

Not gone to waste

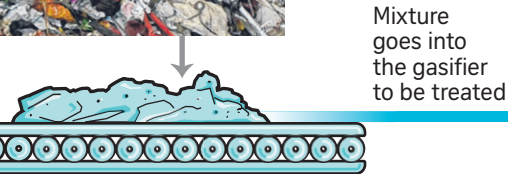
Singapore's first waste-to-energy research facility converts solid waste to a usable synthesis gas (syngas), electricity and other useful by-products using a cleaner and more efficient method known as gasification. Here is how it works.



1 WASTE RECEIVING AND LOADING



Solid waste from NTU campus is sorted, shredded and transferred to a conveyor belt



Mixture goes into the gasifier to be treated

Biomass charcoal (below)
Acts as fuel to aid gasification

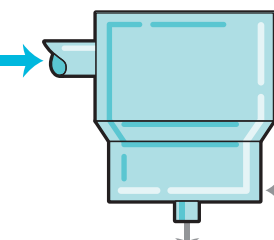
Limestone
Controls molten slag's viscosity



2 HIGH-TEMPERATURE SLAGGING GASIFICATION

Gasifier/melting furnace

- High-temperature and low-oxygen environment turns the solid waste into syngas (mainly a mixture of carbon monoxide and hydrogen)
- Temperature of up to 1,600 deg C at the base of the furnace melts the ash into a molten slag



Syngas

Two by-products (in separate streams)



Glass-like slag
Particles possess sand-like properties and a potential commercially viable construction material



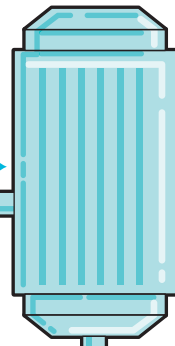
Metal alloy
Recyclable beads of up to 5mm in diameter

NOTE: Final forms are the result of natural water cooling

3 ENERGY RECOVERY

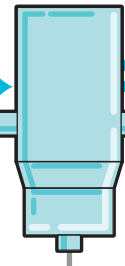
Burner

The syngas is burned



Boiler

The heat generated then turns water into steam in the boiler



Steam turbine

The steam then drives a turbine to produce electricity



Electricity

Particles are channelled back to the furnace to be further "melted"

4 AIR POLLUTION CONTROL

Ash collector

The majority of the solid particles are removed from the gas



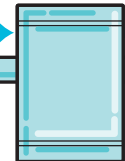
Gas cooling tower

Flue gas – gas that will be released to the atmosphere – is rapidly cooled from around 350 deg C to below 170 deg C



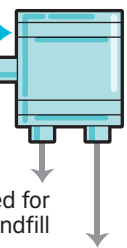
Gas treatment

Additives neutralise the acidic gas, capture heavy metals and absorb other pollutants



Bag filter

Final step: Particles from the gas treatment process are removed



Treated powder ash is collected for disposal at the offshore Semakau Landfill

Exhaust gas released into the atmosphere meets emission standards set out by National Environment Agency (NEA)

FACTS AND FIGURES

\$40 million project

Jointly funded over 10 years by the National Research Foundation, Economic Development Board, NEA and Nanyang Technological University

9 to 10

Operational personnel, excluding researchers, at the waste-to-energy research facility

11.5 tonnes

Amount of waste that the facility is able to handle daily

0.7ha

Size of land leased from JTC

About 97%

Reduction in the weight of the waste to be disposed of after the process

Up to 30 kilowatts

Power output

The facility's **plug and play features** enable the testing of innovative technologies in the waste-to-energy and waste-to-materials domains