

# A Biomass Partnership with Namibia

An opportunity for international and  
regional cooperation

Energy transformation through  
industrial development and  
sustainable land use



This brochure introduces the Biomass Industrial Park (BIP) concept to prospective investors, customers, and interested communities. It showcases outcomes of a BIP, such as regional added value and sustainable land use practices. This brochure explains the business model of the BIP and how it will help to transform the problem of bush encroachment in Namibia into an opportunity.



# Bush encroachment in Namibia

## Background

Tackling bush encroachment in a savanna landscape



Bush encroachment is currently recognised as an environmental crisis in Namibia with severe social repercussions.

Agricultural productivity has declined by two-thirds in recent decades.

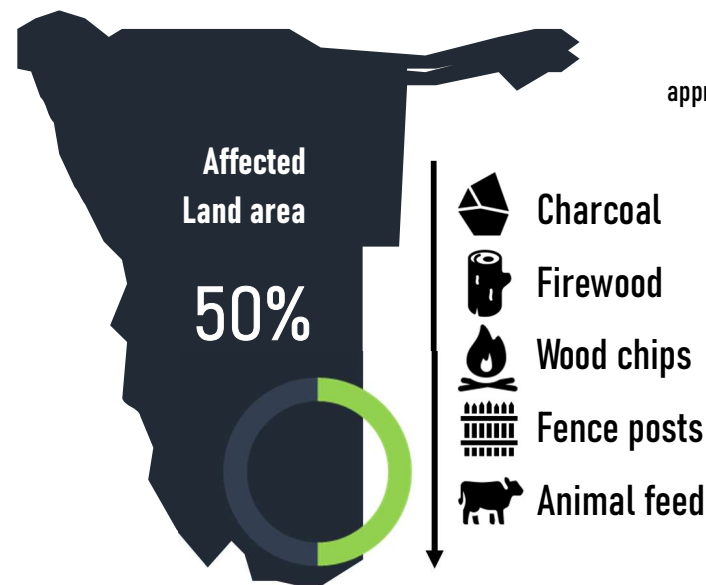
Bush encroachment of Namibian savanna is attributed to decades of **unsustainable land management and climate change**. Excessive spreading of native *Acacia* species such as *Acacia mellifera* occurs when the natural ecological balance between bushes and grasses is disturbed. **Bushes grow at a rate of 3.4 per cent per annum. 45 million hectares of land are affected in Namibia.** Bush encroachment has severely disrupted the local cattle industry and small-scale agriculture. Biodiversity is lost. The landscape looks monotonous and it becomes difficult to spot wildlife.

45 million hectares

Annual bush growth has reached 3.4% per year.

Approx. 14 million tonnes annual woody biomass re-growth

nearly 412 million tonnes of harvestable woody biomass is available



Current utilisation is NEGLIGIBLE

Around 1.85 million tonnes approx. 1% of the total available biomass

Current utilisation status;  
Some bush biomass is still chemically treated or burned in-field  
Charcoal production has potential for enhancement  
Bush biomass offers diverse opportunities for rural income and employment

## BIP

## The Biomass Industrial Park

With the support of Namibian stakeholders, a strategy is being developed to establish bioenergy and raw material centers (Biomass Industrial Parks = BIPs) at multiple locations in the country.

The advantages of a BIP for biomass customers is the establishment of sustainable supply structures. It will allow domestic and international utilisation, in particular for the supply of large customers such as biomass (heating) power plants.

A BIP attracts large amounts of biomass, thus reducing the unit costs for transport, handling and storage. The focus is also on technology transfer and adaptation to support and expand the sustainable and climate-friendly extraction of bush biomass in line with international certifications and regulations as RED II.

