



UNIVERSITY OF<sup>TM</sup>  
**KWAZULU-NATAL**

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# THE ADVANCEMENT OF THE WROSE MODEL TO INCLUDE SOCIO-ECONOMIC AND INSTITUTIONAL INDICATORS

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EDGEWOOD CAMPUS



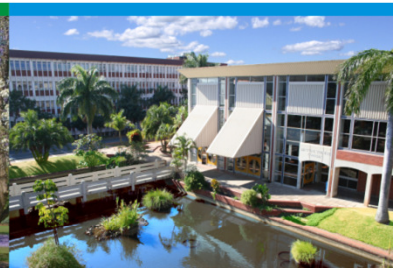
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INSPIRING GREATNESS

# Acknowledgements

- NRF
- SARCHI Waste and Climate Change
- eThekweni Municipality
- DSW



# Outline





Waste management in an emerging economy is a complex socio-technical challenge...



Namaste SA



# Waste Management Challenges in South Africa



- Challenge of meeting high standards in service delivery with limited resources
- Lack of capacity for environmental control systems
- Limited know-how, indiscriminate dumping
- Lack of reliable data on waste streams and GHG emissions indicators
- Poor environmental and waste awareness of the general public

# What is the W.R.O.S.E model?

- ❑ **W.R.O.S.E. = Waste & Resource Optimisation Scenario Evaluation model**
- ❑ Is a **Zero Waste** decision support tool
- ❑ WM Strategies: landfill, landfill gas recovery, recycling, AD and aerobic composting
- ❑ Phase 1 evaluated GHG emissions reductions from applying waste diversion strategies
- ❑ Phase 1 Microsoft Excel Spreadsheet Interface



# The Waste Resource Optimization and Scenario Evaluation Model (WROSE)

- Developed by **UKZN** to assist South African municipalities and the private sector in achieving the zero waste targets
- WROSE was initially developed with 5 scenarios selected as most relevant/appropriate to waste management in the **developing country context**.

