DELEVLOPING & EXECUTING A PLAN FOR DETERMINING THE VIABILITY OF A WASTE-TO-ENERGY PLANT

IWMSA

25 NOVEMBER 2015

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OUTLINE OF PRESENTATION

Looks at the complete package of assessing the viability of establishing a WtE plant

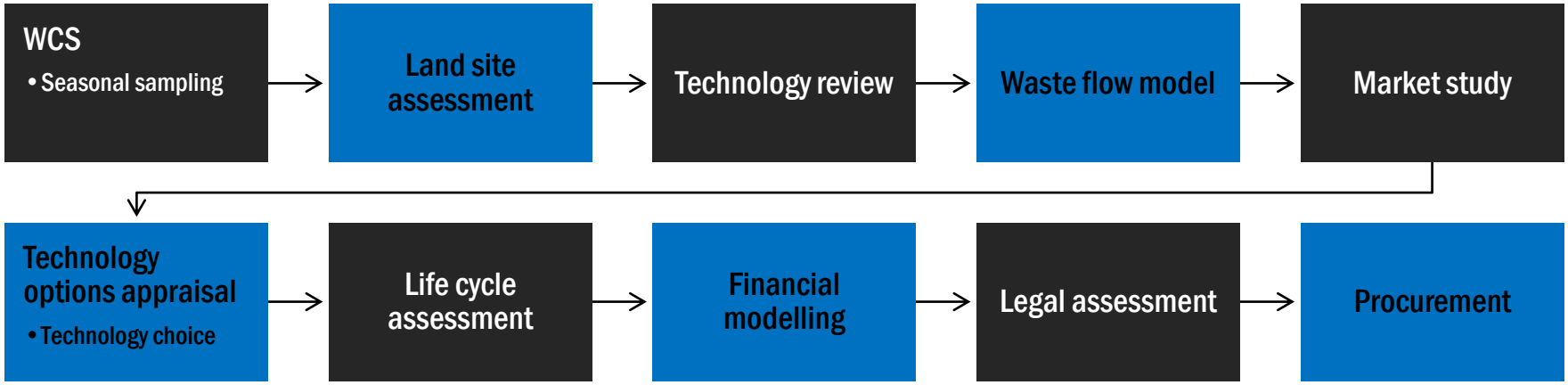
1. Terms
2. Structured approach
3. Waste hierarchy
4. Influencing factors
5. Volumes and composition
6. Project structure
7. Considerations
8. Waste composition
9. Waste generation growth
10. WCS
11. Site assessment
12. WFM
13. AWTT options
14. LCA
15. Market assessment
16. Return on investment
17. Risks

TERMS

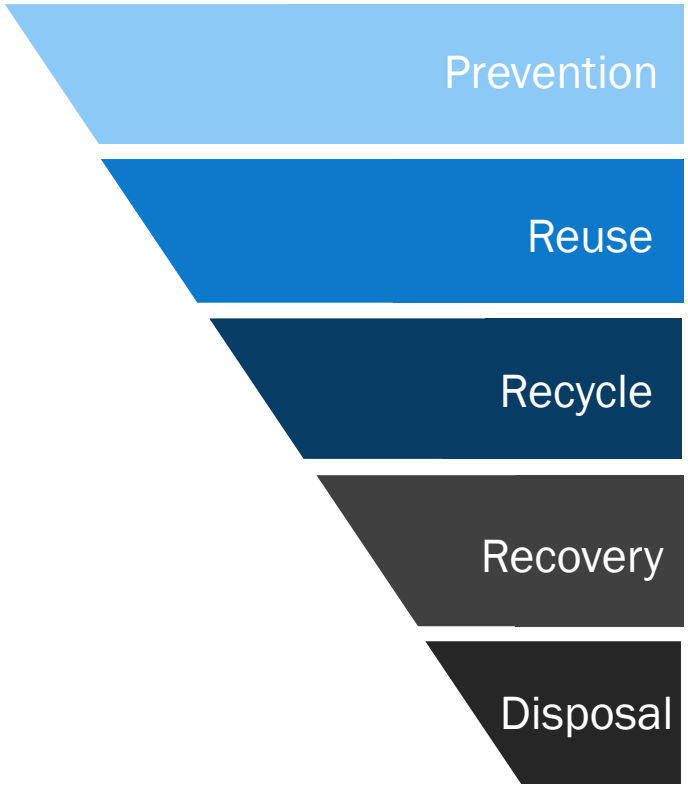
WtE	Waste-to-Energy
1 ton waste	500-600kWh
Heating	1000kWh/ton *kWh is a measure of energy, whilst kW is a measure of power…*
1kwh	3,6MJ
1kwh	1kg coal

STRUCTURED APPROACH TO ALTERNATIVE WASTE TREATMENT TECHNOLOGY (AWTT)

FEASIBILITY STUDY



WASTE HIERARCHY



1 The **reduction** of waste is the most vital point in the waste hierarchy. Reduction usually results in the least environmental and economic life cycle costs. It requires no collecting or processing of materials.

