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Waste characterisation, determining the energy potential of waste

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WtE should consider

Fitness for purpose

- Feedstock requirements compared to expected feedstock quality
- Mass and energy balance
- Scale of operation per unit

Operational expectations

- Reliability of operation assessment (expected availability)
- Maintenance requirements

Municipal solid waste

Why characterisation?

- Technologies address discrete segments of the waste stream
- Decision support - best management option for different materials/waste streams
- “Material flows” modelling
- Planning - recycling and composting programmes
- Sizing of facilities – WtE based on the residual waste
- Estimating costs - transport and separation costs

Why local studies?

- Provide baseline data to measure progress towards local goals i.e. waste diversion targets
- Project material flows in and out of the municipality
- Plan for local MSW infrastructure – size and location
- Seasonal variability in composition and generation rates
- Differences in urban, suburban and rural areas
- Extrapolations from other studies could result in costly mistakes
  - Equipment choices
  - Sizing of facilities

Elements of waste characterisation study

- Representative sampling – catering for variability across the City
- Four seasons – at least one full week per season
- Accurate sorting into multiple waste categories
- Waste quantities by generation source
- Estimation of the heat value if WtE is considered
- Survey of businesses, haulers and brokers to quantify commercial recycling activities and disposal practices

Changes in waste over time

- Changes in population
  - Birth rates
  - Death rates
  - Migration
- Changes in per capita generation
  - Socio-economic status
  - Degree of urbanisation
  - Household size
- Recycling, composting and source reduction initiatives.

Cost of WCS

- You get what you pay for
  - Quick and dirty
  - Comprehensive
- Comprehensive studies are expensive (UNEP, 2015)
  - Good coverage
  - Detailed characterisation
  - Statistical analysis of results
- WtE requires multimillion Rand's worth of investments
- High risk associated with poor/uninformed decision making

Energy potential of MSW

- Depend on the composition of the waste stream
- Self-sustained combustibility of the waste
- Ash content
- Moisture content
  - Varies by location
  - Varies by season
  - Due to rainfall
  - Causes a directly proportional change in real calorific value

WtE Technologies for MSW

- Anaerobic digestion
- Landfill gas recovery
- Solid waste incinerators
- Gasification
- Pyrolysis

Non-burn technologies

WtE technologies – Electricity production

Technology	Electricity production range kWhr/tonne
Conventional incineration (older)	500-600
Conventional incineration (newer)	750-850
Gasification	400-800
Plasma Arc Gasification	300-600
Pyrolysis	500-800

MSW as energy source

- MSW is an inhomogeneous fuel with varying calorific value
- Incineration is only viable at lower calorific value above 7MJ/wet kg
- Electricity production range of MSW

  300 to 850 kWhr/tonne

- Electricity production potential range of low grade coal

  1 467 to 4 444 kWhr/tonne

Conclusions

- WtE requires huge capital investments
- Decisions on technologies must be based on sound evidence
- Technologies are often waste stream specific
- Waste characterisation studies provide evidence
- Comprehensive studies are costly
- Spending money upfront will save money in long run
- Calorific value of MSW is low compared to coal
- WtE is a by-product of integrated waste management not the driver

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Thank You

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