Biomass Partnerships with Namibia

Development of Biomass Industrial Parks (BIP)

Identifying Potentials – Optimizing Processes – Creating Value

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Namibia BIOMASS INDUSTRIAL PARK

IfaS Trier University of Applied Sciences | HOCHSCHULE TRIER

Bush Encroachment

Remember "Out of Africa?"

Item	Encroached	Savannah	Delta
Carrying Capacity	300 cattle *(25ha/lsu)*	600 cattle *(12.5 ha/lsu)*	50%
Evapotranspiration	1.3 Mio. m^3/d	0.34 Mio. m^3/d	74%
Profit	N$ 280,000 / year *(€ 17,600)*	N$ 680,000 / year *(€ 42,800)*	59%

Farm Winnie, Outjo area

Okakarara area

Background Namibia
Bush Encroachment

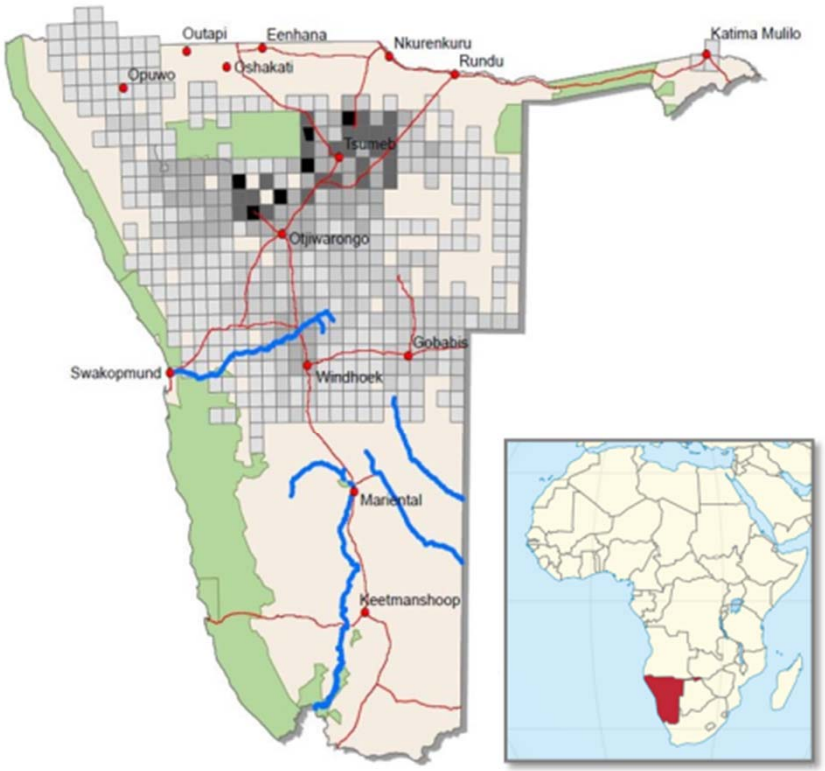
Problem

- >30-45 million ha of productive rangeland bush encroached at an annual growth rate of 3-5%
- Severe impact on biodiversity, groundwater recharge and livestock productivity
- Annual agronomic losses of 100 million EUR due to reduced rangeland productivity *(2/3 of total productivity)*

Opportunity

- >300-450 million tons of standing "unwanted" but valuable biomass with annual growth of 9-18 million tons
- Increasing demand on regional and international markets
- Socio-economic benefits: rangeland restoration, climate change adaptation, employment, energy supply and transition

Total Extent of Bush Encroachment



"Bush Encroachment is a National Disaster"

Hon. Min. MAWF, National Rangeland Policy 2012

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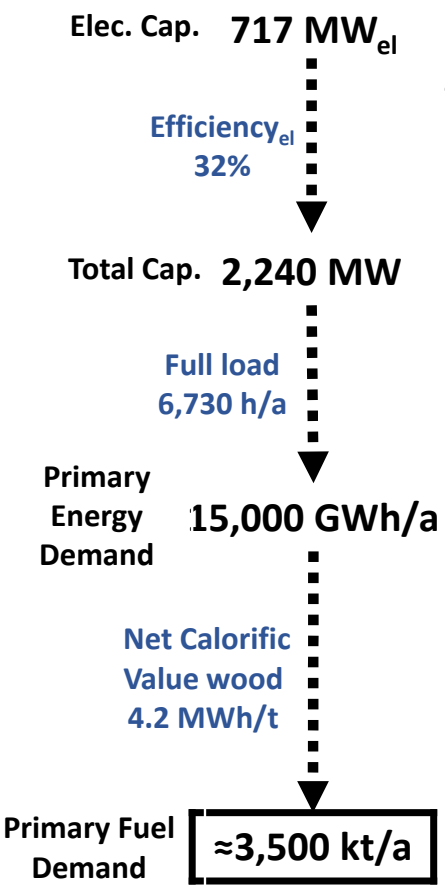
Electricity demand of Namibia

Electricity Portfolio Namibia

Energy Source (Plant)	Installed Capacity Namibia (MW_{el})	Operating Modus
Ruacana hydro-electric	347	Flexible - Depends on water level
Van eck coal-plant	80	Emergency Stand-by
Anixas Diesel	22	Emergency Stand-by
Solar + Wind (2019-2023)	110	Flexible
Highest Peak (2017)	**717**	**100%**
Local generation	193	27 %
	Import 73% 524MW	Local 27% 193MW

Example: 100% Elec. From Biomass



Demand 2018
4,826 GWh_{el}/a
Source: NAMPOWER

LCoE [USD_{cent}/kWh]	
PV	3-6
PV + Battery	12
Wind	3-8
Biomass	17

Fuel Demand VS Bush Stock

	2019	2029
Namibia Bush Growth rate 3 %	9,000 kt/a	12,000 kt/a
Primary Fuel Demand	- 3,500 kt/a	
Remaining Biomass	~ 5,500 kt/a	~ 8,500 kt/a
	61%	**71%**

Consequence: Export needed!

