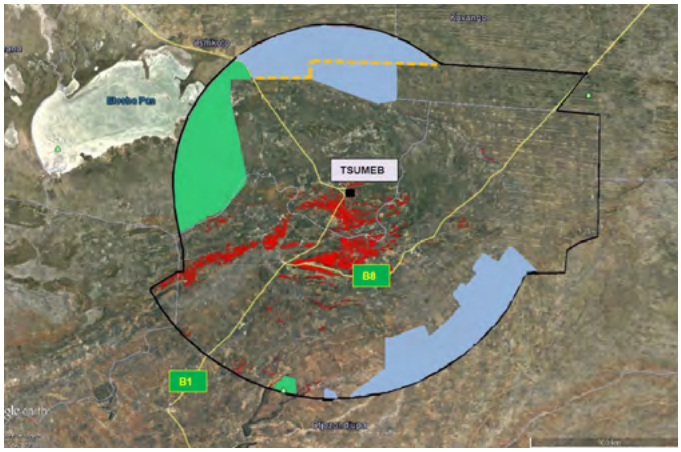

Figure 1: ***Proposed harvesting area for the 40MW biomass power station***

The updated study modelled one harvesting method, namely the fully mechanised method. It was assumed that harvesters earn revenue solely from the price per tonne received for biomass delivered to the power station, which therefore plays a key factor in the commercial feasibility of harvesting projects. Unlike the previous study, this updated study did not include a bushthinning fee of N$300/ha.

OBJECTIVES

In June 2013, NamPower finalised a pre-feasibility study for a biomass power station. The pre-feasibility study assessed the technical, environmental, socio-economic and financial aspects of this project. It was recommended commercially proven combustion technologies be used for the conversion of biomass to heat energy for generating electricity.

In 2018, a micro- and macro-economic impact assessment of a proposed 20MWe encroacher bush biomass power station was completed. More recently, in December 2019 a greenhouse gas assessment of biomass utilisation in Namibia included a proposed 20MWe encroacher bush biomass power station and in October 2020 an environmental impact assessment for a proposed 40MW encroacher bush biomass power station was published.

It is against this background, that there is a need to update the existing macro-economic study completed for a 20MWe biomass power station to reflect the current market conditions and present the benefits should the project be implemented to an increased capacity of 40MWe or even in phases.

KEY FINDINGS

Microeconomic benefits

The microeconomic section of the study focuses on the benefits to gross value addition (GDP) in the country, looking particularly at the impact on agricultural output, value addition from biomass harvesting, benefits accruing to the environment and ecosystem services and employment.

The overall positive microeconomic impacts of the proposed power-plant are as a result of employment creation, salaries and wages, agricultural benefits from livestock production, improved groundwater recharge, reduced CO_2 emissions and the value addition derived from biomass harvesting. At a price of N$750/t, the base scenario generates a total microeconomic benefit of N$4.97 billion, or N$0.81/kWh, over the project lifetime in 2020 (inflation adjusted) value terms. These values represent the direct, indirect and induced additional gross value addition activities (GDP) that take place in the country because of the proposed power station and its up-and-downstream value chains.

Macroeconomic benefits

On the macroeconomic impact, it was noted that while the majority of the employment is generated at the micro level, the contribution to GDP by both personal and corporate income tax is heavily dependent on the price point and harvesting method. The profitability of harvesters is heavily dependent on the price point, but the harvesters remain profitable at the base N$750/t. The construction of the power station will see the greatest short-term addition to GDP, while the operational phase provides a lower but longer-lived contribution. Depending on the year, and depending on the price paid for biomass, the power station will generate electricity worth between -0.05% and 0.21% of GDP per year. The impact on inflation is expected to be negligible, as the 40MWe power station produces approximately 7.2% of total energy sales, and electricity (and other fuels) make up less than 4% of the inflation basket. The balance of payment sees net positive effects, largely due to the import-substitution of electricity as well as contributions from cattle and beef exports (totalling N$6.1 billion in today's terms).

The net present value of macroeconomic benefits (discounted at 5.5% p.a.) totals NAD16.4 billion, or NAD2.68/kWh.

The larger scale of this 40MWe power plant vis-à-vis the 2018 study on a 20MWe power station result in a significantly larger macroeconomic benefit. However, there have been some adjustments to the assumptions and other inputs. As a reminder, the 2018 study estimated the NPV of macroeconomic benefits (in 2018 prices) at N$4.97 billion, or N$1.33/kWh, for the first scenario (more manual harvesting),

