State of Anaerobic Digestion Technology in South Africa

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OUR VISION

To be a leading Technology Station that stimulates and supports **technological innovation** in a **vibrant green economy** towards equitable socio-economic success

OUR MISSION

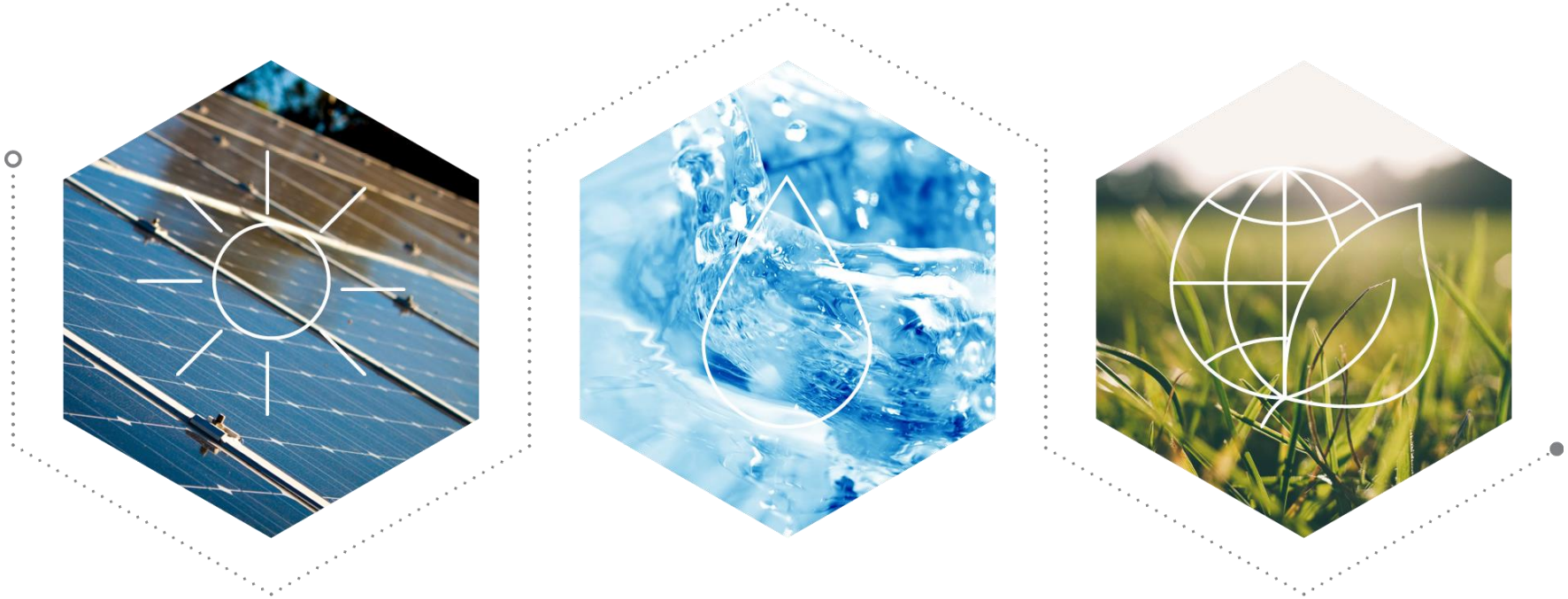
Providing **technical oriented enterprise development support** in the water, energy and environment sector through appropriate **technological innovations** in order to **develop sustainable socio-technical systems**.

Supporting the **green economy** by providing **engineering services to SMEs**

KEY **OBJECTIVES**

- **Initiate, develop and sustain strategic partnerships** to grow the **green economy** through various **technology interventions Develop, integrate, improve, and transfer innovative technologies** for the enhancement of the **green economy**
- Be a **leading technology stations serving the African continent** with **skilled staff** together with **effective and efficient processes and systems**

Applied Research Focus Areas



ENERGY

- Renewable energy solutions
- Energy efficiency
- Waste to Energy conversion
- Energy micro-Grids / Mini Grids
- Energy Storage

