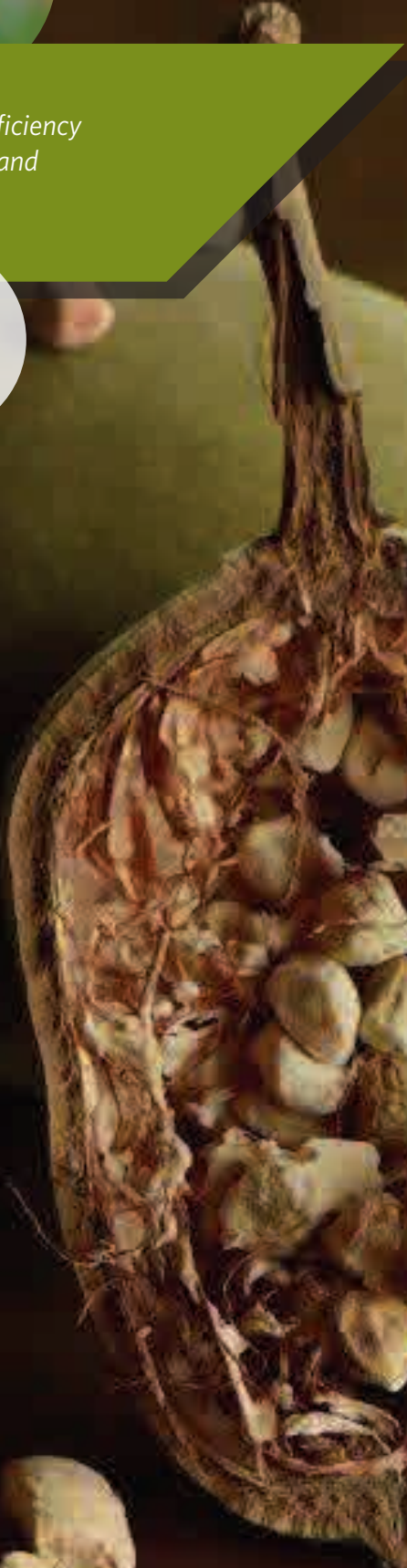




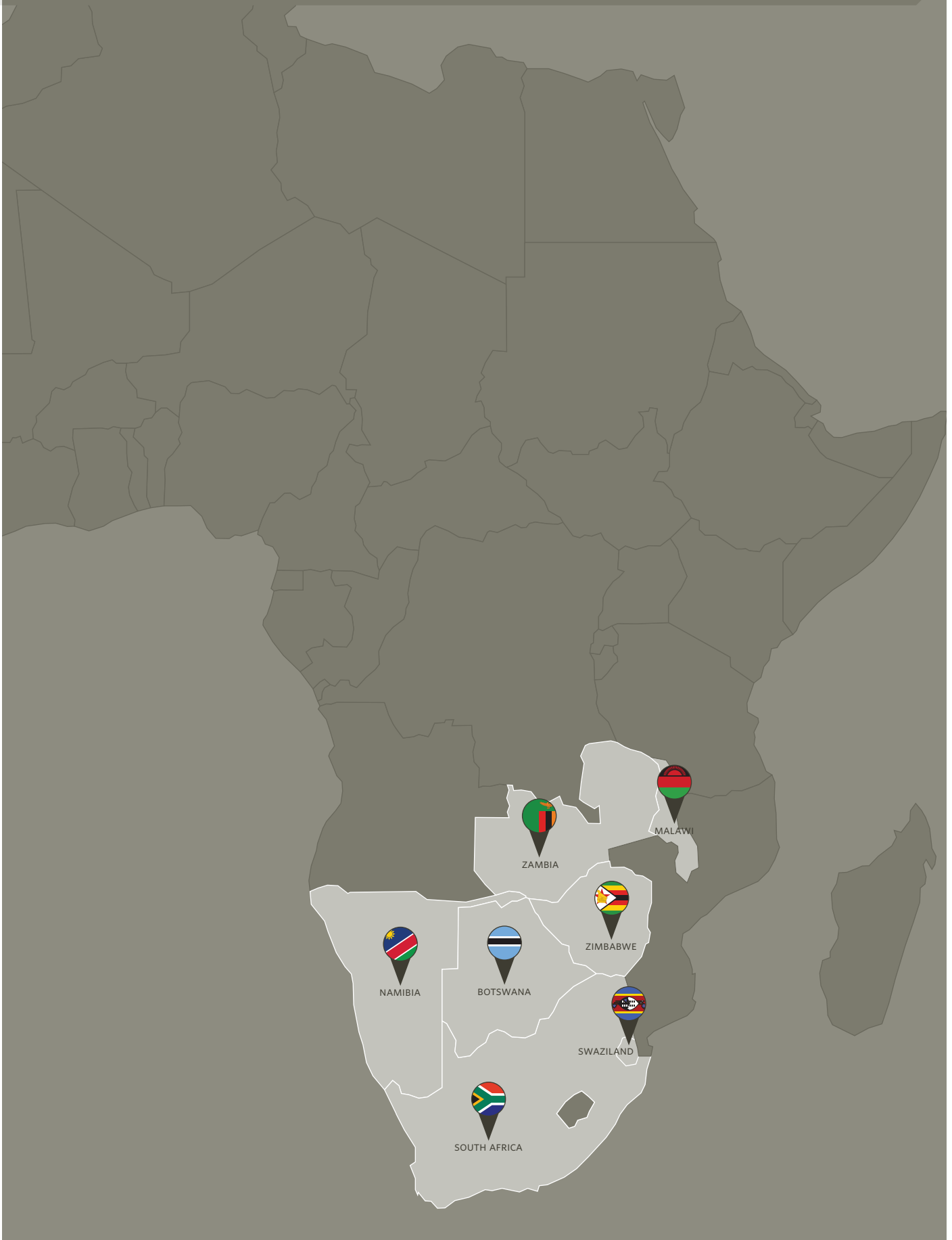
POWERING BIOTRADE

Renewable energy and energy efficiency in the southern African biotrade and small agricultural sector

March
2017



PROJECT AREA: SOUTHERN AFRICA



INTRODUCTION

Marula oil extraction facilities at Maganu Production in Swaziland. This established agro-processing business creates livelihoods for more than a thousand women engaged in the wild Marula harvest.

This is a report on a preliminary research and feasibility study into the introduction of renewable energy and energy efficiency into southern African biotrade value chains.

The project (GIZ ref: 81204227) was undertaken by PhytoTrade Africa and Proof Communication Africa during the period October 2016 to February 2017.

Project area

The project was undertaken in southern Africa, including Zimbabwe, Botswana, Swaziland, South Africa, Malawi, Zambia and Namibia.

Project consultants

The project was undertaken by Cyril Lombard on behalf of PhytoTrade Africa and Jonathon Rees for Proof Africa. They are the authors of this report.



*A healthy southern African
biotrader is primed for the
adoption of renewables
but needs technical and
financial assistance*

*Coffee beans at Kobolondo, the first
organic Fair Trade coffee plantation
in the Kingdom of Swaziland. There
is potential for all of Kobolondo's
processing and roasting to be done
with renewable energy. See page 37*

A SUMMARY OF THE PROJECT'S PRIMARY FINDINGS



The southern African and international biotrade in indigenous plants is healthy, entrepreneur-led, consistent with national development policies, and primed for growth. It is modest in scale and consumes relatively low amounts of energy. All small businesses consulted intend to grow, add more volumes, and to do more processing and manufacturing. This will require significantly more energy, often from new sources.



Energy constraints have to some extent held back the full potential of the industry's development, and if not overcome will continue to retard its growth. Where there is sufficient energy it is the result of a connection to a municipal or national grid, to which energy is supplied mostly by burning coal in distant power stations. There is growing awareness of local and renewable energy generation and storage, an appetite to know more, and an enthusiasm for adoption. This should be encouraged through technical support, sensible and accessible standards, training, and capital investment.



The conditions are right for the Powering Agriculture project to partner with the biotrade sector and energy development organisations in southern Africa and to stimulate an ambitious conversion to renewables on farms, in new and planned processing facilities, and in communities.



DEFINITION OF BIOTRADE

For the purposes of this report, biotrade includes the cultivation, harvest, processing, packaging, promotion and marketing of products made from or including indigenous plants.

This is what we call the biotrade value chain. It includes species such as Marula, Devil's Claw, Baobab and Moringa which are valued for their cosmetic, nutritional or health properties.

Biotrade is closely associated with a collective responsibility for protection and enhancement of these species and the environment in which they grow.

Biotrade provides social and economic benefits in southern Africa including community employment, women's economic involvement, poverty alleviation, entrepreneurial agro-processing and the creation and nurturing of sustainable businesses.

Some of the projects and products we report on are not strictly in the biotrade, but offer similar benefits.





EXECUTIVE SUMMARY

The Powering Agriculture study of the southern African biotrade has identified viable agriculture businesses and examined current energy practice across the biotrade value chain. The project has substantially increased the understanding of renewable energy potential by participants in biotrade.

The project has identified a number of future potential technical and funding collaborators in renewable energy pilot projects.

Across many parts of the biotrade sector, a deficit in energy availability and reliability has become familiar, so there is in some cases a relatively limited understanding of what could be achieved with more energy.

All participants expressed an interest in learning more about renewable energy and getting into a position to adopt renewable technologies.

RENEWABLE ENERGY POTENTIAL

Solar energy has been identified as having high potential as a power source across the project area, which is for the most part in a region of high solar irradiation. It is also the renewable energy source which is most widely recognised by project participants.

In a few cases, there is an opportunity for small scale wind power and micro hydro power generation.

There is already a strong appetite for renewable energy, particularly solar, and in some instances the project participants have done some of their own research or sought quotations for a solar installation.

The primary obstacles to adoption have been identified as a lack of technical knowledge, and the high capital costs of installation.

In addition to enabling greater volume of production, there is evidence that greater availability of energy in rural areas could improve the quality of biotrade products. The availability of drying facilities, for example, would reduce the incidence of mould on biotrade crops like Baobab and Mafurra, and steam sterilisation of Devil's Claw will immediately add 50% value in key export markets.

RENEWABLE DEMONSTRATION

There is a significant opportunity for the biotrade's early adopters of renewable energy, particularly solar, to become demonstration and training hubs, with additional potential support from government.

Several of the participants have expressed an interest in their facility stimulating more widespread adoption of renewables by other agriculture projects and the local community.

GROWING CUSTOMER REQUIREMENT FOR RENEWABLE

Several project participants indicated that their end customers, particularly large customers in Europe and other international markets, increasingly required suppliers to do carbon, energy and water audits. This will likely increase demand for adoption of renewable energy.

For project participants seeking to add value to natural products and move up the value chain, there is a distinct requirement for new technologies which require additional energy.

RECOMMENDATIONS AND PROPOSED NEXT STEPS

The following recommendations are made on the basis of the project's findings to date and future potential impact, aligned with the aims of the Powering Agriculture programme.