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Background Germany
Coal phase-out and CO_2 tax

Source: Agora Energiewende and Sandbag (2019): The European Power Sector in 2018. Up-to-date analysis on the electricity transition.

Current Elections, Press and Protest (2019)

I. Landslide Victory of the Green Party in the European Parliament
II. Critics of YouTuber "Rezo" pushed green movement among younger generation
III. "Fridays for Future" Protests introduced to Germany

Coal Commission – German Parlament

I. Renewable electricity share 2050 shall be 80% and the reduction of GHG shall amount to 80-95% in comparison to 1990.
II. Shutdown of first coal power plants by 2022 *(Lignite = 146 TWh_{el}, **ca. 100 Mio. t**)*
III. Total coal phase-out by 2032 *(Hard Coal = 84 TWh_{el}, ca. 28 Mio. t)*
IV. Carbon Dioxide Tax (or Emission Trading Certificates)
    I. UN-Climate Conference Estimate: 20-80 €/tCO_2 [2020] – 50-100 €/tCO_2 [2030]
    II. Federal Environmental Agency (UBA): Environmental Damage 180€/tCO_2

Bilateral Talks (Namibia-Germany)

I. National Planning Commission – Steering committee joins all affected ministries *(MAWF, MME, MET, MITSMED)* and institutions of Namibia *(N-BiG, GIZ, NamPower, NamPort, TransNamib, etc.)*
II. September 2019 – De-bushing and BIP entered as a topic into the bilateral talks

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Policy Framework for de-bushing

Namibian Constitution

„…to actively promote and maintain the welfare of the people, maintenance of ecosystems, essential ecological processes and biological diversity of Namibia…"

National Agriculture Policy (2015)

"…recognises the problems of bush encroachment … caused by … overgrazing and bush encroachment. The policy defines the aim to establish mechanisms to support farmers in combating bush encroachment..."

National Development Plan (NDP5) [2017-2022]

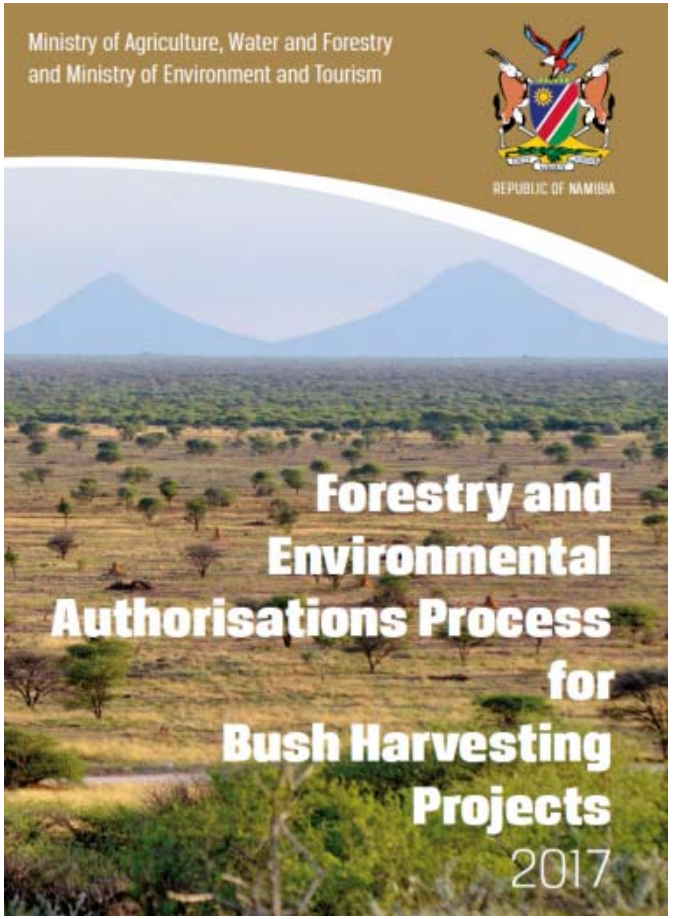
Bush control is a national priority. However Environmental Clearance for bush harvesting is required. (responsibility: MAWF; monitoring: DAS) *[NDP5 objective: 80,000 ha/a]*

Gesellschaft für internationale Zusammenarbeit (GIZ) mbH

Bush Control and Biomass Utilisation Project (BCBU). Bi-lateral Namibian-German Governmental Project, commissioned by German BMZ in cooperation with the Namibian DoF/ MAWF *[Phase I: 2014-2017; Phase II: 2018-2021]*

Namibia Biomass industry Group (N-BiG) [founded 2015]

N-BiG strives to merge individual harvesters, grow its membership base and facilitate bush utilisation and value addition. Reach objectives such as FSC Certification



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International Biomass Partnerships (IBPS)

Biomass Partnership

Long-term bilateral partnership agreement aiming at:

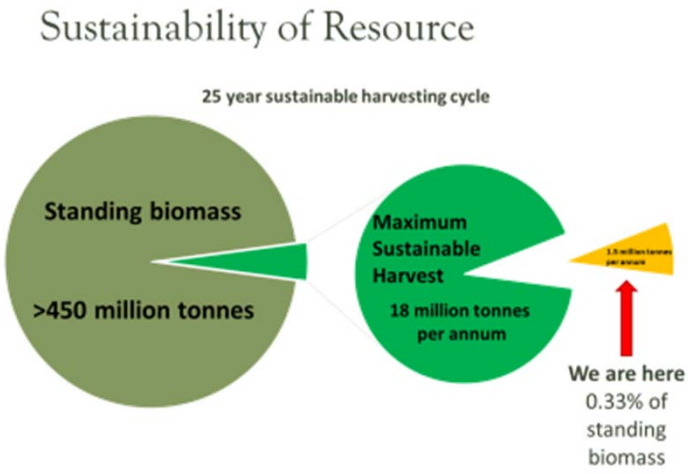
I. transfer of innovative technology to improve efficiency,
II. advanced energy production from renewable sources,
III. reaching GHG emission reduction targets,
IV. up-grading infrastructure
V. land restoration & adaptation and biodiversity safeguarding

