ENERGY MARKET AUTHORITY
Smart Energy, Sustainable Future

Singapore's Renewable Energy Update

52nd Meeting of APEC Expert Group on New and Renewable Energy Technologies

20 March 2019, Hong Kong, China

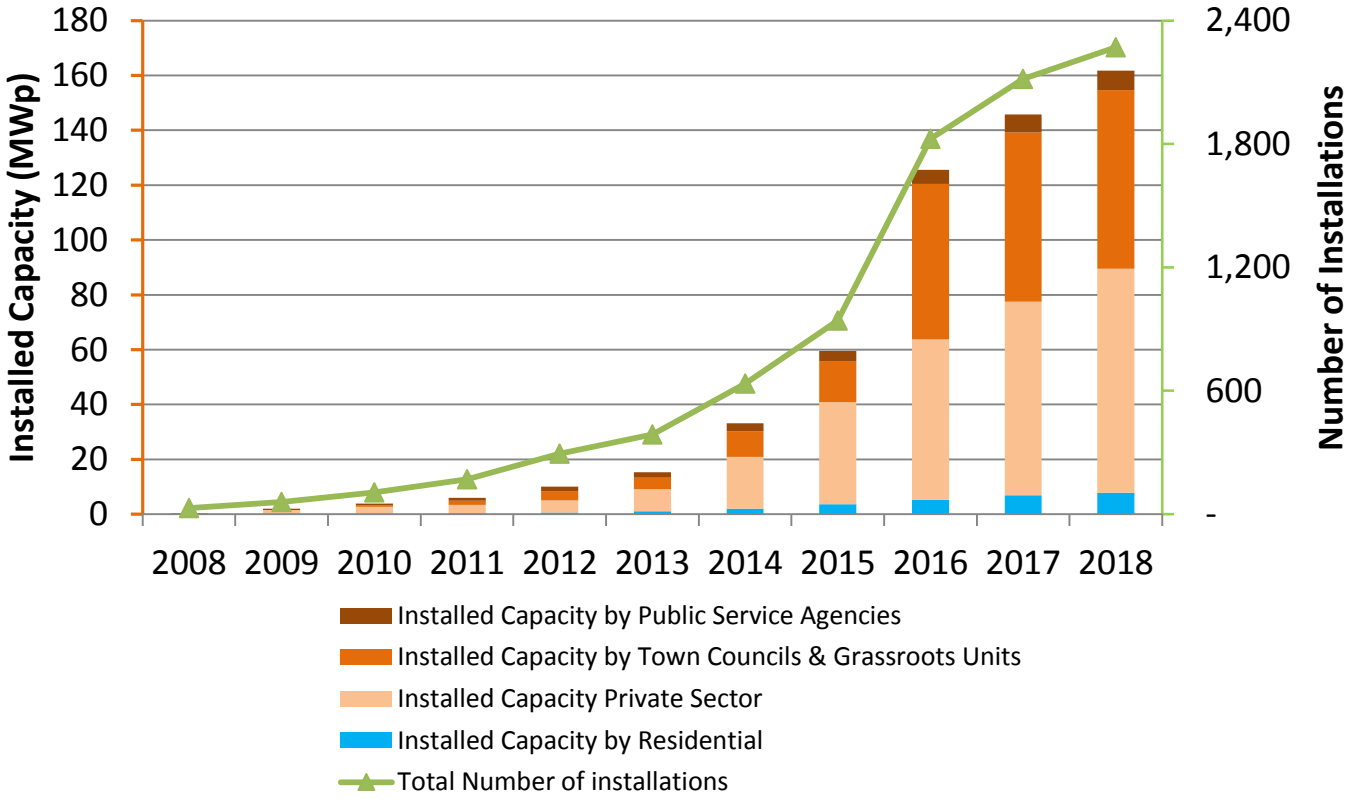
Agenda

1	Introduction
2	Renewable Energy Updates
3	Waste-to-Energy Updates

Renewable Energy Updates

Overview of Singapore's clean energy policy

- Singapore's energy policies aim to address the **Energy Trilemma** in view of our physical constraints
- Solar PV is the **most viable form of renewable energy** in Singapore
- The installed capacity has increased from **0.4 MWp in 2008 to 162 MWp in Q2 2018.**