WATER

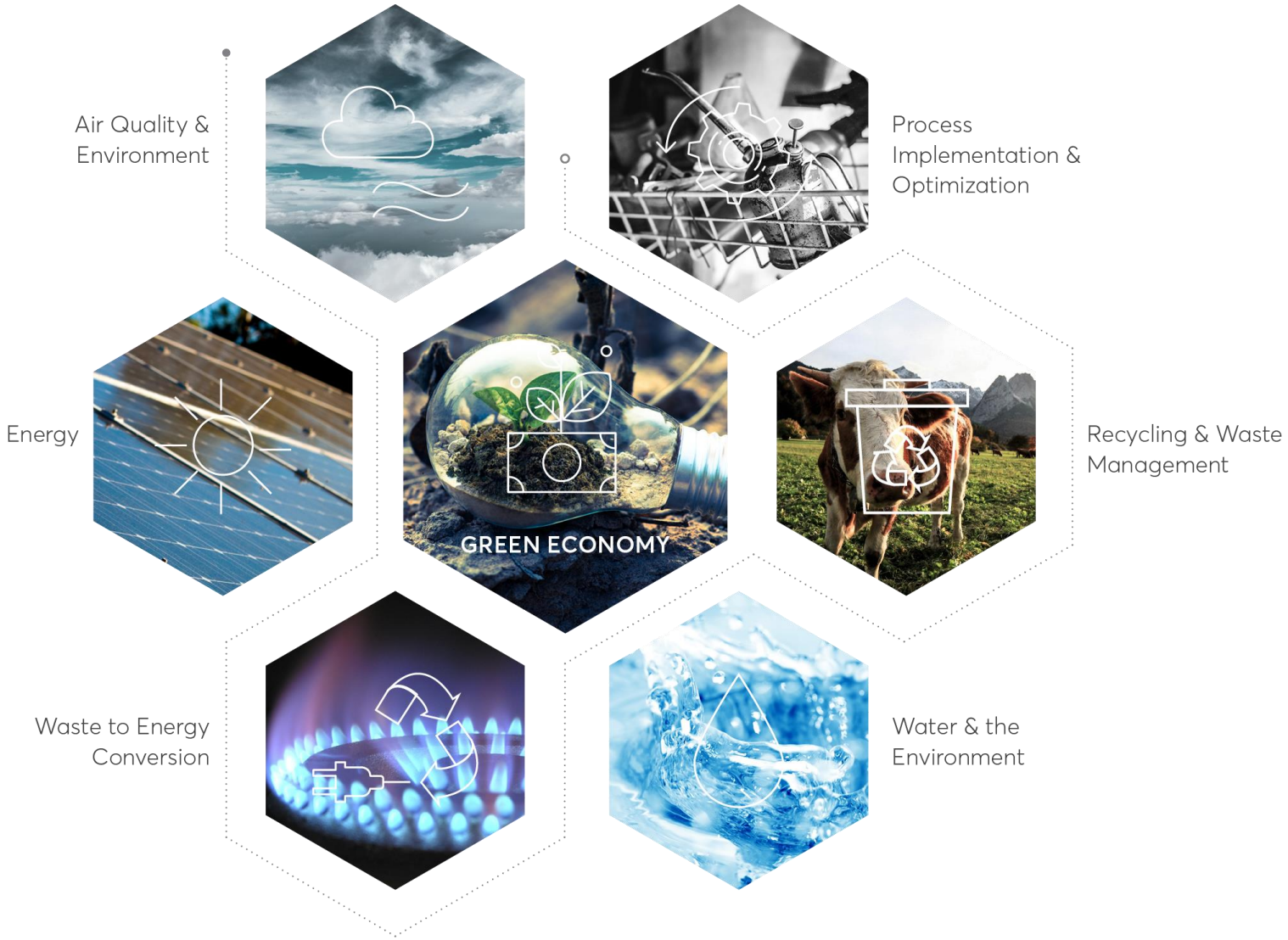
- Water quality and quantity management
- Water filtration, treatment and purification

ENVIRONMENT

- Waste management and optimization
- Air Quality Management
- Environmental efficiency

Products and Services

Support SMEs in the **green economy** by providing **engineering services**



- Test and analysis services relating to
  - Energy auditing
  - Waste characterization and formulation
  - Biofuel laboratory testing and analysis
  - Water quality testing and analysis
  - Air quality auditing and management
- Engineering consultation
- Technology audits and feasibility studies
- Environmental impact assessment
- Applied development, engineering and design services
- Product and process development, improvement and optimisation
- Contracted Research and Development (R&D)
- Prototype development, manufacturing and assembly
- Technology demonstration and training

