Rijkswaterstaat
Ministry of Infrastructure and the Environment

Waste to Energy

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Renewable Energy Market
South Africa

The Hague
June 24th 2013

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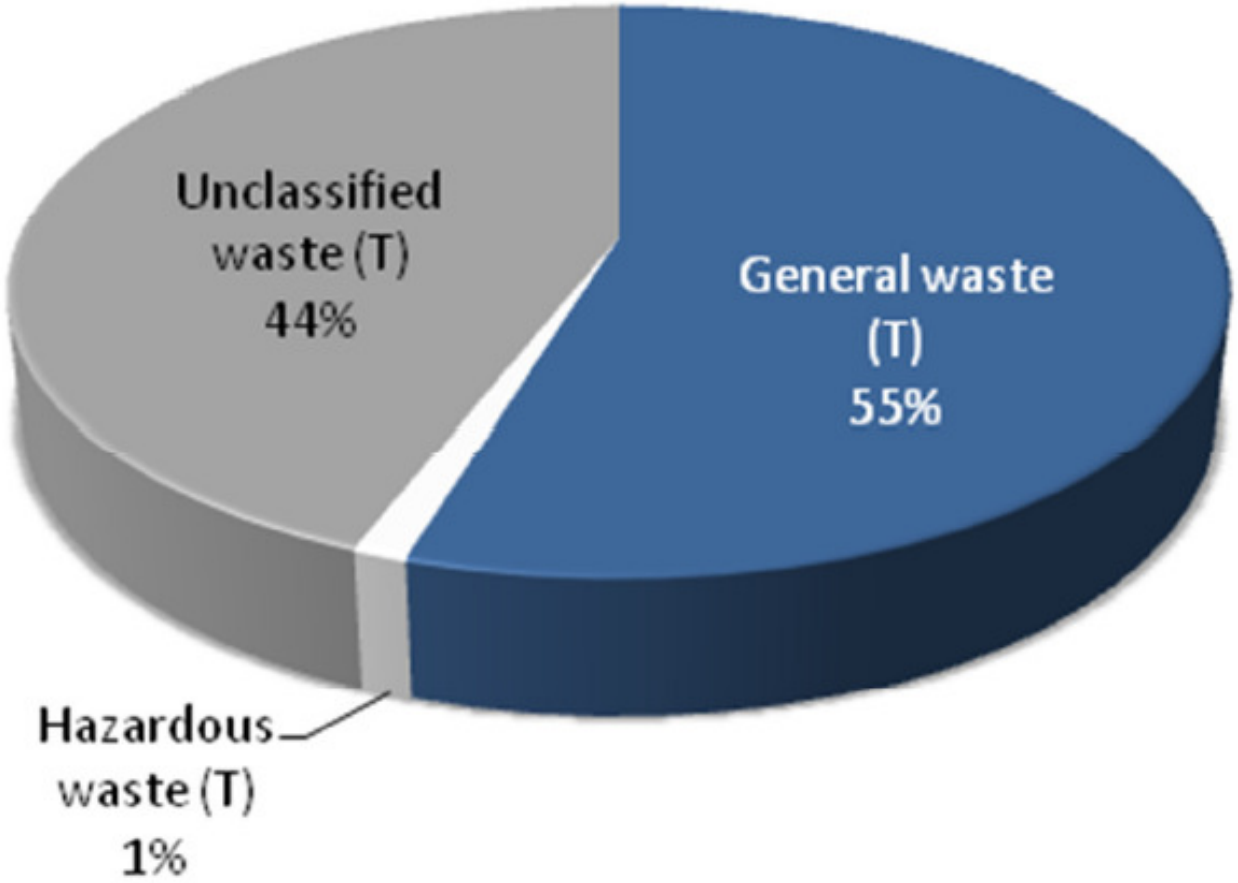
Waste-to-Energy Market Entry Study: South Africa (2013)