2 The **re-use** of waste is the next option. Re-using waste often requires collection but relatively little or no processing. It involves sorting, cleaning, repairing, and/or refurbishing items or spare parts.

3 **Recycling** involves sorting and processing the recyclable products into raw material and then remanufacturing the recycled raw materials into new products.

4 The **recovery** of waste is separated into two parts: the recovery of materials, and the recovery of **energy**. Whichever of the two options is better for the environment and human health is the preferred option.

5 The last resort is **disposal** and is only considered once all other possibilities have been explored. Disposal is any operation that involves the dumping and treatment of waste without energy recovery.

INFLUENCING FACTORS RELATED TO WASTE-TO-ENERGY

STATUS QUO

- State of waste management in the city/ industry
- **Challenges:** airspace issues, community uproar
- **GAP** analysis
- Poor planning
- Urbanization
- Change in economic levels

NEED

- **Energy** for residential/commercial use
- **Reduce** use of fossil fuels
- **Diversion** of waste from landfill

DEMAND

- Introducing an Alternative Process/ **Renewables**
- Reducing **impact** - Global, environment, social and economic
- Address a **current and future** crisis
- Move away from traditional **approaches** eg. Landfilling
- Address compliance **requirements**
- Zero waste?
- Reduce carbon footprint/ **emissions**
- There is constant supply **(feedstock)** of waste and is reliable

VOLUMES AND COMPOSITION

- Comprehensive waste data is required
  - **Volumes**
  - **Composition**
- The study will form the basis for analyzing technologies viable to treat the identified **priority waste streams.**
- Provide information on **quantity** of material available and type of treatment, for example: processing tyres for **refuse derived fuel (RDF)**
- **Food waste** (organics) for gas production
- Good understanding of **priority waste**

PROJECT STRUCTURE

Objective: Important factors for a Waste-to-Energy Project

Review & update technical info

- Status Quo
- Technology capacity
- Cost benchmarks

Financial advisory & strengthening financial model

- Value for money
- Develop & construct PSC model
- Understand risk on model
- Consult & comply to legal & statutory requirements
- Assist on all financial matters
- Waste characterization & calorific value

Socio-economic assessment

- Waste sampling
- Waste characterization
- Analysis & obtain calorific values
- Waste Flow Model
- Study on life cycle assessment of waste

Conducted detailed site assessment

- Consider alternative waste treatment technologies
- Undertake conceptual designs for each site
- Review legislation
- Conduct legal due diligence