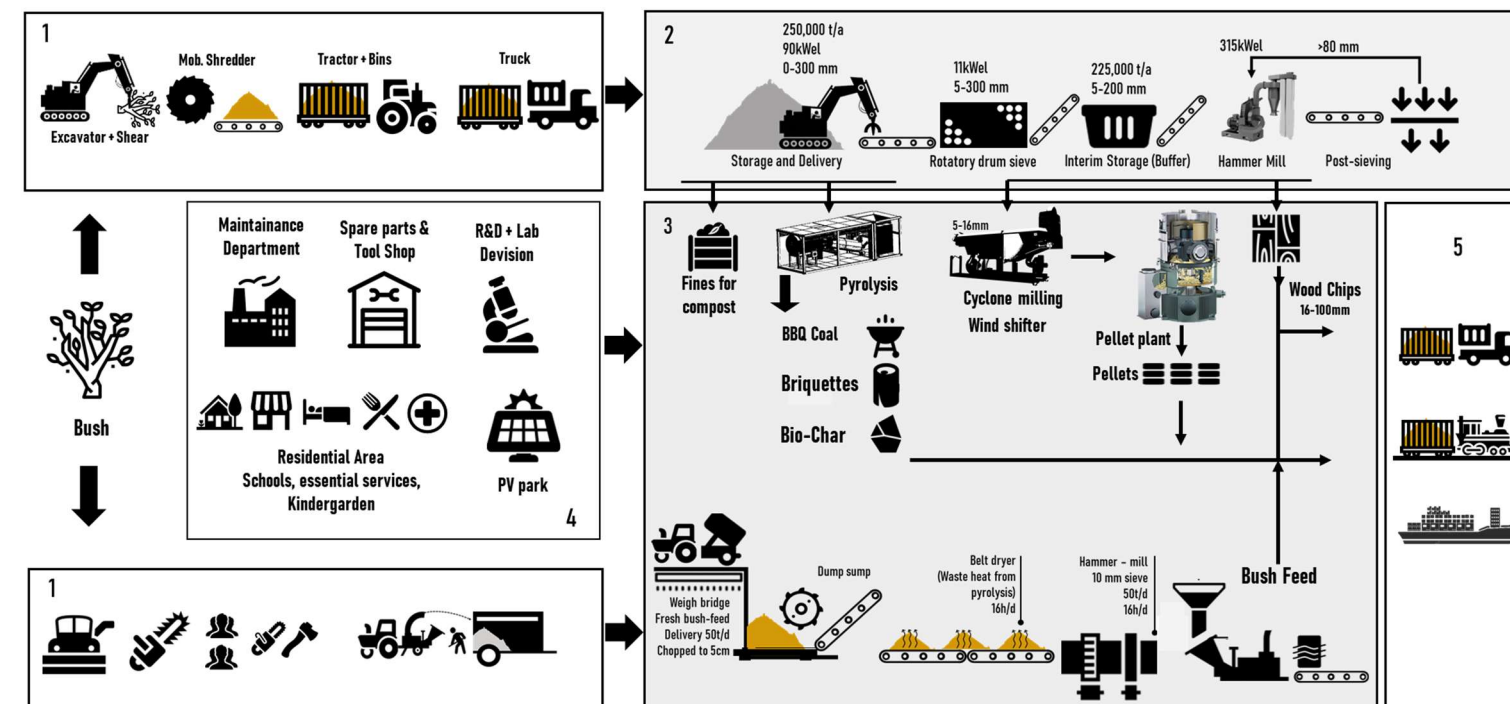
**Important to note is that the enormous scope of the resource ensures that an international off-take does not compete with domestic use.** A BIP will add value to the Namibian local resource base. In addition, capacity building, further education and training opportunities are created for the local population.

The envisioned BIP project aims to process **250,000 tonnes** of encroacher bush biomass per annum, using this raw material and its by-products in a number of different value chains, operated by a host of independent, and yet interconnected entities, leveraging on the available synergies.

