INTEGRATED WASTE MANAGEMENT FACILITY (IWMF)
Meeting Singapore’s long term waste management needs
Content

Singapore’s Waste Management System - NEA’s Vision & Strategies

Overview of Integrated Waste Management Facility (IWMF)

Project Innovations

IWMF Cross-Sectional View

Co-location with Tuas Water Reclamation Plant (TWRP)

Project Timeline
NEA’s Vision and Strategies for a Zero Waste Nation

One of the objectives of the Sustainable Singapore Blueprint is to work towards Singapore becoming a Zero Waste Nation.

Our aim is to reach an overall recycling rate of 70% by 2030.

To meet the objective for a Zero Waste Nation and conserve our precious resources, Singapore has adopted the following waste management strategies:

**Minimisation / Prevention**
- Right-price waste disposal services
- Promote efficient use of resources

**Recycling**
- Maximise resource recovery from waste
- Adopt viable & efficient recycling methods for environmental sustainability

**Waste-To-Energy / Volume Reduction**
- Adopt innovative technology to maximise energy recovery, and minimise land-take & ash residue

**Landfill**
- Minimise landfilling demand and maximise landfill lifespan

Overview of Waste Management System in Singapore

Currently, about 37% of Singapore’s waste generation is incinerated at our 4 waste-to-energy (WTE) incineration plants.

Another 60% is recycled, while the remaining 3% that is non-incinerable is landfill. Incineration has enabled us to reduce the volume of waste by 90%.

The amount of electricity generated by the 4 WTE plants meets up to 3% of Singapore’s total electricity demand.
Broad Objectives of IWMF

The IWMF is an integral part of NEA’s long term plan to meet Singapore’s future solid waste management needs.

As a state-of-the-art flagship facility, it will be developed to achieve greater environmental sustainability and provide Singapore with an affordable waste management system.

The design objectives for the IWMF include:

- **Maximisation of energy recovery**
  Achieved through the adoption of advanced boiler designs

- **Minimisation of environmental impact**
  Achieved by a highly efficient wet flue gas treatment system which ensures cleanest possible air emissions and minimal residue for disposal

- **Maximisation of system resilience**
  Achieved through the adoption of modular design to provide flexibility for operation and maintenance

- **Optimisation of land use**
  Achieved by innovative use of space, plant designs and equipment layout

- **Optimisation of synergies through co-location with TWRP**
  Achieved by integrating IWMF-TWRP processes to reap the benefits of a water-energy-waste nexus

---

Key Waste Streams at IWMF

The IWMF will provide several key solid waste treatment processes in an integrated facility to effectively handle various waste streams such as incinerable waste, household recyclables collected under the National Recycling Programme (NRP), source-segregated food waste and dewatered sludge from the Tuas Water Reclamation Plant (TWRP).

**INCINERABLE WASTE**
Incinerable waste will be treated at the Waste-to-Energy lines at the IWMF.
To be built in phases with a total of **5800 t/d** of incineration capacity when completed.

**HOUSEHOLD RECYCLABLES**
Through the use of advanced sorting equipment, **250 t/d** of recyclables from the NRP will be sorted at the IWMF.

**SOURCE-SEGREGATED FOOD WASTE**
**400 t/d** of food waste will be treated at the IWMF before co-digesting with used water sludge at the TWRP.

**DEWATERED SLUDGE FROM TWRP**
**800 t/d** of dewatered sludge from the TWRP will be treated by the fluidised bed incinerators at the IWMF.
The IWMF’s preliminary layout, including its various treatment facilities, is shown below. It will be co-located with PUB’s TWRP at the 68-hectares Tuas View Basin Site.