Recommendation	Process/implementation
Define 5-8 high-potential projects for 1st phase renewable energy pilot	<ul style="list-style-type: none"> • Engage further with potential co-funders, technical partners and local stakeholders • Develop concept note and risk analysis • Seek commitment and permission from participant's board, shareholders, and management for participation • Develop criteria for participation, minimum requirements and milestones • Criteria to include viability of business, proven need/use for renewable energy, projected business impact, carbon savings, community participation and benefit, ease of access, empowerment of women • Quantify scale of current energy deficit, future energy need and viable renewable technology sources • Conduct detailed technical site inspection
Engage further with biotrade and agriculture sector trade associations to identify current renewable energy initiatives, requirements and gaps	<p>For example, in South Africa:</p> <ul style="list-style-type: none"> • Aloe Council of South Africa • Honeybush Tea Community of Practice • Rooibos Council • South African Essential Oil Producers Association
Develop concept for renewable energy demonstration and training centre/s	<ul style="list-style-type: none"> • Working with existing bodies such as SA Renewable Energy Technology Centre (SARETEC) and SA National Energy Development Institute (SANEDI) – both of which have a mandated energy pilot/training role in the renewables sector • Initiate trial collaboration with Barefoot College (www.barefootcollege.org) and relevant biotrade incubators • Identify viable technologies for demonstration • Determine scope and scale of training offer – develop outline curriculum • Identify training partners
Share project findings with stakeholders from industry, government, trade associations, biotrade companies and communities	<ul style="list-style-type: none"> • Create and distribute public version of report and presentation • Seek high-profile media opportunities to profile biotrade and renewable energy opportunities based on project findings • Host stakeholder workshops to share and discuss findings – with emphasis on future potential projects
Engage with government at national policy level to identify current and future energy plans for sector and how they can be aligned with Powering Agriculture	<p>For example, in South Africa:</p> <ul style="list-style-type: none"> • Bioprospecting Forum (govt & industry) • Department of Environmental Affairs (lead dept for biotrade) • Department of Agriculture • Agricultural Research Council – Institute for Agricultural Engineering • SA PhotoVoltaic Industry Association (SAPVIA)
Engage with municipalities (in biotrade-relevant rural areas) to identify renewable/agriculture plans and ambitions in mandatory municipal Integrated Development Plans (IDP)	<p>E.g. Mopani District Agri-Park and Marula value chain development</p>
Pursue further interviews and field visits to potential project participants – with enhancements based on phase 1 participation	<ul style="list-style-type: none"> • Focus on potential high-value targets selected for most likely impact • Addition of Mozambique and Malawi – some areas not accessible or viable for field visits during current project phase due to rainy season

RENEWABLE ENERGY DEMONSTRATION AND TRAINING CENTRES

There is a significant renewable energy demonstration and training opportunity which could result from the introduction of renewable technology within biotrade businesses in southern Africa.

Even where a business has an identified need for renewable energy, and has awareness of various technology options, the wider community of farmers and local people often has an absence of knowledge, skills or access to energy.

The idea of becoming a renewable energy demonstration and training sector has significant appeal among biotrade businesses, all of whom have a commitment to community development.

If GIZ provided technical assistance and financial support for renewables in a specific business, the investment value could be enhanced by creating training and demonstration opportunities based at those businesses.

One biotrade business, in Zimbabwe, already has a training and demonstration centre where it trains farmers in organic farming systems and certification procedures, and post-harvest handling and processing.

In Windhoek, Namibia, an organisation with a track record of developing appropriate technologies for biotrade product

processing, and transferring these technologies to businesses in biotrade value chains, could be a demonstration and training centre.

Further, an incubator based in one of the Marula areas in South Africa is establishing a facility for training and technology demonstration. The entrepreneur behind the incubator has extensive experience in Marula fruit and oil processing and marketing, and social enterprise development.

There is a strong likelihood that at least one of these opportunities can form a piloting opportunity with Barefoot College.

HOW IT COULD WORK

- Build training/demonstration into a renewables support package – creating obligations to deliver benefits to wider community
- Identify training facilities on farms and within biotrade processing facilities
- Identify and develop trainers – English *and* local languages
- Develop curriculum and training materials – English *and* local languages - working with SA Renewable Energy Technology Centre and industry bodies such as SA PhotoVoltaic Industry Association (SAPVIA)
- Run pilot phase training and demonstration courses
- Monitoring and evaluation of outcomes leading to continuous improvement

A rudimentary solar PV installation at the Bulungula Incubator's primary school project in the Eastern Cape



SAMPLE CURRICULUM

- Energy awareness
 - Fossil fuels – impact and hazards
 - Renewable energy basics
 - Energy efficiency – reasons and benefits
- Energy in agriculture
 - Value from mechanisation
 - Agro-processing opportunities
- Renewable energy technologies – introduction
 - Solar
 - Wind
 - Hydro
- Solar technology
 - PV panels
 - Home vs utility/microgrid scale
 - Installation basics
 - Care and maintenance
 - Troubleshooting
 - Business models

PEOPLE AND ORGANISATIONS CONSULTED

In addition to biotrade companies, the following people and organisations have been consulted or interviewed for the project, or have potential for future project participation.

Organisation	Contact	Relevance and future potential
People and organisations consulted for this project		
SA Low Emissions Development (SA-LED)	Linda Manyuchi - head of project	A key link to local government support and involvement in future projects
Institute for Agricultural Engineering at the Agricultural Research Council (ARC)	Researcher Petrus Britz and CEO Shadrack Moephuli	ARC is an important potential link to South African government support, and other agriculture and energy initiatives
Institute for Tropical & Sub-tropical Crops	Researcher and project manager Rosemary du Preez	Head of a very successful small farmer project in South Africa's Eastern Cape, and a potential future project participant
Standard MicroGrid	Founder Matt Wainwright	Developer of small solar energy system with a business model that brings sustainable power to remote off-grid communities. Potential consultant and technology supplier to a future GIZ project
EcoCert	Dr Marianna Smith	EcoCert may in future include clean energy as a certification standard and requirement
SA National Energy Development Institute (SANEDI)	Clean mobility head Carel Snyman	Government agency responsible for research and pilot projects in the renewable energy sector – potential link to government and other energy projects
CommonLand	Researcher Matt Sephton	Matt is working on development projects in the Honeybush industry, a future potential project participant
GridCars	Winstone Jordaan	Winstone has developed an electric utility vehicle with potential for rural communities engaged in the biotrade harvest
Future potential collaborators, consultants, advisors and participants		
Council for Scientific and Industrial Research (CSIR)	Various	South Africa's primary research institution, with respected divisions focused on renewable energy, agriculture and biotrade
Earthrise Rustlers	Gino Govender	Founder of a rural project which includes agriculture for livelihoods, skills development and food security
Sustaining the Wild Coast (SWC)	Margie Pretorius	SWC is developing alternative livelihoods in the Pondoland region of SA's Eastern Cape province, an area with high agriculture potential but no current energy provision
Black Mamba		Producer of sauces and other food products based on organic and sustainably-produced vegetables
Fair Trade Swaziland	Julie Dixon	Coordinator of agriculture and craft in Swaziland for Fair Trade
Guba Swaziland		Organic grower of vegetables for Black Mamba and other outlets
Nelson Mandela Metropolitan University	Prof Raymond Auerbach	Energy and agriculture specialist
National Cleaner Production Centre	Alf Hartzenberg	Head of industrial efficiency and clean technology
SA German Energy Programme	Marlett Balmer	Coordinator of energy efficiency and renewable energy projects
Agricultural Hub at Tendele		Community-based agriculture project initiated by local anthracite mine
Namibia University of Science & Technology - renewable energy centre		Potential collaborator
Centre for Renewable and Sustainable Energy Studies - Stellenbosch		Potential collaborator

POTENTIAL FUTURE COLLABORATORS

VENTURES WITHOUT LIMITS S&R

Madumuzulu Silinda is the founder of Ventures Without Limits (www.venturesr.com) and was previously the Managing Director of Marula Natural Products (<http://www.marula.org.za>).

Ventures Without Limits is establishing The Ventures Hub in Hazyview, Mpumalanga province, South Africa. This could be an ideal location for a renewable energy pilot project and demonstration centre.

It is in the heart of the Marula area and close to projects supporting SMMEs and women farmers growing tomatoes, pumpkins and cabbages. A current challenge for these farmers is keeping their fresh produce cool.

The hub has one hectare of land and can accommodate training and conferencing facilities for up to 50 people. Silinda's involvement will ensure that there is outstanding Marula value chain expertise along with social enterprise development capacities.

Silinda is also the author of a 2012 report for South African Women in Dialogue entitled "*The feasibility and viability of solar power with reference to rural electrification of nodal areas in South Africa*".

BAREFOOT COLLEGE INTERNATIONAL

The project team met with Sue Stevenson, who heads the Strategic Partnerships and International Development division at Barefoot College International. The organisation is well known for establishing solar power setups in villages

in India (<https://www.barefootcollege.org/solution/solar>). The initiative trains women to assemble, install, repair and maintain photovoltaic (PV) systems at the village level. The PV systems are small, providing around 40w for domestic use. They are backed up by village level workshops which provide around 300w, catering for larger power tools and processing equipment.

Barefoot College plans on expanding operations to southern Africa, with a focus initially on South Africa. Of particular interest in the discussion with Barefoot College is their complimentary idea of working with natural product value chains.

The Barefoot College approach could work well with certain biotrade value chains in southern Africa. Stevenson said Barefoot College was able and willing to discuss the specifics of a future project co-funding with GIZ Powering Agriculture.

In particular, a project with Ventures Without Limits appears to have significant possibilities.

USAID'S SA LOW-EMISSIONS DEVELOPMENT (SA-LED) PROJECT

The SA-LED programme works with the South African government to combat climate change through sustainable economic growth. Several discussions have been held with the SA-LED team, which sees potential for collaboration with Powering Agriculture, particularly at the municipal level with the introduction of renewable energy into small agricultural initiatives.

BIOTRADE VALUE CHAINS

The project looked at a number of value chains for four primary species: Baobab, Marula, Devil's Claw and Moringa.

BAOBAB

AGRICULTURAL
PRODUCTION &
HARVESTING

PRE-PROCESSING:
RAW MATERIALS

PROCESSING:
INGREDIENTS

INGREDIENTS FOR
CONSUMERS

PACKAGED
CONSUMER
PRODUCTS

RETAIL

ECOPRODUCTS *p 17*

MAIN FOCUS AREA

MAIN FOCUS AREA

B'AYOBA *p 39*

KATAVI

KAZA OILS *p 39*

MAIN FOCUS AREA

RAIN *p 25*

ESSE *p 41*

MARULA

AGRICULTURAL
PRODUCTION &
HARVESTING

PRE-PROCESSING:
RAW MATERIALS

PROCESSING:
INGREDIENTS

INGREDIENTS FOR
CONSUMERS

PACKAGED
CONSUMER
PRODUCTS

RETAIL

MAIN FOCUS AREA

PHEPISA *p 21*

MAGANU *p 19*

MAIN FOCUS AREA

MORINGA

AGRICULTURAL
PRODUCTION &
HARVESTING

PRE-PROCESSING:
RAW MATERIALS

PROCESSING:
INGREDIENTS

INGREDIENTS FOR
CONSUMERS

PACKAGED
CONSUMER
PRODUCTS

RETAIL

BOTANICA *p 35*

MAIN FOCUS AREA

MAIN FOCUS AREA

MORINGA MIRACLES *p 47*

MAIN FOCUS AREA

MORINGA DEVELOPMENT ASSOCIATION OF SA (MDASA)