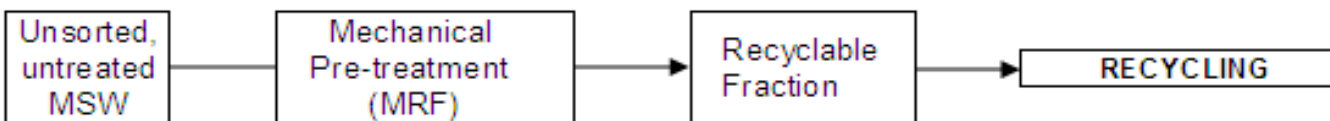
### SCENARIO ONE



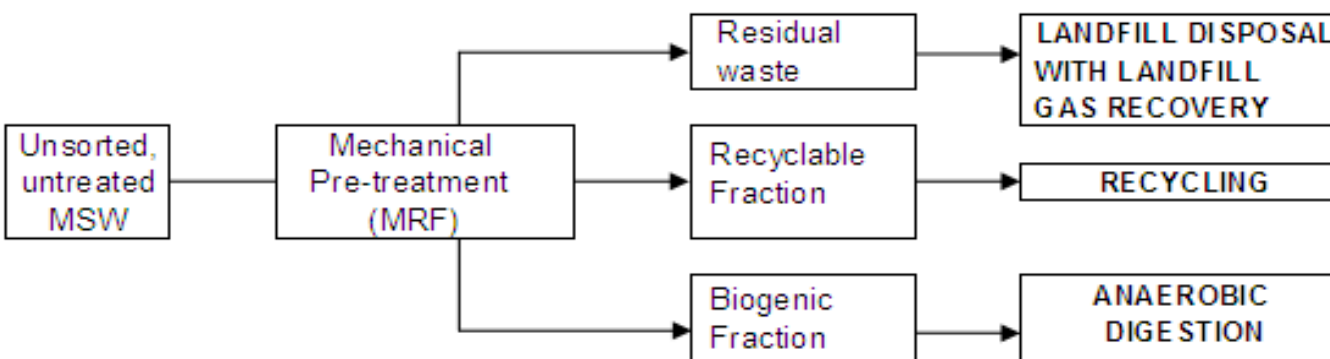
### SCENARIO TWO



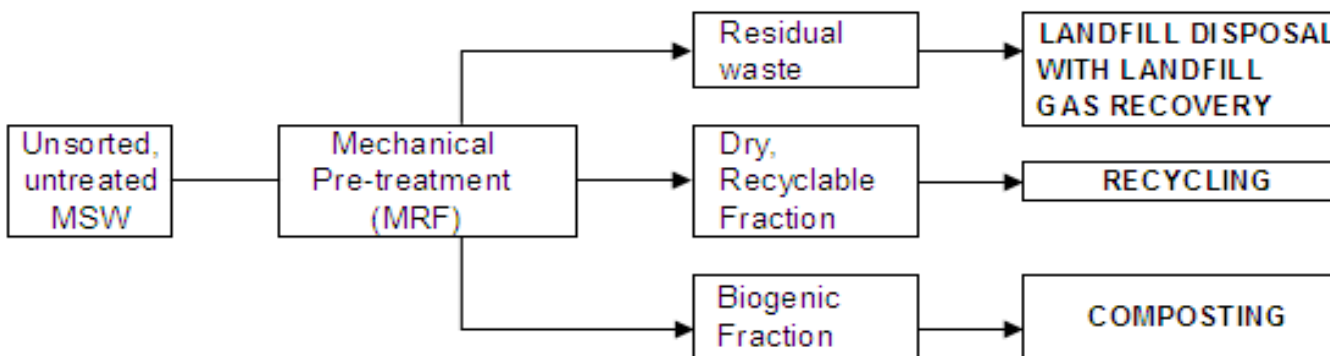
### SCENARIO THREE



### SCENARIO FOUR

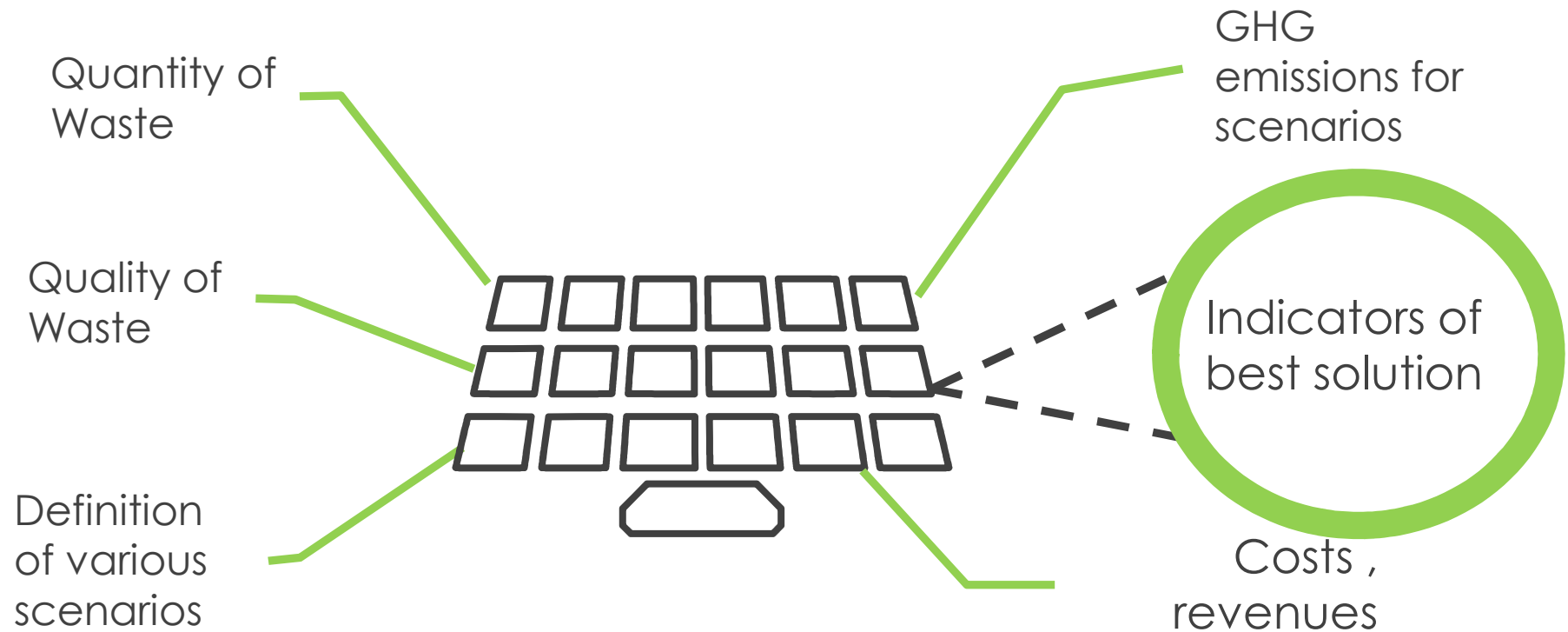


### SCENARIO FIVE





# WROSE Model



## WROSE Cont.

- Each technology and scenario in WROSE aims to aid the municipality in determining a **final decision**
- WROSE outcomes are case specific – strategies and **scenarios can be tailored** to suite individual municipal needs

# WROSE Model Phase 1 Outputs:

Microsoft Excel - wrose

File Edit View Insert Format Tools Data Window Help Adobe PDF

H14 fx

	A	B	C	D	E	F
1	<b>WASTE &amp; RESOURCE OPTIMISATION STRATEGY EVALUATION MODEL</b>					
2	<b>W.R.O.S.E</b>					
3	<b>WASTE MATERIAL OR</b>	<b>Quantity of Waste Disposed/treated/diverted by (tons):</b>				
4	<b>WASTE FRACTION</b>	<b>LANDFILL</b>	<b>LANDFILL</b>	<b>RECYCLING</b>	<b>ANAEROBIC</b>	<b>AEROBIC</b>
5		<b>DISPOSAL</b>	<b>GAS REC</b>		<b>DIGESTION</b>	<b>COMPOSTING</b>
6	Newspaper	5453				
7	General mixed paper (CMW)	7234				
8	Scrap Boxes & Cardboard (K4)	11402				
9	Low density polyethylene (LDPE)	2450				
10	High density polyethylene (HDPE)	1401				
11	Polyethylene-terephthalate (PET)	2037				
12	Polypropylene (PP)	1613				
13	Polyvinyl Chloride (PVC)	8				
14	Polystyrene (PS)	1101				
15	Glass	6861				
16	Steel Cans/Tins	4245				
17	Aluminium Cans	547				
18	Biogenic Food Waste	36608				
19	Garden Refuse: Green	637				
20	Garden Refuse: Wood	46				
21	Other	32287				
22	<b>Total Waste Diverted/Disposed</b>	<b>113930</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

User enters waste fraction quantities to be diverted or disposed of by each strategy.

## Outputs :

GHG  
Emission  
Reduction  
Potential

Landfill  
Space  
saving  
potential

Economic  
Feasibility

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## Need for advancement of WROSE

- The WROSE model has been tested on various case study municipalities within South Africa

The outcome: **Capital and operational costs** are too high for waste management activities with highest GHG emission reduction potential for South African Municipalities

Need for advancement (Phase 2): The **inclusion of socio-economic and institutional indicators** will allow for all 4 pillars of sustainability to be considered in the decision making process.



# Inclusion of Social Indicators

- **Literature review** was conducted to identify key indicators
- A **multi criteria analysis** technique was employed for the assessment of social indicators.
- An **indicator evaluation matrix** was developed to validate the indicators identified.
- Based on the outcome of the process above **3 key indicators** were selected (job creation, health risks and public participation )

