Panel on Environmental Affairs
Special meeting on Saturday, 22 March 2014, at 9:30 am
in Conference Room 1 of the Legislative Council Complex
14th March 2014

WRITTEN SUBMISSION OF CLEAR THE AIR (Charity and NGO)

Dear Honorable Members,,

In 2012 the Panel on Environmental Affairs was approached by the Administration with the proposal to extend Hong Kong's 3 landfills and to approve the building of an IWMF mega incinerator at Shek Kwu Chau capable of handling 3,000 tonnes per day of unsorted waste using mass-burn moving grate technology. Under the Administration's Blueprint , eventually under Stage 2 and Stage 3 thereof, two more additional incinerators would be required.

The 2012 Panel on Environmental Affairs reply to the Administration was as follows:
www.legco.gov.hk/yr12-13/english/panels/ea/papers/ea0527cb1-1079-2-e.pdf

"13. According to the Government, IWMF would require some seven years for reclamation, construction and commission, while landfill extension would need a few years for site preparation works
15. The Panel held another special meeting on 20 April 2012 to continue discussion on the funding proposals. Noting that many measures pertaining to the Policy Framework had yet to be implemented , members were opposed to the reliance on landfills for waste disposal in view of the associated environmental nuisances, as well as the long lead time and cost incurred from restoration of landfills. They stressed the need for an holistic package of waste management measures (including waste reduction, separation and recycling) with waste incineration as a last resort and better communication between the two terms of Government on environmental policies, in particular on the need for incineration. They also urged the Administration to identify other suitable outlying islands for IWMF and promote the local recycling industry. In view of the foregoing, members did not support the submission of the funding proposals to the Public Works Subcommittee for consideration."

The Panel's remarks and decision to the Administration were quite clear.
'Many measures relating to the Policy Framework had yet to be implemented'

- Previous blueprints promised a lot and delivered little, other than hot polluted air, such as Waste Charging laws were to be enacted by 2007, recycling rates would increase 1% per year etc. Only now are we seeing progress towards Waste charging legislation to be in place almost a decade later. As for recycling rates the erection of China's 'Operation Green Fence' revealed the nefarious tip of the trash pile; the Administration had been using statistics on recyclable products imported through Hong Kong and transited to the Mainland and including them in its 'local' recycling rates. The true level of local recycling is still unverified by the Administration and not independently validated. Government figures reveal almost 100% of recyclables are exported, leaving no feedstock to support a varied and viable local recycling

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industry. Throwing money at the situation will not help without enough local feedstock recovered for recycling instead of buried or burned.

'Members **were opposed to the reliance on landfills for waste disposal'**

- We presume that this is also still the position of the current Panel? In spite of this directive the Administration has ignored the panel and seeks instead to increase landfill size for waste disposal ,stating there is no other option for the end of life construction waste. We have previously directed this Panel to reports on the Advanced Plasma Power / Machiels BV Enhanced Landfill Mining joint venture at Houthalen Hechteren landfill in Belgium:

http://www.elfm.eu/Uploads/ELFM/FILE_fb9272c9-b8a4-4611-ad77-895cbc5ec483.pdf

http://www.waste-management-world.com/articles/2011/05/plasma-power-goes-large-at-landfill-mining-project.html

- Millions of tonnes of buried (treasure) materials will be extracted and properly recycled, the remaining materials and soil will be passed through the plasma arcs at the temperature of the sun's surface creating a syngas/hydrogen that will be used to create electricity for the local grid and Plasmarok, a molten lava slag that when cool will be crushed and sold as an inert construction and road aggregate. The landfill site will eventually be returned to its pristine state. So whereas the Administration bleats it has no choice other than extend landfills to handle construction waste, the opposite is true and indeed is possible to recycle that end of life construction waste into a reusable recycled inert aggregate.

'They stressed the need for an holistic package of waste management measures (including waste reduction, separation and recycling) with waste incineration as a last resort'

- The fact that this meeting is held to discuss the very same Administrative policy proposals (just the price changed) means the Government is arrogantly ignoring the previous Panel's directives and is stubbornly trying to force ahead these flawed unchanged policies. The Government , instead of first promoting waste separation at source legislation is pressing ahead with waste charging legislation and putting the cart before the separated horse. Hong Kong people are law abiding; whilst limited separation of waste has occurred in select Government housing estates, private estates, buildings, residences and village houses have to actively seek out private recyclers to handle any separated waste they produce; otherwise there is no alternative for them and it all gets lumped together and landfilled = no recycling. Not only is there no source separation of waste legislation, there is no free Green Bin food waste and yard waste collection system in place as in many 1st world countries, so our daily MSW gets covered in ultra-wet food waste each day, rendering it unrecyclable. One can only presume this a deliberate Government ploy to enhance its case for a mass-burn behemoth and increased landfills to handle the daily 30% ash by weight of what they intend to burn whilst being seemingly at a loss of how to handle the construction waste.

'They also urged the Administration to identify other suitable outlying islands for IWMF'

- The urging was obviously completely ignored.

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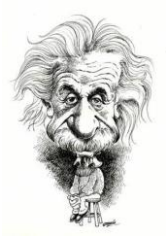
'They also urged the Administration to promote the local recycling industry'

- Local recycling industries cannot flourish without sufficient feedstock. Many recyclables are currently landfilled due to taint by wet food waste and the Administration's seemingly deliberate failure to legally compel source separation and collection of separated waste from all parts of Hong Kong. The Panel should establish a subcommittee to investigate the truth of Government provided 'local' recycling figures before and after 'Operation Green Fence' blocked all unwashed imported recyclables intended for transit, from entering the Mainland. What happened to the rejected materials ? What are the 'real' local recycling figures and modus operandi for calculating same ?

FACT: The Administration has done nothing to acknowledge and change its policies as directed by the Panel on the Environment in 2012 listed above. Indeed its attitude is more a two-fingered salute to the former panel directives since they have changed nothing , just resubmitted the same policies without change and expected to get a different outcome.

"Doing the same thing over and over and expecting different results is insanity" --- Albert Einstein



We see no reason whatsoever for the current Panel on Environmental Affairs to change its previous directives and reasoning to Government in 2012, and no reason for the Panel to support the same regurgitated policies as already rejected in 2012, until such time as the Government follows the Panel's unanimous guidelines therein.
The plain fact is that, if we had landfill enhanced mining and plasma reduction of construction waste, if waste source separation laws were in place, food waste collection in place leaving dry recyclable MSW, promotion of local recycling with dry available feedstock and use of the sewer system for food waste, there would be nothing left to burn or landfill.

Food Waste

More than 40% of our daily domestic MSW dumped in our landfills is food waste.
We submitted to this Panel previously our document 'Some food for thought' wherein we outlined that the Drainage Services Department's existing infrastructure could be easily used

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to handle all our daily food waste if first garburated at transfer stations into a puree, since the water content of Hong Kong wet market food waste (90%) is the highest in the world. The Government subsequently produced its latest Food Waste policy document in which it pooh-poohed our viable idea. Not only is our proposal totally viable, the methodology is recommended by CIWEM and CIWEM (Hong Kong), of which numerous Hong Kong ENB, EPD and Government consultant engineers are members.

For Hon Members' ease of reference I attach self-explanatory information herewith along with the CIWEM document which supports the use of the sewage system for food waste.