DEVIL'S CLAW

AGRICULTURAL
PRODUCTION &
HARVESTING

PRE-PROCESSING:
RAW MATERIALS

PROCESSING:
INGREDIENTS

INGREDIENTS FOR
CONSUMERS

PACKAGED
CONSUMER
PRODUCTS

RETAIL

ECOSO p 33

FUTURE GROWTH AREA

KAMELA p 31

OTHER

AGRICULTURAL
PRODUCTION &
HARVESTING

PRE-PROCESSING:
RAW MATERIALS

PROCESSING:
INGREDIENTS

INGREDIENTS FOR
CONSUMERS

PACKAGED
CONSUMER
PRODUCTS

RETAIL

CRIAA SADC p 51

ESSENTIAL SKINCARE p 48

RAIN p 25

MAIN FOCUS AREA

HERBS A PLENTY p 27

MAIN FOCUS AREA

MUTHIFUTHI & ZUPLEX p 43

FUTURE GROWTH AREA

Significant backward integration – advises supply chain on processing & ingredient technology

ESSE p 41

MAIN FOCUS AREA

BULUNGULA p 23

PARCEVAL p 46

MAIN FOCUS AREA

KOBOLONDO p 37

FUTURE GROWTH AREA

ORGANIC AFRICA p 50

(Potential Community Processing Centre) WILD FRUITS OF AFRICA p 29

MAIN FOCUS AREA

MULANJE MOUNTAIN CONSERVATION TRUST p 52

BIOTRADE RENEWABLE ENERGY POTENTIAL AT A GLANCE

Project	Country	Field visit	Private owner	Community business	Full legal status	Operational years	Expansion planned or underway	Cultivation	Wild Harvest	Processing	Finished products	Retailer	Good standard of operation	Extensive community involvement	Extensive women involvement
EcoProducts	South Africa	x	x		x	10	x		x	x	x		x	x	x
Botanica	South Africa	x	x		x	4	x	x		x	x		x	x	x
Rain	South Africa	x	x		x	5	x			x	x	x	x		
Herbs A Plenty	South Africa	x	x		x	10	x	x		x	x		x		x
MuthiFuthi	South Africa		x		x	10	x	x	x	x			x	x	x
Phepisa	South Africa	x	x		x	3	x	x	x	x	x			x	x
Esse	South Africa	x	x		x	8	x	x		x	x	x	x		
Parceval	South Africa		x		x	25	x	x		x			x	x	x
Bulungula	South Africa	x		x	x	10	x	x						x	x
Maganu	Swaziland	x	x		x	12			x	x	x		x	x	x
Kobolondo	Swaziland	x		x	x	2	x	x		x		future		x	x
Moringa Miracles	Malawi		x		x	2	x		x	x				x	x
Mulanje Mountain Conservation Trust	Malawi			x	x	20	x	x	x	x	x	x	x	x	x
Essential Skincare	Zambia		x		x	5				x	x				
IRDNC	Namibia		x	x	x	20			x	x	x	x	x	x	x
CRIAA SA-DC	Namibia			x	x	10	x		x	x	x		x	x	x
Ecoso	Namibia	x	x	x	x	10	x		x	x			x	x	x
Wild Fruits of Africa	Botswana	x	x		x	20			x	x	x			x	x
Kamela	Botswana	x	x		x	4	x		x	x				x	x
B'Ayoba	Zimbabwe	x			x	15					x			x	x
Katavi	Zimbabwe	x	x		x	10	x				x	x	x	x	x
Organic Africa	Zimbabwe	x	x		x	10	x	x	x	x			x	x	x
Kaza Oils	Zimbabwe	x	x		x	4	x		x	x			x	x	x
MDASA	South Africa	x	x	x	x	2	x	x		x	x		x	x	

	Serves national market	Serves international market	Current energy	Exotic crop	Indigenous crop or ingredients	Primarily local technology	Full-time employment	Seasonal employment	% staff women	Harvesters	Renewable potential	Project follow-up potential	Potential demonstration training centre
	x	x	Grid		x	x	>55		96%	>800	High	High	x
	x	x	Grid		x	x	>15	>30	60%		High	High	x
	x	x	Grid & gas		x		>100				High	High	x
	x	x	Grid		x	x	10	4	60%	100	High	High	x
	x	x	None		x	x	19		High	20	High	High	
	x		Generator		x	x	4			100	High	High	
	x	x	Grid, biomass		x						High	High	x
	x	x	Grid		x		50		90%	100	High	High	
			None		x						High	High	x
	x	x	Grid		x		?			1000	High	High	x
	x	x	None	x		TBC	5	>15			High	High	x
	x	x	Grid		x		20			62000	High	High	
	x		Micro hydro & grid	x	x	x					High	High	x
	x				x		2		100		?	?	
	x	x	Solar		x	x	4		25%	800	High	No	
	x	x	Grid		x	x	15		70	1000	High	High	
		x	Solar & Generator		x	x	17			1500	High	High	
	x	x	Grid		x	x					High	High	x
		x	Limited solar		x					500	High	High	x
	x		Grid & Generator		x		50	100	60%	3000	High		x
		x	Grid		x								
	x	x	Grid, biomass, generator	x	x	x	20	20	50%	500	High	High	x
	x	x	Grid, generator		x	x	5	5	60%		High	High	
	x	x	Grid		x	x	10	10			High	High	x

"If we adopt renewables we will need capital and technical support. We can't afford for renewables to be another business risk."

SARAH VENTER



The wild Baobab harvest creates incomes for rural women in areas with few economic opportunities

ECOPRODUCTS

Information based on a questionnaire, interview with Sarah Venter and field visit in January 2016

Limpopo Province, South Africa

Business viability	Strong
Involvement of women	Excellent
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	Excellent

EcoProducts is a mature business based in South Africa's Limpopo province, where it manages the wild harvest of Baobab fruit and has an agro-processing facility producing high quality organic Baobab oil and Baobab powder.

EcoProducts founder Sarah Venter is a biotrade pioneer who has overseen steady growth for ten years. She runs her business along sustainable principles committed to community development.

The business operates from a light industrial area outside Louis Trichardt. It employs 56 staff, 96% of them local women. Around 800 women harvesters do wild collection of Baobab in a 50,000km² area along South Africa's border with Zimbabwe, an area with few economic opportunities. EcoProducts' sales of Baobab oil to the cosmetics industry and Baobab powder to food and nutrition companies are mostly within South Africa and to the UK and Australia.

ENERGY CONSUMPTION

There is no energy required in the Baobab harvest. EcoProducts' processing facility runs off three-phase municipal electricity from the national utility Eskom. Current consumption is about 1626 units per month at a cost of about R10,000 (€715).

BAOBAB PRODUCTION

EcoProducts facilities run 24hrs a day for five days a week during production season. Baobab pods are cracked open and powder and seed removed by hand before tumbling, sieving and drying. The dried and cleaned powder is weighed and sealed into 10kg bags for shipping.

OIL PRODUCTION

The Baobab seed shell is separated from the oil-bearing kernel and oil extracted in two mechanical screw pressers using three-phase power. The oils are then filtered and pumped into barrels or bottling machines powered off a compressor.

THE FACILITY

EcoProducts operates from a one-hectare facility consisting of several buildings. There is ample scope for a rooftop solar array in a region with abundant sunshine.

EXPANSION PLANS

EcoProducts is expanding and will need more energy, which it has assumed to date will come from grid power and generators. During 2017 the company will add wild-harvested Marula to its product range, with expanded energy requirements.

DEMONSTRATION CENTRE

EcoProducts proposes to become a renewable energy demonstration and training centre for the wider agricultural and agro-processing community.



A young Baobab fruit

The biotrade uses abundant natural resources in a sustainable way



Maganu produces finished retail cosmetic products from oils extracted from indigenous plants such as Marula

MAGANU (MARULA) PRODUCTION

Information based on interviews and field visit to the Maganu facility on 20 December 2016 with operations manager Simo Dlamini and production co-ordinator Bongani Hadzebe

Swaziland

Business viability	Strong and proven
Involvement of women	High
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	Excellent

Maganu Production is based in the Kingdom of Swaziland, about 50km from the commercial capital Manzini.

Maganu started in 2005 with government support. It sells bulk Marula oil and organic cosmetic products under the brand Swazi Secrets; and creates livelihoods for communities across the country.

Marula fruit is supplied by about a thousand harvesters across Swaziland, nearly all poor rural women. The Marula harvest is a primary rural source of cash income and Maganu provides training at village level on sustainable harvesting and storage techniques.

The fruit is used to brew a traditional drink, leaving a tough seed with an oil bearing kernel which is collected by Maganu in 200kg drums.

MARULA PROCESSING

Maganu's offices and processing facility are in a 70x25m brick and corrugated iron building rented from the Swaziland Investment Promotion Authority (SIPA).

Marula kernels are loaded into two hydraulic presses in batches of 5kg. Each press works at 30% yield and produces 300ml oil from a kilogram of kernels - up to 50 litres of oil per day.

Total Marula oil production at Maganu is 10-12 tonnes per annum from 40 tonnes of raw kernels. This is growing steadily and has potential for future rapid growth with two significant potential US customers in the pipeline.

CURRENT POWER SUPPLY

All of Maganu's power is currently supplied through the grid by the Swaziland Electricity Commission, which gets 70% of its energy from South Africa's Eskom utility and 30% from local hydropower. Energy bills are currently R10,000 to R12,000 (€715 - €860) a month.

RENEWABLE ENERGY POTENTIAL

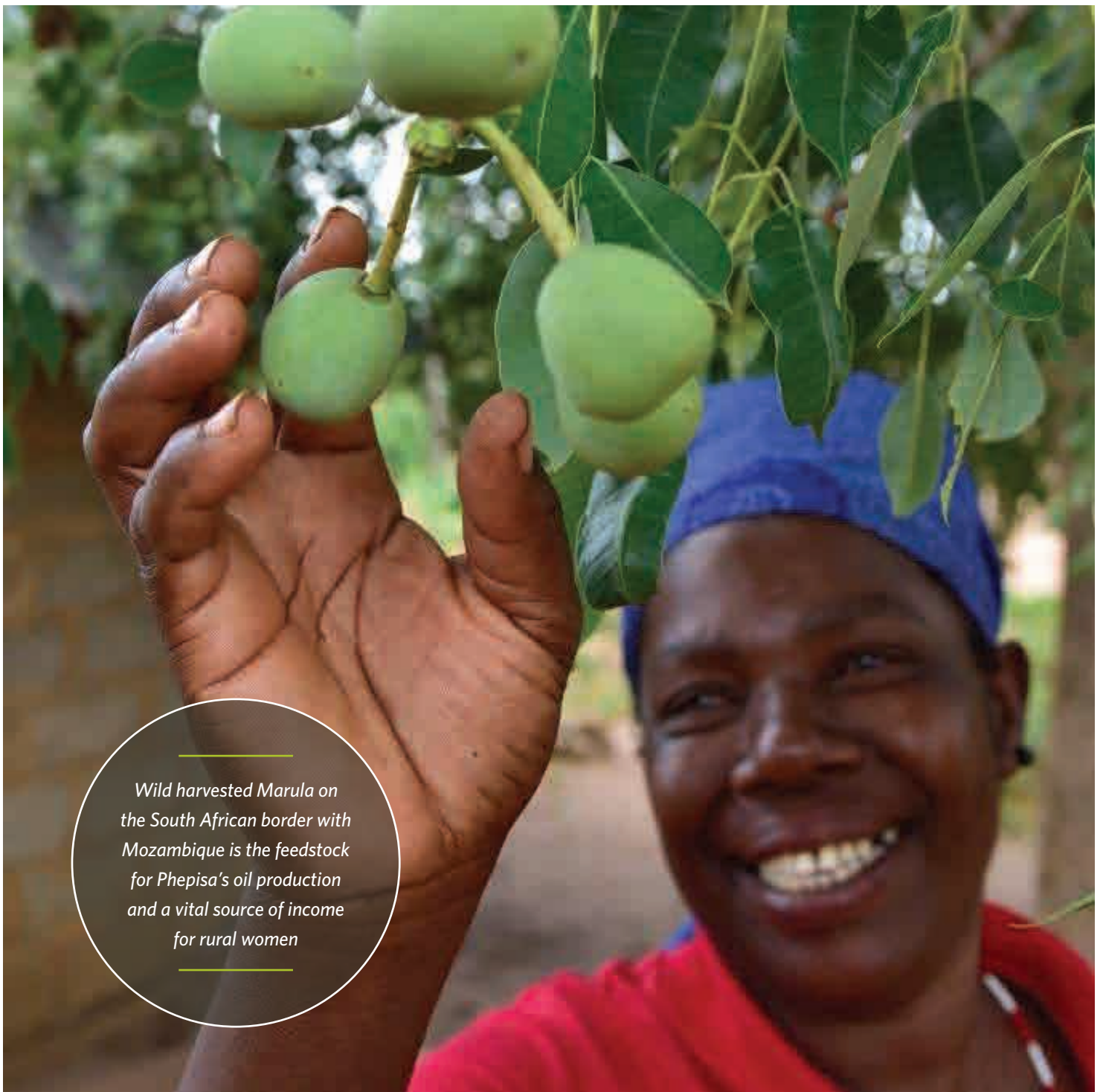
It is believed that all of Maganu's current and future energy needs could be provided by a solar PV array installed on the roof. This would also potentially be able to power a planned Marula juice facility next door.

