SUMMARY OF HONG KONG BLUEPRINT FOR SUSTAINABLE USE OF RESOURCES 2013-2022

**Vision**
Use less and waste less of the Earth’s resources through instilling an environmentally-sustainable culture into Hong Kong people’s daily life.

**Strategy**
- Develop a comprehensive waste management plan and promote a new social contract with the community to conserve resources and reduce waste.

**Overall Target**
- Reduce the Municipal Solid Waste (MSW) disposal rate by 40% on a per capita basis by 2022.

**Policy Directions**
1. Government to take multiple, concurrent actions to prevent and reduce waste
2. Make all out efforts to mobilize the community to participate
3. Fill missing gaps in Hong Kong’s waste-related infrastructure

**Key Actions**
- Drive behavioural change through policies and legislation to reduce waste, such as MSW charging and Producer Responsibility Schemes (PRS).
- Mobilize the community through targeted campaigns, such as with food waste, glass beverage bottles collection, bring your own bag (BYOB), community green stations etc.
- Invest in infrastructure, including Organic Waste Treatment Facilities (OWTFs), waste-to-energy MSW treatment, and landfill extensions.
T-PARK
Energy • Transformation • Community

Waste-to-Energy
A Sustainable Approach of Sludge Disposal
Advanced incineration system, substantially reduces the loading on landfills

- TPARK is the 1st large scale waste-to-energy facility in Hong Kong
- Treating sludge from all major Sewage Treatment Works
- Fluidized bed incineration technology
- 2,000 tonnes of sludge handling capacity per day (largest of this kind in the world)
- 90% volume reduction
- Avoiding sludge landfilling – 1.4 million tonnes since 1 April 2015 [as at Dec 2018]
Energy Recovery and Power Generation

- **Incinerator/Boiler**
- **Steam Turbine**
- **Generator**
- **Condenser**
- **Feed-water Tank**
- **Condensate Tank**
- **Public Grid**
- **Daily Operation**

- **High pressure superheated Steam**
- **Low Pressure Steam**
- **Surplus power**

- **Turbine**
- **Generator**
- **Feed water tank**
- **Condenser**
Electricity generation to sustain the facility operation

Surplus electricity exported to public power grid

Total Power Generation – 170 million kWh (since 1 April 2015) [as at Dec 2018]

Total Power Export – 8.6 million kWh (since 1 April 2015) [as at Dec 2018]
Educational and Leisure Facilities

- **T • HALL** (Exhibition Hall)
- **T • SPA** (Spa Pools)
- **T • SKY** (Upcycling Products)
- **T • THEATRE** (Theatre)
- **T • GALLERY** (Viewing Gallery)
- **T • CAFE** (CAFE)
- **T • SPACE** (Multipurpose Room)
- **T • CORNER** (Green Info Sharing)
Outdoor Facilities

T • GARDEN
(Landscape Garden)

T • GARDEN
(Footbath)

T • ROOF
(Viewing Platform)

T • HABITAT
(Natural Habitat)
# Integrated Waste Management Facilities Phase 1

## Scope of Contract:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Contract Arrangement</strong></td>
<td>Design-Build-Operate (DBO)</td>
</tr>
<tr>
<td><strong>Site Location</strong></td>
<td>Artificial Island near Shek Kwu Chau</td>
</tr>
<tr>
<td><strong>Design Capacity</strong></td>
<td>3,000 tpd of Municipal Solid Waste</td>
</tr>
<tr>
<td><strong>Treatment Technology</strong></td>
<td>Moving Grate Incineration Technology</td>
</tr>
<tr>
<td><strong>Contractor</strong></td>
<td>Keppel Seghers-Zhen Hua Joint Venture</td>
</tr>
<tr>
<td><strong>Design and Construction Period</strong></td>
<td>2017 to 2024</td>
</tr>
<tr>
<td><strong>Operation Period</strong></td>
<td>From 2024 for 15 years</td>
</tr>
<tr>
<td><strong>Capital Cost for Design and Construction</strong></td>
<td>About HK$18.01 billion in MOD prices</td>
</tr>
<tr>
<td><strong>Operation Cost</strong></td>
<td>About HK$13.38 billion in MOD prices for 15 years</td>
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</table>
Key Features