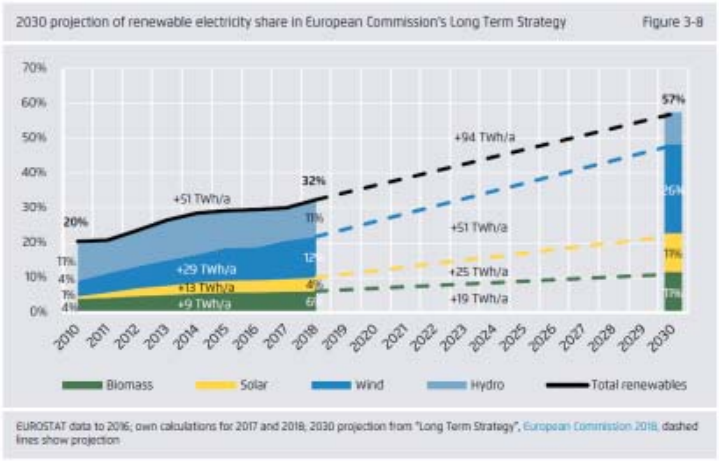
Objectives, Strategy and Benefits in Namibia

I. Harvesting at least 9 Mio. t/a by 2024
II. Stop encroachment by harvesting 18 Mio. t/a by 2030
III. Development of Biomass Industrial Parks (BIPs) to leverage masses
IV. Implement a job-creating bush-to-value industry

Objectives, Strategy and Benefits in Germany

I. Supply Security for alternative fuels
II. Pro-active development support for BIPs and technology transfer
III. GHG mitigation and contribution to energy transition

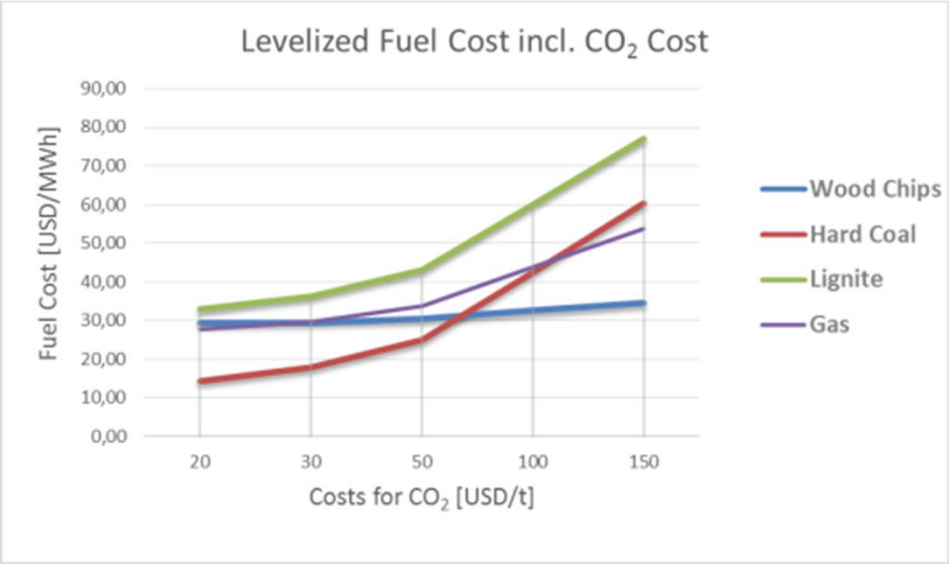


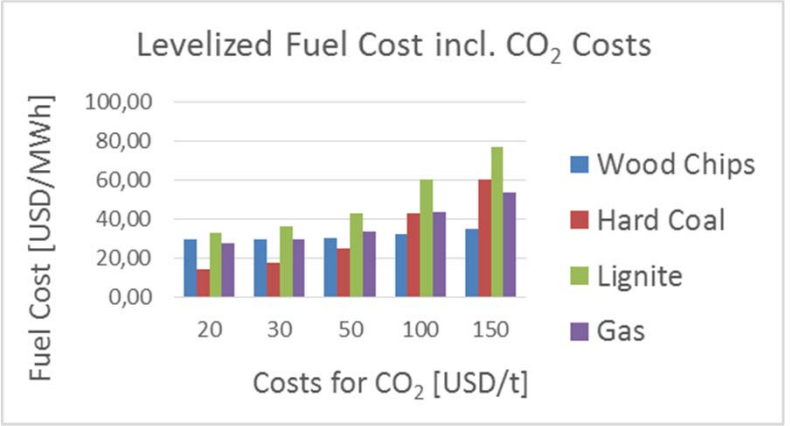


De-bushing – Woodchips VS Coal and Natural Gas

Export of Fuel (Woodchips *[P30-P100]*)

Fuel	Wood Chips	Hard Coal	Lignite	Natural gas	Unit
Calorific Value	924	10.075	5.213	10,37	kWh/m³
	15,1	29,0	15,0	47,3	MJ/kg
	4,20	**8,06**	**4,17**	**13,13**	**kWh/kg**
Density	220	1.250	1.250	0,79	kg/m³
GHG Emission	0,04	0,35	0,34	0,20	kg CO_{2eq}/kWh
GHG Price	40				USD/t CO_{2eq}
	0,04				USD/kg CO_{2eq}
GHG Cost	0,2	2,9	1,4	2,6	kg CO_{2eq}/kg
	0,007	0,11	0,06	0,11	USD/kg
	0,002	0,014	0,014	0,008	USD/kWh
Price	120	58	109	312	USD/t
	0,12	0,06	0,11	0,31	USD/kg
Price incl. GHG	0,13	0,17	0,17	0,42	USD/kg
Total Cost	**0,030**	**0,021**	**0,040**	**0,032**	**USD/kWh**
	30,17	**21,35**	**39,71**	**31,77**	**USD/MWh**
Total Cost	**127**	**172**	**166**	**417**	**USD/t**





Proposed Solution: Biomass Hub

Best Part: it's a BETTER LOCAL BUSINESS!!