Cancer, death, still births , orofacial clefts in proximity to incinerators

Not once in any correspondence have we seen evidence from the Administration to refute the massive amounts of peer reviewed available multi-country expert reports showing how modern incinerators' proximity kill adults and children, pollute the environment and food chain with dioxins and other suspended particulate toxins and how 70% of what is burned is deposited into the landfill in the sky, whilst the remaining toxic ash needs to be, landfilled.

Our Landfills are nearly full

An easy statement to make- ask Government to define 'FULL'. In USA and elsewhere there are landfills that go upwards of 150 meters high (Puente Hills) instead of outwards. Is there some reason why our landfills cannot rise higher, or better still, be reverse-mined back to beneficial use as Government housing estates, sports facilities or parks ?
http://edition.cnn.com/2012/04/26/us/la-trash-puente-landfill/

Plasma Plants take too much land & the (NASA invented) technology cannot treat 3,000 tpd

The Administration seeks to misinform the public and legislators alike.
Here is data supplied by Air Products UK:
Myth 1 - Plasma Plant land requirement is enormous
Actual:

TONNES PER DAY	AREA	PLOT SIZE
1000 tpd: 20-25 acres	= 81,000 m2	**285m x 285m**
2000 tpd: 35-40 acres	=142,000 m2	**377m x 377m**
3000 tpd: 50-55 acres	= 202,350 m2	**450 x 450 m2**

They are modular and can be sited next to a landfill to save MSW transport through the city and by sea.

Myth 2 – plasma cannot handle 3,000 tpd MSW

A standard Westinghouse plasma modular arc system handles 950 tonnes of RDF per day – the waste stream is first recycled to create the RDF. Plant commissioning now in Teesside UK. Second plant adjoining first also 950 tpd under planning permission.
A standard Solena MSW to biofuel plant can handle 1,550 tpd per module.
Solena plant in Tilbury UK under construction for BA, second plant for Lufthansa under construction in East Germany.
Want more capacity, just add more modules.

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COST – incinerator and landfill extension package

The Administration seeks billions of dollars for this combined project. Incinerators cannot exist without landfills to receive the daily 30% by weight toxic ash. The fly ash (7-12% by proportion depending on feed stock) needs to be encased with cement to attempt to prevent leachate – which doubles the amount of fly ash deposited in landfill. Incinerators defeat recycling as they are voracious (hence the words 'mass-burn'). The Administration omits the fact that it will eventually have to go cap in hand to Legco again for funds ($ 10 billion ?) for a man- made island to be reclaimed in the sea near Lantau that will become the new ash lagoons which will be required ad infinitum by incinerator inefficient technology. Government will have to provide the land.

The incinerator and landfills will have recurrent yearly operational costs running into hundreds of millions of dollars.

Health treatment costs will rise.

Plasma Gasification Plant cost

Well, HK$ ZERO cost to Government and society.

The plasma plant company will fund the plant cost, Government just has to supply the land.

The operators will profit with a gate charge per tonne of MSW, by sale of the electricity generated to the grid or PRD grid, by recovered precious metals or recyclables and by sale of the Plasmarok inert slag as road aggregate or building sand.

There is no ash to landfill.

There are no yearly operational plant costs for Government to fund.

There is no longer a need for increased landfills and recurrent costs so they can be reverse-mined and construction waste can be turned into Plasmarok and sold.

Toxic landfill gas component emissions affect nearby residents

http://www.epa.gov/ttnchie1/ap42/ch02/final/c02s04.pdf

Some of the emissions components from landfill gases are shown in the following US EPA tables:

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Table 2.4-1. DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS[a]

(SCC 50100402, 50300603)

Compound	Molecular Weight	Default Concentration (ppmv)	Emission Factor Rating
1,1,1-Trichloroethane (methyl chloroform)[a]	133.41	0.48	B
1,1,2,2-Tetrachloroethane[a]	167.85	1.11	C
1,1-Dichloroethane (ethylidene dichloride)[a]	98.97	2.35	B
1,1-Dichloroethene (vinylidene chloride)[a]	96.94	0.20	B
1,2-Dichloroethane (ethylene dichloride)[a]	98.96	0.41	B
1,2-Dichloropropane (propylene dichloride)[a]	112.99	0.18	D
2-Propanol (isopropyl alcohol)	60.11	50.1	E
Acetone	58.08	7.01	B
Acrylonitrile[a]	53.06	6.33	D
Bromodichloromethane	163.83	3.13	C
Butane	58.12	5.03	C
Carbon disulfide[a]	76.13	0.58	C
Carbon monoxide[b]	28.01	141	E
Carbon tetrachloride[a]	153.84	0.004	B
Carbonyl sulfide[a]	60.07	0.49	D
Chlorobenzene[a]	112.56	0.25	C
Chlorodifluoromethane	86.47	1.30	C
Chloroethane (ethyl chloride)[a]	64.52	1.25	B
Chloroform[a]	119.39	0.03	B
Chloromethane	50.49	1.21	B
Dichlorobenzene[c]	147	0.21	E
Dichlorodifluoromethane	120.91	15.7	A
Dichlorofluoromethane	102.92	2.62	D
Dichloromethane (methylene chloride)[a]	84.94	14.3	A
Dimethyl sulfide (methyl sulfide)	62.13	7.82	C
Ethane	30.07	889	C
Ethanol	46.08	27.2	E
Ethyl mercaptan (ethanethiol)	62.13	2.28	D
Ethylbenzene[a]	106.16	4.61	B
Ethylene dibromide	187.88	0.001	E
Fluorotrichloromethane	137.38	0.76	B
Hexane[a]	86.18	6.57	B
Hydrogen sulfide	34.08	35.5	B
Mercury (total)[a,d]	200.61	2.92×10^{-4}	E

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Compound	Molecular Weight	Default Concentration (ppmv)	Emission Factor Rating
Methyl ethyl ketone[a]	72.11	7.09	A
Methyl isobutyl ketone[a]	100.16	1.87	B
Methyl mercaptan	48.11	2.49	C
Pentane	72.15	3.29	C
Perchloroethylene (tetrachloroethylene)[a]	165.83	3.73	B
Propane	44.09	11.1	B
t-1,2-dichloroethene	96.94	2.84	B
Trichloroethylene (trichloroethene)[a]	131.40	2.82	B
Vinyl chloride[a]	62.50	7.34	B
Xylenes[a]	106.16	12.1	B

NOTE: This is not an all-inclusive list of potential LFG constituents, only those for which test data were available at multiple sites. References 10-67. Source Classification Codes in parentheses.

[a] Hazardous Air Pollutants listed in Title III of the 1990 Clean Air Act Amendments.

[b] Carbon monoxide is not a typical constituent of LFG, but does exist in instances involving landfill (underground) combustion. Therefore, this default value should be used with caution. Of 18 sites where CO was measured, only 2 showed detectable levels of CO.

[c] Source tests did not indicate whether this compound was the para- or ortho- isomer. The para isomer is a Title III-listed HAP.

[d] No data were available to speciate total Hg into the elemental and organic forms.

Table 2.4-2. DEFAULT CONCENTRATIONS OF BENZENE, NMOC, AND TOLUENE BASED ON WASTE DISPOSAL HISTORY[a]

(SCC 50100402, 50300603)

Pollutant	Molecular Weight	Default Concentration (ppmv)	Emission Factor Rating
Benzene[b]	78.11		
Co-disposal		11.1	D
No or Unknown co-disposal		1.91	B
NMOC (as hexane)[c]	86.18		
Co-disposal		2420	D
No or Unknown co-disposal		595	B
Toluene[b]	92.13		
Co-disposal		165	D
No or Unknown co-disposal		39.3	A

[a] References 10-54. Source Classification Codes in parentheses.