We take a multi-pronged approach to support renewables

RIGHT PRICING

Do not subsidise. Recognise positive and negative externalities for economically sustainable outcomes

REGULATION REDUCTION

Simplified rules for lower compliance costs & streamlined registration requirements

RESEARCH AND DEVELOPMENT

Partner the industry and research community to test-bed solutions; facilitating the adoption of Energy Storage Systems

RAISING DEMAND WITH GOVERNMENT TAKING LEAD

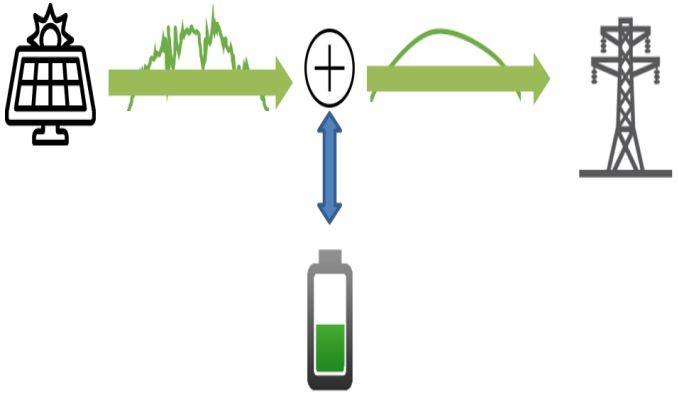
The SolarNova Programme aggregates public sector demand for solar PV

R&D - Partner with industry to test-bed solutions

Solar Forecasting

Awarded grant call to develop solar forecasting solutions based on weather science.

Allow us to more efficiently manage the system back-up for intermittency.



Energy Storage Systems (ESS)

Launched utility-scale ESS test-bed to evaluate technologies and help catalyse the use of ESS

Enhance grid stability and facilitate greater deployment of solar

Raising demand, with government taking lead

SolarNova Programme, 350 MWp by 2020

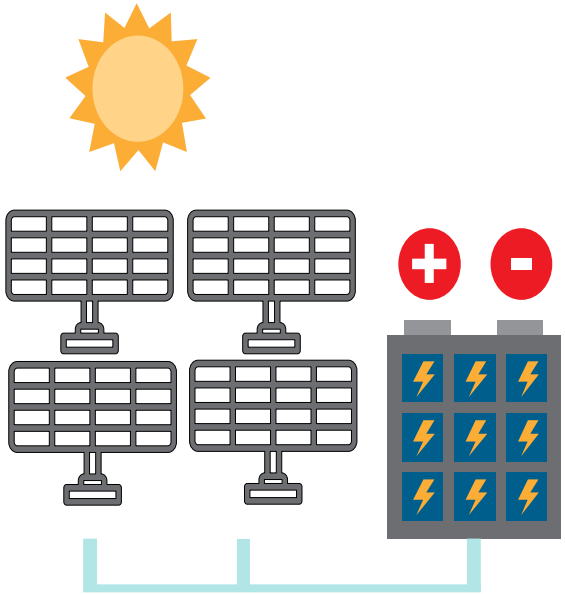
- 1st tender, 76 MWp
- 2nd tender, 40 MWp
- 3rd tender, 50 MWp

Plan to raise solar adoption to **1 GWp beyond 2020**

SolarLand

Floating PV Deployment

ESS is a game-changing technology that can support higher solar adoption and increase system efficiency



In Oct 2018, EMA rolled out the **ACCESS (ACCelerating Energy Storage for Singapore) programme** to facilitate the deployment of Energy Storage Systems in Singapore. ACCESS partners can work with EMA to pilot use cases and design business models to operate ESS in Singapore.

In Oct 2018, EMA published a **policy paper on ESS** to provide regulatory clarity for the industry. The existing framework allows ESS to participate in the energy, regulation and reserves markets.

EMA's first **Regulatory Sandbox** will test the grid operator's (SP PowerAssets) use of ESS at a substation at a residential areas. Findings will guide our regulatory approach for the grid operator.