Advisory for procurement

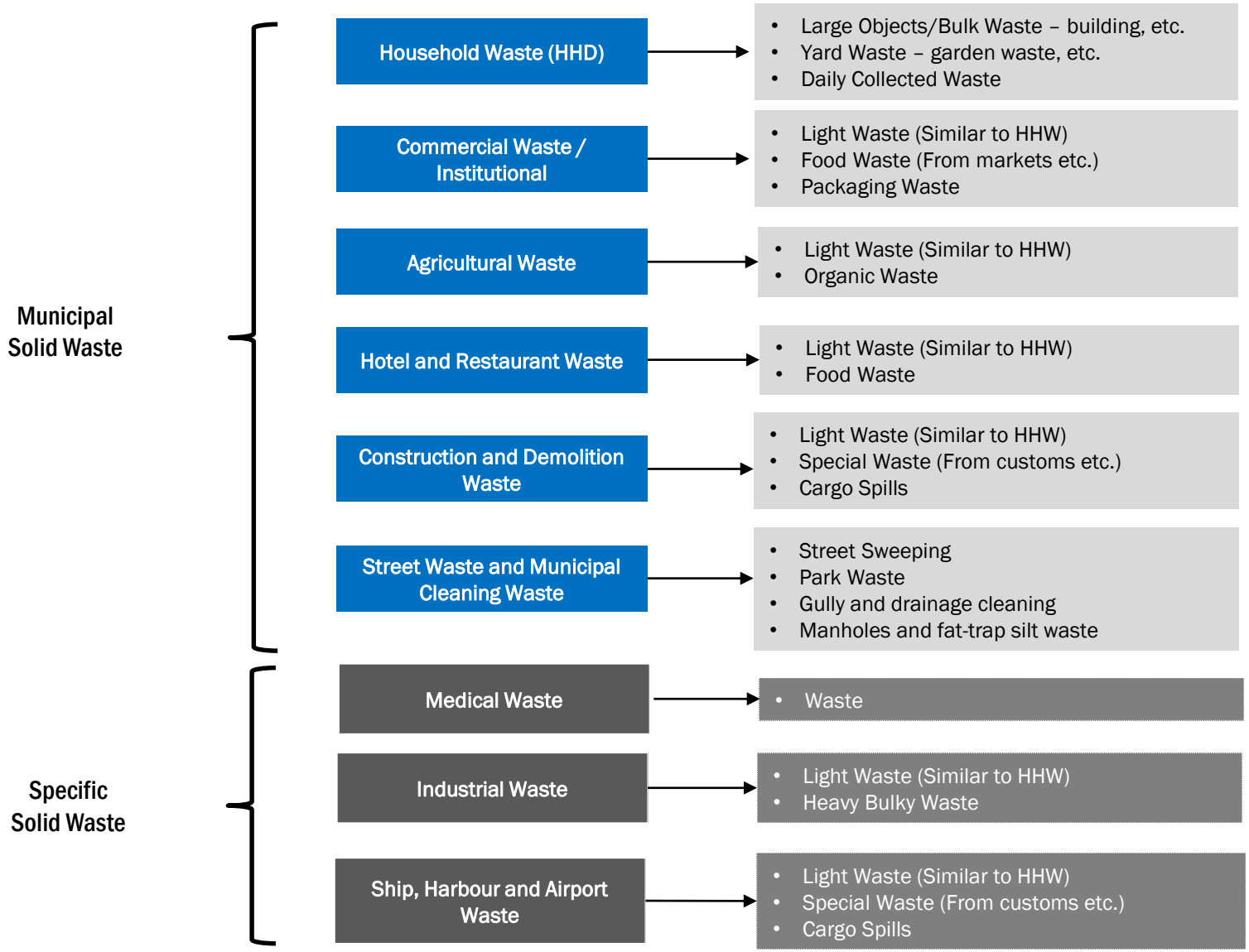
- Review & update procurement plan
- RFQ documents
- Compile all documents
- Treasury views & recommendations
- Evaluate & pre-qualify bidders