[b] Hazardous Air Pollutants listed in Title III of the 1990 Clean Air Act Amendments.

[c] For NSPS/Emission Guideline compliance purposes, the default concentration for NMOC as specified in the final rule must be used. For purposes not associated with NSPS/Emission Guideline compliance, the default VOC content at co-disposal sites = 85 percent by weight (2,060 ppmv as hexane); at No or Unknown sites = 39 percent by weight 235 ppmv as hexane).

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Table 2.4-4. (Metric Units) EMISSION FACTORS FOR SECONDARY COMPOUNDS EXITING CONTROL DEVICES[a]

Control Device	Pollutant[b]	kg/10^6 dscm Methane	Emission Factor Rating
Flare[c]	Nitrogen dioxide	650	C
(50100410)	Carbon monoxide	12,000	C
(50300601)	Particulate matter	270	D
IC Engine	Nitrogen dioxide	4,000	D
(50100421)	Carbon monoxide	7,500	C
	Particulate matter	770	E
Boiler/Steam Turbine[d]	Nitrogen dioxide	530	D
(50100423)	Carbon monoxide	90	E
	Particulate matter	130	D
Gas Turbine	Nitrogen dioxide	1,400	D
(50100420)	Carbon monoxide	3,600	E
	Particulate matter	350	E

[a] Source Classification Codes in parentheses. Divide kg/10^6 dscm by 16,700 to obtain kg/hr/dscmm.
[b] No data on PM size distributions were available, however for other gas-fired combustion sources, most of the particulate matter is less than 2.5 microns in diameter. Hence, this emission factor can be used to provide estimates of PM-10 or PM-2.5 emissions. See section 2.4.4.2 for methods to estimate CO_2, SO_2, and HCl.
[c] Where information on equipment was given in the reference, test data were taken from enclosed flares. Control efficiencies are assumed to be equally representative of open flares.
[d] All source tests were conducted on boilers, however emission factors should also be representative of steam turbines. Emission factors are representative of boilers equipped with low-NO_x burners and flue gas recirculation. No data were available for uncontrolled NO_x emissions.

Yours faithfully,

James Middleton

Chairman
Clear the Air Charity NGO

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Puente Hills Landfill, Los Angeles, California

Covering roughly 700 acres and towering almost 500 feet high, Los Angeles' largest landfill, Puente Hills, takes in 12,000 tons of garbage a day and currently holds 3.7 million tons.

http://www.theatlantic.com/technology/archive/2013/04/touring-the-largest-active-landfill-in-america/274731/
Hewitt told us that Puente Hills now rises to the height of a forty-storey building, meaning, as Hume notes, that if the landfill was a high-rise, "it would be among the twenty tallest skyscrapers in Los Angeles, beating out the MGM Tower, Fox Plaza, and Los Angeles City Hall."

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Food Waste Disposers

Purpose

This Policy Position Statement outlines the main issues relating to the use of food waste disposers (FWD) in the management of food waste from domestic kitchens. FWDs are installed beneath sinks to separate food waste at source and grind it in order that it can be treated via the wastewater collection and treatment system. FWDs are an alternative to disposing food waste with solid waste. The issues include the effect of food waste on the wastewater system, diversion of food waste from landfill to recycling (CEC, 2008a), avoidance of extra vehicle movements for separate collection, avoidance of vermin attraction, improving yield of dry recyclables and avoidance of storing putrescible food waste in or close to kitchens with its associated health and odour implications.

CIWEM calls for:

1. Policies and strategies should be evidence based.
2. In addition to providing energy, anaerobic digestion (AD) conserves the nutrients from the feedstock into the digestate and using this digestate on land helps to maintain soil organic matter and complete nutrient cycles.
3. Ground food waste is valuable biogas substrate.
4. In-sink FWDs are an environmentally acceptable option for separating food waste at source and conveying it to treatment and use via existing infrastructure.
5. In-sewer processes can reduce or remove dissolved load before it reaches wastewater treatment works (WwTW).
6. The global warming potential of FWD to public sewer and AD is as good as kerbside to AD and better than centralised composting, incineration or landfill.
7. Exclusive emphasis on kerbside collection of source segregated biowaste has been mistaken.
8. A diversity of environmentally valid options for biowaste will ensure as many citizens as possible are willing to participate.
9. FWDs are an opportunity for cost saving to society as a whole.
10. Regarding the management of food waste, 'one size' will not fit all; home composting fits some, kerbside collection fits others and FWD fit others, especially (but not exclusively) people in flatted properties.

The Chartered Institution of Water and Environmental Management (CIWEM) is the leading professional body for the people who plan, protect and care for the environment and its resources, providing educational opportunities, independent information to the public and advice to government. Members in 98 countries include scientists, engineers, ecologists and students.

Context

The food waste disposer (FWD) was invented in 1927 by architect John W. Hammes of Racine, Wisconsin, USA to be a convenience for his wife. In 1938 his company started manufacturing and selling FWD. Some cities in USA mandated FWD for all new build residential properties. FWD fit the standard drain outlet hole of kitchen sinks. They comprise a 'grind chamber' which has perforated walls; the floor is a spinning disc with lugs that throw food scraps against the wall by centrifugal force. There are no knives in a FWD so it cannot cut plastic or fingers. FWDs operate with a stream of cold water that conveys the ground food waste through the drains. Particles cannot escape the grind chamber until they a small enough to pass the outlet screen.

Today approximately 50% of households in the USA have a FWD; in some cities more than 90% have them. Initially sewerage engineers in the USA were apprehensive that the output of FWDs might affect sewers and/or wastewater treatment adversely but a review of experiences in about 300 municipalities concluded their fears were unfounded (Atwater, 1947). New Zealand and Australia also have high rates of installation at more that 30% and more than 20% respectively. Installation in EU Member States (MS) is 5% or less. However the density of installation in commercial kitchens is very much greater. Generally domestic food waste in the EU is dealt with as part of the solid waste system; however in some MS interest in FWD is growing for reasons discussed below.

European policy (CEC, 2008a) advocates the "waste hierarchy" priority order of options: prevention; preparing for re-use; recycling; other recovery, e.g. energy recovery; and disposal. The EU Landfill Directive (CEC, 1999) requires MS to reduce the amount of biodegradable waste disposed to landfill in order to reduce methane emissions. Methane (CH_4) has 25-times the climate change effect of carbon dioxide (CO_2) over 100 years (IPCC, 2007). The EU also aspires to change from a disposal society to a recycling society.

Quested and Johnson (2009) estimated 5.8 million t/year of food waste is collected by local authorities in the UK, mainly in the residual waste stream (general bin). This equates to 230 kg/household.year. Europe has given emphasis to separate [kerbside] collection of biowaste for many years but even so a large proportion of biowaste is still in mixed waste (CEC, 2008b), this makes resource recovery more difficult. The European Commission's Green Paper (CEC, 2008b) on biowaste says that only 30% of biowaste is separately collected and treated biologically. Clearly, many citizens remain unwilling to participate in separate kerbside collection.