Case Study: Energy Mix Sekhukhune District Leolo Mountain

- Identified as a presidential nodal point due to its poverty level
- Climate change vulnerability assessment has identified three of the local municipalities to be highly vulnerable
- Has high level of poverty, lack of enough and affordable energy and water services
- Leolo is according to GAP 4 and 6 and also the environment outlook of the province is one of the areas of plant endemism in the province.
- The area is composed of 10 small villages with 704 households, the village lack provision of basic services like water.
- Farming activities are affected

Typical rural cooking and heating energy

Women the most burdened

Piles and piles of wood in homes

Forests depletion

Long distances
to fetch wood

Smoky cooking place

What are Micro-digesters?

- Small-scale anaerobic digestion systems
- This process involves the production of biogas on a small-scale
- The digestion production capacity for small-scale units should be below 80 kW.
- Micro-digesters serve small communities, small farms and make the production of biogas at a reasonable cost.

6 cubic metre bio-digester system

Micro-digester operations

Feedstock:

- 1) Micro-digesters are fed with organic waste on a daily basis.
- 2) Organic waste includes (Cattle dung, pig manure, chicken manure etc)
- 3) Other types of organic waste include (food waste, municipal waste,)
- 4) Sewage and waste water treatment
- 5) Agricultural foods (maize, sugar cane) and wastes
- 6) Biomass is also a type of feed, which used as a supplement

CONTRIBUTION OF BIOGAS TECHNOLOGY TO RURAL AREAS

- *Better and cheaper fuel for cooking, lighting and power generation.
- * Produces good quality enriched manure to improve spoil fertility.
- * Effective and convenient way for sanitary disposal of human excreata, improving the hygienic conditions.
- * generate social benefits -reducing burden on forest, reduction in drudgery of women and children.
- * As a smokeless domestic fuel it reduces the incidence of eye and lung diseases.

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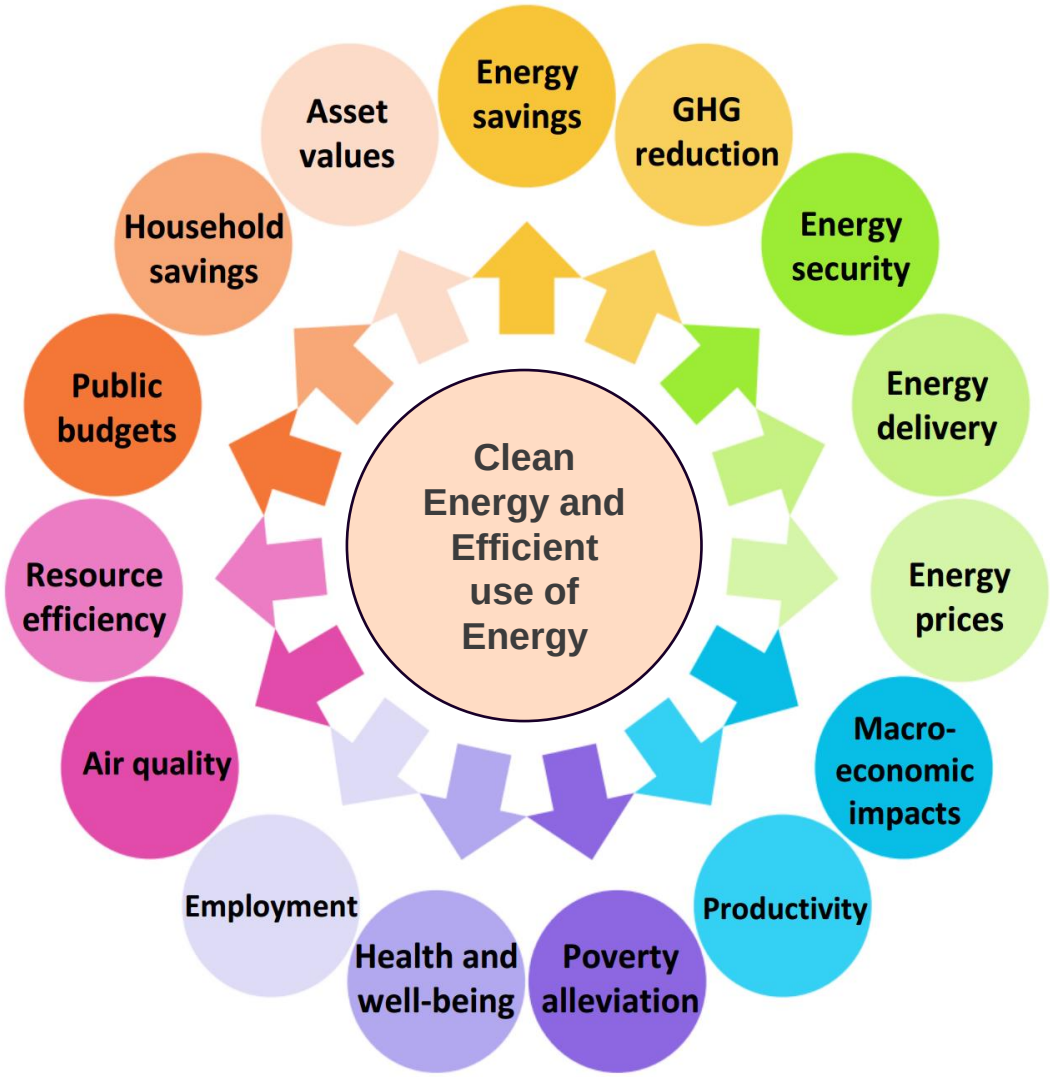
Benefits of the technology