The BIP follows a holistic bush utilisation approach and the activities are subdivided in **five realms**



### Proposed BIP structure

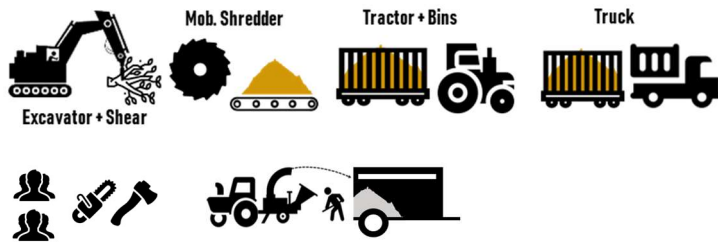




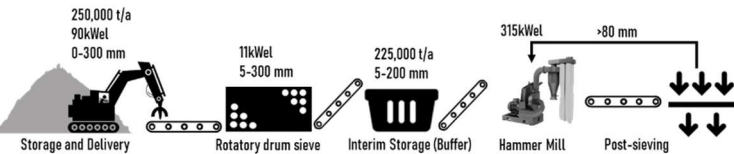
# 1 Harvesting

Harvesting of bush comprises the **mobilisation**, drying, primary crushing for volume reduction of biomass and *transport to the BIP*. Bush is cut with an excavator equipped with a **hydraulic shear**.

In order to provide **250,000 t/a** of raw material to the BIP, it is necessary to work with 6 – 8 harvesting units, which consist of **excavators, mobile chippers, tractors and bins, wheel loaders and trucks**.

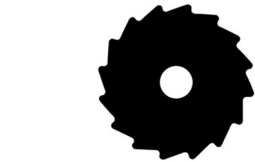


The performance of the treatment chain depends on the milling process. In the proposed process, the hammer mill can treat around **390 – 520 t/d**. One treatment chain can produce between **105,000 – 135,000 t/a** of chipped wood.



Based on these results, two production lines are needed to treat around **800 – 1,000 t/d** and **200,000 – 250,000 t/a**.

# 3 Processing



**Composting**  
Fines, bark and ash from the post-harvesting process will be collected and composted. Undersize fraction (<5mm).



## Pyrolysis

Presently, a steel kiln with the annual input of 7,200 t/a of biomass will produce 1,880 t of charcoal. Fines can be used to produce charcoal briquettes with greater NCV. In addition, 300 t/a of biochar and 1.2 GWh/a of heat are generated.



## Wood chips

Expected is a gain of approx. 152,000 t/a. The wood chips grain size will be in the range of 16-100 mm, with different fractions such as P30, P50 and P100.



## Pellets

The size of the pelletizing plant has been set to approx. 50,000 t/a as this equals the expected amount of the undersize fraction (4-16mm) from the post-harvesting realm.



## Bushfeed

A natural product, produced from thinner branches, twigs and leaves of trees and bushes. Bush feed is of great value to Namibian livestock production.

# 4 Additional Services



## Renewable Energy provision

Size of the system  
**5,000 kWp**

Area requirement  
**41,917 m<sup>2</sup>**

Levelized cost of Electricity (LCoE)<sup>1</sup>  
**1.1 N\$/kWh**



## Electricity – Solar PV

## Residential areas

A BIP is estimated to attract a community of approx. 425 residents with new 250 jobs



Estimated cost<sup>1</sup> for the projected social service centers and buildings **N\$ 38 million**

# 5 Logistics



The BIP will cover its energy needs from an **industrial sized solar photovoltaic (PV)** plant which guarantees supply of more than **10,146,820 kWh**. A **5 MWp PV** plant covers more than a fifth of the energy demand of the BIP

The BIP is expected to generate around **250 new direct jobs** within the area. Considering its remote location, it is essential to deliver basic *accommodation and services* for the employees and their families.

In regard to the cost structure, minimum requirements in the **ILO convention** (also in line with FSC and PEFC certification procedures) are considered. Proposed housing of employees exceeds the minimum requirements of ILO convention and offers options to choose between houses or flats depending on personal circumstances. Other than accommodation, the proposed housing scheme will have **day care centers, schools, dispensaries, small supermarkets, community centers, fitness centers, gardens, a security fleet** and more.

**Logistics is an important realm** in the BIP as it enables material to flow smoothly until it reaches domestic and international customers. The national transport network is extensive, and of high standards. Specifically, the port infrastructure allows for export operations. However, all transport modes would require upgrades to cater for the specifics of biomass volume transport.