Maganu is an established business with a committed investor and has substantial potential to expand and create more jobs. It has a strong appetite for renewables. Introduction of renewable energy would depend on technical support, training and capital investment.

The facility could be used as a renewable energy demonstrator for biotrade and agriculture projects in Swaziland.

Marula oil ready for shipment from Maganu's facility near Siteki in Swaziland



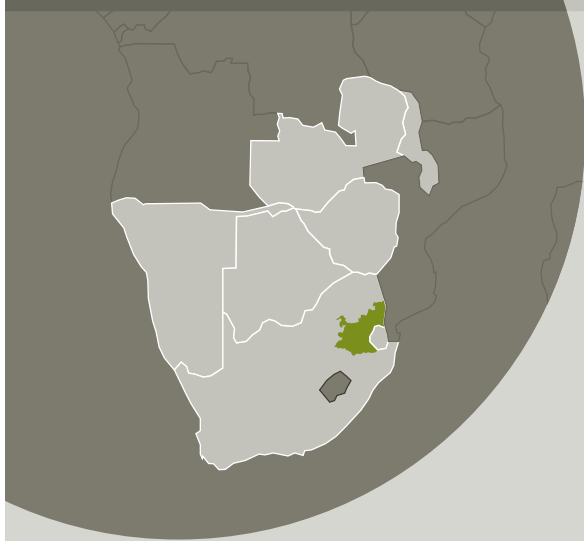


Wild harvested Marula on the South African border with Mozambique is the feedstock for Phepisa's oil production and a vital source of income for rural women



Marula harvesters in the Phepisa oil pressing facility

PHEPISA



Based on a field visit to Phepisa production facilities and surrounding villages, and an interview with business support managers Sibusiso Mathenjwa and Nonhlanhla Mahhungela.

Mpumalanga, South Africa

Business viability	Unproven
Involvement of women	High
Renewable energy awareness	Fair
Renewable energy potential	High
Future project potential	Good

Phepisa is an early-stage high-potential natural products business based on the processing of Marula for oil, with expansion planned in Moringa and Castor beans. It is located in the east of the Mpumalanga province, near the Mozambique border. Business founder Phephsile Maseko is also national co-ordinator of the Traditional Healers Organisation.

Marula fruit is sourced from about 100 local women who wild harvest the fruit in January and February. The fruit flesh is removed and the seed cracked by hand in villages to expose the oil-bearing kernel. This is slow, tiresome, manual work but local women nevertheless manage to supply about three tonnes a year of kernels to Phepisa.

The business aims to expand to up to 12 tonnes of feedstock supplied from the community, which would be greatly assisted by modest mechanisation of processes supported by a better energy supply.

PRODUCTION FACILITIES

Phepisa has a rudimentary production facility on its own land, with two manual presses, a microwave oven, electric scale and basic packaging facilities.

The factory is currently able to press only five litres of oil a day, from 12kg of Marula seed kernels. The oil is graded and packed for shipment in 200 litre drums. This phase of storage urgently requires a cold room.

ENERGY

Phepisa has a serious energy deficit. There is no grid energy available at the Phepisa facility, which generates power from a 12kVA generator donated by the Council for Scientific and

Industrial Research (CSIR). It works three hours a day, but this is insufficient for business needs.

The national utility Eskom and local Nkomazi municipality has quoted Phepisa nearly R800,000 (€57,140) to connect to the nearest substation 2,5km away. This is unaffordable.

The generator drives the water pump but isn't able to produce the required 1,000l/hr for irrigation. The generator also powers lights and office equipment.

FUTURE ENERGY REQUIREMENTS

Phepisa's viability and growth is constrained by an absence of processing machinery and a reliable power supply. It needs a cold room to store its oil product.

Phepisa site showing water storage, pump and generator room





View of a typical small farm and homestead along the Qora River



In the Bulungula district of South Africa's Eastern Cape province, women spend many hours a day carrying water up steep hills. Solar pumps would enable huge savings of time and energy

BULUNGULA

Based on an interview and field trip in November 2016 to Bulungula Incubator and surrounding villages

Eastern Cape Province, South Africa

Business viability	Unproven
Involvement of women	High
Renewable energy awareness	Low to high
Renewable energy potential	High
Future project potential	Excellent

Bulungula is a village in one of the least-developed parts of South Africa, with manual agriculture struggling with a lack of energy, machinery and skills. Modest renewable energy interventions have potential to make a significant impact.

A community owned lodge was started in 2004 and the Bulungula Incubator in 2007 as a rural development NGO to bring basic healthcare, education, energy and agriculture to the community.

The 100km² Bulungula district covers 6,000 people in four villages in the Bulungula district.

AGRICULTURE POTENTIAL

The very fertile Transkei region has good rainfall and significant agricultural potential, but many current limitations. Animals roam freely, which means crops need to be fenced at a cost greater than most households can cope with. There is almost no mechanisation or technology currently applied. The topography requires significant pumping resources which don't exist. In most cases water is carried to homesteads by women, a practice which consumes a disproportionate share of daily time and energy. The absence of energy and lack of mechanisation substantially reduces the area of land which can be cultivated and the viability of even small-scale agriculture.

Grains are still ground by hand with a stone. Many farmers give up and there is less land being farmed than 20 years ago.

THE OPPORTUNITY

Even simple crops like cabbages are imported into Bulungula from Mthatha, 100km away down a bad road and a journey

that takes up to three hours each way. The Bulungula Incubator project is trying to replace imports of cabbage, potatoes, onions and tomatoes with local production.

The goal is to set up a village market, and then to supply local schools and a hospital and the local trading store.

CURRENT ENERGY

The Bulungula area is not currently on the grid. Solar panels were installed on each hut by government, but many of them are faulty. Among possible solutions are solar pumps, supported by maintenance and training.



Agriculture in the district is manual and mostly done by women

Cattle are prized as a store of wealth



“One of the big problems is we lack renewable energy knowledge, but our heart is in right place and we dream of building a new factory which wins international awards for green energy and sustainability.”

BEV MISSING

Rain has created sustainable employment through the production of cosmetics from natural plant ingredients

RAIN

Information gathered from an interview with Bev Missing and field trip during November 2016

Western Cape, South Africa

Business viability	Strong
Involvement of women	High
Renewable energy awareness	Fair
Renewable energy potential	High
Future project potential	Excellent

Rain is a socially-aware business making and packaging artisan cosmetic products from natural plant ingredients, for sale in its 22 retail outlets.

The business operates from an old 1,500m² flour mill in the Western Cape town of Swellendam, where it creates jobs for as many semi-skilled and disadvantaged people as possible. The business is expanding and expects to open a further ten shops in 2017.

2016 turnover was R42m (€3m), up from R32m (€2,3m) in 2015. The company added 104 jobs between 2012 and 2014 and expects further employment increases.

More than 90% of what Rain sells is made by the company. It trades on its sustainability story, combined with natural Fair Trade ingredients. Most of Rain's packaging is hand-crafted. The business has around 650 product lines and is launching a range for the hospitality and spa sector.

ENERGY

Most of Rain's energy is sourced from the municipal grid, with gas used to melt soaps and for heaters in winter. There are two standby diesel generators. Power bills come to around R12,000 (€860) a month at the factory, and R2,500 (€180) a month average at retail outlets.

EMPLOYMENT

Rain employs mostly women including 23 of 27 managers and 85% of factory staff. Most of the staff are local.

BIOTRADE INGREDIENTS

The feedstock for the Rain business is mostly oils from natural products sourced from across southern Africa, including Baobab, Aloe, Mafurra, Mongongo, Marula, Kalahari Melon, Cape Chamomile, Ximenia, Kigelia and Namibian Myrrh.

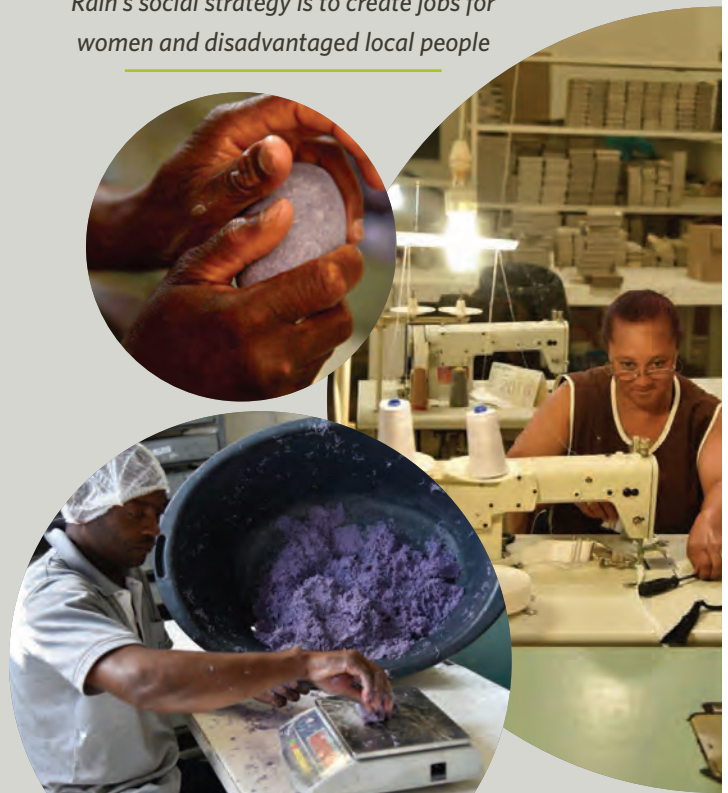
AWARENESS

Rain founder and manager Bev Missing regards herself as an environmentalist but has limited knowledge of renewable energy. This is something she wants to address as planning proceeds for a new green facility.

FUTURE ENERGY

The planned new Rain facility will be designed around renewable energy, but Missing currently worries about her lack of technical knowledge and the large capital costs of renewables.