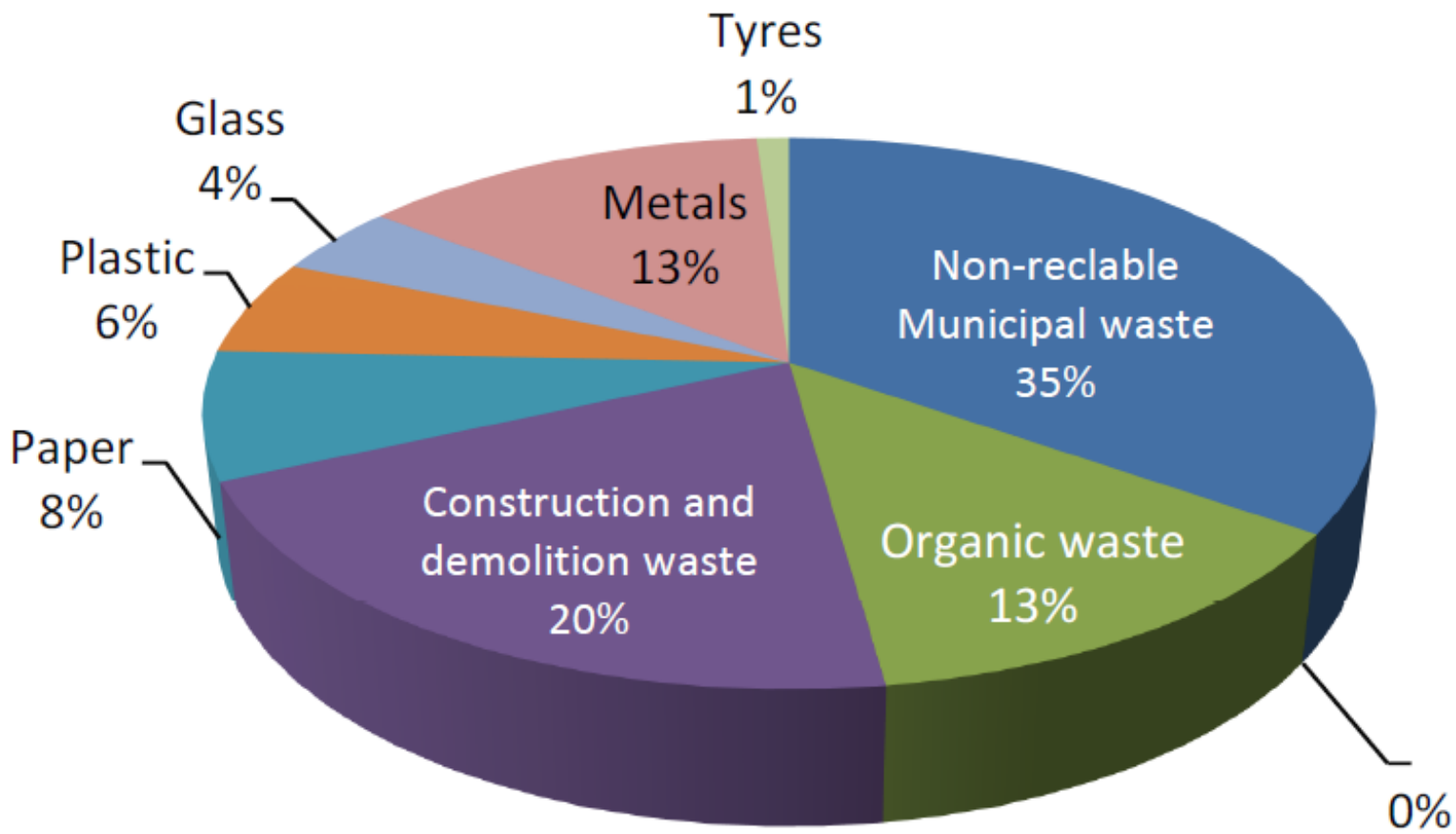
- **Urban-Econ (Pty) Ltd Development Economists**
- **EScience Associates (Pty) Ltd**