<sup>1</sup> Location – Namibia  
Direction for driving from Otjiwarongo to Walvis Bay. Google Maps, 30 Oct. 2020  
<https://www.google.com/maps>



# Sustainability

## Regulatory Framework

In line with the Ministry of Environment, Forestry and Tourism in Namibia (MEFT) and Environmental **Authorisations Processes** for Bush Thinning Projects (2017)

## High Standards

Long-term off-take agreements will introduce high socio-ecologic and techno-economic standards and international benchmarks.

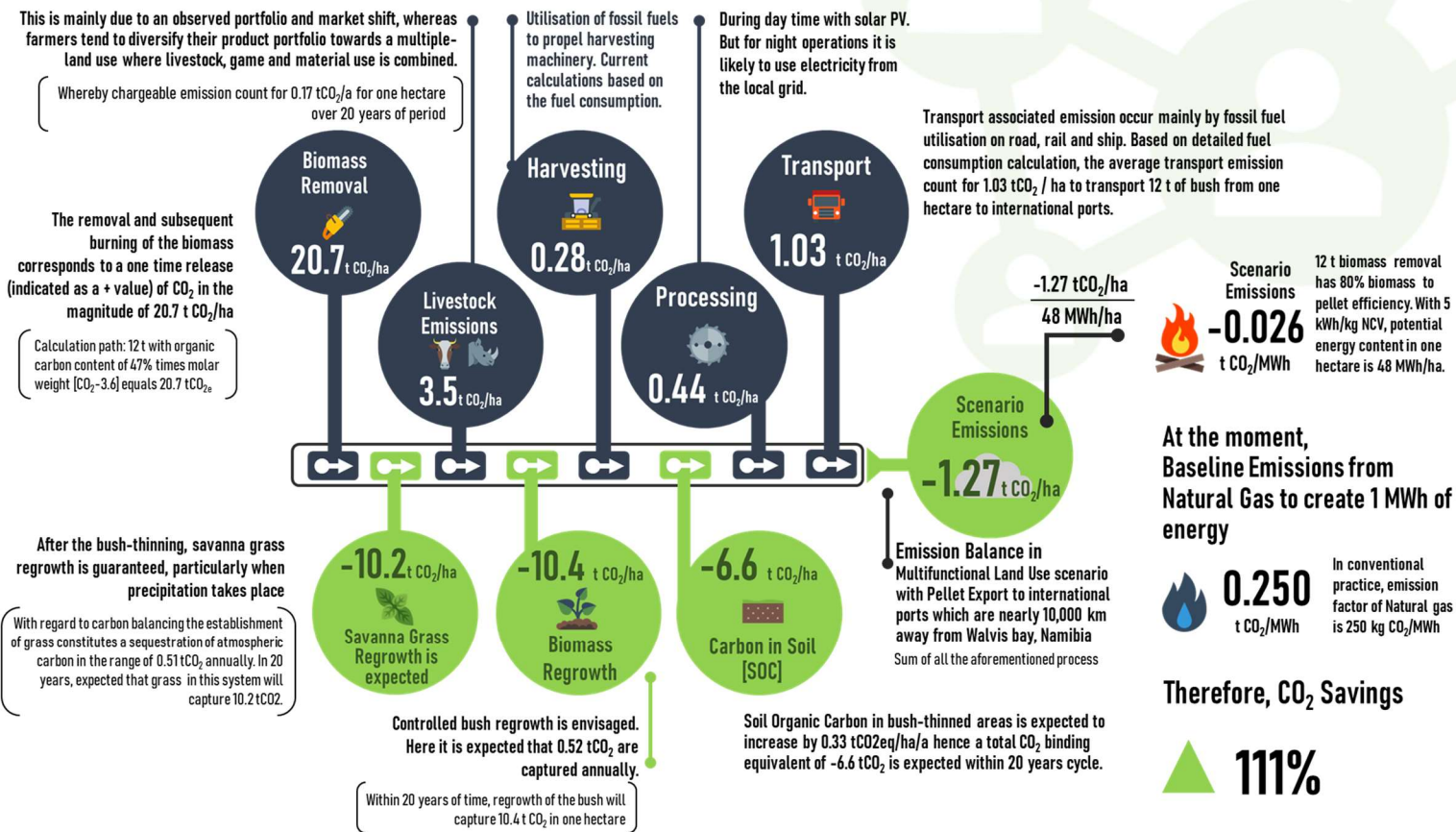
## International Certification

Develops and applies proven standards such as FSC and SBP certification in order to meet international requirements.



# GHG Balance

# Outcome



# Certification

# Sustainable biomass verification

There are different verification and certification systems that recognise biomass sustainability. BIP's biomass verifications act as independent documentation that the products are sustainably produced and supplied.