Rain's social strategy is to create jobs for women and disadvantaged local people

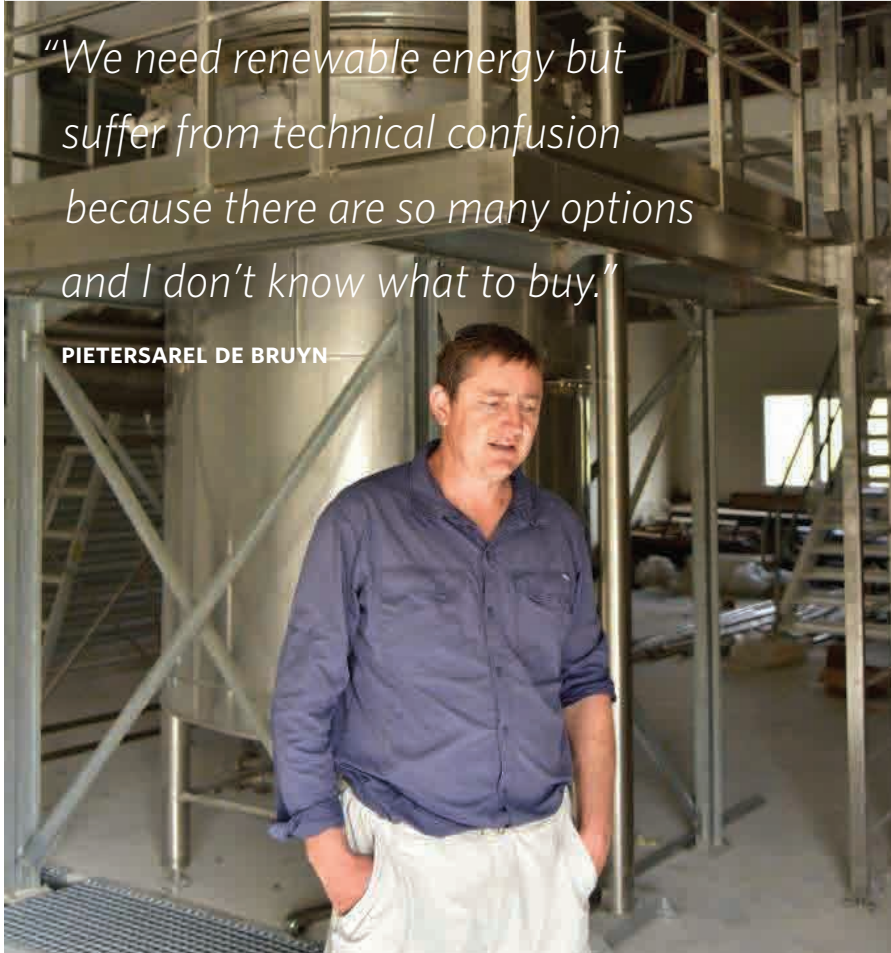


Pietersarel de Bruyn
inspects his essential oil
plantation in the Overberg
region of South Africa's
Western Cape province



*"We need renewable energy but
suffer from technical confusion
because there are so many options
and I don't know what to buy."*

PIETERSAREL DE BRUYN



Preparing Lavender for oil extraction



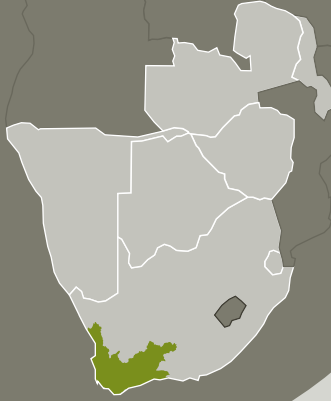
Microhydro potential...



*Seedlings in the Herbs A Plenty
nursery are planted out on the
company's own land and supplied
to other biotrade growers*

HERBS A PLENTY

Information based on a questionnaire and field visit in November 2016



Caledon, South Africa, Western Cape

Business viability	Strong
Involvement of women	Good, high potential
Renewable energy awareness	High
Renewable energy potential	High
Future project potential	Excellent

PROCESSING FACILITY

Herbs A Plenty is a dynamic business based on the cultivation and processing of indigenous plants for essential oils. The farm is located in the Overberg district of the Western Cape. It is run by agricultural economist and innovator Pietersarel de Bruyn.

The business works with 30 species of plant, mostly Lavender, Lavandin, Rosemary and Geranium. It is organic and has high potential for adoption of renewables including solar, wind, hydro and biogas. Herbs A Plenty has a turnover of around R4,5m (€320,000) and is poised for significant growth following a recent expansion.

The business exports oils and fragrances, mostly to the USA, Europe and Australia. It aims to produce 60 tonnes a year by 2019. Herbs A Plenty has a substantial nursery providing seedlings for its own cultivation and distribution to other growers.

EMPLOYMENT

Herbs A Plenty employs ten full time farm staff plus four seasonal labourers. 60% of the labour force are women.

ENERGY

The business runs on three-phase power supplied by the national grid. A 2.2kw pump supplies water to the nursery and some of the growing area, with a 11kw pump irrigating the rest of the farm.

In the processing facility, energy is used to heat 600kg of steam using an electro-boiler. Pre-heating the water with solar power will reduce energy consumption by as much as a third.

ENERGY FUTURE

A reliable source of new energy is essential to the Herbs A Plenty expansion. De Bruyn has started to investigate the potential for

solar water heating for steam production, plus solar, wind, hydro and biogas generation.

A 200m² new processing facility was recently established on the farm, with a roof suitable for a large solar array. A small drying room uses ambient air temperature but could be more efficient with solar drying technology.

Current energy costs are about R10,000 (€715) a month, but will increase substantially as production expands. De Bruyn estimates the company will use around 45,000kWh per month when running at full capacity.

MICROHYDRO POTENTIAL

A near-perennial tributary of the Klein Rivier runs through the property, providing significant micro-hydro potential.

BIOGAS POTENTIAL

At full production, Herbs A Plenty expects to produce 700 tonnes of biomass from its waste products. It could also access hundreds of tonnes of chicken manure from the 10-15 chicken farms within a 10km radius.

AGRI-PROCESSING VISION

De Bruyn has a vision to establish essential oils as a large-scale agricultural industry in SA. He has a concept for a new processing facility as a centre for sustainable organic agricultural processing based on renewable energy sources.

This business will stimulate agri-processing, skills development and create a generation of new farmers. De Bruyn sees the potential to become a local demonstration and training hub for renewables.


BIOTRADE COMMUNITY PROCESSING CENTRES

Frank Taylor has proposed in Botswana's biotrade masterplan that government support the establishment of Community Processing Centres (CPC) to stimulate grassroots agro-processing and value addition to wild harvested plant products.

He plans a prototype CPC be set up on his 20ha premises to pilot community processing, training and technology trials. This would be a major opportunity to pilot renewable technologies which can then be rolled out in rural communities.

Taylor envisages a future network of up to 20 CPCs, some in communities which currently have no power provision at all. Energy will be required to ensure the hygienic conditions required for processing for international markets.

The primary processing needs which can be supplied by renewables would be drying, cooling, decortication of the seed and oil extraction.



"A Community Processing Centre can only work and bring real benefits to people if it has power. Renewable energy means a CPC can be established close to the wild plant resource in a way that benefits the most remote and disadvantaged communities."

FRANK TAYLOR

WILD FRUITS OF AFRICA

Information based on an interview with Frank Taylor and a field visit to his processing facilities in Gabane, Botswana, in January 2017

Botswana

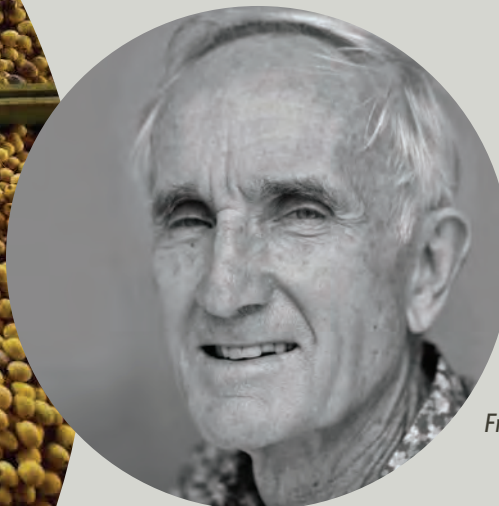
Frank Taylor is one of the original innovators and pioneers in biotrade. He set up Veld Products Research and Development as an NGO in 1981 with the intention of generating income for rural people in Botswana, and he works with the poverty alleviation unit in the office of the President.

His 1000m² factory in Gabane, near the capital Gaborone, is one of the first facilities in southern Africa to process Marula fruit into finished products for local sale and export.

Now, with support from USAID, Taylor has helped to set up the Natural Products Association of Botswana and drafted the country's national biotrade masterplan. At its heart is sustainable exploitation and management of at least 40 indigenous plant species, from African Chewing Gum and Wild Raisin to the Sour Plum and Kalahari Truffle.

The aim is to professionalise the sector and establish Botswana as a centre of biotrade excellence based on quality controls, environmental best practice and adding value to natural products - all informed by scientific research.

Taylor has stimulated school children to collect the biggest and sweetest wild fruits as part of a project to identify and supply better genetic material for planting. He has helped to create an environment in which wild harvesting is done on the basis of a baseline survey of the plant resource, and where every harvester is trained and can provide traceability for the product they collect.



Frank Taylor



“Renewable energy will expand the range of plant species we can process, creating an income for the San with minimal disruption to their traditional environment.”

The distinctive flower and seedpod of Devil's Claw

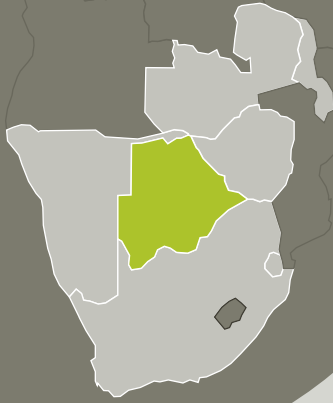


San people are organised into harvester communities for the wild collection of the Devil's Claw tuber



KAMELA

Information based on an interview with Anne and Greg Laws at the PhytoTrade AGM and a field visit to the Kalahari desert in February 2017



Northwest Botswana

Business viability	Good
Involvement of women	Excellent
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	High

Kamela is based on the wild harvest of Devil's Claw in the Kalahari by the San Bushmen, the region's original hunter-gatherer community. Business owners Greg and Anne Laws are based on a 7500ha game farm which belongs to the San, who have exceptional knowledge of plants' medicinal and nutritional value.

Devil's Claw has a high-value tuber harvested and dried for its analgesic properties. It occurs widely across Botswana and Namibia. Kamela has built a network of buying point managers in remote San settlements, with responsibility for record keeping and harvester training. It has registered 700 harvesters to date, 80% of them San women. The business currently produces around 3,5 tonnes per year of dried Devil's Claw, but has orders for 30 tonnes.

Venda chickens are a hardy African breed



ENERGY

Kamela has no grid power but runs a small lodge off a 6kVa generator. The Kamela office has six 250W solar panels, a 1,6kw inverter and two lead acid batteries.

EXPANSION

Kamela plans to expand by processing every indigenous plant which can be sustainably collected, including Morama Bean, Kalahari Truffle and Ximenia. This will require a new energy source for drying, crushing and oil extraction, and storing oils in a harsh environment where temperatures soar to 46 degrees Celsius.

Kolbroek pigs are being bred by Kamela to supply quality meat products to the luxury lodges of the Okavango



KALAHARI MEATS

Kamela is also setting up a Kalahari meat processing business and has begun to breed indigenous *Kolbroek* pigs and hardy *Venda* chickens. It plans to start a charcuterie providing high-quality hams, sausages and bacon to the luxury lodges of the Okavango Swamps.