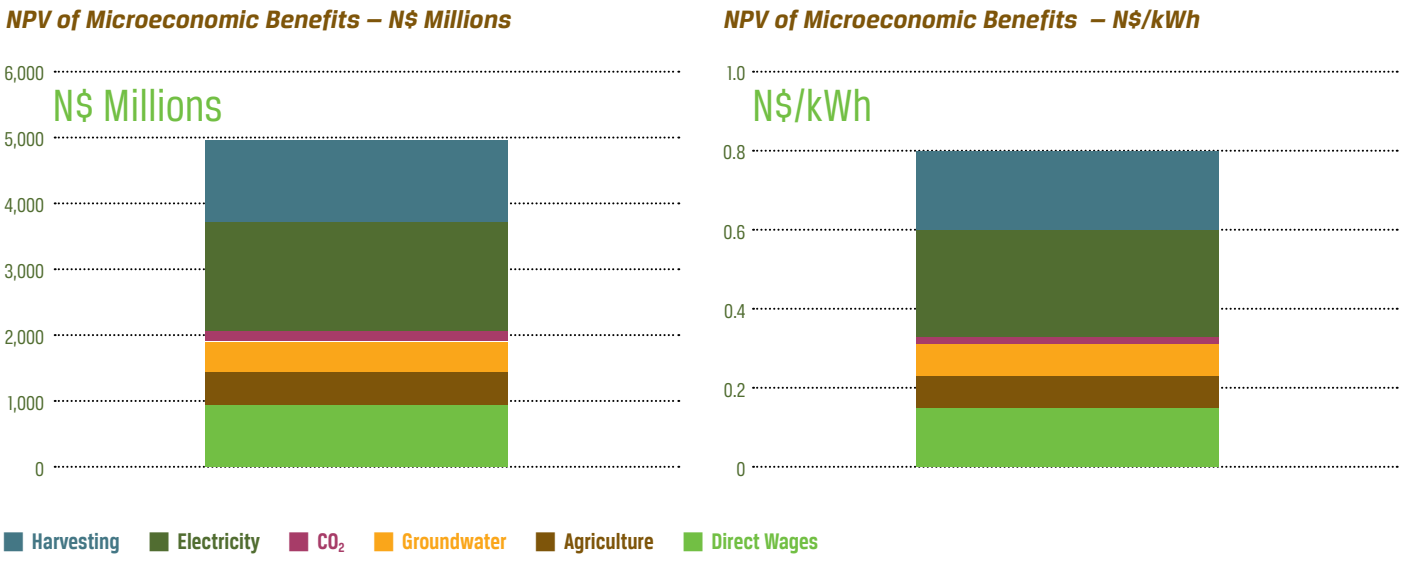

*Figure 2: **Net Present Value (NPV) of microeconomic benefits***

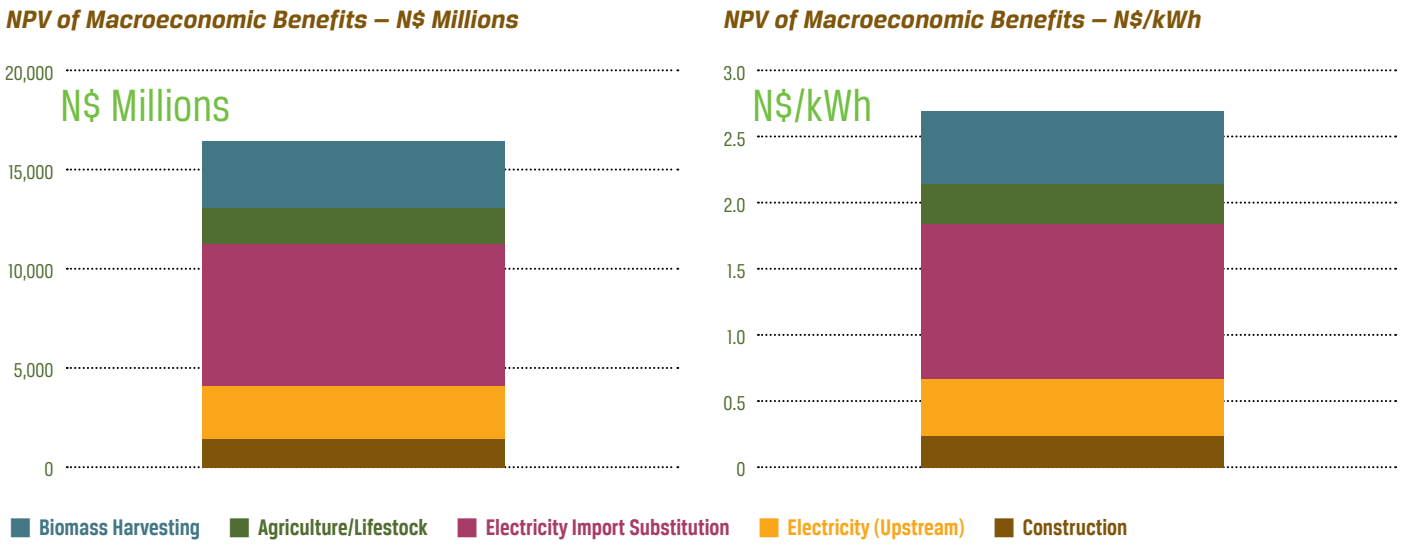

*Figure 3: **Net Present Value of Macroeconomic Benefits***

and at N$4.76 billion, or N$1.28/kWh, for the second scenario (mostly fully-mechanised harvesting).

Various alternative scenarios were also modelled and included as appendices. For the sake of brevity, the scenarios within the appendices are illustrated through charts and tables highlighting the core results and outputs given the changes to the underlying assumptions and inputs.