• MSW incineration plant employing advanced moving grate technology (capacity: 3,000 tonnes per day) to substantially reduce the volume of waste by 90%
• State-of-the-art flue gas treatment and discharge system & ash and residues treatment system
• Mechanical sorting and recycling plant (capacity: 200 tonnes per day)
• A desalination plant and a wastewater treatment plant to providing sustainable water supply and to recycle wastewater for reuse
• Environmental education facilities showcasing state-of-the-art technologies and environmental protection measures
Modern Moving Grate Incineration Technology – 3T

- **Temperature** at least 850°C to completely destroy organic matters
- High **Turbulent** Currents to achieve complete combustion
- At least 2s residence **Time** at 850°C or above to achieve complete combustion

- ✓ Proven experience
- ✓ Safe and robust system
- ✓ Meeting EU Emission Standards
- ✓ Low construction and operation costs
- ✓ Small footprint
Waste to Energy

- 3 steam turbine generators rated at 55MW (1 turbine per module of 2 incineration lines)
- Waste-to-energy system to harness the renewable energy source (~480 million kilowatt-hours of electricity per year for use by 100,000 households)
- Reduce greenhouse gas emission (~440,000 tons CO₂/year)
Electricity will be generated from incineration for export to the grid.

- Electricity may be imported during start-up and emergency shutdown of IWMF.
- Power cable connecting IWMF and the grid will consist of 132kV submarine cables and 132kV land cables.
Current Status:

<table>
<thead>
<tr>
<th>Composition</th>
<th>Domestic Waste</th>
<th>Commercial Waste</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Waste</td>
<td>~ 2,300 tons/day</td>
<td>~ 1,300 tons/day</td>
<td>~3,600 tons/day (~35% of MSW)</td>
</tr>
</tbody>
</table>

Prevent and reduce food waste at source

Donate surplus food for human consumption

Recycle to recover energy and nutrients

Waste-to-energy treatment of MSW

Clean landfilling
Waste Avoidance & Food Donation

• The Food Wise HK Campaign aims to promote public awareness and instill behavioural changes in various sectors to reduce food waste generation.

• Through the Environment and Conservation Fund (ECF), we have supported 34 projects for NGOs with HK$60 million for the collection of 5000 tonnes of surplus food for donation to about 5 million people.
Organic Resources Recovery Centres

- **ORRC1 - Siu Ho Wan**
  - 200 tonnes/day
  - Commissioned in July 2018

- **ORRC2 – Sha Ling**
  - 300 tonnes/day
  - To be commissioned in 2021

- **ORRC3 – Shek Kong**
  - 300 tonnes/day
  - Conducting engineering feasibility study

We plan to build 5 – 6 ORRCs in the territory for turning food waste to energy.
Organic Resources Recovery Centre Phase 1
Siu Ho Wan, North Lantau

Start intake food waste from 1 July 2018

Highlights:
- Design Capacity: 200 tonnes/day
- Surplus Electricity: 14 million kWh (~3,000 households consumption)
- By-products: 6,500 tonnes/year compost products
- Capital Cost: $1,589.2M

Benefits:
- Divert 73,000 tonnes of food waste from landfills every year
- Reduce 25,000 tonnes of greenhouse gas emission
Food Waste to Energy Journey

Composting Hall
- Mixing Unit
- Composting Tunnels
- Centrifuge

Pre-treatment Lines
- Trommel Sieves
- Crusher

Waste Water Treatment Plant

Anaerobic Digestion Tanks

Desulphurisation

1000 m³ Waste Bunker

5 Tipping Bays

Ammonia Stripping Plant

3 nos. 1.5MW CHPs

Flaring System

17 nos.
Organic Resources Recovery Centre Phase 1
Siu Ho Wan, Lantau Island

Commissioned in July 2018
Anaerobic Digestion

- Food Waste is pre-treated to remove impurities, then the suspension is pumped into the Suspension Buffer Tank.
- Food waste undergo anaerobic digestion (AD) process to produce biogas.
- Biogas extraction at the top of the AD tanks.