Waste generation in South Africa

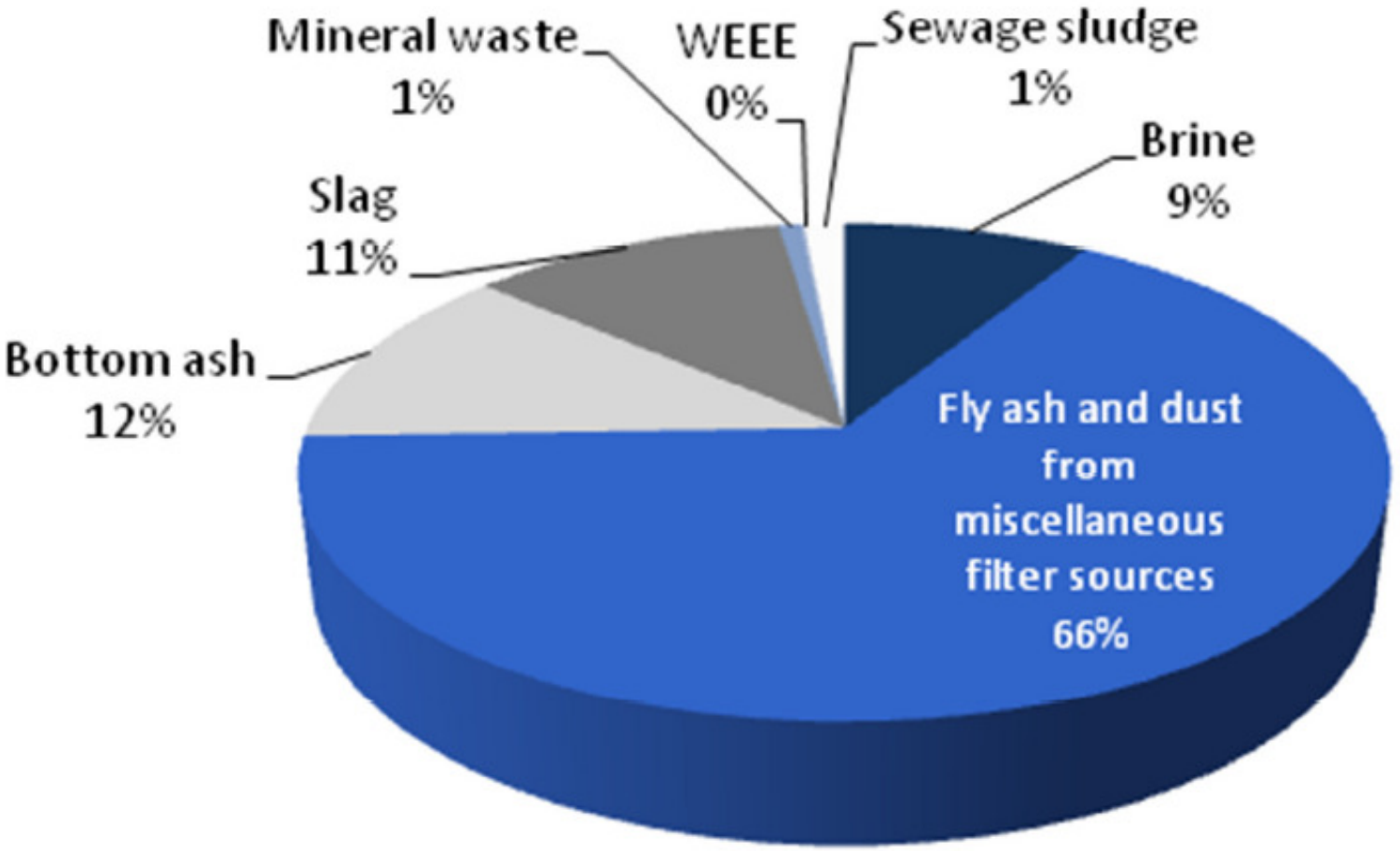
Waste Composition, 2011



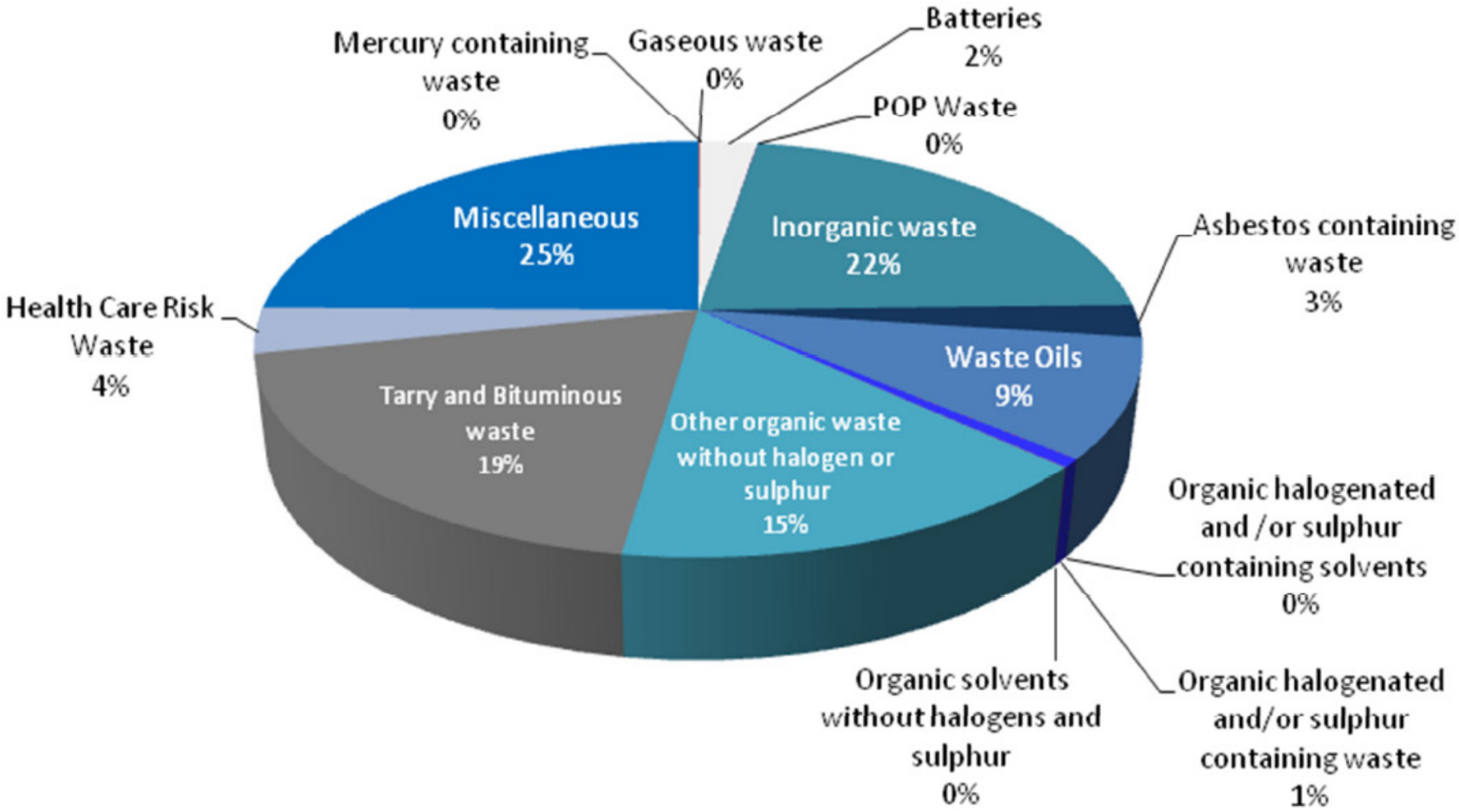
General waste composition, 2011



Unclassified waste, 2011



Hazardous waste, 2011



Landfill life span

Landfill lifespan from 2013 (estimated years)									
Ekurhuleni		Tshwane		Johannesburg		Cape Town		eThekwini	
Platkop	23	Kwaggasrand	0	Robinson deep	15	Coastal Park	6	Bisasar	1.5
Simmer and Jack	4.3	Soshanguve	8	Ennerdale	0	Bellville	0	La Mercy	0
Weltevreden	11	Onderstepoort	1	Marie Louise	0	Visserhoek North	6	Marianhill	5
Rietfontein	7	Hatherley	18	Goudkoppies	4	Visserhoek South	1	Lovu	18
Rooikraal	15	Ga-Rankuwa	8					Buffelsdraai	55
		Bronkhorst-spruit	13						
		Temba	0						
		Garstkloof	0						

Generation and Land filling Quantities of Selected Wastes in SA

Waste Type	Generated (tonnes/annum)	Recycled (tonnes/annum)	Landfilled (tonnes/annum)
Municipal Waste (Non-Recyclable)	8,062,934	0	8,062,934
Commercial and Industrial Waste	4,233,040	359,441	973,599
Organic Waste	3,023,600	1,058,260	1,965,340
Sewage Sludge	637,360	130,160	500,508
Paper	1,734,411	988,614	745,797
Plastic	1,308,637	235,555	1,073,082
Tyres	246,631	9,865	326,766
Other	36,171,127	0	3,6171,127

General Waste Generation and Usage Figures (tonnes)

Waste Stream	Generated	Recycled	Landfilled	Recycled%
Municipal Waste (non-recyclable portion)	8 062 934	-	8 062 934	0
Commercial and Industrial Waste	433 040	359 441	973 599	77
Organic Waste	3 023 600	1 058 260	1 965 340	35
Sewage Sludge	673 360	172 784	500 508	26
Paper	1 734 411	988 614	745 797	57
Plastic	1 308 637	235 555	1 073 082	18
Tyres	246 631	9 865	236 766	4

FOUR KEY FEATURES OF A BANKABLE RENEWABLE ENERGY PROJECT:

- Proven technology.
- Reliable fuel supply.
- Revenue certainty.
- Grid connection on reasonable terms.