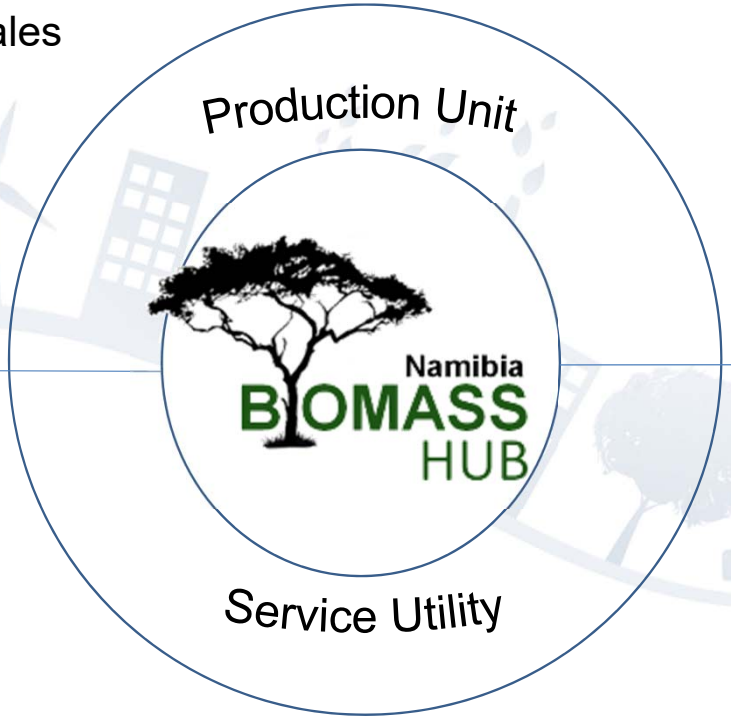
Bush Thinning - Economy of scales

Commitment to the benefit of bush to value industries.

Costs savings gained by bulk production.

Product Diversification

Business expansion through different by-products;



Anchor Market - Centralization

One primary —anchor tenant creating defined inter-connections.

Trigger Effect

Catalyst to create synergies

Environment for fostering technological advancement in clean biomass production,

Travelling University

Biomass Industry Park: Synergies

Harvested Material

310 000 t_{DM}/a

A: Manufacturing & Service Businessess

B: Residential Area

D: Academic and R&D Area

C: Energy, Water, and Waste Management.

Biomass Industry Park Services

Gender Equality Component

Financing

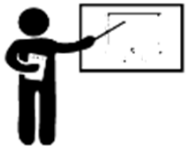
- Fundraising: R&D funds, development funds.
- Networking and match making with potential international partners (e.g: Germany).
- Contracting.

Centralized Service Facility

- Support in storage/transport infrastructure.
- Cooperative-like rental/sharing service.
- Raiffeisen Cooperative Model

Structured After-care Service

- Provide- advice- assist in after-care harvesting practices implementation.



Capacity Building

- Trainings. Formation, and education.
- International workshops.
- Good governance (communities)
- Maintenance.

Research & Development

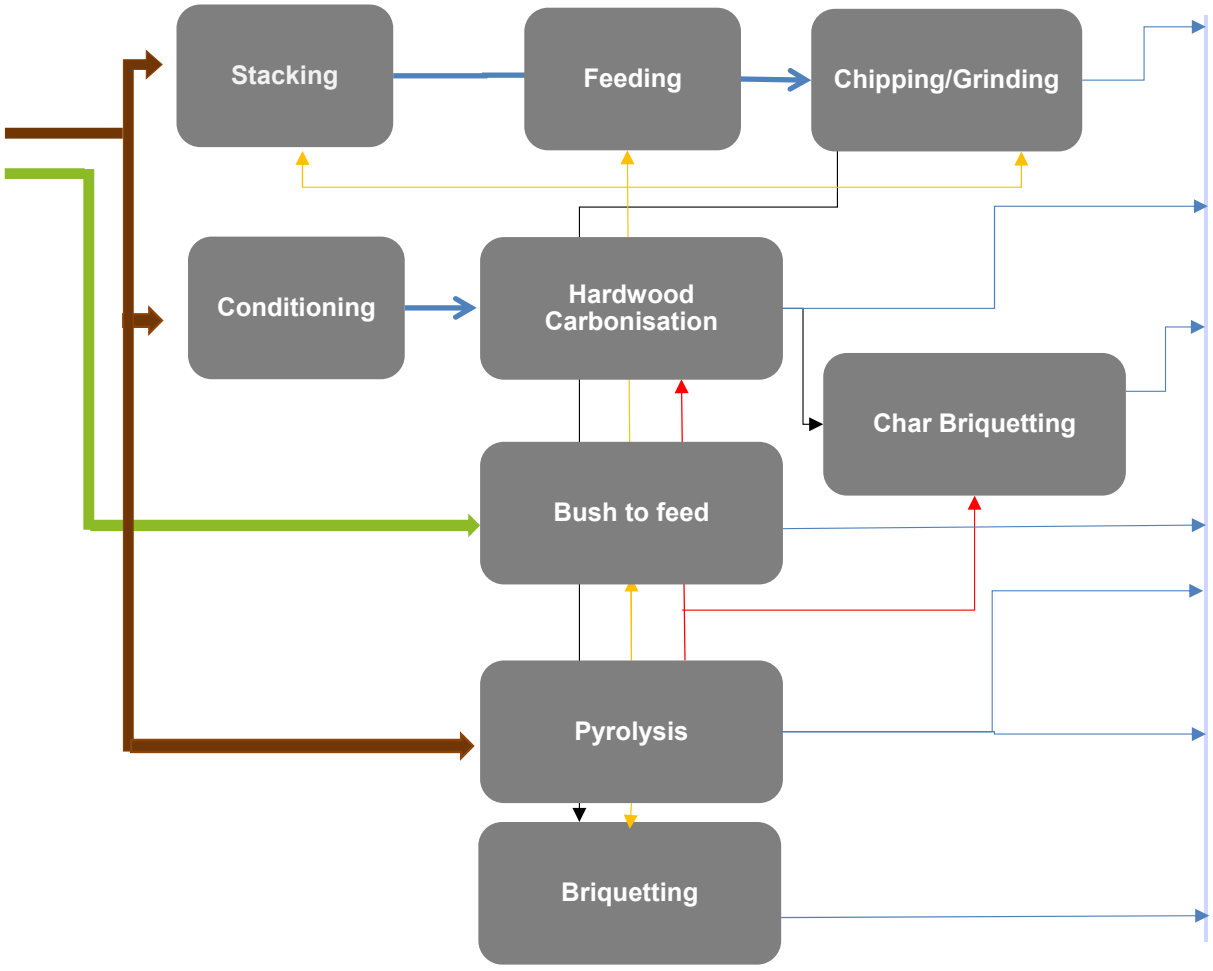
- Environmental Compliance Service.
- Carbon emission certificate and CSR
- Biodiversity certificate.
- DBFZ