'Kerbside' collection of source segregated wastes requires the solid waste from domestic and commercial premises to be stored in separate containers, collected separately and taken to treatment facilities. Dry recyclables (paper, glass, plastic and metal) can be segregated mechanically after collection but their value is reduced if they are contaminated with wet food waste. The biodegradable fraction of solid waste is generally composted or anaerobically digested (AD). CH_4 from AD is used as renewable energy and the digestate as soil improver. Separate collection often necessitates extra truck traffic, especially during summer when it is not acceptable to store biodegradable waste for long periods prior to collection because of odour.

Discussion

1. Experience from other MS with a longer history of kerbside collection of source segregated food waste than the UK's shows clearly that some citizens are unwilling to participate (e.g. Kegebein et al., 2001) and also that diligence about excluding physical contaminants declines (Riedel, 2008). Waste managers report non-participation is especially problematic in 'flatted' properties.
2. Home composting might be ideal but many households are unwilling or unable to do this. Smith and Jasim (2009) showed that fears about CH_4 emission for poor home composting are exaggerated. They found people who composted food waste compensated by putting their more difficult to compost garden waste in the kerbside bin, consequently there was little reduction in the mass of biodegradable waste collected, but the character changed.
3. FWDs use water to transport the ground food waste out of the grind chamber and through the drainage system. Some field studies to measure water use by households with and without FWD showed water use is related to food preparation events, not to the number of people in a household. Two studies from Sweden (Nilsson et al., 1990 and Karlberg & Norin, 1999) and one from Canada (Jones, 1990) were unable to detect any influence of FWD installation on the per-capita volume of water used. The Swedish studies found water use decreased during the period when FWD were used but they concluded it would not be appropriate to attribute this directly to the fact that FWD had been installed. The Canadian study concluded the influence on water use was not significant within the overall "noise" in measured water use. The largest field study into FWD was in New York City, it involved 514 apartments with FWD compared with 535 apartments without FWD. They were in 4 different localities to reflect some of the city's diversity. The survey comprised 2014 people in total; it concluded the average water use attributable to FWD was 6.9 l/hhd.day [1] (New York City DEP, 1999). Evans et al. (2010) found the flow into a WwTW did not change significantly between the time when there were no FWD and when 50% of the 3700 households used FWD. On the basis of these and other studies, 6 l/hhd.day (one flush of a modern toilet) would be a conservative (upper) estimate of additional water use, this is of no consequence to sewer hydraulic capacity and negligible in terms of sewage pumping or water resources.
4. Domestic FWD have a 350 to 750 W motor. Based on field studies of usage, the annual electricity consumption is about 3 kWh/hhd.year.
5. Kegebein et al. (2001) estimated that where the ground food waste is treated by AD, the electricity generated from the biogas would be 73 kWh_e/hhd.year. Evans et al. (2010) found that when 50% 0f households used FWD, the biogas increased by 46% (P=0.01) and that this equated to 76 kWh_e/hhd.year. In 2005, 64% of the UK's sewage sludge was treated by AD, by 2015 this will have increased to 85%.
6. Thermal electricity generation uses about 80 litres water/kWh_e, the UK's average electricity generation emission factor is 0.541 $kgCO_2e/kWh_e$, thus the offset from the electricity from biogas is 6000 l water and 41 $kgCO_2e/kWh_e$ this is a net annual benefit of 3900 l water and 40 $kgCO_2e$ per household.
7. Kegebein et al. (2001) measured the particle size distribution of FWD output using two mixtures of foods and also waste from the university's cafeteria. They found 40-50% of the output was <0.5 mm, 98% was <2 mm and 100% was <5 mm by

[1] hhd = household

sieve analysis; between 15 and 36% of the output was in their 'dissolved' fraction. They observed sediment-free transport at 0.1 m/s, which is well within design standards for sewers (0.48 - 0.9 m/s - Ashley et al., 2004). Nilsson et al. (1990) simulated 15 years of FWD use using a mixture of foods that included 8.5% w/w lard and 1.7% w/w margarine, they found no blockage. They also compared apartment buildings with and without FWD and found no difference in their sewers by CCTV inspection [others have reported similar CCTV results].

8. Combined sewer overflows (CSO) are the 'safety valves' on sewers so that when stormwater exceeds the hydraulic capacity of sewerage, the excess wastewater can be released with minimum harm. CSOs are fitted with 6 mm screens; clearly the output of FWDs will not block 6 mm screens but when CSOs do discharge, FWDs will add to the load in the discharge, albeit mitigated by in-sewer processes (see 12 below) and into rivers in spate. The answer to preventing CSO discharges is minimising the input of surface water.

9. Fat, oil and grease (FOG) should never be poured down drains. Instructions on the installation and use of FWD contain information to this effect. FOG blockages in sewers are a significant issue but a conclusion from analysing FOG samples collected from around the USA was that FWD were not implicated (Ducost et al., 2008 and private communication Keener, K. Purdue University, 2010).

10. The unintended consequences of obliging people to store food waste might be nuisance [odour and vermin] and exposing them to health risks. The British Pest Control Association considered that since 98% of the ground food waste is <2 mm, it would not be detectable by rats (Adrian Meyer private communication 2005). In contrast spilled and poorly contained food on the surface does attract rats, gulls and other scavengers. Wouters et al. (2002) reported that keeping separated food waste in kitchens increases bioaerosols and allergens compared with mixed waste that contains food waste; they concluded this is a respiratory risk to susceptible individuals.

11. Life cycle assessments in Australia, Israel and USA have all concluded that FWDs discharging to public sewers are good solutions for food waste. Evans (2007) reviewed the 100-year Global Warming Potentials (GWP) of different options and found the GWP of delivering segregated food waste to anaerobic digestion (AD) via FWD and the sewers was equivalent to kerbside collection and transport to AD by road (≈ -170 $kgCO_2e$/t food waste). Both routes to AD were better than composting, incinerating or landfilling (-14, +13 and +740 $kgCO_2e$/t food waste respectively). The incineration and landfilling scenarios both included energy recovery. The composting scenario was based on a survey of in-vessel plants in Netherlands that pre-dated the Animal by-Products Regulation (CEC, 2002) – compliance with ABPR would have increased energy and carbon use. The FWD route saved the local authority (Herefordshire and Worcestershire) more than £19 /hhd.year (based on their 2005 audited data) but [at the time] the cost transfer to wastewater treatment was unknown.

12. The question of cost transfer was resolved by comparing the influent monitoring data for the WwTW that serves Surahammar in Sweden for the period when there were no FWDs with the period when 50% of households used FWDs (Evans, et al., 2010). 24 hour composite samples of influent had been collected 4 weekly (generally on Wednesdays); the average loadings of BOD_7, COD, N and NH_4^+ all decreased but the differences were not statistically significant. Average annual biogas increased by 46% (P=0.01). This is consistent with the earlier finding (when only 30% of households had FWD) that electricity use in activated sludge had not increased (Karlberg and Norin, 1999). There had been no cost transfer, indeed

were value is obtained from biogas, FWDs confer a financial benefit. Evans et al. (2010) hypothesised that biofilms on the sewer walls had acclimated to the changed wastewater composition and biodegraded the dissolved load, aided by the relative increase in carbonaceous matter from the food waste. Battistoni et al. (2007) from a field study in Italy also concluded that the additional carbonaceous matter aids nutrient removal. Generally, domestic sewage [without FWD] has an excess of nitrogen and phosphate compared with carbon and therefore carbon (e.g. methanol and/or acetic acid) has to be purchased for biological nutrient removal in wastewater treatment unless there is a non-domestic discharger of C, such as a brewery.