CONSIDERATIONS

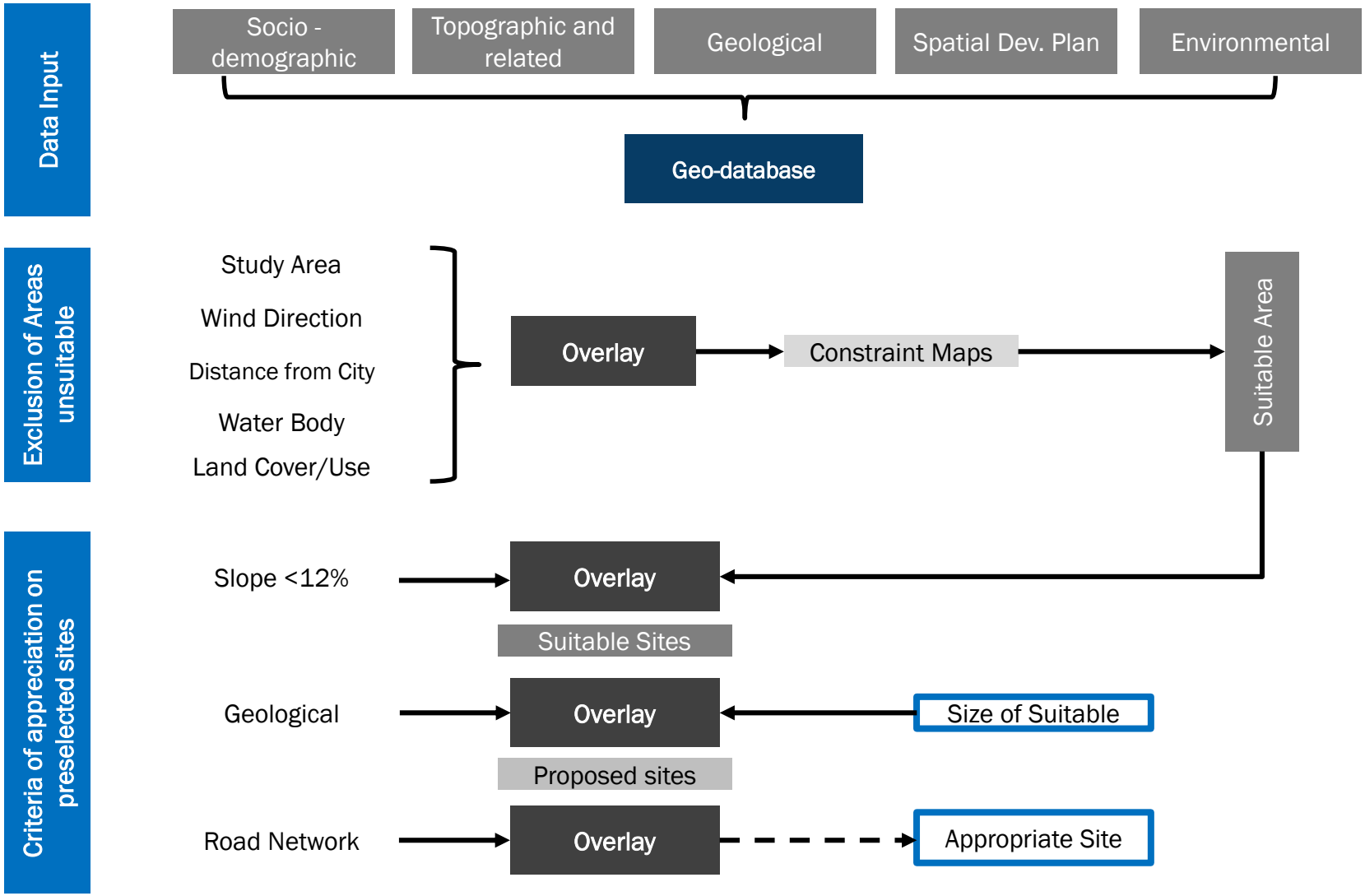
- Population growth rate / establish future trends
- Socio-economic groups
- Accuracy and relevant data collected and analyses
- Diversion as priority
- Impacts and effects:
  - Establishment of new landfill site
  - Establishment of alternate treatment technologies
    - Recycling
    - Composting
    - Treatment
  - Successful implementation separation at source
  - Private waste collection
  - Effect of AWT on landfill life expectancies - recalculate life expectancies, predict and measure various scenarios
- Alternate waste treatment technology - assess financial sustainability
- Innovation
  - Logistics
  - Costs to transport and dispose waste
  - Use of old landfill sites for alternate treatment facilities