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Local Examples and Experience

Area	Developer	Substrate input	Power output
Alice, Eastern cape	CAE / University of Fort Hare	4000 m^3 of dairy and piggery manure	2X132 kVa electricity generators
Athlone Industria	Alrode brewery Farm Secure Energy, Wastemart, CEA/New Horizon waste to energy	400 t of organic waste per day	Biomethane – 760 m3/hr CO2 – 18 ton/day
Bela-bela Limpopo	CAE Humphries Boerdery piggery		
Belville		Waste water treatment plant	
Bonnievale	FarmSecure Carbon	> 5t bovine manure	
Bredasdorp	IBert	4t abattoir waste per day	
Cavalter	IBert EnviroServ/ Chloorkop LFG Cullinan	20t abattoir waste per day	100 kW 500 Kw 190 kW
Darling Uilenkraal	CAE/Uilenkraal dairy farm	Bovine manure	600 kW
Darling GrootPost	FarmSecure manure	Bovine manure	
Durban	Bisasar road LFG	3500–5000 refuse per day	6 MW
Durban	Marrianhill LFG Ekhurleni LFG	550–850 t per day	1.5 MW
Grabouw	Elgin Fruit and juices Ibhayi brewery	> 5 t of fruit waste per day	500 kW
Jan Kempdorp	iBert Jacobsdale	5.5 t abattoir waste per day	135 kW 150 kW

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Local Examples and Experience

Area	Developer	Substrate input	Power output
Johannesburg	WEC/Northern Wastewater Treatment	Sewage sludge	1.2 MW
Johannesburg	Works		19 MW
Klipheuwel	Robinson Deep	700 t organic waste per day	
Klipheuwel	Reliance Composting	> 5 t of manure per day	600–700 kW
(Zandam)	Farmsecure	Refinery waste water	4.2 MW
Mossel Bay	Biotherm SA, Mossel Bay PetroSA	4500 m^3 of wastewater per day	10% of the plant's
Newlands	SAB Miller		energy demand
Paarl	Drakenstein municipality		14 MW
Pretoria	Bio2watt / Bronkhorst-Spruit Biogas plant	Manure	4.6 MW
	Prospection brewery		
Queenstown	iBert	42 t mixed waste from a piggery per	
Riverdale	iBert	day	100 kW
	Robertson	4 t abattoir waste per day	150 kW
	Rosslyn brewery		
Springs	BiogasSA / Morgan Springs Abattoir	Slaughter waste and organic waste	0.4 MW
Stellenbosch	Veolia water Technologies / Distell	1000 m^3 wastewater per day	
Stellenbosch	Rhodes Food Group	35 kg per day (testing feedstock)	
Franschhoek	Selectra	Sewage, silage, manure	0.5 MW
	Selectra	Sewage, silage, manure	1 MW
	Selectra	Sewage, silage, agricultural waste	1 MW