13. FWDs do add to biosolids production but the increase is small. Food waste is typically 70% moisture and 90% volatile solids. It is very biodegradable; the volatile solids reduction during AD is about 90%. Thus, 1 t food waste (fresh weight) contributes about 50 kgDS to digestate production, which is recycled as part of the biosolids recycling programme with all of its proven safeguards.
14. Some municipalities have banned FWDs but on examination bans have been based on apprehensions and fears about adverse consequences and have been rescinded when objective assessments have been made. New York City rescinded its 17 year ban following field study (New York City DEP, 1999). Since 2008 both Stockholm, Sweden and Milwaukee, USA have encouraged FWD installation and use because they want to increase biogas production at their WwTWs.

Key Issues

1. Food waste is one of the largest fractions of household waste and it is the most difficult to manage because it has a high moisture content, sticks to dry recyclables (which reduces their potential for recycling), attracts pests and becomes malodorous.
2. Removing food waste at source unlocks the potential for recycling other fractions (Yang et al., 2010). Some citizens will practice home-composting, others will participate in kerbside collection but experience has shown that some (especially in flatted properties) will do neither of these. FWDs are a means of separating food waste at source and conveying it to treatment using existing infrastructure.
3. CIWEM considers that a diversity of environmentally acceptable options is needed for managing food waste so that there is maximum participation. A substantial body of published research demonstrates that FWDs are an environmentally acceptable option and that the reasonably expected fears of adverse consequences are unfounded. The GWP of FWDs delivering to AD [the dominant form of sludge treatment, by weight, in the UK] is as good as delivering food waste to AD by kerbside collection by trucks and better than centralised composting, incineration [EfW] or landfill.
4. CIWEM considers emphasising kerbside collection of source segregated food waste to the exclusion of other options has been a mistake because experience from around the world has shown that a sizeable proportion of the population do not participate.
5. CIWEM applauds the water utilities in the UK for increasing AD and biogas utilisation and for using such a large proportion of the biosolids on land (83% in

2008/09 for England and Wales) to conserve organic matter and complete nutrient cycles.

6. FWDs save at least £30 /hhd.year for food waste collection and treatment or disposal and appear to have little or no effect on the cost at WwTW, probably because of in-sewer acclimated biofilms. There is negligible impact on water resources. Where there is AD and biogas utilisation, FWDs contribute to wastewater treatment financially.
7. CIWEM considers that in this, as in all other aspects of water and environmental management, policy and strategy should be evidence-based.

Conclusions

1. CIWEM considers the evidence demonstrates that FWDs are valid tools for separating kitchen food waste at source and diverting it to treatment, use and recycling via the existing infrastructure and that they offer the opportunity for cost savings compared with other routes.

2. CIWEM considers that FWDs offer the opportunity for wider participation in resource recovery from wastes by a greater proportion of the population than has been the case with exclusive advocacy of kerbside collection, which whilst acceptable to some, is not acceptable to all.

3. CIWEM considers food waste and other organic residuals should [wherever possible] be treated and then used on land to conserve soil organic matter and complete nutrient cycles. The use of biosolids and other organic resources on land should be viewed from the perspective of the soil rather than from the origins of the materials. It is important to move to a holistic view of all aspects of organic resource production, use, soil protection, countryside stewardship, water protection, air protection and crop and livestock production. CIWEM considers there is scope for simplified, proportionate, science-based regulation of all organic resources and for co-treatment.

February 2011

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Note: CIWEM Policy Position Statements (PPS) represent the Institution's views on issues at a particular point in time. It is accepted that situations change as research provides new evidence. It should be understood, therefore, that CIWEM PPS's are under constant review, and that previously-held views may alter and lead to revised PPS's.

Dear Hon Cyd Ho and members of the Panel on Environmental Affairs 2013-14,

15th October 2013

UPDATED Version

Dealing with our wet food waste

The big problem with Hong Kong's ultra-wet food waste (WFW) is…..

- It's very wet and difficult to handle (90% water content in wet market food waste, 70-75% water content in malls and restaurant WFW)
- It requires more energy to burn than it inherently contains. http://www.massbalance.org/downloads/projectfiles/1826-00237.pdf (p.8) *European food waste 4.2 MJ/kg calorific value (CV*) but European food waste has on average only 30% moisture content, so HK WFW will be even lower (CV). Hong Kong has the wettest worldwide putrescible waste w/ 90% moisture levels from wet markets & avg 70+% domestic WFW versus 56% Korea, 50% Japan, 30% Europe.
  Anaerobic digestion is an appropriate treatment for putrescible wet food waste(WFW), not incineration. The Government's "Bury 'N Burn" waste '*plan*' is for 3 incinerators & extended landfills – however you cannot combust low CV /high moisture WFW without co-combusting additional higher CV feedstocks, (thus defeating recycling efforts) since at least 6 MJ/kg CV in the feedstock is needed for combustion.
  http://www.waste-management-world.com/articles/2013/07/is-waste-to-energy-to-answer-for-india.html

  But Hong Kong can consider another method…… methane generating food waste is the smelly and obnoxious component of MSW ; *48% of HKG daily MSW is putrescible waste (42.3% wet food waste / 1.6 % yard waste / 4.3% used nappies + cotton wool)*
- WFW is a health hazard as it generates methane – methane is 21 times more damaging to the environment than CO_2 so it is flared off at the landfills 24/7.

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- It is the prime reason why we need to employ so many Refuse Collection Vehicles (RCV's) to clear the problem daily from HKG's WSW generators
- It is the reason why odorous RCV's get a bad name
- It accounts for many of the RCV trips per day, 48% of HKG's daily MSW is putrescible waste
- RCV's spill stinky leachate on the road
- Were food waste not present in MSW we could reduce waste collection frequency and its weight and significant costs to handle, transport and landfill.

So why not remove food waste at source and before it gets into the MSW ?

This would:

- Avoid the smell at collection points and landfills
- Avoid the smell from RCV's on the roads
- Improve public health
- Reduce the need to clean the roads
- Enable MSW to remain dry and more easily recycled and/or plasma gasified / syngas converted to bio diesel or aircraft / ship fuels
- Reduce the frequency of RCV trips
- Make people more aware of the packaging and food waste they generate

So how do we progress?

(instead of stepping backwards with HKG ENB's Bury 'N Burn Blueprint)

At present we are planning to introduce two anaerobic digestion organic waste treatment facilities (OWTF) for 200 tpd & 300 tpd (Total 500 tpd WFW) These will generate about 7.5 MW of power using anaerobic digestion that converts the waste to sugars and then gas to drive turbines but these will generate about 50 tpd of low quality compost as a result. Where is all the low grade compost going to go? No-one will buy it. **Do we need to spend this money ?**

Altogether the OWTF's will cost about $HK 3 billion to build and well over $HK 250 million per year to operate and ***will treat only a miserable 12.5% of the almost 4,000 tonnes food waste generated each day,*** mainly from hotels, wet markets, food stalls and the catering industry as well as residential units.

The remainder of the food waste problem could be avoided and many of the issues

identified above could be eliminated if we were to make hotels, restaurants, caterers, markets, businesses etc and individuals responsible for processing their own food waste.