PEFC

Program for the Endorsement of Forest Certification Schemes



FSC

Forest Stewardship Council



SBP

Sustainable Biomass Program



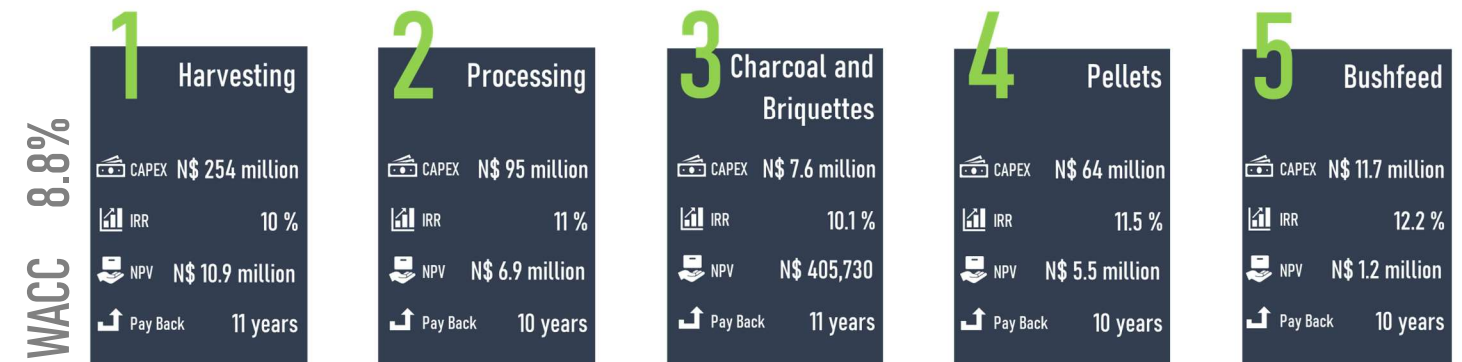
SURE

Sustainable Resource Verification Scheme



# Business Plan

The calculation below shows the financial KPIs (**liquidity as well as the financial strength and profitability**) in each realm with proposed material outputs.



# Investment Plan<sup>2</sup>

The table below is a detailed summary of the business plan along with the KPIs such as NPV, IRR, Pay-back period based on free cash flow discounting in the baseline scenario. The 4<sup>th</sup> column shows the minimum selling price based on the respective process. The **IRRs** show that each individual BIP realm is capable to exceed 8.8% WACC and hence create positive net present values (NPV) still including dividend payments.