WASTE COMPOSITION EXAMPLES

WASTE CHARACTERISATION STUDY



SITE ASSESSMENT APPROACH



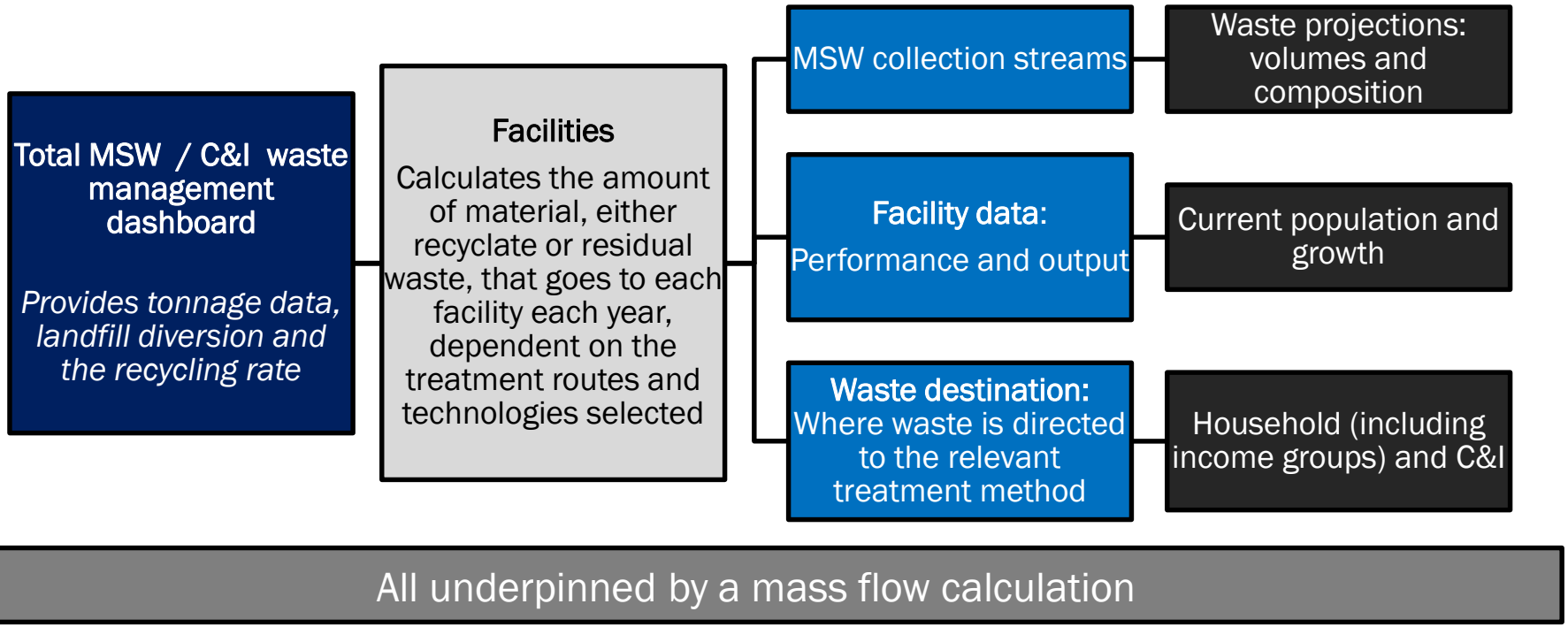
RISKS

Description		Risk
1.	Land Ownership	Council Owned Land
2.	Land Fit for purpose	Zoned for waste disposal
3.	Logistics for building and operating plant	Flat adequate space
4.	Logistics for receiving waste	No change to current collection routes – minimise haulage
5.	Residual Waste available	500,000 tpa total
6.	Off-Take: Heat Off –take: Electricity Off –take: RDF for Cement industry	• Distance of transporting heat could prove to be expensive if market not in reasonable distance (Market Assessment) • Both existing landfills are ideally placed for feeding the energy off – take into the City Power grid • None of the sites assessed are positioned suitably to transfer the RDF to the sidings to cement kiln, substantial investment in infrastructure, land and transport will be required

WASTE FLOW MODEL

- A waste flow model can be used to make **informed decisions** about **future waste strategies** and/or required infrastructure
- It plays a pivotal role in feasibility studies around waste **treatment infrastructure**
- It provides a comprehensive snapshot of **current waste** arisings, through collection and onto recycling / recovery and disposal
- It then builds up **projections** of future waste arisings, including the effects of changes in composition
- Waste flow modelling can help to investigate **the best option** for dealing with waste

WASTE FLOW MODEL



CONSIDERATIONS CHOOSING A TECHNOLOGY

- Financial implications on budgets
- Site issues
- Legislation and regulations
- Human resources
- Market potential for technology outputs
- GHG mitigation potential of different technology options
- Water usage for technology option
- Investor budget

ALTERNATIVE WASTE TREATMENT TECHNOLOGY (AWTT) OPTIONS

Landfill Gas to Energy

Landfilling is the mass disposal of waste to land under controlled circumstances. Energy can be recovered from the waste through collection of gases resulting from natural decomposition of the waste.

Anaerobic Digestion

Anaerobic digestion (AD) is the decomposition of organic waste in the absence of oxygen.

Incineration

Incineration is the mass burning of waste to reduce the volume of waste and enable the production of energy in the form of electricity and/or heat.

Mechanical Heat Treatment

Mechanical Heat Treatment (MHT) involves a mechanical sorting combined with a thermal heat treatment processing.

ALTERNATIVE WASTE TREATMENT TECHNOLOGY (AWTT) OPTIONS

Open Windrow Composting

Composting is the simplest form of biological treatment and is suitable for the treatment of some source-segregated biological or organic / putrescible waste streams.

Clean Material Recovery Facility

A clean materials recycling facility (MRF) is suitable for the processing of dry mixed recyclables that are seperated at source.