POLICY RECOMMENDATIONS

It is recommended that the national policies that promote bush control towards rangeland restoration, such as the National Rangeland Strategy (2012), the Harambee Prosperity Plan II (2021) and the Fifth National Development Plan (NDP5, 2017), be operationalised through the utilisation of Namibia's encroacher bush resources for electricity generation.

The key considerations to optimise the micro- and macroeconomic benefits from the 40MWe biomass power station include the harvesting methods utilised, the price paid for biomass, and the capacity factor of the power station. The N$750/t price point is the most feasible of the assessed points for both the power station and harvesters and was therefore used as the base case. For the project going forward, it is recommended that a biomass pricing framework facilitates an offer in the region around N$750/t to favour both harvesters and the power station.

ABOUT THIS POLICY BRIEF

This brief is based on the extensive report Update of an existing Macroeconomic Impact Assessment for a Biomass Power Station in the Oshikoto region prepared by Cirrus for NamPower, Namibia Biomass Industry Group (N-BiG) and MEFT/GIZ – Bush Control and Biomass Utilisation Project.

The views expressed in this brief are not necessarily those of the funders.

For more information about the assessment and the findings, please contact:

Bush Control and Biomass Utilisation Project
Johannes Laufs, Team Leader
T +264 (0) 61 429 250
E johannes.laufs@giz.de

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM
german cooperation DEUTSCHE ZUSAMMENARBEIT
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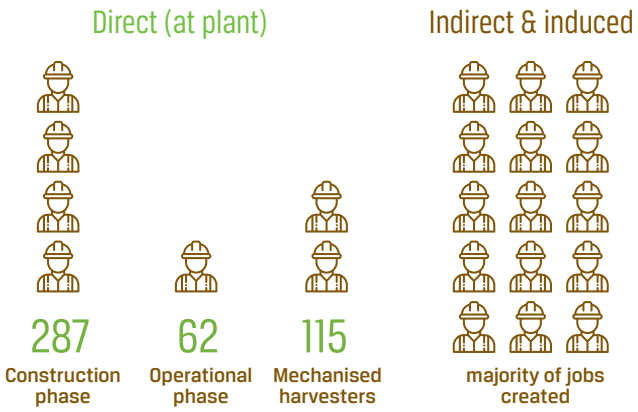
Electricity generation utilising encroacher bush in Namibia

Key Facts and Figures

Although there are assumed biomass-based power generation costs associated with operating and maintaining a biomass power station, there are also significant economic benefits which were quantified at approximately N$0.81/kWh for the microeconomic benefits and N$2.68/kWh for the macroeconomic benefits. Some economic factors considered for this quantification are highlighted below.



Direct and indirect employment effects

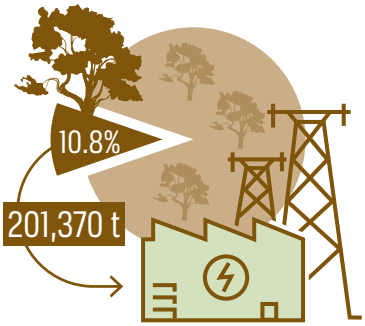
The **power station** will directly employ a peak of **287 people during the construction phase**, and maintain **62 positions during its 25-year operational phase**. The **mechanised harvesters** will employ **115 people**. The overwhelming majority of jobs created by the project will be **indirect and induced**. Many indirect jobs will be created on the biomass supply chain (i.e. harvesting and processing operations), while induced employment will be the result of the increased local consumption of goods and services as a result of the employment created by the power station and biomass supply chain.

The proposed harvesting site

is a **radius** of approximately **100 km** with more than **46 million tonnes of biomass** available for harvest.

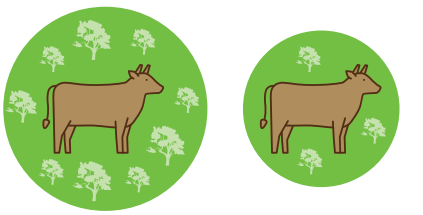
Annual fuel requirement

A 40 MW power plant has an annual fuel requirement of **201,369.67 tonnes** (t) of biomass, which equates to a maximum **10.8%** of the available encroacher bush being utilised over the full 25-year lifespan of the plant.



Use of land

It is estimated that the carrying capacity of encroached land is 17 ha per head of cattle and that **carrying capacity will improve** to 10 ha per head of cattle four years after bush thinning.



+22.7 mil m³

Groundwater recharge

Using a conservative estimate and after all offset costs are accounted for, the **extractable groundwater resource is expected to increase by a net 22.7 million m³** over the 25-year project lifespan. The real net value of groundwater recharge is N$460.2 million, or N$0.08kWh.

Livestock industry and Namibian economy

The livestock industry has an extensive upstream value chain and well-developed downstream value chain, implying that **for every N$1** of output generated by this industry, **N$3.63 of output is generated** in the economy as a whole, across various different up-and downstream activities.

Local market for wood chips

The biomass power plant more than doubles the local market for wood chips in Namibia.