EMA-SP ESS Testbed to evaluate the performance of different ESS technologies (lithium-ion and redox flow) for different grid applications (e.g. frequency regulation, reserves, peak shaving) under Singapore's hot, and humid environment.

Formed **Technical Standards Working Group** under Enterprise Singapore (ESG)'s Singapore Standardisation Programme to track and monitor International Standards in ESS (e.g. fire safety and communications/control protocols), and to establish local technical guidelines for ESS deployment in Singapore based on industry and government needs.

ASEAN-IRENA MOU on Renewable Energy

- Signed by the ASEAN Secretary-General Dato Lim Jock Hoi and IRENA Director General Adnan Amin at the 11th Singapore International Energy Week on 30 October 2018.

- Facilitate the scaling up of RE deployment in the region to support ASEAN's aspirational target to increase the component of renewable energy in the ASEAN Energy Mix to 23% by 2025.

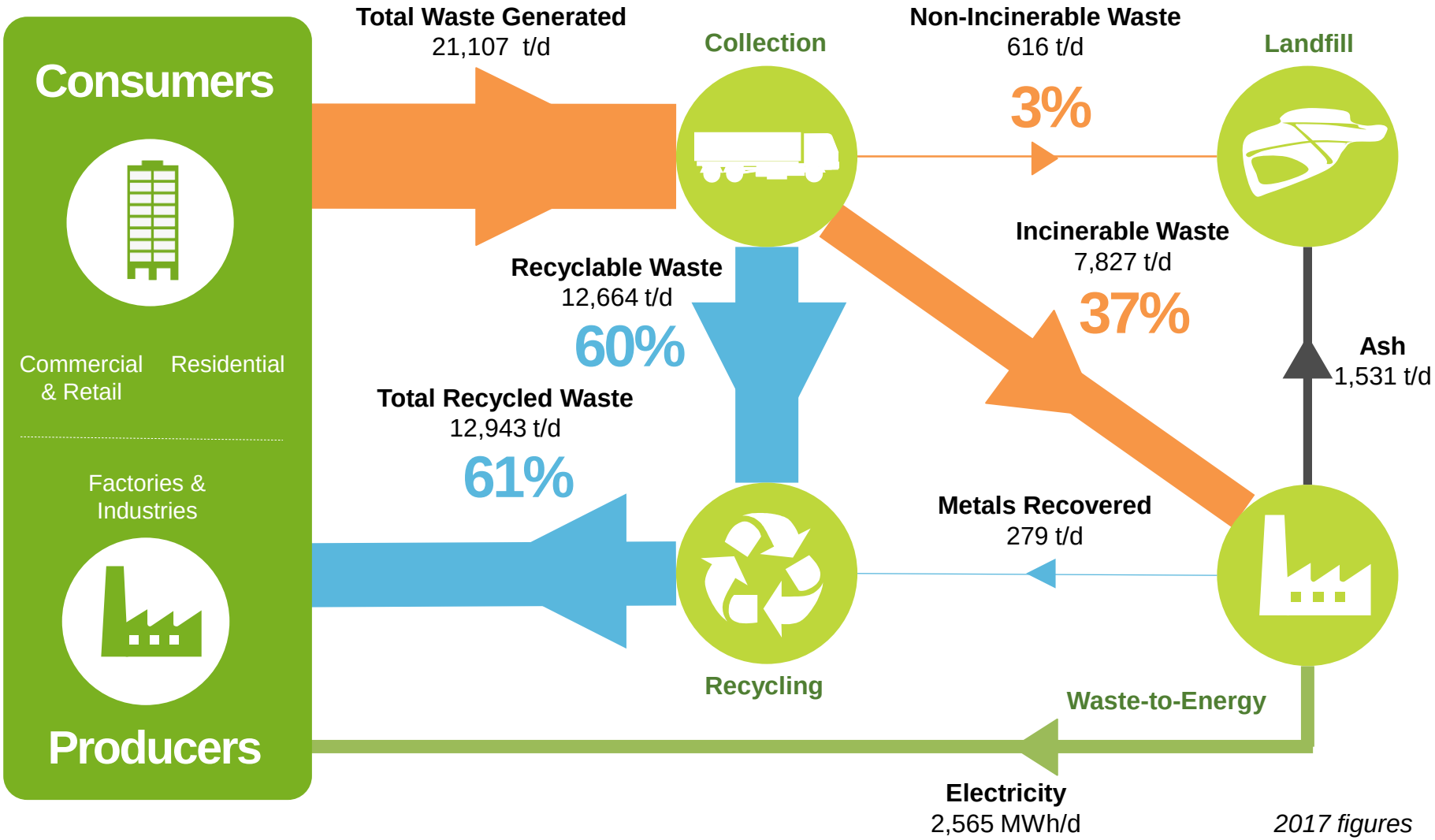
ASEAN-IRENA MOU on Renewable Energy

The Action Plan identifies six key areas for these joint activities:

1. Energy planning in the context of integration of high shares of RE sources into the ASEAN energy mix
2. Assessments and roadmaps for accelerated RE deployment
3. RE policy and regulatory frameworks
4. RE technology and innovation
5. Training and capacity building on renewable energy-related topics
6. Development of bankable renewable energy projects and support for project facilitation.

Waste-to-Energy Update

Overview of Solid Waste Management System

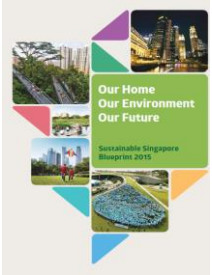


Sustainable Singapore Blueprint (SSB)

A Vibrant & Sustainable City

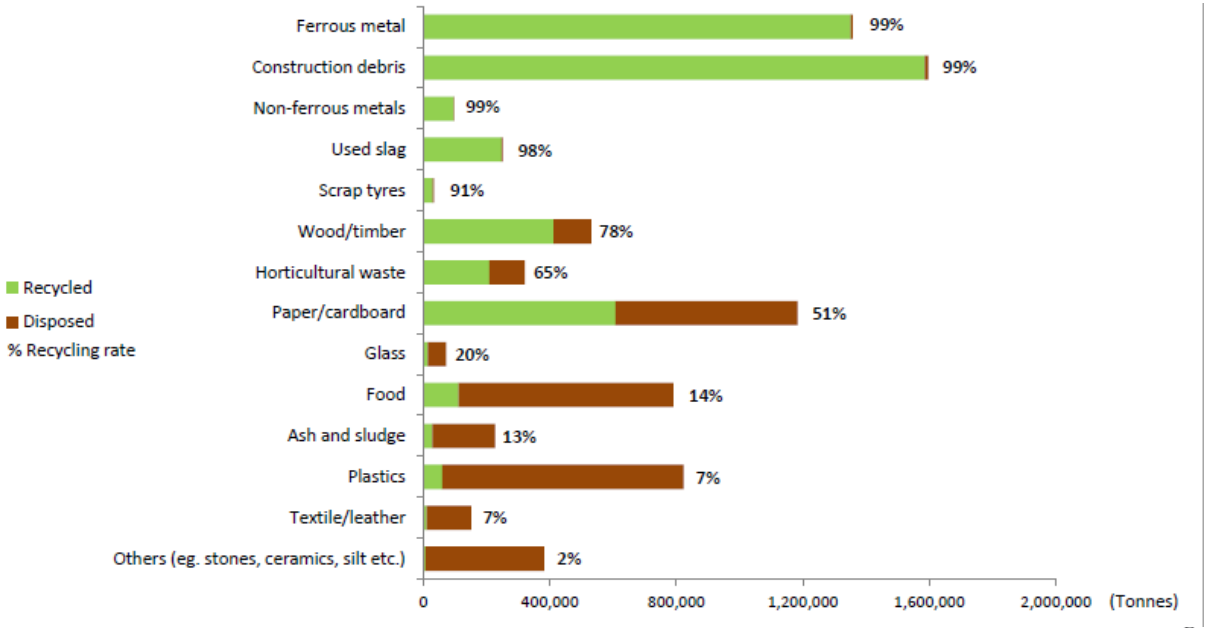
Towards A Zero Waste Nation

- Put in place infrastructure and programmes for the 3Rs
- Keep Singapore clean and resource efficient
- Achieve overall recycling rate of 70% by 2030