**IWMF Preliminary Layout**

**Project Innovations**

1. **Maximisation of Energy Recovery**

The IWMF will be able to achieve a high overall plant efficiency of 28% through the following:

- Optimised combustion process and boiler designs
- Increased steam parameters from 370°C / 35 bar → 440°C / 55 bar
- External biogas superheaters to boost steam parameters from 440°C / 55 bar → 480°C / 55 bar
- Optimised ACC system implemented

**TWRP as a Used Water Treatment Facility**

This advanced and compact water reclamation plant will treat both domestic and non-domestic used water conveyed from the Deep Tunnel Sewerage System. It will have the largest Membrane Bioreactor (MBR) facility in the world. It will feature an Integrated NEWater factory which will contribute to the long-term goal of increasing the supply of NEWater for Singapore. The TWRP will also incorporate technologies that improve its energy efficiency and reduce manpower requirements.

The amount of excess electricity that the IWMF exports to the grid is about 200MW. This is enough to power 300,000 four-room HDB apartments.
Project Innovations

2. Minimisation of Environmental Impact

The IWMF will be designed with an advanced Wet Flue Gas Treatment (FGT) system to ensure the cleanest possible air emissions, potentially the IWMF will also be designed to meet future tightening of air emission requirements.

The proposed Wet FGT system will require lower chemical dosage as compared to a Dry FGT system.

- Scrubber tower (height = 30 metres)
- Acidic gases are neutralised in wet scrubbers
- Fly ash captured separately upstream

The Wet FGT will reduce residues for disposal and help to extend the lifespan of Semakau Landfill.

Project Innovations

3. Future Proofing

The IWMF will be designed to facilitate future renewal of its facilities while remaining operational. The adoption of modular design at IWMF will provide flexibility for operation and maintenance to enhance overall system resilience. This will enable the IWMF to operate beyond a typical design lifespan of about 30 years for a WTE plant.

Key design features of the IWMF’s main structure will enable the following:

- Easy dismantling and removal of equipment during the renewal process
- Adequate working space for large equipment (e.g. cranes)
- Removal of roof and side panels, when necessary

This will provide the opportunity for IWMF to incorporate new technologies and upgrade its facilities, where feasible.

It will also enable the IWMF to continue reaping co-location benefits with the TWRP.
The preliminary design layout has adopted innovative use of space to house all facilities while optimising land use.

Boiler designed with high 1st vertical pass

Steam turbines located below horizontal boiler pass

Process water and fly ash treatment within building

Facilities located below forecourt / waste reception hall:
- Material Recovery Facility (MRF)
- Workshop

Reduce land use by about 2 ha.
Co-location of IWMF and TWRP

The IWMF and the TWRP will be maximising both energy and resource recovery in their respective solid waste and used water treatment processes.

The co-located IWMF and TWRP will be the first of its kind that is being planned from ground up. It will enable NEA and PUB to reap the benefits of a water-energy-waste nexus.

Synergies between IWMF and TWRP

Material Handling Synergies
1. Food waste from IWMF to TWRP for co-digestion with used water sludge
2. Dewatered sludge from TWRP to IWMF for treatment and electricity production

Water Synergies
6. Water from TWRP to IWMF for process use
7. Used water from IWMF to TWRP for treatment

Energy Synergies
3. Power supply from IWMF to TWRP
4. Biogas from TWRP to IWMF for higher overall plant thermal efficiency
5. Steam from IWMF to TWRP for sludge thermal hydrolysis and greasy waste treatment

Other Synergies
8. Foul air from TWRP to IWMF for combustion air

Key Benefits of Water-Energy-Waste Nexus

Generating green energy and supplying back to the electricity grid
Maximising synergies while ensuring operational resilience
Optimising land use for solid waste and used water treatment
Achieved cost savings for both IWMF and TWRP

IWMF Project Timeline

2014-2016
IWMF Preliminary Engineering Study and Design

2015-2016
Pre-Qualification of Engineering, Procurement and Construction (EPC) contractor(s) and EPC Tender calling

2016-2017
Pre-Qualification of Owner’s Engineer (OE), OE Tender calling and Appointment of OE

2019 onwards
Award of EPC Tenders and Detailed Design & Construction