Economics of waste management

Landfill Gate Fees (Rand/ton)					
	Ekurhuleni	Tshwane	Johannesburg	Cape Town	eThekwini
General waste	R 118.75	R 121.00	R 141.72	R 333.20	R 228.00
Garden refuse	R 61.34	R 0.00	R 151.82	R 0.00	R 71.60

WtE in SA

IN SUMMARY:

- The primary method of waste disposal of municipal as well as commercial and industrial waste in SA is landfilling. Increasingly commercial and industrial wastes are being recovered. The extent to which this is taking place however, is not certain as the reporting of waste handled, transported, recycled and/or recovered is not currently legislated.
- At present incineration is applied in specific industries for the destruction of hazardous waste but not always directly linked to WtE. This happens either through mass burn incineration or through refuses derived fuel projects.
- Less than 10% of South African municipalities generate electricity from landfill gas WtE processes, and only the larger metro municipalities that realise economies of scale have so far implemented WtE projects. These include Johannesburg, Tshwane, eThekwini and Ekurhuleni that have projects in various stages of planning, construction and implementation.
- SA thermal WtE is still in its infancy stage and the majority of projects are undertaken by a few private companies with a number of local authorities having undertaken pre-feasibility studies to investigate the potential for WtE projects through PPP projects.
- Biological WtE technology in SA is currently limited to the extraction of methane gas from landfills, agricultural waste and water treatment facilities.

TECHNOLOGY	EXAMPLES	CURRENT APPLICATION IN SA
CURRENT TECHNOLOGICAL LANDSCAPE		
Cement Kiln Co-Combustion	Cement kilns using old tires as an alternative fuel source.	Some kilns have been converted to take advantage of this technology.
Fluidised bed Co-Combustion	Co-combustion of site specific process wastes.	Two paper companies currently operate fluidised bed boilers where paper recycling sludge and waste bark are disposed off and energy is captured. The best known example is the atmospheric fluidised bed boiler at Mondi Merebank. Another project concerns the conversion of the Sappi Tugela Pulp and a Paper Mill from a coal fired boiler to a biomass and coal co-fired boiler.
Landfill Gas Utilisation	Methane of gasses from landfills are captured and combusted to generate electricity.	Landfill gas from the Bisasar Road and Marianhill landfill sites in KwaZulu Natal (KZN). In Johannesburg a project was completed in 2011 that produced 11MW of energy from five landfill sites. Ekurhuleni has installed landfill gas capture systems at Simmer and Jack, Weltevreden, Rietfontein and Rooikraal landfill sites that are currently only used for the flaring of methane gas. However the municipality is in the process of operating pilot projects to test the feasibility of electricity generation.
Bio-Digestion	Sewage sludge, small-scale farm wastes, digested to combustible gas.	Some small-scale off grid applications used on farms as well demonstration plants.
Bagasse Boilers (sugar industry waste)	Bagasse cogeneration of steam and electricity.	In general, sugar mills in SA use the bagasse they produce as a fuel source to operate boilers. A number of sugar producers including Tongaat Hulett, TSB and Ilovo have bagasse energy recovery projects planned.

NEAR FUTURE IMPLEMENTATION

Fluidised Bed Boilers	Refuse or processed municipal WtE via combustion.	Used by paper industries for on-site wastes. Other industries, including the agro-processing and cement sectors are becoming increasingly aware of its benefits for on-site waste management.
Mass Burn Incinerators	Municipal WtE via combustion.	Feasibility studies done, interest shown by private investment companies and municipalities alike (Blue IQ undertook a feasibility study on mass burn in the Gauteng province).
Plasma-Gasification	Beautifuels, research done by the South African Nuclear Energy Corporation (NECSA).	Laboratory research performed, pilot-scale required. Afro Energy has shown interest in implementing larger sites.
Pyrolysis	Pyrolysis of plant wastes from the Working for Water Programme.	Interest shown by various municipalities where high intensity deforestation of invasive species are or will be done e.g. the Western Cape and KZN.