SSB Domestic Waste Targets in 2030
- **30% recycling rate**

SSB Non-Domestic Waste Targets in 2030
- **81% recycling rate**



Guiding Principles for Waste Management in Singapore

a. Ensure adequate, sustainable and affordable infrastructure to manage solid waste

b. Reduce waste-to-landfill through waste minimisation and resource recovery

c. Adopt a circular economy approach to waste management

TOWARDS ZERO WASTE

Sustainable Singapore

Considerations for Waste Infra Planning

Semakau Landfill

6th WtE IP (artist's impression)

District-level Pneumatic Waste Conveyance System (DPWCS)

Automated Material Recovery Facility

Land Efficiency

Waste Minimisation / Prevention
- Right-pricing of waste disposal fees
- Promote efficient use of resources in production processes

Recycling
- Maximise resource recovery from waste
- Adopt viable & efficient recycling methods to sustain clean environment

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

Landfill
- Minimise landfilling demand
- Maximise landfill lifespan

Cost Effectiveness

Labour Productivity

Collection and Recycling

Waste-to-Energy Facilities in Singapore

Senoko WtE Plant (2,400tpd)

Keppel Seghers Tuas WtE Plant (800tpd)

TuasOne WtE Plant (3,600tpd)

1979 → 1986 → 1992 → 2000 → 2009 → 2019 → 2023

Ulu Pandan WtE Plant (1,100tpd) (Decomm in 2009)

Tuas WtE Plant (1,700tpd)

Tuas South WtE Plant (3,000tpd)

Integrated Waste Management Facility – WtE Phase 1 (2,900tpd)

Tuas One Waste-to-Energy Facility

This is an artist impression of a possible design

Project

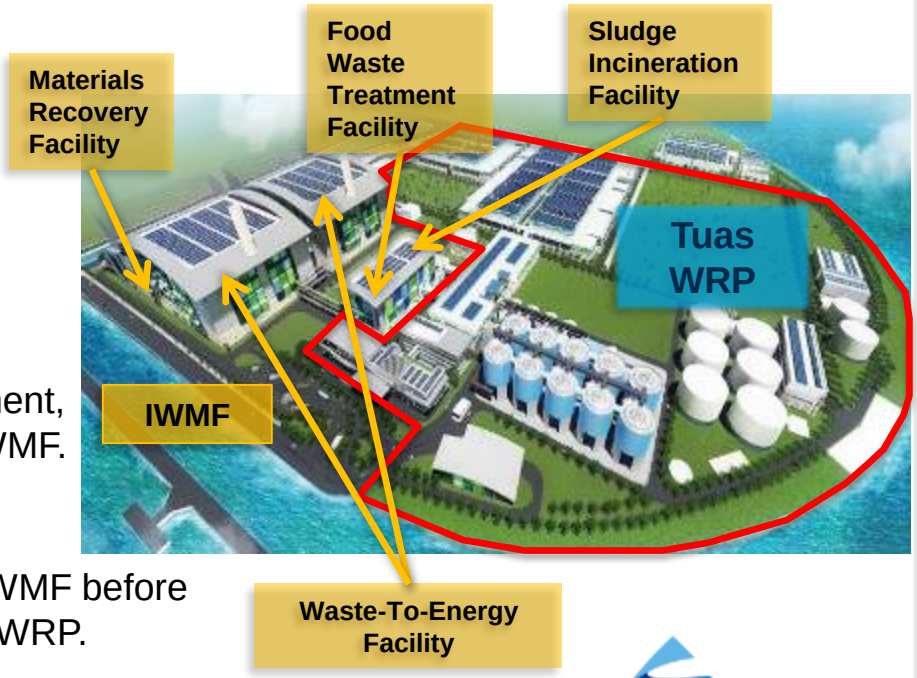
- Design, Build, Own and Operate (DBOO) Model
- Awarded to Consortium MHI & Hyflux
- Expected operation 2019
- 25 year contract.

