

## NTU and NEA launch unique S\$40m Waste-to-Energy Research Facility

**Nanyang Technological University, Singapore (NTU Singapore)** and the **National Environment Agency (NEA)** have launched a new **Waste-to-Energy Research Facility** that turns municipal solid waste from the NTU campus into electricity and resources. Its opening marks a step closer towards Singapore's vision of becoming a zero-waste nation.

Located in Tuas South, the facility is a \$40 million project supported by the **National Research Foundation Singapore, NEA, the Economic Development Board (EDB)** and **NTU**, for its construction and operation over its projected lifetime.

The first-of-its-kind facility in Singapore is managed by NTU and houses a unique slagging gasification plant, which is able to heat up to 1,600 degrees Celsius, unlike conventional mass burn incinerators which operate at around 850 degrees Celsius.

The high temperature of the plant turns rubbish into syngas (mostly carbon monoxide and hydrogen) that can be used to produce electricity, slag – a glass-like material that can potentially be used as construction material – and metal alloy granulates that can be recycled.

Launched today by Guest-of-Honour, **Mr Masagos Zulkifli, Minister for the Environment and Water Resources**, the plant was designed and built by a multidisciplinary team from NTU, working closely with national agencies and industry.

Led by NTU's **Nanyang Environment and Water Research Institute (NEWRI)**, the research facility will facilitate test-bedding of innovative technologies for converting waste into energy and useful materials through unique plug-and-play features. These technologies, if proven successful and implemented, can enable more energy and materials to be recovered from waste, thereby prolonging the lifespan of Semakau Landfill.

In Singapore's context, slagging gasification technology has potential to complement the current mass burn technology as it can treat diverse mixed waste streams that cannot be handled by these mass burn incinerators today.

This slagging gasification plant also demonstrates another first with the use of 'clean' biomass charcoal as auxiliary fuel – a unique combination not yet proven in the market.

The new research facility makes NTU the only educational institution in Singapore to treat all of its solid waste using its own facilities.

**NTU President Professor Subra Suresh** said: "As a global leader in green technologies, NTU has deep expertise in waste management and environmental technologies. Being able to treat our own campus waste and to use it for research is well aligned with the NTU Smart Campus vision,

to be a living testbed for advanced tech-enabled solutions aimed at tackling some of the most pressing challenges which Singapore and the world are facing.

“The NTU and NEA Waste-to-Energy Research Facility will enable our scientists to scale up promising ideas from lab prototypes into practical engineering solutions for sustainable waste management, contributing to NTU’s aspiration to become a zero-waste campus and Singapore’s vision of a zero-waste economy where waste is upcycled into valuable resources.”

**Mr Tan Meng Dui, Chief Executive Officer of NEA**, said, “This partnership with NTU Singapore reflects NEA’s expanding focus on waste management technologies, building on NEA’s traditional strengths in waste-to-energy facilities. The Waste-to-Energy Research Facility is the first of its kind in Singapore. It achieves both waste-to-energy and waste-to-resource at one waste treatment facility, producing syngas to power the plant and slag which can be used for construction. The launch of this research facility in this Year Towards Zero Waste is thus timely, and holds special significance.”

### **Possible research projects at the new WtE Research Facility**

Over the next few years, NTU scientists and engineers from NEWRI will collaborate with industry and academic partners to embark on various research projects aimed at developing and testing technologies in the waste-to-energy domain.

Unique to the research facility is the ability to test-bed new technologies in “plug-and-play” style, which includes the capability to process diverse feeds like municipal solid waste, incineration bottom ash and sludge; provisions for the evaluation of gas separation technologies to supply enriched-oxygen air; syngas upgrading and novel flue gas treatment techniques.

### **How the gasification plant works**

Municipal waste from the NTU campus is transported to the facility, which can treat 11.5 tonnes of waste daily.

The waste is sorted, shredded and transported via a conveyor and a bucket lifted to the top of the furnace tower to be fed along with biomass charcoal that helps maintain the high temperature of the molten slagging layer at the base of the furnace.

The waste is dried and gasified as it moves down the furnace. About 85 per cent of the waste weight will turn into syngas, 12 per cent into slag and metal alloy, and the remaining 3 per cent into fly ash.

The syngas flows from the top of the furnace to the secondary combustion chamber, where it is burned to heat a boiler to generate steam.

The steam then drives a turbine-generator to generate electricity to offset the energy consumption to operate this research facility. In a commercial larger scale plant of this type, the

amount of electricity output can be significant enough to self sustain the plant operations with the excess channelled into the electricity grid.

The exhaust flue gas from the boiler is then treated with slaked lime and activated carbon and passed through bag filter, before being discharged as cleaned gas through a stack into the atmosphere.

Moving forward, NTU expects to partner more companies to develop and trial new solutions at this open test-bed facility that aims to contribute to Singapore's quest to be a more sustainable nation.

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