The best choice of course would be not to waste food in the first place. However, we are an affluent society in Hong Kong and can afford to bin half the food we buy and we no longer have pigs to feed…

So..

Why not make every restaurant, wet market, business, caterer, hotel and household responsible for sorting food waste at source and disposing of their own food waste as it is generated **using waste disposal shredding (garburator) units with outfalls linked to the existing sewerage system ?**

It would foster a sense of responsibility and everybody could get involved and feel good about doing the right thing. Even easier than taking the lift down to the ground floor and walking to the garbage area. A garburator system needs to be inexpensive to install and operate when compared with housing costs and it should not require fancy new technology.

So, consider making sink outlet WFW shredding disposal units mandatory in households and industrial garburator units in restaurants, hotels, hospitals, schools and the catering industry, businesses etc, & connected to the sewage system. The DSD waste water sewage handling system is already there and capable of accepting it.

Phase 1- every hotel, restaurant, food business, hospital and wet market management etc would have industrial sized food waste shredding units - extending to Phase II Govt housing estates next, then Phase III to the rest of HKG households that have a legal sewage connection, so there would be no discrimination.

For those premises not connected to the existing sewage system such as village houses there would be a **GREEN BIN** collection scheme, charged for at sewage rates, which would be delivered to neighborhood industrial WFW shredding disposal units connected to the existing sewage network.

GREEN BIN

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Shrieks of horror ! we cannot do that, Government will rant *(because they never thought about it whilst blindly idolising their regurgitated 'Bury ' N Burn Blueprint')*

OK let's check the feasibility then……

http://www.biwater.com/Articles/325198/Biwater/BW_Home/waste_water/waste_water_projects/Stonecutters_Island_STW.aspx

Stonecutters treatment plant is designed to handle up to 2,764,800 cubic meters of waste water sewage per day by 2016, albeit DSD advise it will be 2.45 million tonnes per day. Stonecutters currently handles approx 1.6 million cubic meters of waste water (1.6m tonnes per day) of which the remaining sludge is approx 800 (eight hundred) tonnes per day. Disposing of a few extra thousand cubic meters of shredded WFW (70-90% water content) would add a very small additional load to Stonecutters capability to process additional sewage above the current 1.4 million tonnes load per day, since between 70%-90% of the 3,500 tonnes WFW is already water anyway!

The Stonecutters sewage treatment plant is ideally suited to handle such a relatively small additional quantity (3,500 tpd WFW) and is already operational.

Such a small increment of the incoming sludge would be negligible and it would all have calorific value (CV) so it would benefit the new Tsang Tsui sludge incineration process we have already implemented (at least once it's commissioned) and it will generate power

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which is already being negotiated to be fed into the grid.

The Big Advantage with this proposal will however be……

It uses existing facilities and technology but more importantly the pre-processing will be done by hotels, restaurants, caterers, fast food outlets, businesses, hospitals, wet markets, Government and private estates and at least 2 million households, - everybody doing their bit and thereby using existing end of line reception resources and diverting the vast majority of daily MSW from landfills!

Excellent…! we will mobilize the entire population and they will feel "good" about doing the right thing (they even do not have to walk to the garbage area with it any more) **provided the idea is marketed correctly.**

So where do we go from here…….

Government Departments are highly adept at passing the responsibility buck.
CEDD at Area 137 Wan Po Road handles Hong Kong's 18,000+ tpd (reusable fill) construction waste for export.

So let's suggest ENB pass on their WFW problem to DSD…. ENB has a great incentive to do this and for DSD, this would be minimal fuss, just slightly more dehumidified sludge to be shipped to Tsang Tsui sludge incinerator each day- The garburator scheme could even win brownie points for the beleaguered Government of CY Leung.

Make it Free

The funds will be easily recovered by the reduced handling costs and landfill benefits
Provide vouchers not cash subsidies for every household from the Budget surplus to install a sink waste disposal unit from appointed installers (paid by voucher) and make them mandatory to install and to use. (1 x Govt provided free garburator voucher per household … HKG people love freebies even if they are mandatory)

Non households, hotels and catering business outlets etc must buy their own commercial units and be inspected by FEHD under licensing conditions.

Next: Charge heavily for WFW disposal from the general public dumped at garbage collection points… and instead propose the use of private sector WFW collectors for **GREEN BIN** contents to dedicated reception points for disposal in each neighborhood for shredding and feeding into the sewage system. Government could actually pay for this collection service since the reduced number of current RCV trips and transfer stations would cover the costs of WFW GREEN BIN collections

We would need to deal with glass recycling. Glass has a very low calorific value (0.7 MJ/kg) Govt should encourage a new local recycling business to keep people at the bottom end of the chain employed. Glass can be ground to produce a substitute for aggregate in concrete products., Alternatively glass could be plasma gasified to produce an inert vitrified molten slag that can be used as a construction aggregate substitute given that all our building aggregate here is imported. Likewise plasma gasification could treat the construction waste that cannot be recycled and convert it to usable vitrified inert aggregate.

So with a new direction and using existing operating end-of-line reception facilities at Stonecutters we can handle our existing and future WFW, which is almost half of our daily MSW.

The other half of the daily MSW can be locally recycled as RDF (Refuse Derived Fuel) thus providing more local jobs and then sold to Europe as high CV feedstock in the interim; Europe considers MSW as a commodity feedstock for its overcapacity incinerator networks and which relies on same for its electricity and heat generation.

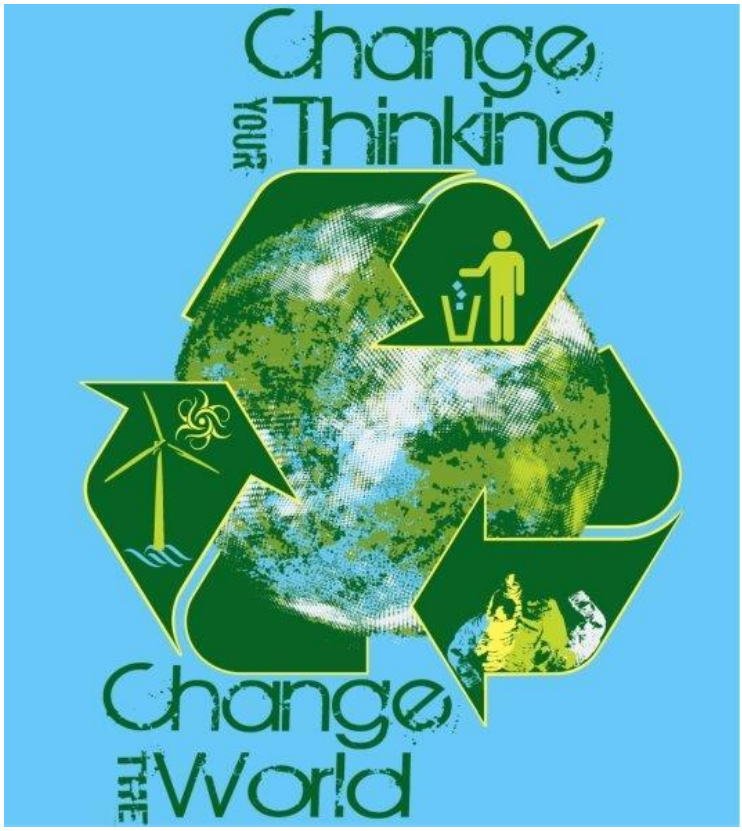
This will give Hong Kong breathing space to commission enhanced landfill mining at its landfills using plasma gasification technology that can produce bio diesel and bio fuels for airlines and Ocean Going Vessels (OGV's our biggest source of pollution).