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Local Examples and Experience – Bio2Watt Bronkohsprit Biogas Project

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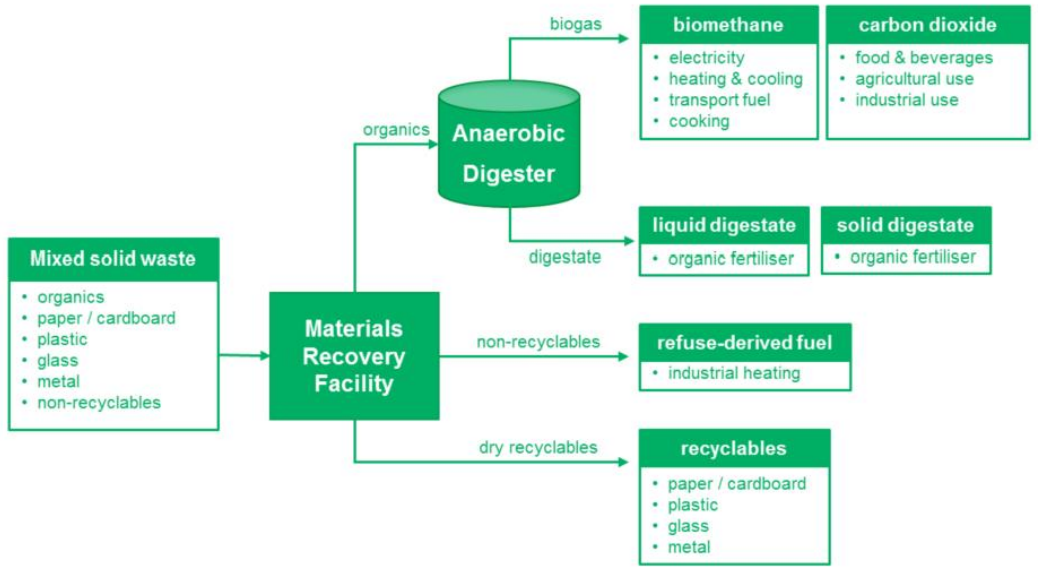
Local Examples and Experience – New Horizon Energy Athlone Biogas Project

Location	Athlone, Cape Town
Project developers	Clean Energy Africa (Pty) Ltd and Waste-Mart Energy (Pty) Ltd
Feedstock	500 – 600 ton/day high organic mixed waste (200 – 300 ton/day organics)
Gas output	1200 Nm^3/hr biogas, separated into approximately 760 Nm^3/h bio-methane and 18 tons per day CO_2 (760 Nm^3/hr CH_4, 740 Nm^3/hr CO_2)
Technical specifications	▪ MRF: manual sorting, magnetic and physical separation, air blowing, an Organic Extruder Press. ▪ 98% methane purity
Sources	Shmulevich & Otterman (2016); Friedman (2017); Otterman (2017)



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Drivers for the uptake of biogas in South Africa

- Economic
  - Waste disposal cost
  - Electricity prices increases
  - Fluctuating fertilizer prices

- Environmental
  - Climate change mitigation
  - Reduced landfill usage
  - Cleaner energy
  - Increased energy security
  - Nutrient rich by-product
  - Potentially lower agricultural carbon footprint

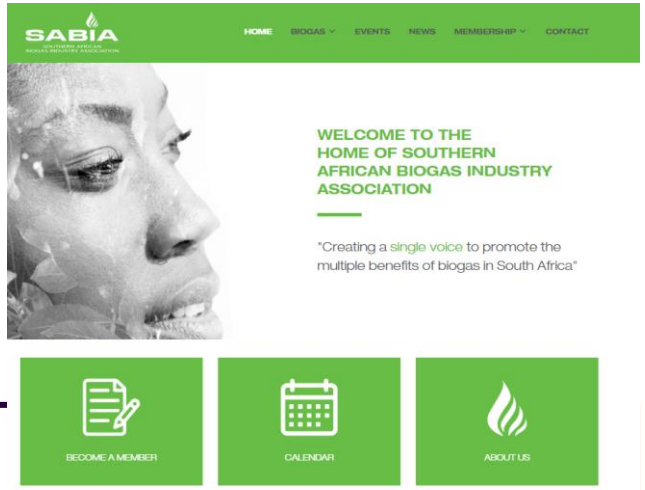
- Social
  - Job creation
  - Investment