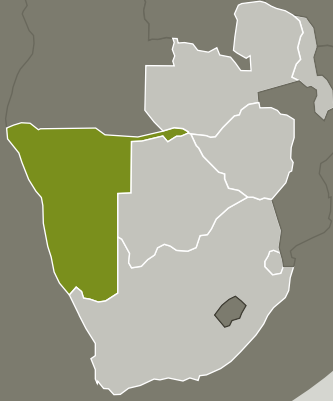


"A new solar energy system would let us add value to our Devil's Claw product by around 50% with a ripple effect across the value chain, from our end customers to 1500 harvesters."

GERO DIEKMAN

ECOSO DYNAMICS

Information based on interviews at PhytoTrade AGM in 2016 and in 2017 in Namibia



Central Namibia

Business viability	High
Involvement of women	High
Renewable energy awareness	Moderate
Renewable energy potential	High
Future project potential	High

Ecoso Dynamics sources wild-harvested Devil's Claw from Namibia and Botswana. Processing operations take place on a cattle farm outside the town of Okahandja in central Namibia. The business is run by biotrade veteran Gero Diekman.

The farming operation employs 17 people for Devil's Claw processing, ten of them women, with a further 14 employed in beef production.

Dried Devil's Claw is sorted, quality controlled, weighed, packed and containerised for export to Europe, China and the US as a raw ingredient and in a range of finished products including tablets and tea. It is used mostly for its analgesic and pain relief properties.

ENERGY USE

There is no energy used in the wild harvest of Devil's Claw, which is dug out of the ground by hand then sliced and sun-dried on nets.

The farm and processing facility operate a hybrid system of solar (30%) and diesel generators (70%). The farm has no grid power. The solar panels are twenty years old and ineffective and the generator costs R150 (€11) a day in fuel.

FUTURE ENERGY REQUIREMENT

Ecoso plans to move up the value chain with a Devil's Claw product meeting higher standards of quality through sterilisation. Steam sterilising will add up to 50% to the product value, requiring solar water heaters for pre-heating and a biofuel or electricity system to boil water. Indoor drying

and homogenisation will also require electricity. Extraction of the active ingredient can be considered in future, requiring significant additional power.

Diekman has plans to install a new solar power system of up to 15kw, with power output to also supply worker accommodation.

Devil's Claw is harvested by hand to ensure the plant is not damaged





Will Coetsee is a pioneer in the cultivation and processing of Bulbine Frutescens, which is intercropped with Moringa trees. Pumping water for drip irrigation is a major consumer of energy.

BOTANICA NATURAL PRODUCTS

Information based on an interview with Will Coetsee and field trip in January 2017

Alldays, Limpopo Province, South Africa

Business viability	Strong
Involvement of women	Moderate
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	Excellent

Botanica Natural Products is based in the north of South Africa's Limpopo province and is focused on the cultivation and processing of Bulbine and Moringa.

It is run by Will Coetsee, a sustainable agriculture entrepreneur with a biodiversity degree, who is a pioneer in commercialising medicinal plant species. He is the first commercial scale producer of Bulbine and is committed to providing training, creating business and agricultural skills, and developing livelihoods in the local community.

Bulbine accounts for 95% of sales but active diversification is underway. Moringa leaf powder produced for the nutritional market is expected to become a significant part of the business. The business has 200,000 plants under drip irrigation in a 10ha area. Coetsee plans expansion to fifty hectares.

The business currently produces about 25 tonnes of product each year, with production capacity for 100 tonnes.

PRODUCTS

Botanica produces a plant extract from Bulbine, mostly for the cosmetic market, and is moving into the nutraceutical ingredient market with Moringa and Baobab. Processed Bulbine gel is sold as a raw ingredient in 25kg or 200kg drums or as finished products.

Sales of Bulbine are mostly to the West African skincare market (60%) and 30% to Europe.

EMPLOYMENT

The business employs 15 full-time staff, 90% of them Pedi and 60% women. There is seasonal employment for about 30 people.

CURRENT ENERGY USE

As much as 80% of energy consumed by Botanica is for pumping water for irrigation, using three 380V three-phase centrifugal pumps. The business runs off power from the Eskom grid, on a rural energy tariff, with a 250kva transformer. Energy costs are around R6,000 (€430) a month. Other energy consumed is in the processing facility, for lighting, heating, hydraulic presses and a pasteuriser.

The planned second facility will be primarily for Moringa processing, and will likely see a >50% increase in energy consumption.

RENEWABLE ENERGY POTENTIAL

Coetsee is ready to embrace renewables if costs allow and technical support is available.

Botanica has significant potential for the adoption of solar PV. A new 810m² facility is being planned for a site adjacent to the current facility, with a north-facing roof that can comfortably accommodate more than 400m² of solar PV.

TRAINING AND DEMONSTRATION

Coetsee is enthused by the idea that he could become a renewable demonstration and training centre providing surplus solar power to neighbouring farms and communities.



Many of Kobolondo's neighbours are subsistence farmers who would benefit from coffee cultivation and solar water pumps



Kobolondo founder Vanessa Stephens indicates the site where a future solar-powered coffee processing and roasting facility may be built

KOBOLONDO COFFEE

Information based on field visit to Kobolondo and interview with owner/manager Vanessa Stephens

Swaziland

Business viability	Unproven, high potential
Involvement of women	Good
Renewable energy awareness	Moderate
Renewable energy potential	High
Future project potential	Excellent

Kobolondo Coffee is a small early-stage entrepreneurial farming operation which is the first to grow and roast coffee in the Kingdom of Swaziland. It is run by Vanessa Stephens in partnership with women from the local Phopyanye community.

Kobolondo expects its first harvest in 2018. It aims to create a niche brand of single-origin sustainably-grown and harvested organic Fair Trade coffee, with processing based on renewable energy, and which benefits the local community through job creation and skills development.

Kobolondo grows Arabica coffee from seed and plants the seedlings in an open field adjacent to modest maize and potato fields, or in nearby indigenous forests.

The aim is to have three hectares of own coffee production and to encourage local farmers to grow another 6ha. By 2017, Kobolondo hopes to have ten women farmers growing coffee, each supporting at least five people.

CURRENT ENERGY SITUATION

Kobolondo has no energy supply or current requirements. The nearest grid connection is 10km away.

Water is gravity fed from the Phopyanye River. It is recommended that installation of a solar pumping system be investigated to provide water security. If trials are successful, the technology could be introduced to other community farmers.

FUTURE ENERGY REQUIREMENTS

Kobolondo's short-term development and commercial plans have specific energy requirements for mechanical coffee processing and drying, roasting and packing as well as irrigation, a nursery, office, tasting room, shop and visitors centre. This could all potentially be powered by solar and there is substantial interest in participation in the Powering Agriculture project.

The project owners see potential for renewables to power the entire coffee operation, and would like to become a demonstration centre for the local community.

*Community worker
in Kobolondo's
young coffee
plantation in the
Pigg's Peak district
of Swaziland*

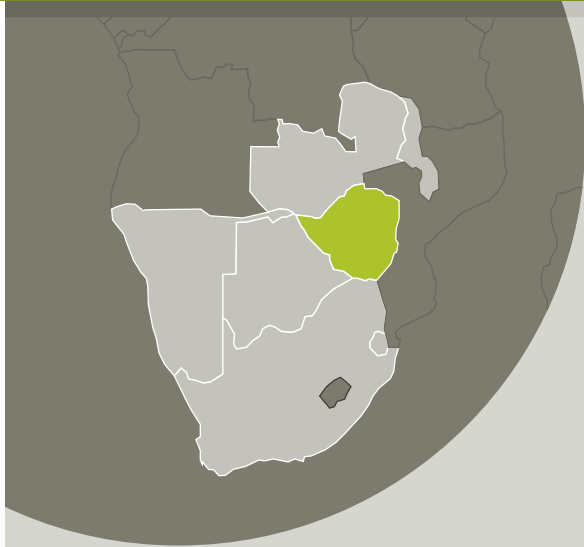




—
Baobab trees grow to thousands of years old and are a rich source of nutrients and valuable oils for the global cosmetics industry
—

B'AYOBA

Information based on an interview at the PhytoTrade AGM in 2016 and a field visit to Zimbabwe in 2017



Zimbabwe

Business viability	Strong
Involvement of women	High
Renewable energy awareness	High
Renewable energy potential	High
Future project potential	Excellent

B'Ayoba is an established Zimbabwean business involved in the wild harvest and gathering of Baobab for processing and export to the local and international cosmetics and nutrition sector.

It is run by former PhytoTrade chief executive Gus Le Breton and employs 50 full-time staff, 30 of them women, and up to 100 part-time workers. There is a national network of more than 3000 seasonal baobab harvesters, most of them women.

B'Ayoba produces bulk baobab powder and oil and added value products ranging from health snacks, jams and juice mixes to hair care products. Sales are to southern African customers and to the US and Europe. A second Baobab business, Kaza Natural Oils, operates from the same premises.

ENERGY USE

The first stage of Baobab processing involves cracking the fruit pod to remove powder and seed. This takes place in four rural processing centres in the south and north of the country. These centres have 100m² sheds and shipping containers for storage, but no current energy supply.

Most of the energy is consumed in the central processing facility, which is on the unreliable national grid, and has around 20kw of processing equipment. Powder and seed are separated in a rotating drum (2kw) then sieved (5kw). The seed is pressed into oil (12kw) and the seedcake milled (3kw).

The Zimbabwean grid is supplied in equal measure by coal burning power stations, hydro power from Lake Kariba and Eskom power from South Africa.

B'Ayoba consumes about 8000kWh each month across the business, including collection centres. The business is on graded tariffs of between 10 and 14 cents (10 and 14 €cents) per kilowatt hour. Generator power costs closer to 40c (40 €cents) per kilowatt hour. Total energy costs are around US\$600 (€600) a month for the grid and a further \$800 (€800) on diesel generator fuel.

ENERGY FUTURE

B'Ayoba aims to shift all processing to solar power and has identified its 1800m² factory roof as a suitable location for a solar array. This would also become an energy resource for the surrounding community of about a thousand households which currently uses firewood and kerosene. Adoption of solar is, however, restricted by high capital costs.

"We do theoretically have grid energy but a third of our production is supported by a generator because of power failures. We could generate renewable energy for the business and surrounding community from solar, but can't afford the up-front capital cost. We know we have to do it and it is a clear business ambition - we would switch to 100% solar tomorrow if we could. Clean energy would not only save money but also enhance the appeal of our products, which in turn brings expansion and more jobs."



ESSE

Based on interviews with Trevor Steyn at the PhytoTrade AGM in 2016 and a factory visit in 2017

KwaZulu-Natal, South Africa

Business viability	High
Involvement of women	High
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	High

Esse produces high-end cosmetic products from natural plant ingredients sourced from Namibia, Botswana, Malawi, Mozambique and Zambia. Key species include Baobab, Rooibos, Kalahari Melon and Cape Chamomile.

The business grew by more than 300% over the past three years and is struggling to make enough product to meet demand. A lack of sufficient reliable energy is a serious business constraint.

Esse employs 38 people, most of them women, and has thousands of women harvesters in the supply chain. Products are marketed and sold under the Esse brand as well as Africa Organics.

CURRENT ENERGY PRACTICE

Esse uses grid energy from the Eskom utility for steam generation, pumping, heating, mixing, filtering, lighting and

offices. Some steam is provided by a boiler burning wood from invasive Eucalyptus. Esse is part of a community-based carbon offset scheme through a company called Credible Carbon.