Travelling University

Biomass Industry Park: Synergies

Harvested Material

310 000 t_{DM}/a



Wood chips
191 500 t/a

Charcoal
20 000 t/a

Char Briquettes
12 000 t/a

Thereluctantgourmet.com

Animal Feed
160 t/a

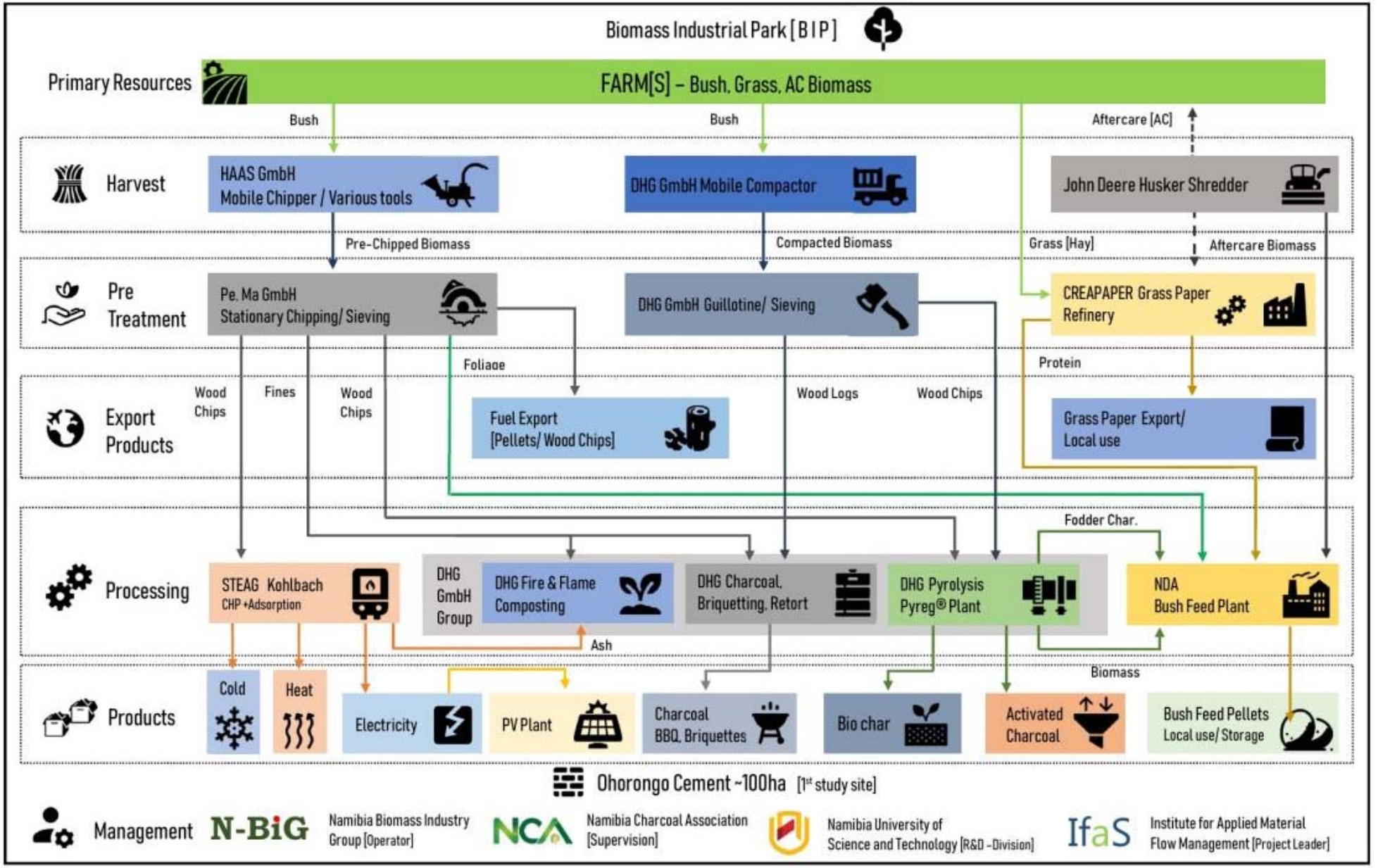
Bio-fuel
4 500t/a

UScommodities.com

Biochar (AC)
600 t/a

AG Biochar LLC, Modesto, California.

