

## Eighth Regional 3R Forum in Asia and the Pacific

# Waste-to-Energy Experience: The Case of Singapore

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# Outline

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1. Background and Singapore's Waste Management Story
2. Solid waste management in Singapore
  - Key considerations for policy formulation / infrastructure development
  - Waste management strategies
3. Development and management of WTE Infrastructure

# 1 BACKGROUND

# Introducing Singapore



**Country and a City-State**

**Small Land Area**  
719.2 km<sup>2</sup>

**Dense Urban Setting**  
5.61 mil population

**Limited Natural Resources**



# From Past to Present

## From **Direct** landfilling



Lim Chu Kang



Choa Chu Kang



Lorong Halus



...to  
**Offshore**  
landfill



# Vision for Waste-to-Resource Management

## A Vibrant & Sustainable City



### *Towards A Zero Waste Nation*

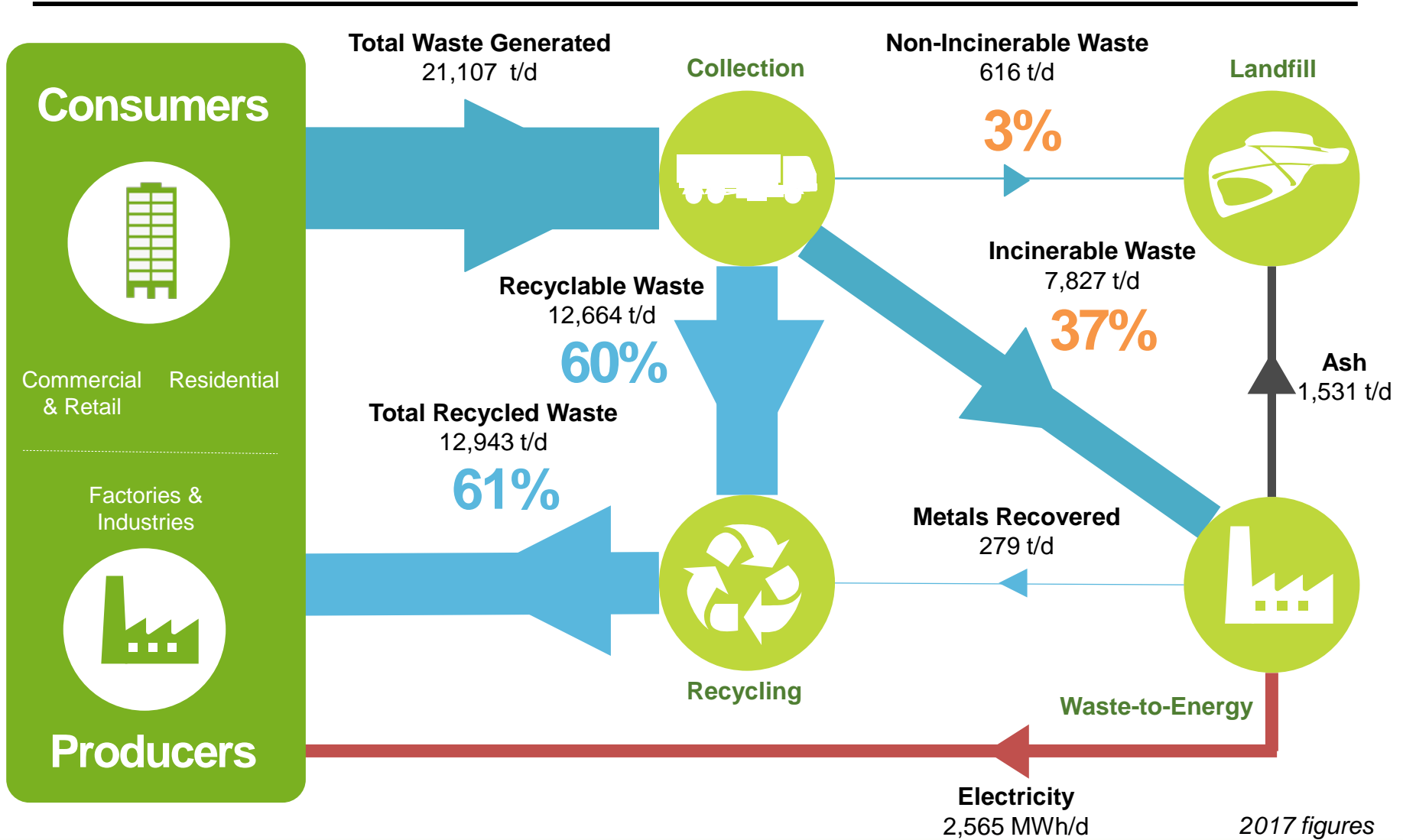
- Put in place infrastructure and programmes for the 3Rs
- Keep Singapore clean and resource efficient