- Legislative/Policy
  - Changes in legislation
  - Renewable energy incentives and programmes

Biogas Technology Matrix

Biogas Industry in South Africa

An Assessment of the Skills Need and Estimation of the Job Potential



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Barriers

- Environmental licensing process
- Market for digestate
- Commercial viability of technology very slim when compared to other energy sources
- Infrastructure
- Quality of substrate and location
- Control and competing interest
- Contractual obligation
- Institutional support and social perspective
- Investment readiness
- Legislative and policy
- Local capacity
- Research and data

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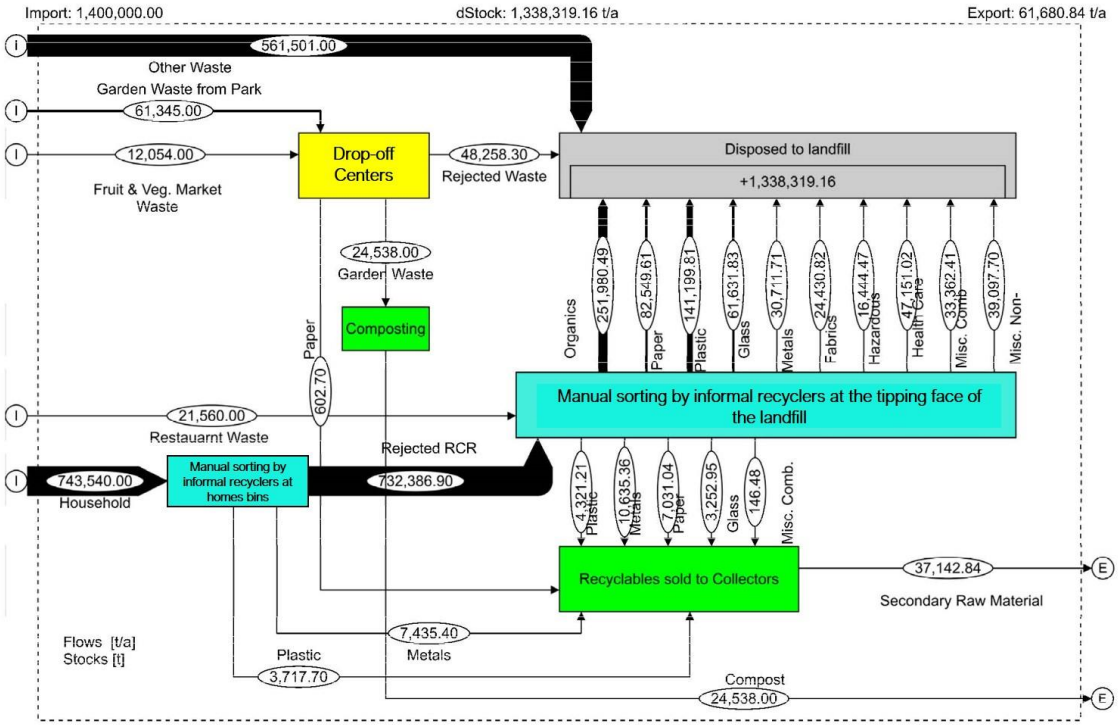
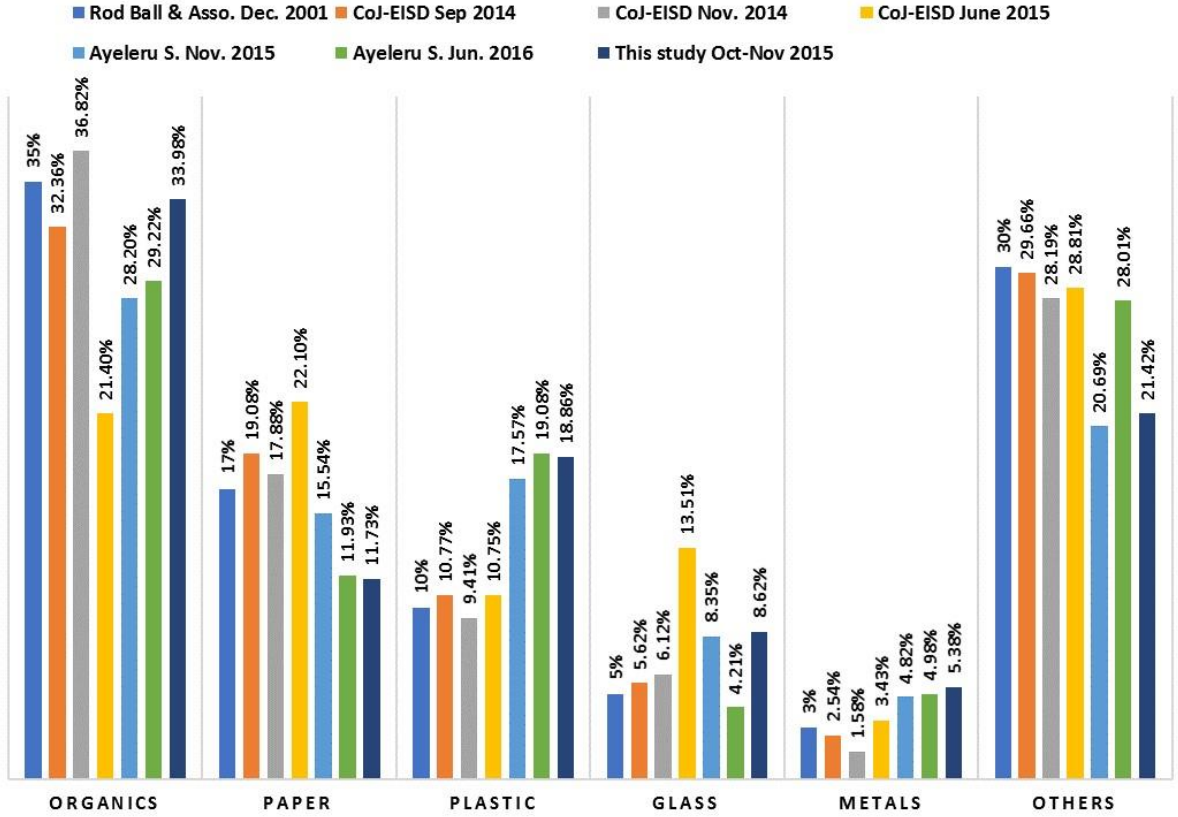
Barriers: Case of the City of Johannesburg