BIP Realm	Product	Quantity	BEP	Act. Market Price	Source	Jobs	Turnover	CAPEX	Tax	WACC	IRR	NPV	PBP	Variable Sensitivity Rank						
		[t/a]	[EUR/t]				[EUR/a]	[EUR]	[EUR/a]	8.8%		[EUR]	[a]	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>				
Harvesting "Bush-thinning"	Bushfeed feedstock (FM)	48,000	13	undefined	Farm level	36	cp. Bushfeed	248,000	cp. Bushfeed		cp. Bushfeed									
Harvesting "De-bushing"	Biomass raw material (DM)	250,000	26	38	N-BiG	86	6,880,000	13,700,000	200,000		10.0%	597,009	11	Sales price	Operating time	Working days				
Post-harvesting	Compost	22,500	-5	-5	n.a.	40	9,220,000	5,240,000	140,000		11.0%	377,244	10	Feedstock price (Input material)	Wood chips selling price	Fines for pellets (Selling price)				
	Undersize (for Pellets)	52,000	42	87	Kah/BPC															
	Oversize (for Pyrolysis)	7,500	31	31	N-BiG															
	Wood chips	152,000	41	46	N-BiG															
Pyrolysis	Restaurant Charcoal	338	290	290	NCA	24	98,094	910,000	20,000		10.1%	22,171	11	Wood coal ratio	BBQ coal price	Wood price				
	Charcoal	1,259	242	242	NCA		304,693													
	Briquettes	226	67	67	NCA		15,109													
	Biochar	242	348	450	IfaS		84,216													
Bushfeed	"BIP" Bushfeed	11,000	218	225	DAS	22	2,450,000	642,000	13,000		12.2%	68,144	10	Sales price	Moisture	Heat energy price				
Pelleting	Industrial Pellets (I2)	49,400	147	162	CIF ARA	23	4,460,000	3,470,000	28,000	11.5%	302,645	10	Moisture	Pellet price	Feedstock price					
Additional Services	Social Services	cp. RoadMap				12		1,760,000	n.a.	2021							2022		2023-2024	
	SEBIP's <i>(here in EUR/a)</i>	494,000		10	per ton pellets					Jan	Dec	Jan	Dec	Jan	Dec					
Logistics	Truck/Road	236,723		34	TWC/ Imperial		8,048,576		160,972	Planning, Form of organization structure		Testing, adapting and construction								
	Train/Rail			26	TWC/ Imperial		6,154,793		123,096											
	Ship/See			31	MACS		7,338,408		146,768	Implementation of processing plants										
Total						243	45,053,889	25,970,000	831,836	Harvesting							Build	Operation and transfer		

Projected time-frame

# BIP facts

- ✓ A BIP will create and up-scale domestic and international market opportunities for Namibian bush biomass **and hence address the bush encroachment problem in the country.**
- ✓ **Annual re-growth is 14 million tonnes which need to be harvested per year to STOP further encroachment.** Namibia's demand for bush will not likely exceed 15 - 20 % of this annual re-growth.
- ✓ Estimated 412 million tonnes of woody biomass is available and in excess for a sustainable harvest.
- ✓ The BIP investment and business plans are promising. Economic and technical feasibility as well as ecological sustainability are key factors of a BIP.



## Way forward



### Road Show

In collaboration with Namibian authorities and stakeholders, we are interacting with financing institutions, governments and entrepreneurs, in Namibia and internationally.

### International off-take

We are engaging the potential international off-takers – within our existing stakeholder network and beyond. We are in discussion with relevant implementation bodies in Namibia and support the creation of domestic ownership.



### Certification

We are organising and preparing the certification of the bush biomass. Legal and organisational structures have to be defined clearly and in close co-operation with Namibian institutions and stakeholders.

### Testing and Adaptation

Additional technology and process testing and optimisation under real outdoor conditions are essential. We are selecting, testing, adapting and optimising technologies and processes.



### Marketing and research for new value chains

BIP provides opportunities far beyond the production of pellets, wood chips and pyrolysis products. With the multifunctional land use necessary for sustainable aftercare, new products can be developed.

### Operator/Promotor

We are defining and developing the foundation of a Special Purpose Vehicle (SPV) company structure. It will define the group of companies and organizations that will jointly launch this novel and innovative project.



Supported by



Project partners



**Biomass Industrial Park**  
A Biomass Partnership with Namibia



**IfaS** Institut für angewandtes  
Stoffstrommanagement

**Prof. Dr. Peter Heck,**  
Managing Director, Institute for Applied Material Flow Management  
Environmental Campus Birkenfeld/University of Applied Sciences Trier  
[p.heck@umwelt-campus.de](mailto:p.heck@umwelt-campus.de)