**Sustainable Singapore Blueprint 2015**  
**70% recycling rate by 2030**



# 2 SOLID WASTE MANAGEMENT IN SINGAPORE **KEY CONSIDERATIONS & STRATEGIES**

# Overview of Solid Waste Management System

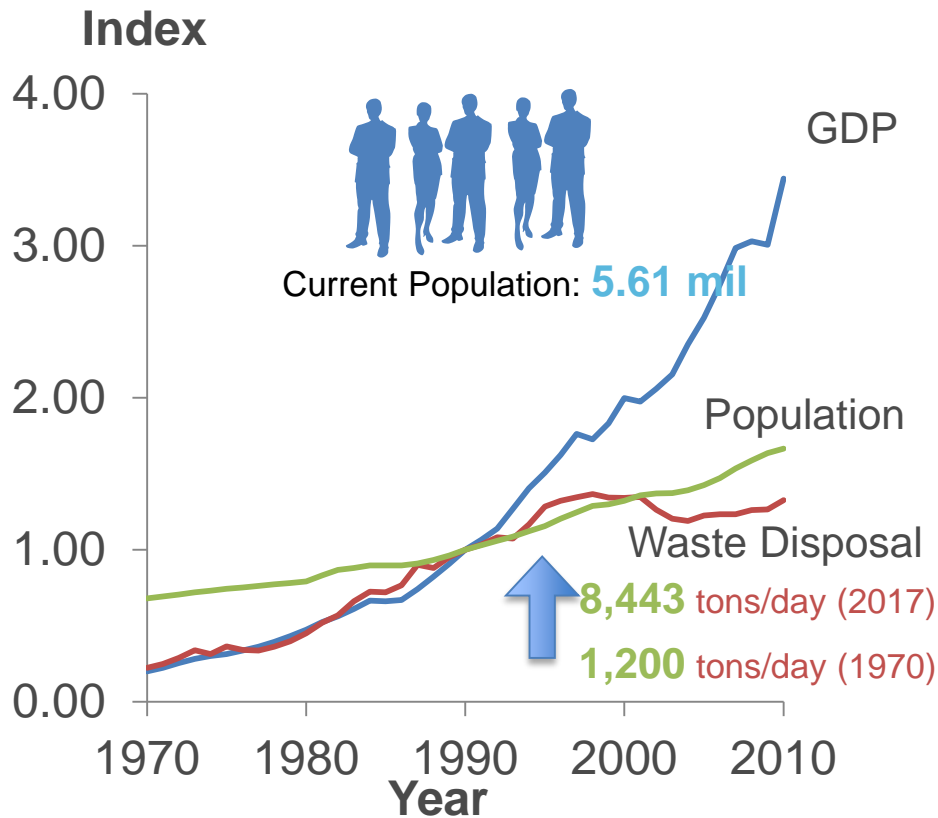






# Challenges – Waste Growth and Land Scarcity

- Rapid increase in waste generation with population & economic growth
- Increasing land scarcity for new waste infrastructure developments



At this rate of waste growth...



New waste-to-energy

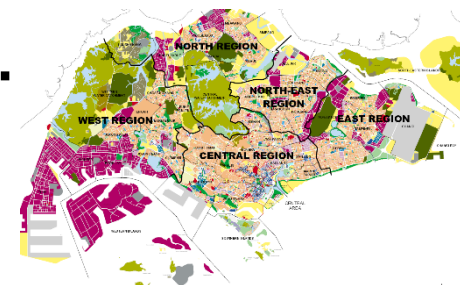
**7-10** years



Current landfill will be filled by **~2035**

New offshore landfill every **30-35** years

**But...**



Limited land Area: **719 km<sup>2</sup>**



# Waste Management Strategies



## Waste 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

## Towards a “Zero Waste Nation”



# **3** DEVELOPMENT AND MANAGEMENT OF WTE INFRASTRUCTURE

# Waste-to-Energy Plants

## Waste-to-Energy Facilities in Singapore



# PPP Approach: Waste-to-Energy Industry

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Capitalise on private sector expertise, resources and innovation  
Value for Money proposal - financial discipline & cost-effective solutions

DBOO with a full take-or-pay approach



## PPP model:

Government purchase incineration services from Special Purpose Companies (SPC) formed by WtE IP Developer

## PPP structure:

NEA as regulator will:

- Long-term take-or-pay Incineration Services Agreement (ISA)
- Set and collect gate fee and electricity revenue to fund the service payments
- NEA pay SPC for:
  1. Availability of incineration capacity;
  2. Actual amount of waste incinerated; and
  3. Generation of electricity.