<b>WASTE RESOURCE OPTIMIZATION AND SCENARIO EVALUATION MODEL : SOCIO - ECONOMIC INDICATORS</b>						
	<b>WASTE QUANTITY (tons per day ) /MW OF ELECTRICITY</b>	<b>NO. OF JOBS</b>	<b>DIRECT HEALTH RISKS</b>	<b>INDIRECT HEALTH RISKS</b>	<b>PUBLIC PARTICIPATION IN WASTE MANAGEMENT PROCESS</b>	<b>PUBLIC PARTICIPATION IN EIA PROCESS</b>
<b>SCENARIO 1: LANDFILLING</b>	<b>0</b>	<b>0.0</b>	<b>Respiratory Issues, , Fatigue, Headaches, Influenza type Symptoms</b>	<b>Cancer, Low Birth Weight, Birth Defects</b>	<b>No public participation necessary</b>	<b>Public participation process required</b>
<b>SCENARIO 2: LANDFILL WITH GAS RECOVERY /ELEC GEN</b>	<b>0</b>	<b>0</b>	<b>Wheezing, nausea, headaches</b>	<b>Asthma, respiratory issues</b>	<b>No public participation necessary</b>	<b>Public participation process required</b>
<b>SCENARIO 3: RECYCLING</b>	<b>0</b>	<b>0.0</b>	<b>Respiratory issues, influenza type symptoms, nausea, headache, tiredness</b>	<b>Asthma, respiratory issues</b>	<b>No public participation necessary due to separation at MRF</b>	<b>Public participation process required</b>
<b>SCENARIO 4: ANAEROBIC DIGESTION</b>	<b>0</b>	<b>0</b>	<b>Tiredness, headache, nausea</b>	<b>N/A</b>	<b>No public participation necessary due to separation at MRF</b>	<b>Public participation process required</b>
<b>SCENARIO 5: ANAEROBIC COMPOSTING</b>	<b>0</b>	<b>0</b>	<b>Fungal spores and bacteria causing Breathing problems, nausea</b>	<b>Fatigue and headaches</b>	<b>No public participation necessary due to separation at MRF</b>	<b>Public participation process required</b>

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# Institutional Indicator Evaluation

- An assessment of applicable **legislation and regulation** per scenario was carried out
- An assessment of **license requirements, costs and time frames** per technology was conducted
- Organized into **3 main categories**: Environmental, energy, financial and administrative legislation
- Input into the WROSE model