MAJOR BENEFITS

The resultant resumed former landfill land (270 hectares) can be used for local public housing units instead of waiting 50 years (with maintenance costs of the closed sites) after

the closure of the landfill, as at present due to subsidence and methane problems.

Message for Hong Kong Government



Yours sincerely,

James Middleton

Chairman

www.cleartheair.org.hk

Technical Update October 2013

Update as provided by our technical engineer advisors. 15th October 2013 in response to public queries:

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The whole point about separately processing the easily biodegradable 3,500 cubic meters per day wet food waste component of the waste stream at source is to ensure that the ultra wet, smelly and potentially unhealthy elements are removed before they contaminate the remaining bulk of the waste.

Having removed food waste, the remainder of the recyclable waste stream remains dry and is much more easily dealt with, allowing the dry waste component to be reused or recycled in a much more efficient manner (thus creating new business recycling opportunities and jobs in areas like Tuen Mun, which could become **Green Tuen Mun** instead of a fly ridden smelly landfill Tuen Mun.)

Even those unrecyclable parts of the dry waste, the residues from the reusing and recycling processes, can be retained in a sufficiently dry state such that their calorific value remains high and, under these circumstances, the gasification or plasma gasification Syngas process can be beneficially used to produce electrical power in a Green way i.e. we can avoid the recourse of having to burn fossil fuels or adding recyclables to co-combust food waste in a Neolithic incinerator in a pathetic attempt to burn water, thus requiring more increased energy above what can be extracted from the process, thereby avoiding unlocking historically sequestered CO2 into the atmosphere where the vast majority of world scientists believe it leads to global warming.

It can be emphasised that efficient disposal in a fluidised bed + plasma reactor converting recently formed organic materials is sustainable. Recycling recently generated carbon content in the waste does not involve changing the volume of carbon in the dynamic carbon cycle. This is contrary to releasing sequestered carbon into the atmosphere by burning fossil fuels which is not sustainable and leads to the global warming events we are experiencing.

In answer to recent public queries:

Addition of special bacteria at the CEPT sewage treatment plant to the pulped food waste is NOT necessary.

http://www.biwater.com/Articles/325198/Biwater/BW_Home/waste_water/waste_water_projects/Stonecutters_Island_STW.aspx

The processes involve quite normally occurring bacteria which are encouraged to participate as part within the sewage treatment process by placing them in a stable and favourable

environment whilst they are dosed with “food” comprising raw, semi digested and fully digested components.
Food waste, when it is placed with sewage, as is proposed, will be digested by the same types of bacteria as are present in our own digestive systems and are excreted along with the food waste from our own digestion processes. Hence, we might conclude that the same bacterial processes will occur as the sewage passes down the pipes to the treatment plant as occurs in our own digestive systems whether the sewage comprises digested food or raw waste food. (which food waste in Hong Kong’s situation has a massive water content level already, being in excess of 70% water for Mall waste and 90% water for wet market food waste)
The critical factor here is to pulp and thereby dilute the waste sufficiently so as not to inundate the bacteria and to allow sufficient time for the bacterial digestion processes to occur en-route before the waste reaches the treatment plant where residues are separated by the sedimentation process to leave the sludge and processed water.
(A mesh screen at the sewage plant would possibly be required to sort any floating Styrofoam food packaging that might remain after the pulping process)

In Hong Kong the sludge will shortly be incinerated at Tsang Tsui fluidised-bed plant rather than being placed in the landfill, while the processed water, as at present, will be returned to the sea where yet more natural bacterial digestion processes occur, eventually resulting in the next cycle of the food generation process.
This is the ultimate recycling process and has evolved over many millions of years with mankind being an integral part of the top end of the process. In the modern sewage treatment process, engineers have harnessed the naturally occurring bacterial processes and have nurtured them to enhance their ability to deal with the huge volumes of waste which need to be dealt with and arise from urbanisation and placing too many people in too small a space for traditional nature to deal with on its own.

Despite Stonecutters plant being able to easily handle all our daily 3,500 cubic meters of wet food waste in minutes, Hong Kong has 10 additional sewage plants and pipe delivery networks that could also be enlisted to do the like actions:

This concept is totally viable.

It reduces the mal-perceived need for landfill extensions and retrograde lethal polluting incineration plants as promoted by the ENB.

It will create new jobs in areas currently opposed to landfill extensions.

It will promote recycling instead of burning and resultant necessary toxic ash landfill and costs.

It will obviate the need for expensive man-made islands as the new ash lagoons required by incinerators ad infinitum.

It makes sense, something currently lacking in the ENB's tunnel vision for our waste blueprint.

It uses readily available in-situ sewage networks and will cost little to setup the pulping at Transfer stations.

It complies with 2012 Panel on the Environment's directions to Government: (*still ignored by the administration*) and is shown below for your ease of reference:

http://www.legco.gov.hk/yr12-13/english/panels/ea/papers/ea0527cb1-1079-2-e.pdf

13. Details of the funding proposals for the three landfill extension projects are set out in LC Paper No. CB(1)1369/11-12(01) which is hyperlinked in the Appendix. According to the

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Government, IWMF would require some seven years for reclamation, construction and commission, while landfill extension would need a few years for site preparation works. In this connection, the IWMF Phase I project and the landfill extension projects should be pursued as a package to ensure that Hong Kong could maintain environmental hygiene and handle waste properly and timely. Deliberations by the Panel on the funding proposals for landfill extension are summarized in the ensuing paragraphs.

15. The Panel held another special meeting on 20 April 2012 to continue discussion on the funding proposals. Noting that many measures pertaining to the Policy Framework had yet to be implemented, members were opposed to the reliance on landfills for waste disposal in view of the associated environmental nuisances, as well as the long lead time and cost incurred from restoration of landfills. They stressed the need for a holistic package of waste management measures (including waste reduction, separation and recycling) with waste incineration as a last resort and better communication between the two terms of Government on environmental policies, in particular on the need for incineration. They also urged the Administration to identify other suitable outlying islands for IWMF and promote the local recycling industry. In view of the foregoing, members did not support the submission of the funding proposals to the Public Works Subcommittee for consideration.

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4.1.2 Waste Quality

4.1.2.1 The characteristics of Organic Waste in Hong Kong have been investigated in a number of surveys as described in the following. The Contractor shall note that the information provided under Clauses 4.1.2.2 to 4.1.2.4 of the Specification Part A is for Contractor's reference only and will not form part of the Contract. The Employer is not responsible for the accuracy of the data.

4.1.2.2 In 2005, the quality and quantity of food waste produced by a selected group of generators had been investigated. The characteristics of the food waste from the selected generators are shown below.