Compressed FW
4 800 t/a


Biomass Industrial Park [BIP]
Primary Resources
FARM[S] – Bush, Grass, AC Biomass
Bush
Bush
Aftercare [AC]
Harvest
HAAS GmbH
Mobile Chipper / Various tools
DHG GmbH Mobile Compactor
John Deere Husker Shredder
Pre-Chipped Biomass
Compacted Biomass
Grass [Hay]
Aftercare Biomass
Pre Treatment
Pe. Ma GmbH
Stationary Chipping/ Sieving
DHG GmbH Guillotine/ Sieving
CREAPAPER Grass Paper Refinery
Foliage
Protein
Export Products
Wood Chips
Fines
Wood Chips
Fuel Export
[Pellets/ Wood Chips]
Wood Logs
Wood Chips
Grass Paper Export/
Local use
Fodder Char.
Processing
STEAG Kohlbach
CHP +Adsorption
DHG GmbH Group
DHG Fire & Flame Composting
DHG Charcoal, Briquetting, Retort
DHG Pyrolysis Pyreg® Plant
NDA
Bush Feed Plant
Ash
Biomass
Products
Cold
Heat
Electricity
PV Plant
Charcoal
BBQ, Briquettes
Bio char
Activated Charcoal
Bush Feed Pellets
Local use/ Storage
Ohorongo Cement ~100ha [1st study site]
Management
N-BiG
Namibia Biomass Industry Group [Operator]
NCA
Namibia Charcoal Association [Supervision]
Namibia University of Science and Technology [R&D -Division]
IfaS
Institute for Applied Material Flow Management [Project Leader]

Advantages and Disadvantages

Pros

- Qualified jobs
- Maintenance
- Electricity
- Bulk factor
- Regional added value
- Control of T
- Control of the process
- No overheating
- Easy access
- More operating hrs

Cons

- Market competition
- Limited area
- System vulnerability
- Big Investment

Process of Harvesting

							Machinery $ Finance	TOTAL	
6,7	1,6	1,2	0,8	3,4	3,9	2	12,9	32,7	EUR/t

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Logistic: Highest/Lowest Price Scenario

Stakeholder

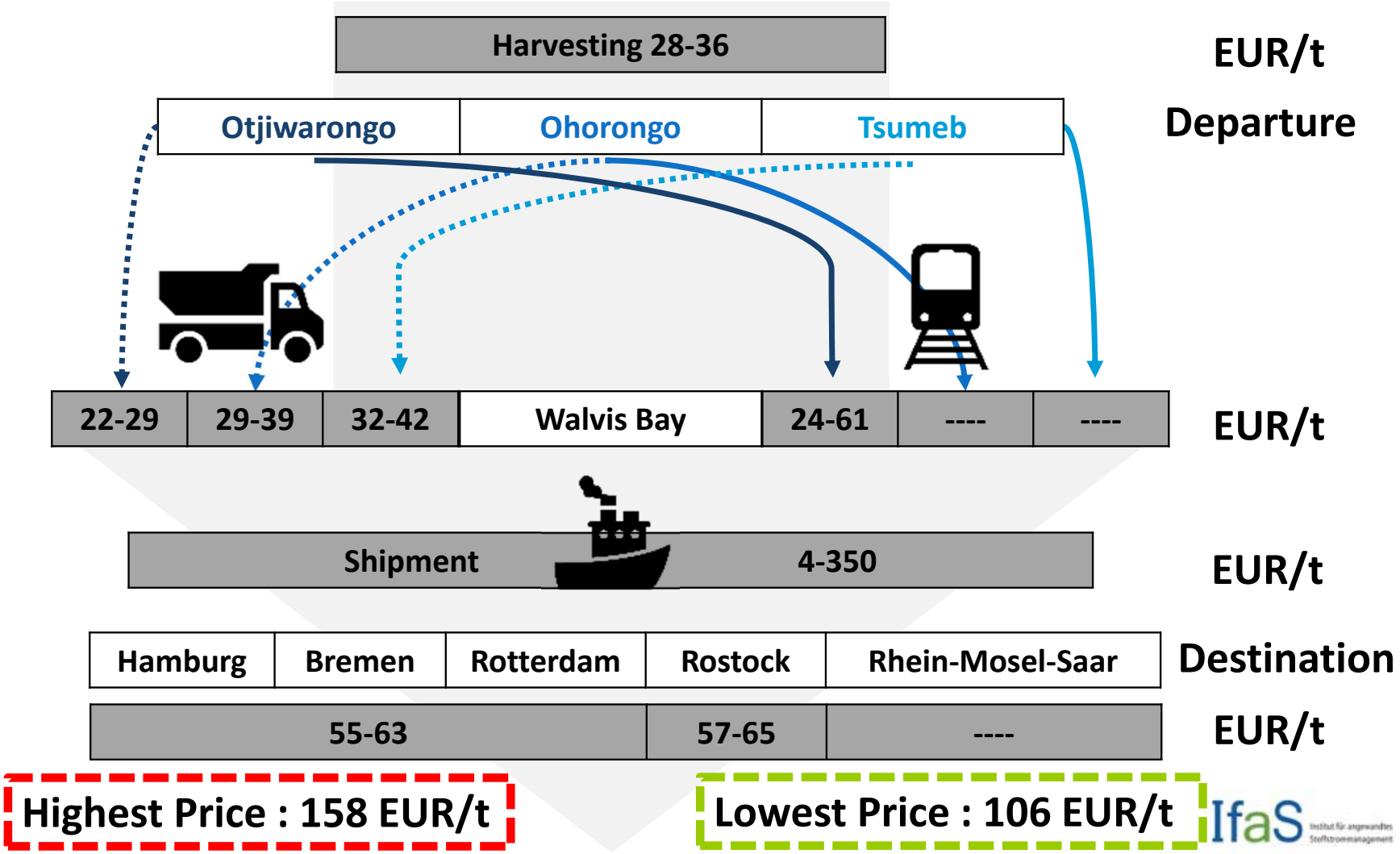
Imperial logistics

Transworld Cargo

transnamib

Walvis Bay Corridor Group

MACS



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Road/Trucks - BIP to Walvis Bay