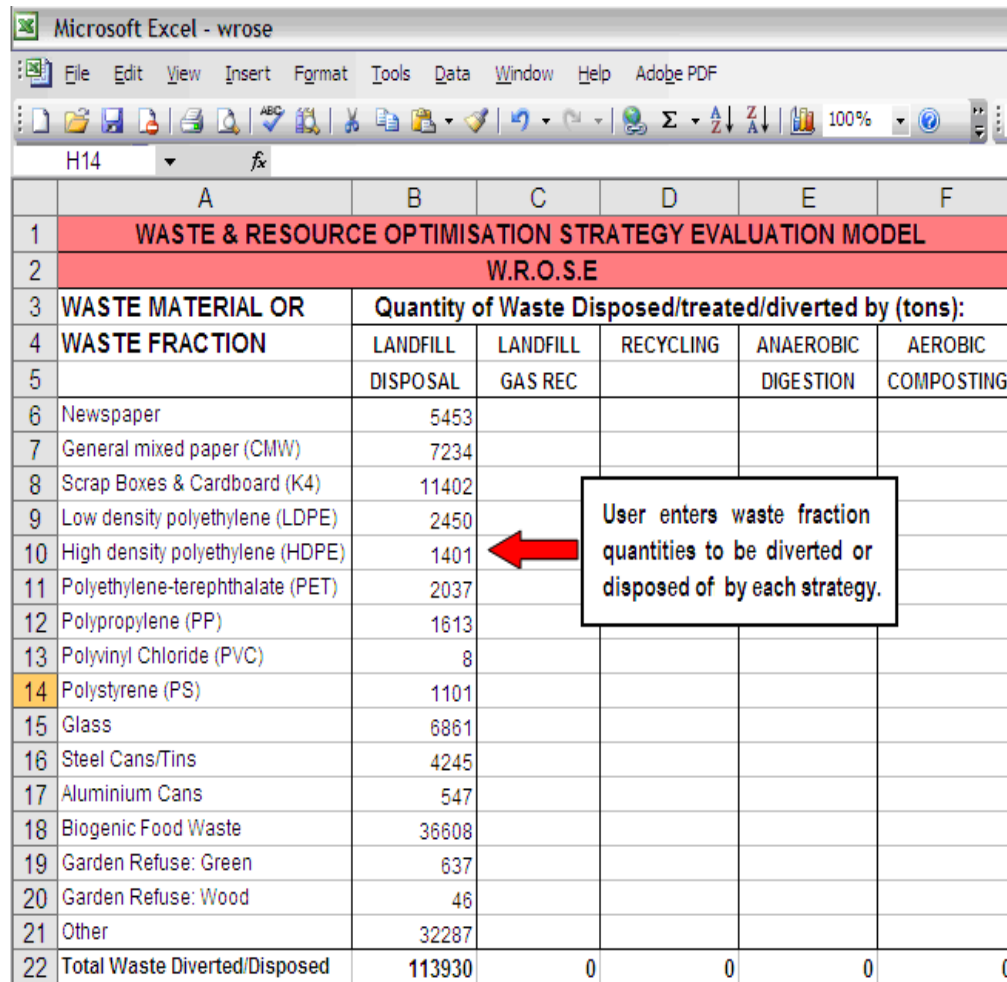
## Institutional Indicators

SCENARIOS	WASTE STREAMS	ENVIRONMENTAL LEGISLATION	ENERGY LEGISLATION	FINANCIAL & ADMINISTRATIVE REGULATION	LICENCE REQUIRED
<b>SCENARIO 1: DISPOSAL OF UNSORTED UNTREATED MSW TO LANDFILL</b>	<b>General MSW</b>	The Constitution	N/A	Occupational Health and Safety Act 1993	
		The Environmental Conservation Act	N/A	Municipal Systems Act 2000	
		National Environmental Management Act	N/A	Municipal Structures Act	
		National Environmental Management Waste Act	N/A	Municipal Finance Management Act	Atmospheric Emissions Licence
		National Environmental Management: Air Quality Act	N/A	Supply Chain Management	Waste Licence ( For Storage, Treatment, Disposal and Processing of waste)
		Atmospheric Pollution Prevention Act	N/A	Asset Management	
		National Integrated Coastal Management Act	N/A	Generally Recognised Accounting Practices 17 & 19	



# WROSE Model Phase 2 Outputs

## Outputs :



WASTE & RESOURCE OPTIMISATION STRATEGY EVALUATION MODEL					
W.R.O.S.E					
WASTE MATERIAL OR WASTE FRACTION	Quantity of Waste Disposed/treated/diverted by (tons):				
	LANDFILL DISPOSAL	LANDFILL GAS REC	RECYCLING	ANAEROBIC DIGESTION	AEROBIC COMPOSTING
Newspaper	5453				
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GHG  
Emission  
Reduction  
Potential

Landfill Space  
saving potential

Economic  
Feasibility

Job creation  
Potential

Health  
Risks

Institutional  
Implications

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# Application of WROSE Phase 1