Dirty Material Recovery Facility

A dirty material recycling facility (dMRF) involves separating valuable materials from a mixed ‘dirty’ waste stream.

Mechanical Biological Treatment

MBT combines both mechanical and biological treatment methods. These will be supported by a combination of pre-treatment and sorting techniques and a selection of emissions and quality control techniques.

ALTERNATIVE WASTE TREATMENT TECHNOLOGY (AWTT) OPTIONS

Gasification

Gasification is a thermal treatment wherein pre-treated waste is exposed to very high temperatures in an environment with little oxygen.

Pyrolysis

Pyrolysis is a thermal degradation of a substance at high temperatures in the absence of oxygen.

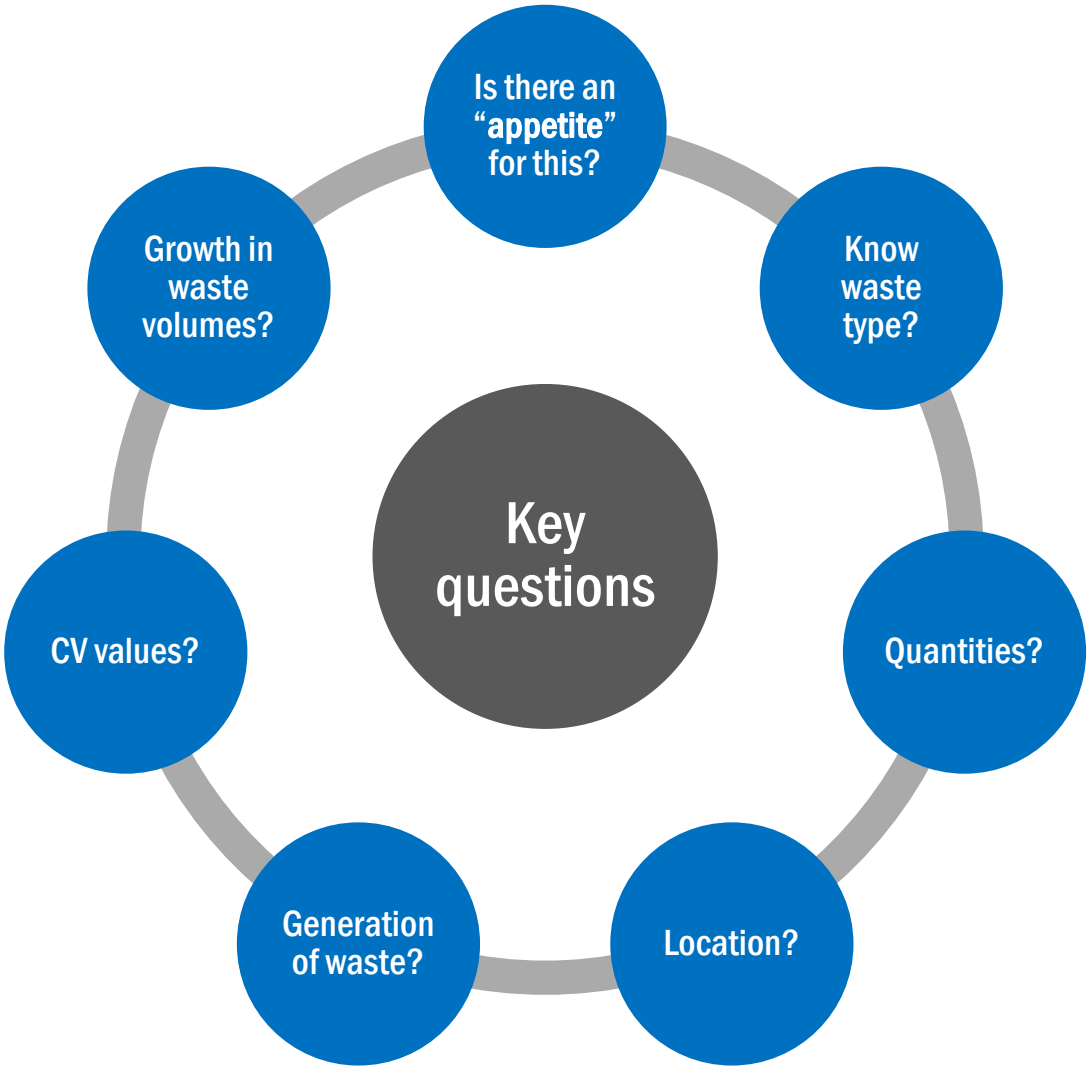
Plasma Gasification

Plasma gasification is a variation on gasification which uses a plasma torch/arch to produce gas.