Stakeholder

Imperial logistics

Transworld realtime logistics Cargo

Load weight	Transport costs	Distance	Price
24 - 32 t	13 NAD/km	Otjiwarongo (450 km)	22 - 29 EUR/t
	0,8 EUR/km	Ohorongo (600km)	29 - 39 EUR/t
		Tsumeb (650km)	32 - 42 EUR/t

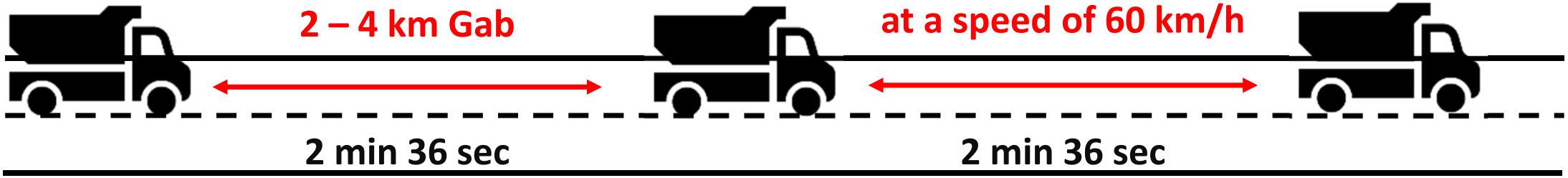
Status Quo: 100.000 t/a transports

Trucks returning empty

Chance: Way Back transports

≥ 100.000 t/a Euqipment Investments required

t/a	Transports p. a	Transports p. day
100.000	3.135 - 4.132	13 - 17
500.000	15.674 - 20.661	65 - 86
1.000.000	31.348 - 41.322	131 - 172



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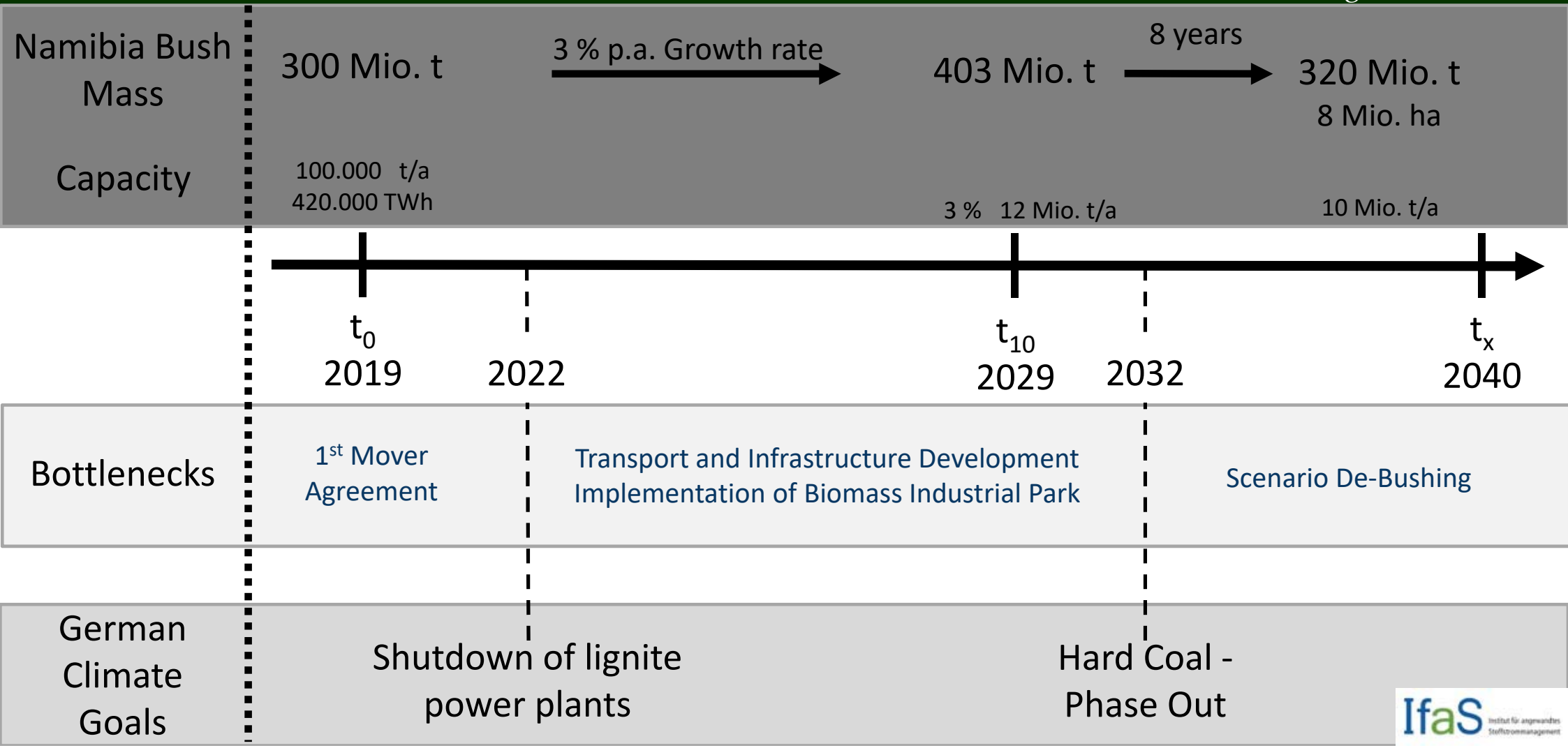
Namibia's Capacity vs. Germany's demand

Multiplication:
Outreach to Kuba, Bostwana South Africa, Angola, etc.