# 6th Waste-to-Energy (WTE) Plant - Under Construction

## Key information

- TuasOne WTE Plant
- DBOO PPP contract for 25 years
- Expected operation date: 24 May 2019
- 3,600 tonnes/day of domestic & industrial solid waste



## Preliminary concept of 6<sup>th</sup> WTE Plant

### 1. Minimise Land Footprint

- 750 tonnes/day/hectare
- Most compact plant in the world



### 2. Maximise Energy Recovery

- Generate 120MW of electricity
- Net energy efficiency of 25 %

### 3. Minimise Residue to Landfill

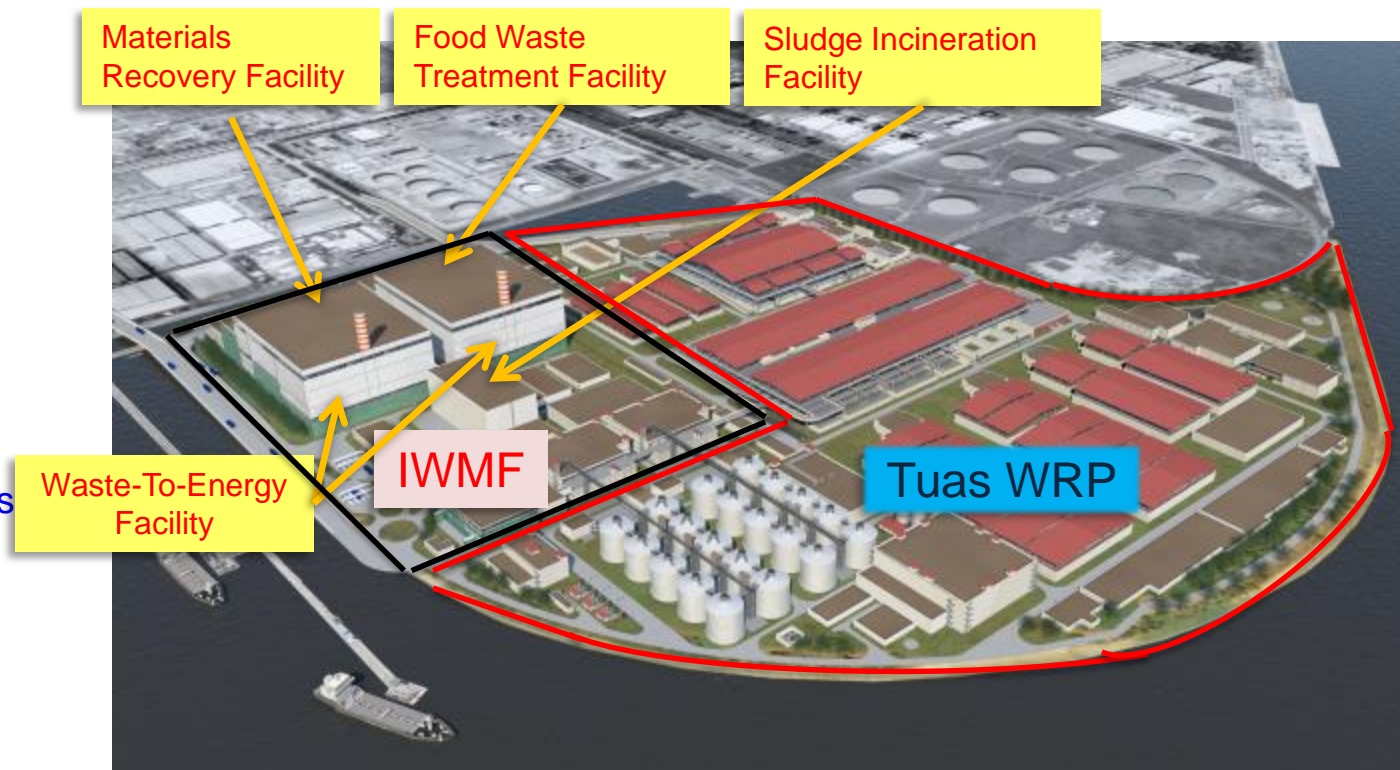
- Waste volume reduction  $\geq$  90%
- Recovery of ferrous metals from bottom ash