<table>
<thead>
<tr>
<th>Suspension Buffer Tank</th>
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<tbody>
<tr>
<td>No. of tank</td>
</tr>
<tr>
<td>Capacity</td>
</tr>
<tr>
<td>Mixing system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anaerobic Digester</th>
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</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>No. of stage</td>
</tr>
<tr>
<td>No. of tank</td>
</tr>
<tr>
<td>Capacity per tank</td>
</tr>
<tr>
<td>Operating Temperature</td>
</tr>
<tr>
<td>Retention Time</td>
</tr>
<tr>
<td>Mixing system</td>
</tr>
</tbody>
</table>
Electricity & Heat Generation

- 3 nos. Combined Heat and Power generation units to combust treated biogas to generate electricity and heat
  - Electricity capacity: 1500 kW / unit;
  - Heat capacity: 1600 kW / unit
  - Electricity & Heat generated is used for the operation of O · PARK 1.
  - Surplus electricity is exported to the power grid

Electricity Generation at O · PARK 1

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual electricity generation</td>
<td>~26 million kWh / yr</td>
</tr>
<tr>
<td>Annual electricity export to the Grid</td>
<td>~14 million kWh / yr</td>
</tr>
</tbody>
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## Summary of ORRC Phases 1 & 2

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Food Waste Recycling Capacity</strong></td>
<td>200 tonnes/day</td>
<td>300 tonnes/day</td>
</tr>
<tr>
<td><strong>Capital Cost</strong></td>
<td>HK$1.5B</td>
<td>HK$2.5B</td>
</tr>
<tr>
<td><strong>Running Cost</strong></td>
<td>HK$72M/yr</td>
<td>HK$100M/yr</td>
</tr>
<tr>
<td><strong>Biogas Generation</strong></td>
<td>20,000 m³/day</td>
<td>30,000 m³/day</td>
</tr>
<tr>
<td><strong>Biomethane Production</strong></td>
<td>--</td>
<td>5 million m³/yr*</td>
</tr>
<tr>
<td><strong>Surplus Power Generation</strong></td>
<td>14 million kWh/yr (~3000 households)</td>
<td>24 million kWh/yr* (~5000 households)</td>
</tr>
<tr>
<td><strong>Compost Generation</strong></td>
<td>6,500 tonnes/yr</td>
<td>10,000 tonnes/yr</td>
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</tbody>
</table>

* For ORRC2, we are yet to decide on whether the surplus biogas would be used to produce biomethane or electricity.
Food Waste/Sewage Sludge
Anaerobic Co-digestion Trial Scheme

- Food waste sourcing
- Food waste pre-treatment
- Delivery of pre-treated food waste to the Sewage Treatment Works;

- Modification of existing digestion facilities
- Co-digestion operation
- Electricity generation for internal power consumption

New initiative in using the existing sewage treatment works for turning food waste into energy.
**Food Waste/Sewage Sludge Anaerobic Co-digestion Trial Scheme**

**Tai Po Industrial Estate**

**Scope of Contract:**

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<th>Contract Arrangement</th>
<th>Design-Build-Operate (DBO)</th>
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<tbody>
<tr>
<td>Design Capacity</td>
<td>50 wet-tonnes per day</td>
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<tr>
<td>Contractor</td>
<td>ATAL Engineering Limited</td>
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<tr>
<td>Design and Construction Period</td>
<td>2017 to 2019</td>
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<tr>
<td>Operation Period</td>
<td>From 2019 for 6 years</td>
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</tbody>
</table>
Synergy of Co-location and Co-treatment

• Utilize the existing anaerobic digestion system

• achieve synergy in co-location and co-treatment of different waste types

Turning Waste to Energy

• Improve nutrient balance and enhance the biogas yield

Reduction of Greenhouse Gas (GHG) Emission
Pre-treated food waste will be transferred to the sewage treatment plants (STW) for co-digestion with sewage sludge. The digested sludge will then be incinerated at the T-Park. We plan to extend this operation to other STWs in HK to help reducing space and cost requirements for food waste recycling.
We will continue to develop more waste-to-energy facilities, including ORRCs, IWMF and co-digestion projects.