In-Vessel Composting

In-vessel composting (IVC) is a way of accelerating the composting process within an enclosed environment.

SUITABILITY TO TECHNOLOGY



LIFE CYCLE ASSESSMENT

The software used to conduct the LCA is the Waste and Resources Assessment Tool for the Environment (WRATE).

- WRATE reports against six environmental impacts.
- Negative numbers indicate an environmental benefit (through the off-setting of potential impacts)
- Otherwise, the smaller the positive value, the better.

Impact assessment		Unit
1.	Global Warming Potential (climate change)	kg CO_2-Eq
2.	Acidification Potential	kg SO_2-Eq
3.	Eutrophication Potential	kg PO_4-Eq
4.	Freshwater Aquatic EcoToxicity Potential	kg 1,4-DCB-Eq
5.	Human Toxicity Potential	kg 1,4-DCB-Eq
6.	Abiotic Resource Depletion	kg antimony-Eq

MARKETS ASSESSMENT

The objectives of this report are to:

- Determine the **local and international** off-take markets for the various recyclable waste streams identified through the WCS, as well as the recovery of energy from the residual waste stream
- Determine the **off-take market** for residual waste arising as a **by-product** of the process of WtE as part of the larger feasibility study

Categories researched:

- Recycling trends in South Africa
- Potential recyclable materials
- Technology assessment
- Local market interest
- Social implications

RETURN ON INVESTMENT

- The markets assessment is a critical part of the project preparation period
- Provides information about costs (explicit and hidden)
- Indication of whether costs can be met from within budgets without disruptions to other activities
- Allows for the identification, quantification, mitigation and allocation of risks
- Prompts organisations to consider how the Project will be structured
- Identifies constraints which may cause the Project to be halted
- Ensures that the Project is developed around a proper business plan

VALUE FOR MONEY

- Capital investment
- Operational and maintenance costs
- Affordability
- Reference case
- NPV
- IRR
- Revenue forces
  - Energy sales
  - Recyclables
  - Residual

The study demonstrates:

- Is technology and operations **affordable?**
- Transfers appropriate technical, operational and financial **risk** to the private or public party
- Gives **value for money**

ECONOMIC DRIVERS

Developing the waste and renewable energy sector have included:

- Waste disposal and landfill gate fees/landfill tax
- Penalties/avoidance schemes
  - Landfill allowance schemes
  - Fines
  - Carbon trading
- Energy prices
- Investment subsidies
  - ROCs
  - LECs
  - PFI Credits

RISKS

Inadequate transmission infrastructure to evacuate power to off-takers	Challenge to the procurement process	Time impact	Available project site fit for purpose
Land use authorisation	Supporting infrastructure	Design risk	Site availability risk
Availability of finance	Environmental risk	Quantity of waste	Calorific value of waste (composition of waste stream)

RISKS

Public opposition to project	Regulatory compliance	Value for money and affordability	Level of demand for project
Council authorisation to proceed	Decline in economic activity	Currency risk	Forecast risk
Political-Instability due to elections and/or election outcome dispute	Delays in obtaining approvals and permits	Lack of bankable off-takers	Off-take agreements (demand for output)

FUNDING OPTIONS

Financing of waste management services is dependent on accurate costing of the required services.

- Turnkey
- Design – build – operate
- Part ownership
- Municipal market will need to follow MFMA/Treasury guidelines

Capital

- Own funding
- Municipal Infrastructure Grant (MIG)
- Consolidated Municipal Infrastructure Programme (CMIP)
- Extended Public works Programme (EPWP)
- Donor funding
- Financial institution
- Public-private partnerships
- Provincial and National government allocations

Operational

- Tariffs
- Rates
- Equitable share
- Donor funding
- Carbon credits
- Product revenue

COMPLIANCE AND LEGISLATION

- Follow legal framework
- Environmental
- Energy department(NERSA)
- Requirements
- Authorizations

Consider the following Energy Regulations

Electricity License

- The National Energy Regulator of South Africa established in terms of the National Energy Regulator Act, 2004 (“NERSA”)
- 3-6 months

Gas License

- The Gas Regulator established in terms of NERSA
- 1-1,5 years

Petroleum Products License

- The controller of products
- 2 months–1 year

THANK YOU