FUTURE ENERGY

Esse recently added 1000m² of processing and manufacturing facility, with more planned. The business can't get enough energy from the Eskom utility, which is notoriously unreliable in the area, thus limiting its expansion and production capacity.

ENERGY EFFICIENCY

Business owner Trevor Steyn has a better than average awareness of energy efficiency, "and that's the reason we survive". Production facilities are all new, energy phases are balanced and it deploys timers to control lighting. A new high-efficiency biomass boiler for steam generation would allow all other power demand to be met by solar.

"We can't get enough power from Eskom and this deficit limits our ability to expand. I am looking at any new source of energy, and would definitely do renewables if not at the expense of cash flow, production and survival. Renewable energy would enable our expansion and fulfil the company ethic. We want to go off the grid for marketing, cost and ethical reasons. We wanted to do it while building the new factory, but the cost was prohibitive. Using solar PV for lighting would have tripled the capital cost."



Kigelia africana fruit pod. Any guess why it's called the Sausage Tree?

"We want renewables but it is daunting. I need somebody to come and make it work. We could reduce our operating costs if we had solar, and produce a better product faster and at higher volumes."

GILL WHITTINGTON BANDA

MUTHIFUTHI

Based on interviews with MuthiFuthi owner/manager Gill Whittington Banda

KwaZulu-Natal, South Africa

Business viability	Strong
Involvement of women	High
Renewable energy awareness	Fair
Renewable energy potential	High
Future project potential	Excellent

MuthiFuthi makes plant extracts from African indigenous medicinal plants in the KwaZulu-Natal province of South Africa. Most of the ingredients are medicinal and cultivated, with Kigelia from a wild harvest. They are dried, processed and packed on a remote 15ha site near the Tugela River.

The business was started by current owner Gill Whittington Banda's late husband, a traditional healer who set up a EU project to cultivate and process traditional plant species. Most of the harvester community and workers are energy poor, with no access to the grid.

Whittington Banda's primary goal is community benefits. She would like to be an early adopter of renewables and spread the benefits of clean energy into local communities.

MuthiFuthi supplies raw materials to manufacturers and brand owners, and finished products directly to consumers. Processing consists mostly of drying, chopping and crushing into powder. It sells about three tonnes of dried product a year.

Kigelia accounts for about a tonne of product by volume (30%) followed by African Ginger (500kg). Moringa is expected to be a growth business producing up to a tonne of product by 2018. Other major target species are Climbing Potato (*Bulbine natalensis*), Bitter Aloe (*Artemisia afra*) and Forest Elephant Foot (*Warburgia salutaris*).

Processed product is transported by diesel vehicle to a small warehouse with grid power in the port city of Durban, where it is weighed, stored and packed.

EMPLOYMENT

MuthiFuthi employs 19 full-time women at its growing site and nursery, all of them rural Zulus. There are a further 20 local rural harvesters of wild Kigelia.

ENERGY USE

There is no electricity on the MuthiFuthi site or in the nearby village. A petrol pump brings water to the site from the Tugela River, and the site has a petrol-driven hammer mill.

ENERGY FUTURE

Whittington Banda would love to embrace renewable energy but is constrained by a lack of technical knowledge and finance. She anticipates finding business efficiencies from drying plants using accelerated indirect solar technology, and replacing the petrol water pump with solar. The local community would benefit from small-scale solar lighting.

A reliable energy supply would also enable the business to plan more and respond better to large orders.

ALTERNATIVES TO SOLAR

Access to significant volumes of cow manure and waste plant material may provide opportunities for biogas production.

EXPANSION PLANS

A second company, ZuPlex, buys raw ingredients from MuthiFuthi and is being set up to export value-added products to new markets. This could triple business turnover from today's R500,000 (€35,715) a year. Among products will be a Kigelia extract, with up to five tonnes a year of raw material available. ZuPlex is aiming to lease a new facility in the Dube Agrizone adjacent to the King Shaka International Airport. Whittington Banda expects to have a fairly energy intensive operation based on pre-processing, extraction and packaging of high-value plant materials but hopes the facility can be designed around renewables. She aims to export up to 300 tonnes a year.



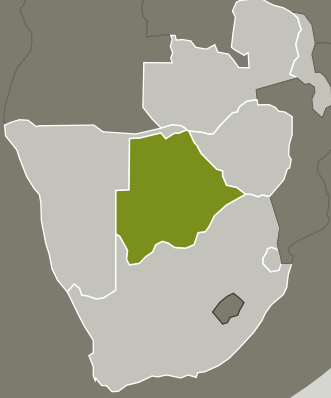
"Our ambitions for full oil production will require a more reliable source of energy. In a perfect world we'd take ourselves right off the grid and use renewables only."

- TRIS LAHTI



DLG NATURALS

Information based on an interview with Tris Lahti and a field visit to the DLG facility in Gabane, Botswana, in January 2017



Botswana

Business viability	Unproven
Involvement of women	High
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	High

DLG Naturals is a new business set up to extract oil from the Marula seeds discarded by the adjacent Wild Fruits of Africa Marula processing facility. Marula fruit is also brought to the factory gate by harvesters from the local community.

It supplies oil produced on site to customers mostly in the US, and distributes Baobab, Mongongo and Kalahari Melon Oil which it sources from southern African suppliers.

DLG currently produces just 50kg of Marula oil a week as it struggles to overcome early-stage teething problems in its facility. It aims to supply two tonnes of oil in 2017. One of the business' main goals is employment based on a sustainable biotrade.

ENERGY

DLG has struggled with the intermittent nature of the three-phase power it currently gets from the national grid. Energy is required for drying Marula seed in the rainy season and to prevent mould. Factory power requirements include a depulper, hydraulic screw press, centrifuge filter and lighting.

Marula seeds are dried before the oil-bearing kernel is removed through a decortication process



PARCEVAL

Summary based on interview with Parceval CEO Ulrich Feiter at PhytoTrade AGM

Western Cape Province, South Africa

Business viability	Strong and proven
Involvement of women	High
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	Excellent

Parceval is a pharma company which cultivates and sources botanical raw materials which it processes, formulates and packages for the herbal medicine sector. The business was established in 1992 by current chief executive Ulrich Feiter and operates from a farm in Wellington, in South Africa's Western Cape province.

It grows more than 120 of its own plant ingredients, and sources many more from SA, Madagascar, Tanzania, Ghana, Nigeria and Namibia.

Products include herbal extracts, tinctures, and ingredients for the cosmetic and pharmaceutical market, including the popular Linctagon brand.

The business employs 50 people, most of whom are women. Parceval works with 80 - 100 harvesters for its medicinal *Pelargonium sidoides* crop.

ENERGY CONSUMPTION

Harvesting of plants grown on the Parceval farm is by hand, with energy consumed by transport and in the drying process, which uses grid power from the Eskom utility. Some of the drying is subcontracted and uses gas heat exchangers. Gas is used for cooking and heating in factory processes.

The firm's electricity bill is as much as R30,000 (€2,140) a month. HVAC systems for cooling and filtering air are the biggest consumers of energy. Parts of the factory require sterile air.

Some water heating is done with wood from alien gum trees harvested on the property; and a solar water heater provides hot water for washing hands, bodies, floors and equipment.

BUSINESS AND ENERGY FUTURE

Parceval's current premises, including offices and quality control, currently cover about 1,700m². The business plans to more than double its manufacturing capacity with an additional 700-1,000m².

The expanded premises will require more energy, which management has assumed to date will be sourced from the Eskom grid. Solar power has been investigated but the costs quoted to date are more than a R1m (€71, 430) and this is not regarded as a viable capital expense. Feiter says solar or other renewable energy sources would definitely be considered if there was funding support or a subsidy.

AWARENESS

Awareness of renewable energy is regarded by management as good, but based on general knowledge rather than specialist expertise.

The business is keen to participate in future energy efficiency and renewable energy projects, with interest in energy audits, financial assistance and matched funding with the Department of Trade and Industry.

Parceval would also like support for staff training in energy efficiency, both at home and work.

"Energy efficiency makes financial sense, energy sense and ethical sense."

MORINGA MIRACLES

Based on a questionnaire completed by PhytoTrade Africa member Iain Church, the manager at Moringa Miracles Ltd, plus follow-up correspondence

Malawi

Business viability	Unproven
Involvement of women	High
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	Excellent

Moringa Miracles is an early-stage agricultural business in Malawi, based on the wild harvest of Moringa leaves. It employs 20 full-time Malawian staff and is starting to work with 62,000 harvesters organised into smallholder programmes.

The business produces oil from Moringa seeds and a powder from the leaf, which it aims to supply to international wholesale markets.

Future domestic demand may supply feeding programmes. The business is working with international NGO Mary's Meals to repeat a successful 2009 trial that looked at how Moringa could boost the nutritional content of humanitarian meals.

FACILITIES

Moringa Miracles currently has processing facilities for oil production only and has yet to develop its powder processing capacity.

ENERGY SUPPLY

Management at Moringa Miracles says unreliable grid power in Malawi is crippling small businesses and that renewables are crucial to survival in a country with abundant sunshine.

Energy from the national utility ESCOM as well as generators are used for processing operations, and solar is being investigated as a future energy source.

Current energy consumption and costs are not known as the business has not completed a full year of production.

ENERGY FUTURE

Moringa Miracles Ltd has expansion plans which it says will require more energy. The hope is that this can come from solar, particularly if battery technology allows 24/7 operations. The business has already investigated container-based solar units from www.renovagen.com.

Manager Iain Church is an engineer and has a decent awareness of renewables from the British Army, where he oversaw research into military applications for renewables.

This is recognised as a business with high potential for significant impact arising from the adoption of renewable energy technologies, but will require technical assistance and financial support. The business has been asked to provide further details following completion of its first harvest and processing cycle.

ESSENTIAL SKINCARE

Information based on completion of a questionnaire

Zambia

Business viability	Unproven
Involvement of women	Fair
Renewable energy awareness	Low
Renewable energy potential	Good
Future project potential	Unclear

Essential Skincare is a small Zambian skincare products business employing two people including the owner. It formulates plant oils and extracts based on indigenous species including Kigelia, Baobab powder, Marula oil, Rooibos extract and Mongongo oil.

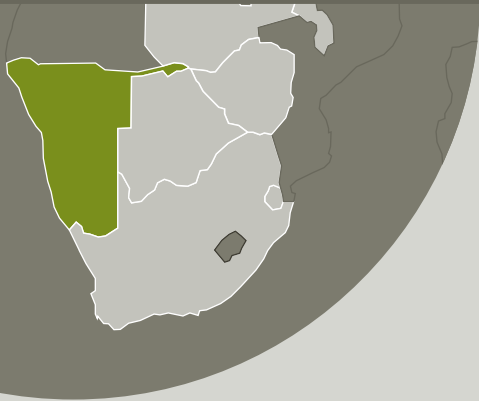
Energy from Zambia's national grid is used in the manufacturing process, supplemented by a diesel generator.

The business does not know how much energy it consumes. It may expand in future but is not aware of any future energy needs.

Awareness of renewable energy opportunities and energy efficiency is low and no renewables are currently being used or planned.

However, the business is interested in participating in a future renewables project.

OPUWO PROCESSING FACILITY & INTEGRATED RURAL DEVELOPMENT AND NATURE CONSERVATION (IRDNC)



This is a short summary of an interview with Karen Nott from the IRDNC and Opuwo Processing Facility in the Kunene/Kaokaveld region of northwestern Namibia.