WTE Facility

- Domestic & Industrial Solid Waste
- 3,600 tonnes/day
- 120 MW
- 24% net efficiency
- 500 tpd/ha

Integrated Waste Management Facility

A new Waste Management Facility being developed by NEA to treat 4 different wastestreams:



INCINERABLE WASTE

5,800 t/d will be treated at the Waste to Energy lines, 8 lines to be built in phases

HOUSEHOLD RECYCLABLES

Through the use of advanced sorting equipment, **250 t/d** of recyclables 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

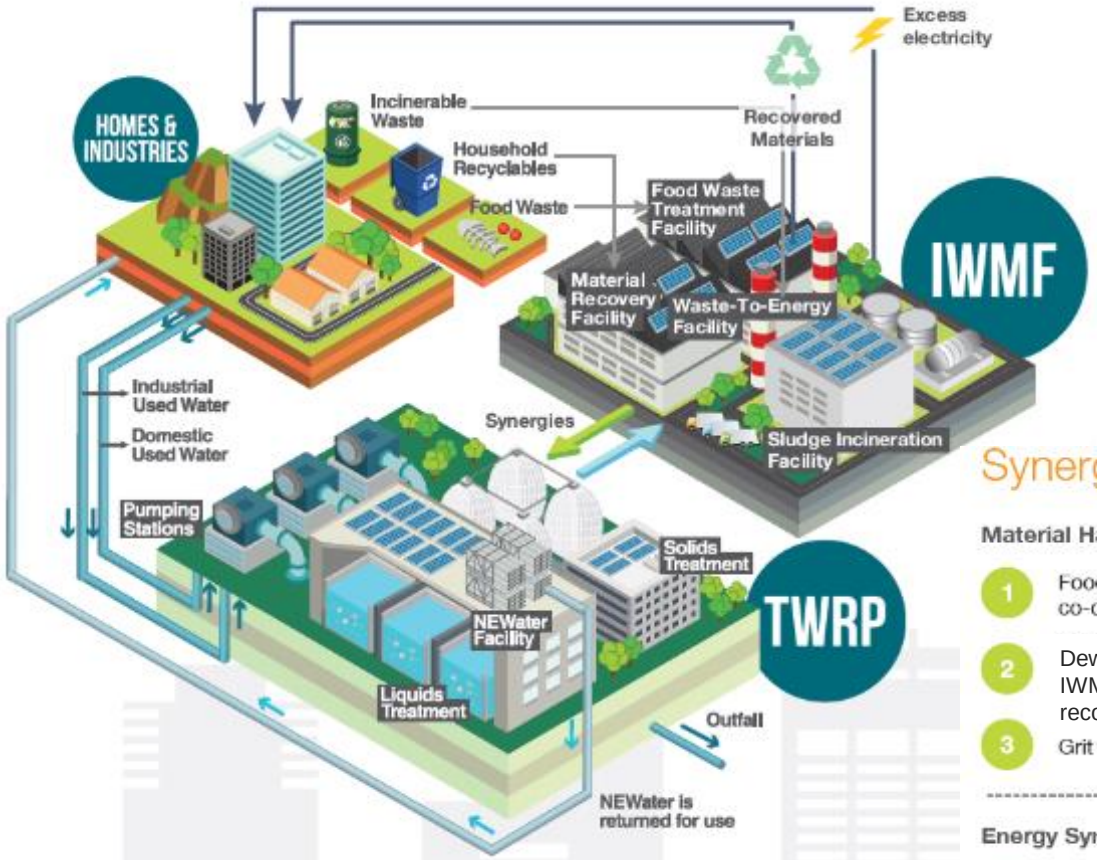
800 t/d of dewatered sludge from the TWRP will be treated by the fluidised bed incinerators at the IWMF.

TUAS NEXUS

Tuas Nexus Synergies

To reap the potential synergies of a water-energy-waste nexus, the two facilities (IWMF & TWRP) aim to integrate solid waste and used water treatment processes to maximize energy and resource recovery.

The integration of PUB's TWRP with NEA's IWMF will be the first of its kind in the world that is being planned from the ground up.



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 is disposed of at IWMF for treatment and energy recovery
3. Grit from TWRP to IWMF for treatment

Water Synergies

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

Energy Synergies

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

TUAS NEXUS

Useful links

- Energy Market Authority (RE policies)
  https://www.ema.gov.sg/Renewable_Energy.aspx
- National Environment Agency (Waste Management)
  https://www.nea.gov.sg/our-services/waste-management/overview

Thank you