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Barrier: City of Johannesburg Infrastructure Challenge

Indicator	Landfill gas	Fresh produce market	Fruit and veg Interwaste	Pikitup	Food waste Interwaste	Abattoir waste	Abattoir waste Interwaste	Food industry X	WWT sludge	Fats Interwaste
Control and competing interests	Very Poor **	Very Good **	Poor ***	Good ***	Poor ***	Poor *	Poor ***	Poor *	Very Poor ***	Poor ***
Level of support and administrative implications	Satisfactory **	Good ***	Satisfactory **	Satisfactory ***	Satisfactory ***	Very Poor ***	Very Poor ***	Satisfactory *	Good **	Satisfactory *
Planning horizon and clarity of business implications	Very Poor ***	Very Poor ***	Very Poor ***	Very Poor ***	Very Poor ***	Very Poor ***	Very Poor ***	Lack of info	Very Poor ***	Very Poor ***
Public opinion	Lack of info	Lack of info	Lack of info	Lack of info	Lack of info	Satisfactory **	Satisfactory **	Lack of info	Lack of info	Lack of info
Geographical and physical accessibility	Very Good ***	Very Good ***	Good *	Poor ***	Good *	Satisfactory **	Good *	Good *	Good ***	Good *
Suitability for anaerobic digestion	Not applicable	Satisfactory ***	Satisfactory ***	Good *	Good *	Satisfactory **	Satisfactory **	Good *	Good ***	Poor *
Nutrient content	Not applicable	Poor **	Poor **	Satisfactory *	Satisfactory *	Good *	Good *	Lack of info	Satisfactory ***	Very Poor *
Suitability for biofertilizers	Not applicable	Good **	Good **	Poor *	Poor *	Satisfactory *	Satisfactory *	Lack of info	Good ***	Lack of info
Technological feasibility	Poor **	Satisfactory *	Satisfactory *	Satisfactory *	Satisfactory *	Good **	Good **	Satisfactory *	Very Good ***	Good *


Thank YOU

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