環境局 Environment Bureau

環境保護署 Environmental Protection Department

Food Waste • Waste To Energy

O·PARK1

5 Sham Fung Road, Siu Ho Wan, North Lantau Island

www.opark.gov.hk

Towards a Low Carbon Lifestyle

"Every single grain on the plate is the fruit of hard work." Cherish food crop is a traditional Chinese virtue

Unfortunately, the rate of food waste generation increases along with the rising living standard.

Actually, food waste contains precious organic resources which can be recycled and even turned into energy.

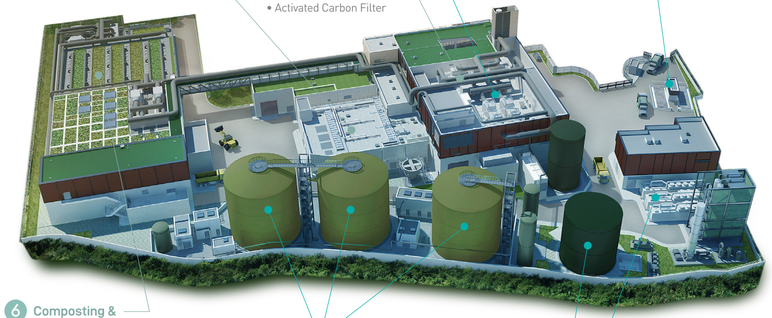
What is classified as recyclable food waste?

Food waste is any waste, whether raw, cooked, edible and associated with inedible parts generated during food production, distribution, storage, preparation or consumption of meals.

- ✔ Fish and poultry organs and intestine
- ✔ Egg shells
- ✔ Expired food
- ✔ Tea leaves and coffee grounds
- ✔ Soup pulp and Chinese Medicine pulp
- ✔ Pet food etc
- ✘ Shells
- ✘ Large bones
- ✘ Food packaging
- ✘ Plastic utensil
- ✘ Aluminum and metal can

O·PARK1

Convert food waste into energy and compost by proven and highly reliable anaerobic digestion technology



Renewable Energy

	2016	2016	2018
Energy Plus Facilities	**T·PARK**	**Solar Farm at the Siu Ho Wan Sewage Treatment Works***	**O·PARK1**
Surplus electricity generated (million kWh / year)	~17.5	~1.1	**~14**
Approximate power consumption by households (no. of households/ year)	~4,000	~230	**~3,000**

* It is the largest solar farm in Hong Kong

Food Wise • Recycling • Waste to Energy

O·PARK1

Being one of the largest scale in Asia, O·PARK1 is a treatment facility that converts food waste into electricity. It is also the first organic resources recovery centre developed in Hong Kong, which combines environmental protection, multi-technology and education in a single facility, marking a new milestone of Waste-to-Energy.

O·PARK1 has a design capacity of 200 tonnes per day. It adopts anaerobic digestion and composting technologies to recycle source separated food waste into biogas and compost. The biogas is used to generate electricity. Apart from self-sustaining the internal operation of O·PARK1, about 14 million kWh of surplus electricity, which is equivalent to the power consumption by some 3,000 households, can be exported each year. About 20 tonnes of compost can be generated as by-product per day.

Support from the Industry

Support from the commercial and industrial (C&I) sectors in source separation and delivery of food waste to O·PARK1 is crucial to its effective operation. At present, we have gained the support from over 200 C&I establishments.

Food waste reduction in Hong Kong

Aug 2008
Commencement of Kowloon Bay Pilot Composting Plant

Jun 2010
Food Waste Recycling Partnership Scheme

Jul 2011
Food Waste Recycling in Housing Estates

May 2013
Foodwise Hong Kong Campaign

Feb 2014
A Food Waste & Yard Waste Plan For Hong Kong 2014 - 2022

Jul 2014
Food Waste Donation Project under Environment and Conservation Fund

Nov 2015
Foodwise Eateries Scheme

O·PARK1

1 Food Waste Reception

Receiving Food Waste from (C&I) Sectors

Weight of food waste received are recorded at the weighbridge. It is then unloaded at the bunker of the Waste Reception Area. Grab crane is used to mix and transfer the food waste into hopper, entering the Pre-Treatment System. The enclosed tipping bays are equipped with double doors to prevent odour from escaping from the plant.

Bunker

4 Biogas Handling

Desulphurisation and Purification of biogas

Biogas is diverted to the desulphurisation column for biological oxidation of Hydrogen Sulphide (H_2S), to avoid corroding the downstream system.

Production Quantity (m^3/hr)	Hydrogen Sulphide (H_2S) Concentration (ppm)	
	Raw Biogas	Cleaned Biogas
~1,500	~3,000	≤ 300

Compositions and Characteristics of Biogas inside Biogas Holder			
Biogas Holder Capacity (m^3)	Methane (CH_4) Content (%)	Carbon Dioxide (CO_2) Content (%)	Relative Humidity (%)
1,500	60-70	30-40	100

Double Membrane Gasholder

Desulphurisation Column

2 Pre-Treatment Facilities

Separating Inert Materials and Recyclables

Crushers tear up the packaging materials, smash and turn the food waste into suspension with the addition of process water. Suspension is then transferred to the trommel sieve drums and sand grit traps to remove impurities, e.g. glass, stone and sand. Metals are also separated for recycling.