Northwest Namibia

Business viability	Good
Involvement of women	High
Renewable energy awareness	High
Renewable energy potential	High
Future project potential	None

Karen Nott runs a successful organic operation based on the collection of wild species for processing and sale as essential oils in southern Africa and to France. The Kunene Conservancies Indigenous Natural Products Trust, which owns the facility, employs four full time staff, three men and a woman, all of whom are Otjihimba.

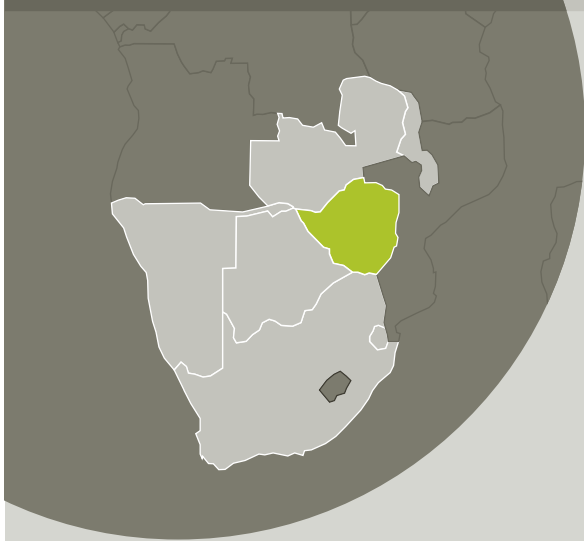
Approximately 800 harvesters, half of them women, are involved in the gathering of plant material in deep rural areas, for processing and sales as essential oils. Target species include Namibian Myrrh, Bushman's Candle, Devil's Claw and Resurrection Plant.

The processing facility uses three-phase municipal power but this is being replaced with solar. Energy consumption is currently about R4,000 (€285) a month, including a visitors centre, filtering, laboratory systems, cooling, boilers and office equipment. The harvesters use solar pumps for water extraction.

There is very high awareness of solar energy potential and good awareness of energy efficiency. This includes monitoring of consumption on boilers, and taking care to turn lights off.

This business is in the final stages of a grant application to the Green Climate Fund for conversion of all energy consumption to solar; and has therefore declined to participate further in the Powering Agriculture project.

ORGANIC AFRICA



Information based on interviews with Dominik Collenberg at the Organic Africa head office in Harare, Zimbabwe, in February 2017

Zimbabwe

Business viability	High
Involvement of women	High
Renewable energy awareness	High
Renewable energy potential	Good
Future project potential	Excellent

Organic Africa is a significant biotrade business in Zimbabwe, producing essential oils and herbal teas from more than 20 plant species including chilli, papaya, sunflower, chamomile and moringa.

The herbs and spices are collected sustainably from the wild and grown by small farmers in six harvesting and growing areas across the country.

The company has an office and production centre - for the drying, sorting and packing of products - in the capital, Harare, and a facility where 200 people are trained annually.

It has 1,952 harvesters in its supply chain, of which 1,400 are women (>70%). Organic Africa has a partnership with the German natural ingredients company Martin Bauer, which requires suppliers to monitor their environmental footprint.

FUTURE POTENTIAL

Organic Africa's production centre produces 100 tonnes of herbs and spices a year, which is harvested off 50ha of land. By 2018 they hope to triple this and thereafter eventually produce 500-1000 tonnes of herbs and spices off 200ha of land.

ENERGY TODAY

The business currently has a relatively low energy use. Most production relies on solar drying. Steam distillation was until recently powered by a diesel burner but now uses coal and wood. Production energy cost US\$25,000 (€25,000) in 2016.

FUTURE ENERGY

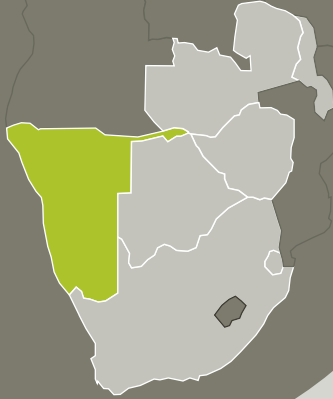
Organic Africa hopes to embrace renewable energy ahead of a substantial increase in production, including special tunnels for drying plant material. They plan to use solar, hydro and biomass.

Organic Africa will build a zero carbon training centre at its farm in 2017. This will be a showcase of zero carbon practises for southern Africa. Organic Africa hopes to train at least 500 people a year by 2018 and ultimately at least 1500 people annually.

"Our ethos is based on sustainability. The cost of conversion to renewable energy is prohibitive. We would welcome a project that enabled us to convert to renewable energy, and would like to use our training facility as a renewables demonstration centre."

CRIAA SA-DC

Information based on a questionnaire and discussion with Michel Mallet during a field visit to Windhoek, Namibia



Namibia

Business viability	Strong
Involvement of women	Excellent
Renewable energy awareness	Good
Renewable energy potential	High
Future project potential	High

CRIAA SA-DC stimulates and manages the harvesting and primary processing of wild plum (*Ximenia americana*) oil in Namibia, working in partnership with the Tulongeni Twahangana Cooperative (TTC).

It employs 15 full-time staff including 10 women. The operation works with around 1,000 harvesters from TTC, around 98% of them women.

Women organised within TTC collect *Ximenia* seeds on foot in a manual rural harvest. The seeds are stored in the small town of Eenhana in northern Namibia, then transported to the capital Windhoek for processing. The oil is processed, packed and stored at the Katutura Artisans' Project (KAP). The end-product is a cold-pressed virgin *Ximenia* oil.

CURRENT ENERGY CONSUMPTION

There is no energy other than transport used in the *Ximenia* harvest. The Windhoek processing facility uses three-phase 380V grid electricity for processing and a cold room. Solar is used for water heating and gas for boiling water. Average monthly consumption is 1,820 kWh with annual consumption around 21,850 kWh.

The CRIAA SA-DC management use 220V grid power and three 200l solar water heaters to run the offices, which are responsible for TTC planning, management, admin, finance and marketing. Annual consumption is around 12,000 kWh, averaging about 1,000 kWh monthly.

EXPANSION AND FUTURE ENERGY NEEDS

CRIAA SA-DC/TTC is planning to expand and anticipates needing more energy for processing and storage.

CURRENT AWARENESS

There is a reasonable awareness of renewable energy technologies, and a substantial appetite for knowledge and technical support leading to adoption. Among identified needs are PV lighting and PV refrigeration, but capital costs are perceived as a barrier. Mallet notes that grid electricity costs in Windhoek for domestic and industrial uses are high compared to northern Namibia.

PRIMARY ENERGY REQUIREMENTS

Technical support and financial assistance for expansion of renewables

CRIAA SA-DC provides business development services to other biotrade companies in Namibia, including the Marula oil producing business Eudafano Women's Cooperative, which involves 2,500 women in 23 village associations. KAP has a history of successfully developing appropriate technologies for the handling and processing of products such as Marula fruit and oil, Kalahari melon and seed oil, and Devil's Claw; and then transferring technology and knowledge to other stakeholders in biotrade value chains. It supports the idea of a renewable energy and technology demonstration, training and transfer centre.

MULANJE MOUNTAIN CONSERVATION TRUST

Information based on an interview with Carl Bruessow at the PhytoTrade AGM in 2016. A field trip was postponed due to the rainy season.

Malawi

Business viability	High
Involvement of women	High
Renewable energy awareness	High
Renewable energy potential	High

The Mulanje Mountain Conservation Trust is an environmental fund which encourages local initiatives in sustainable agriculture, energy and conservation.

The trust is based on development principles and works on Mt Mulanje on both sides of the Malawi/Mozambique border. It is active in agriculture and has an emerging interest in natural products and value creation along agriculture supply chains.

The trust's focus is on sustainable organic production of honey and tea, with work underway to improve agricultural methods and start producing black pepper, vanilla, passion fruit, cashew and macadamia nuts, cinnamon and turmeric.

A supply chain is being developed for growing, harvesting, processing, packaging and retail of tea. A tea research foundation has been established.

EMPLOYMENT

The trust creates work for about 3000 bee keepers. Six professional staff work in biodiversity research, environmental education and forestry, with eight support staff in the nursery.

ENERGY

The community is participating with the trust in electricity generation based on micro hydropower. As at November 2016 there was one operational 50-100kw turbine, with two others washed away in a flood. Two more are under construction. The business becomes sustainable at 1MW of hydropower.

The trust has set up the Mulanje Electricity Generation Agency (MEGA) as an ethical investment vehicle which is 100%

community owned. The aim is to use donor financing to deliver development and energy.

The MEGA social enterprise already provides power to schools and clinics, and is an income generating activity for local business people. It is the first fully authorised independent power provider in Malawi. Previously, power was either unavailable or sourced from a diesel generator at a cost significantly higher than the unreliable national grid.

ENERGY FUTURE

The trust wants to use locally produced energy to add value to food production and processing. Its business plan aims at generation of 1MW of electricity - up from 60kw - in the next five years.

There are concerns about resilience of the hydro generation system considering climate change and variable water supply.

On some parts of the mountain there is insufficient water flow for hydro, and the trust wants to explore the potential of solar.

BIOMASS

There is believed to be high potential for biomass production. The trust seeks to authorise the use of land by small forestry operations and to identify technical expertise to support the growing of gum trees as a fuel source.

PRIMARY ENERGY REQUIREMENTS

Technical support and financial assistance for expansion of renewables.

PROJECT OBJECTIVES

- *Build a baseline from which to design and implement pilot projects for the introduction of renewable energy and energy efficiency into southern African biotrade*
- *Develop a knowledge base of constraints, challenges, opportunities and appropriate energy technologies for wider dissemination to the sector*
- *Create opportunities and needs analysis for a programme including training and skills development and SME support in rural energy supply*

PROJECT CONTEXT

All biotrade value chains have a direct impact on household food security and support farmers' livelihood strategies in rural areas with marginal agricultural opportunities.

The biotrade sector, and closely related agro-processing sector, potentially involves millions of rural people in southern Africa. The value chains and SMEs in the PhytoTrade Africa network are vulnerable and have many constraints to growth and sustainability. These include complex supply chains, inexperience with product development and market access, difficulties with access to finance and significant energy challenges, including:

- *Inaccessibility and high costs of grid power*
- *Inefficiencies in power consumption*
- *Absence of renewable energy alternatives*
- *Difficulties accessing renewable energy technology*
- *Low awareness of energy efficiency*

This project has gathered information which starts to address the current lack of knowledge and information about energy constraints in the biotrade.

METHODOLOGY

The project was conducted in three primary ways:

- *A questionnaire to members of PhytoTrade Africa distributed across southern Africa. These are typically people working in the biotrade.*
- *Interviews with PhytoTrade members and external experts working in agriculture and energy.*
- *Field visits to agriculture and biotrade projects with value chains which were identified as having most potential for the introduction of renewable energy.*

PLANT SPECIES GLOSSARY

THE FOLLOWING ARE SOME OF THE PRIMARY PLANT SPECIES IN THE SOUTHERN AFRICAN BIOTRADE.

Baobab - *Adansonia digitata*

Bulbine - *Bulbine frutescens*

Devil's Claw - *Harpagophytum procumbens*

Kigelia - *Kigelia africana*


Marula - *Sclerocarya birrea*

Mongongo - *Schinziophyton rautanenii*

Moringa - *Moringa oleifera*

Ximenia - *Ximenia americana*

Rain is a business employing women and disadvantaged people to make a range of 650 cosmetic products from natural plant ingredients sourced from the biotrade



**kalahari melon
& scrub olive
olive oil soap**