# Integrated Waste Management Facility (IWMMF) - Waste-Water-Energy Nexus (Future Development)

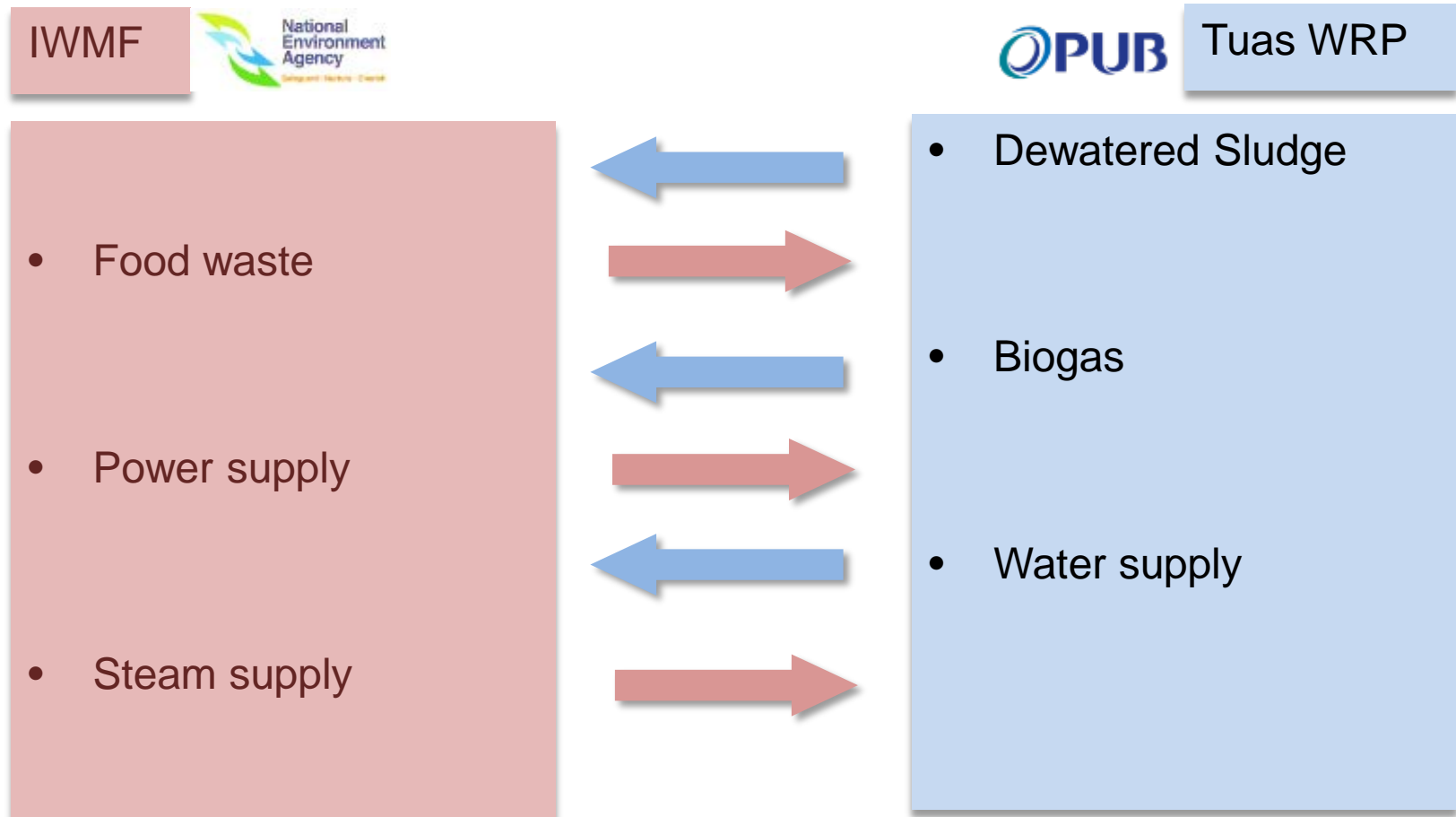
IWMMF will have treatment processes for incinerable waste, household recyclables, food waste and dewatered sludge from Tuas Water Reclamation Plant (Tuas WRP).

## Design objectives

- Maximise energy and resource recovery
- Minimise environmental impact
- Optimise land use
- Optimise process synergies with Tuas WRP



# Co-location Synergies between Tuas WRP and IWMF



Physical Synergies include the Administration Building and Site-wide infrastructure on site



# Semakau Landfill

## *Maximise Lifespan of Semakau Landfill*

- Lack of sea space to expand the size of Singapore's only landfill
- Improve quality of incineration ash to increase possibility of ash application
- Increase resource recovery to extend the lifespan of Semakau Landfill



# Conclusion

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**Vision:**

**A zero waste nation**

**A vibrant and sustainable Singapore**



# Our Environment

Safeguard • Nurture • Cherish