SWOT of WTE market in SA

STRENGTHS	WEAKNESSES/ THREATS	OPPORTUNITIES
• Significant quantities of landfilled waste and untapped waste resources. • Access to relatively advanced banking and financial institutions. • A developing regulatory and legislative system. • Declining air space of landfill sites in the metropolitan municipal areas. • Shortages in electricity supply. • Greenhouse gas reduction initiatives. • Policy including the National Waste Management Strategy (NWMS) and the Department of Energy (DoE) Independent Power Producer (IPP) programmes that allocated 25MW to electricity to be derived from landfill gas and 12.5MW to be derived from biomass.[1]	• Bureaucratic challenges when dealing with national, provincial and local government. • Opposition from environmental and citizen groups that can lead to delays in issuing of environmental authorisations and licences. • WtE systems require large investments.	• Supply of waste concentrated mainly in the larger municipalities (Cape Town, Pretoria, Johannesburg, etc.) • Increasing cost of coal and electricity creating a demand for alternative energy sources. • Households and light commercial waste equal to more than 5 million tonnes per annum (2012). • Small-scale out-of-the-box WtE solutions implemented on farms/ remote areas or in the forestry and mining industries.

CHALLENGE	OPPORTUNITY FOR THE DUTCH SECTOR
TECHNOLOGY CHALLENGES	
• Lack of versatility: many WtE technologies are designed to handle only one or a few types of waste. • Waste-gas clean-up: the gas generated by processes like pyrolysis and thermal gasification must be cleaned of tars and particulates in order to produce clean, efficient fuel gas. • Conversion efficiency: some WtE pilot plants, particularly those using energy-intensive techniques like plasma, have functioned with low efficiency or actually consumed more energy than they were able to produce.	• Introduce a versatile WtE solution for SA. • The Dutch sector could possibly introduce a technology to SA which will process waste-gas which does not produce tars and particulates. • Dutch companies could bring tested technologies which will allow for efficient production of energy from waste.
STRATEGIC CHALLENGES	
• Regulatory hurdles: the regulatory climate for WtE technologies can be complex. Firstly there are regulations that may prohibit a particular method of WtE. The electrical grid is also still protected by yet more regulations, presenting obstacles to waste-energy producers. • High capital costs for large scale applications due to unavailable know-how. • Complex PPP: arrangements required to secure long term agreement to source waste stream. • Delays in issuing of Environmental authorisations and licenses: due to pressure from environmental groupings opposing incineration. • Zoning and land ownership issues: relating to PPP arrangements. • Procurement Processes: within municipalities.	• Dutch companies may provide cheaper options due to the fact that the WtE industry in the Netherlands is further advanced.
GENERAL CHALLENGES	
• Opposition from environmental and citizen groups, because traditional incineration-based WtE technologies can produce significant pollution from the burning of waste, environmental and citizen groups have often opposed such systems. • Securing long-term power purchase agreements with municipalities. • Landfill disposal is still the cheapest and easiest option but not the most sustainable.	• Dutch companies could introduce their WtE clean technologies. Public relations will be required to raise awareness about advanced technologies.

Conclusion

The WtE market is still in its infancy stage in SA due to low landfill costs and high capital investment required for WtE plants. Opportunities exist for Dutch businesses that offer advanced clean technologies that correspond well with the SA context. Differentiation needs to be made between public and private sector WtE projects as waste types, technologies, project structuring and drivers to implement WtE differs.

PPPs are important in developing WtE projects that involve municipal waste typically collected by local authorities. SA has advanced environmental legislation that governs WtE both in terms of waste management requirements as well as air emissions requirements. WtE initiatives, however, still face challenges such as public opposition due to a fairly strong anti-incineration lobby. The Netherlands is a world leader in WtE technologies, with experience and know-how in offering environmentally friendly and clean WtE solutions.

Anaerobic digestion of waste materials and other biomass streams are becoming more conventional in the SA market. Thermal treatment coupled to energy recovery is currently dominated by private sector initiatives that generate suitable volumes of waste. As landfill space continues to decline, land suitable for development of landfills are increasingly sought after by other economic activities, an increased shift towards recycling and thermal treatment is clear. WtE is an ideal solution to generate energy from the waste currently in landfills, and the Dutch companies with their relevant experience and know-how should partner with relevant SA companies to implement WtE in large South African municipalities.

Thank you for listening!

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