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Petition – Way forward

What does Namibia need? What does the Biomass Industry strive for?

a. Official **expression of interest** that the partners are ready to acknowledge biomass from Namibia as a potential resource. Comprising no concerns at the socio-ecological level. *(Catchwords: over-exploitation, over-felling, GHG balance, child labor, biodiversity, etc.)*

b. Clear **commitment** that testifies the willingness to mutually work out (pro-actively think) solutions for large-scale biomass valorization (*from harvest via BIP to power plant)* with the overarching goal to guarantee supplies, lower unit costs and built-up a new biomass industry in Namibia strengthening local economy.

c. Design of a **draft contract** to illustrate how a 10 year contract shall look like, incl. obligations and requirements. Goal is to generate a Bankable Off-take Agreement.

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CO_2 – Transport Emission

Forschungs Informationssystem (FiS)
Mean Value Scenario

	gCO_2/tkm	km	$kgCO_2$/t
Truck	117	100	12
Rail	65	600	39
See	32	10,000	320
SUM			**371**
Hard Coal			2,852
CO_2 Saving to Biomass	*87%*		
N-Gas			2,626
CO_2 Saving to Biomass	*86%*		

Forschungs Informationssystem (FiS)
Worst Case Scenario

	gCO_2/tkm	km	$kgCO_2$/t
Truck	160	100	16
Rail	120	600	72
See	60	10,000	600
SUM			**688**
Hard Coal			2,852
CO_2 Saving to Biomass	*76%*		
N-Gas			2,626
CO_2 Saving to Biomass	*74%*		

Forschungs Informationssystem (FiS)
Best Case Scenario

	gCO_2/tkm	km	$kgCO_2$/t
Truck	75	100	8
Rail	10	600	6
See	5	10,000	50
SUM			**64**
Hard Coal			2,852
CO_2 Saving to Biomass	*98%*		
N-Gas			2,626
CO_2 Saving to Biomass	*98%*		

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CO_2 – Transport Emission

Verband der Bahnindustrie

	gCO_2/tkm	km	$kgCO_2$/t
Truck	95	100	10
Rail	21	600	12.6
See	33	10,000	330
SUM			**352**
Hard Coal			2,852
CO_2 Saving to Biomass	*88%*		
N-Gas			2,626
CO_2 Saving to Biomass	*87%*		

See Freight Emissions [50,000 t vessel]		
Bunker Consumption	1,030	t
CO_2 Factor Bunker	3.101	kg CO_2/l
Density Bunker	1.01	kg/l
Bunker Consumption	1,040,300	l
CO_2 Emissions	3,225,970	$kgCO_2$
	0.065	$kgCO_2$/kg

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BUE Fragen:

a. Kann De-bushing Auswirkungen auf Entwaldung haben? Kann sichergestellt warden, dass kein Waldholz verwendet wird.

Die kontrollierte Waldnutzung in Namibia zielt auf hochpreisiges Stammholz ab. Dieses kann durch Entbuschung nicht gewonnen werden. Demnach sind keine Auswirkungen einer gesteigerten Entschbuschung auf den Wald erkennbar.

b. Auswirkungen der Biomassehubs auf Köhler? Wirtschaftlicher Zusammenhang für Farmer

Verbesserung der Arbeitsbedingungen, Kohlenstoffeffizienz und Treibhausgasbilanz. Hubs fördern FSC Kohle und erhöhen dadurch die Anzahl und den Standard der Arbeitsplätze.

Die Farmer profitieren von geregelten Abnahmen und bekommen ihr Savannenbiom als Grundlage ihrer Weidewirtschaft zurück.

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BUE Fragen:

c. Warum nicht mehr Holzbriketts zur Befriedigung der Nachfrage nach Holz zum kochen?

Hubs nutzen Economy of Scale und reduzieren den Preis für Feuerholz, erhöhen die Verfügbarkeit und dämmen illegalen und non-FSC konformen Holzschlag ein.

d. Weiterverarbeitung zu höherkalorischen Produkten? Reduktion von THG und Steigerung der lokalen Wertschöpfung?

Pellets und Wasserstoff erscheinen machbar. Pellets kurzfristig, Wasserstoff langfristig.

Ziel der Hubs ist es, die größtmögliche Wertschöpfung in Namibia zu erreichen und die THG Emissionen pro Einheit weitestgehend zu minimieren, z.B. durch Nutzung von Solarenergie in der Prozesskette.

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BUE Fragen:

e. Argumente zur Steigerung des Verständnis der Bevölkerung für Holzimporte aus Afrika

Beitrag zum Klimaschutz und Erreichung der Klimaschutzziele

Erhalt des schwindenden und gefährdeten Savannenbioms

Entwicklung von Afrika durch Aufbau der Biomasseindustrie

Vermarktung nach Deutschland ist ökonomisch wertschöpfender als die Nutzung im Land

Beitrag zur Verbesserung der Terms of Trade mit Afrika

Entwicklung komplexer Wertschöpfungsketten in einer Bioökonomie u.a. T-shirts aus Holz, Papier aus Grass, Futter aus Busch,

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Thank you very much for your attention

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