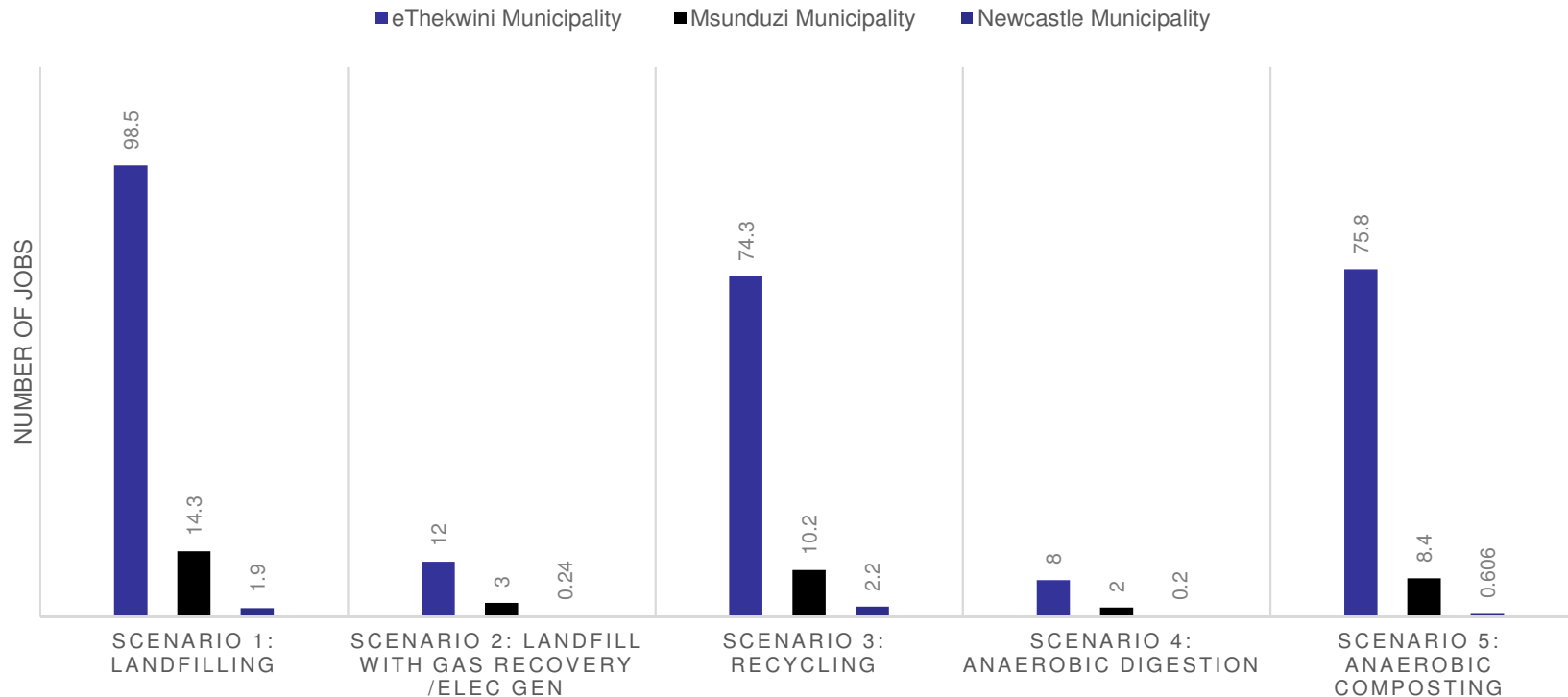
- 3 Case study municipalities selected for the testing of the model
- The outcome of the scenario analysis conducted for all three case studies produced different results than that of the outcome of phase 1 of the WROSE scenario analysis.
- The initial outcome of the scenario analysis determined that scenario 4 (the use of AD, recycling and LFGTE) has the potential for highest GHG emissions reduction.
- Scenario 4, however results in high capital and operational expenditure, therefore is not economically viable for the municipalities in question.

## Results: Application of phase 2

- The impacts of **scenario 1 (Landfilling)** on health was the **highest** both directly and indirectly. **Scenario 4** (the use of AD) has the **least** direct impact on health and the no indirect impacts.
- **All 5 scenarios** trigger **various institutional indicators** and will require specific licence requirements and rigorous EIA processes which need to be considered in the project planning phase.

# Results: Application of phase 2

## JOB CREATION POTENTIAL COMPARISON



Scenarios 1 (Landfilling), 3 (Recycling) and 5 (Composting) are most preferable in terms of job creation potential as these scenarios are more labour intensive than scenarios 2 and 4

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# Conclusion

- With the application of all four sustainability indicators, **scenario 5 (MPT, recycling and composting)** emerged as the most suitable in terms of best **environmental benefits, lower costs, higher job creation potential and minimal health risks and institutional red tape.**
- Application of comprehensive indicators on case study municipalities will assist in decision making which have highest **environmental** benefits, lower **costs**, higher **job creation** potential, minimal **health risks** and **institutional red tape**

# Way Forward

- To assess the potential for the development of **social license (to ensure social inclusion and awareness)** for alternative waste management strategies
- To utilize WROSE to promote integrated waste management as a climate change **stabilization mechanism** for South Africa
- Refine the model through the **application of various case studies at national level**
- Continuous updating for the insurance of **relevance and validity** of indicators

# THANK YOU

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