Trommel Sieve Drum

5 Heat and Power Generation

Self-sustained Operation and Power Export

Electricity is generated through the combustion of biogas for self-sustaining the operation, and surplus electricity is exported to the power grid. Heat recovered from the system is consumed by the heat demanding processes within the facility.

Emission Level of Generation Units	Total Suspended Particulates (TSP)	Carbon Monoxide (CO)	Nitrogen Oxides (NO_x)	Sulphur Dioxide (SO_2)	Volatile Organic Compounds (VOCs)	Hydrogen Chloride (HCl)	Hydrogen Fluoride (HF)
mg/Nm³	≤ 15	≤ 650	≤ 300	≤ 50	≤ 150	≤ 10	≤ 1

Combined Heat and Power Generation Units

3 Anaerobic Digestion

Anaerobic Digestion and Waste-to-energy

Make use of the microorganisms to convert the organic matter contained in the pre-treated food waste suspension into biogas, waste-to-energy.

Number of Anaerobic Digestion Tank	Capacity per Anaerobic Digestion Tank	Operating Temperature	Retention Time
3	~4,300 m^3	~35°C	~25 days

Anaerobic Digestion Tank

6 Composting

Dewatering and Composting

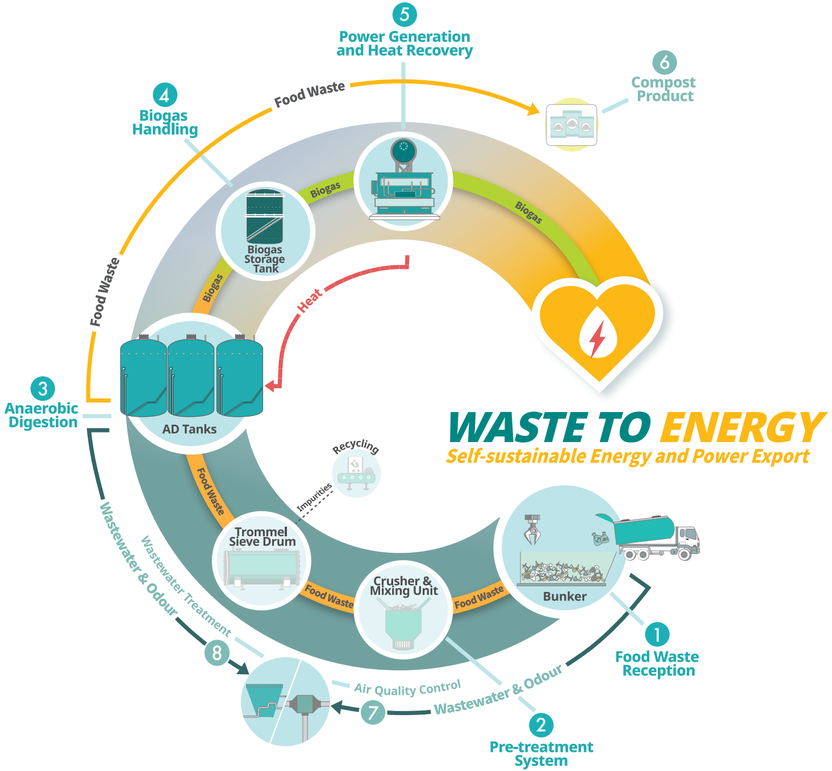
Digestate is first dewatered by the centrifuge, then mixed with bulking agent. After 14 to 20 days of composting process reaching a temperature over 55°C, the organic residuals will be converted into compost.

Production Quantity (t/y)	pH	Moisture Content (%)	Organic Matter (% of dry weight)	Carbon to Nitrogen Ratio
~6,500	5.5-8.5	25-45	> 20	≤ 25:1

Composting Tunnel

WASTE TO ENERGY PROCESS

Simplified version of organic resources treatment process



7 Air Quality Control

Highly Effective Deodorisation System

Facilities are confined and maintained at negative pressure to avoid odour dispersion. The odorous gases are extracted to the deodorisation system to remove dust particles, odorous compounds (mainly hydrogen sulphide and ammonium).

Odorous Substance	Average Concentration	Maximum Concentration	CAPCS	
			Removal Efficiency	Discharge Quality
Hydrogen Sulphide (H_2S)	5 ppm	10 ppm	≥ 99 %	≤ 0.1 ppm
Odour Unit	10,000	20,000	≥ 98.9 %	≤ 220

(1) The odour unit is odour unit/m^3

Centralised Air Quality Control System (CAPCS)

8 Wastewater Treatment

Purify Wastewater for Reuse

The system can remove a majority of total suspended solids, phosphorus , ammonia, organic substances and nitrogen. Treated effluent is reused within the facility, and the excessive volume is discharged to public sewage treatment works for further treatment.

Parameters (mg/L)	Raw Wastewater	Wastewater after Pre-treatment	Wastewater after Ammonia Stripping Plant	Wastewater after Biological Treatment	Discharge Standard
Biochemical Oxygen Demand (BOD)	2,500	1,630	1,550	400	≤ 800
Total Nitrogen (TN)	4,000	3,450	345	100	≤ 200

Ammonia Stripping Plant