Composition of Food Waste in Hong Kong

Parameter	Public markets	Hotels	Food factories	Shopping malls
Moisture (%)	74.8	70.2	60	70.4
Total Organic Matter (%TM)	87.7	95	92	88.1
Total Organic carbon (%TM)	49.4	55.6	50.0	49.6
Kjehldal Nitrogen (%TM)	2.6	2.9	5.6	5.0
C/N ratio average (-)	25.5	21.1	9.6	16.7
C/N ratio range (-)	9.7-39.0	15.7-17.7	7.5-13.9	12.2-22.2
Arsenic (As, mg/kg)	< 0.10	< 0,10	< 0,10	< 0,10
Cadmium (Cd, mg/kg)	1.83– 5.08	0.78- 2.09	0.86- 1.83	1.17- 4.71
Chromium (Cr, mg/kg)	1.73- 23.1	2.34- 5.41	0.98- 1.92	1.25- 33.0
Copper (Cu, mg/kg)	3.07- 15.9	2.73- 5.20	2.68-3.14	2.12- 11.0
Mercury (Hg, mg/kg)	<0.010	< 0.010	< 0.010	<0.010
Nickel (Ni, mg/kg)	2.87- 20.0	4.20- 5.41	1.44-2.51	2.09- 13.5
Lead (Pb, mg/kg)	2.1- 12.6	1.27– 6.69	0.99- 1.92	1.27- 8.72
Selenium (Se, mg/kg)	0.58- 1.19	0.41- 0.93	0.30- 0.52	0.30- 1.96
Zinc (Zn, mg/kg)	8.98- 45.8	9.41- 15.5	9.03- 15.5	23.2- 64.7

4.1.2.3 In 2008, an investigation was conducted to study the nature of the organic material and the form and type of Inert Materials presented in the Organic Waste. The investigation revealed that there existed 5-20% of inert material among the waste during waste generation stage. Plastics were the major component of Inert Materials in combination with some glass or broken pottery.

4.1.2.4 In 2009, a study on Organic Waste composting conducted revealed that the results of heavy metal content were consistent with the data presented in Clause 4.1.2.2 of the Specification Part A. Other important characteristics of the Organic Waste in Hong Kong such as moisture content, volatile solids concentration and nitrogen content had also been investigated and the findings are summarized below.

Main Constituents of Organic Waste in Hong Kong

Parameter	Public Markets from FEHD	Public Markets from The Link	Food Industries / Hotels / Shopping Malls	Street-level Eateries
Moisture (%)	78	90	63	79
Total Organic Matter (VS as %TM)	88	86	94	93
Kjehldal Nitrogen (%TM)	4.1	4.6	3.6	4.9

Legco Panel on Environmental Affairs
Legco Finance Panel Public Works Subcommittee 25th February 2014

Dear Members,
We previously wrote to you with our suggestion for food waste handling in Hong Kong. (see attached document 'Some Food for Thought').

This failed to attract any response from the ENB so we wrote to the Chief Secretary asking her to appoint consultants to look into our idea; here is the unhelpful reply:

From: cso@cso.gov.hk [mailto:cso@cso.gov.hk]
Sent: Wednesday, February 12, 2014 6:06 PM
To: dynamco@netvigator.com
Subject: Letters to the Editor, January 30, 2014
Dear Mr Middleton,
Thank you for your emails of 31 January and 1 February to the Chief Secretary for Administration. Contents of your emails are noted and passed to the Environment Bureau for reference.

(Miss Jenny Wong)
Assistant Secretary
Chief Secretary for Administration's Office

Subsequently last week the ENB held a media conference to publish its latest policy document: 'A Food Waste and Yard Waste Plan for Hong Kong 2014 – 2022'
http://www.enb.gov.hk/en/files/FoodWastePolicyEng.pdf

At ANNEX on page 30 of the above document it states:

Miscellaneous methods• Some volume reduction; • Some useful end products if treatment is completed • Usually for small scale operation • Usually require second stage treatment or involve high operational cost
Grinding up food waste and disposing of it via the sewerage system: ***it would have adverse impact on the sewers and sewage treatment works. Large scale practical experience especially for multi-storey buildings is lacking and inconclusive internationally. Some cities have banned such practice***

CIWEM http://www.ciwem.org/about.aspx
The **Chartered Institution of Water and Environmental Management** (CIWEM) is the leading professional body for the people who plan, protect and care for the environment and its resources, providing educational opportunities, independent information to the public and advice to government. Members in 98 countries include scientists, engineers, ecologists and students. The Hong Kong branch of CIWEM is shown at:
http://www.ciwem.org/knowledge-networks/branches/hong-kong.aspx
http://www.ciwem.org/knowledge-networks/branches/hong-kong/committee.aspx
Miss Winnie Leung of HK Govt EPD is a committee member of CIWEM Hong Kong.

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No doubt numerous other ENB and EPD engineer officials are members of CIWEM and should accordingly follow CIWEM's policies.

http://www.ciwem.org/policy-and-international/policy-position-statements/food-waste-disposers.aspx
Here is CIWEM Hong Kong's listed policy of Food Waste Disposers

http://www.ciwem.org/knowledge-networks/panels/wastewater-management/food-waste-disposers.aspx
Here CIWEM outlines its Policy Position Statement on Food Waste Disposers and the beneficial use of the sewage system to transport macerated food waste.
I have attached the CIWEM document from the link and highlighted the most relevant paragraphs for your ease of reading.

Summary of CIWEM Policy Statement:
3. Ground food waste is valuable biogas substrate.
4. In-sink FWDs are an environmentally acceptable option for separating food waste at source and conveying it to treatment and use via existing infrastructure.
5. In-sewer processes can reduce or remove dissolved load before it reaches wastewater treatment works (WwTW).
6. The global warming potential of FWD to public sewer and AD is as good as kerbside to AD and better than centralised composting, incineration or landfill.
7. Exclusive emphasis on kerbside collection of source segregated biowaste has been mistaken.
8. A diversity of environmentally valid options for biowaste will ensure as many citizens as possible are willing to participate.
9. FWDs are an opportunity for cost saving to society as a whole.
10. Regarding the management of food waste, 'one size' will not fit all; home composting fits some, kerbside collection fits others and FWD fit others, especially (but not exclusively) people in flatted properties

Conclusions of CIWEM Policy Statement
1. CIWEM considers the evidence demonstrates that FWDs are valid tools for separating kitchen food waste at source and diverting it to treatment, use and recycling via the existing infrastructure and that they offer the opportunity for cost savings compared with other routes.
2. CIWEM considers that FWDs offer the opportunity for wider participation in resource recovery from wastes by a greater proportion of the population than has been the case with exclusive advocacy of kerbside collection, which whilst acceptable to some, is not acceptable to all.

Obviously the Policy Statement from the expert organisation CIWEM which embraces FWD, also adopted by CIWEM Hong Kong, contradicts the above Policy Document which states:

***Grinding up food waste and disposing of it via the sewerage system:** it would have adverse impact on the sewers and sewage treatment works. Large scale practical experience especially for multi-storey buildings is lacking and inconclusive internationally. Some cities have banned such practice*

Accordingly we would suggest the Legco Panel direct Government to seek advice from CIWEM and reconsider their seemingly non-expert conclusion, especially when Hong Kong food waste is of a higher water content resulting in less solids to macerate than European like putrescibles. Also to give consideration of incorporating AD plants at waste water plants as in the UK proven examples:

http://www.waste-management-world.com/articles/2012/12/40-000-tpa-food-waste-to-biogas-plant-opened-at-bristol-sewage-works.html

04 December 2012

Mansfield based biowaste to biogas technology developer, Monsal has completed the installation of the first UK anaerobic digestion food waste facility to be located at a sewage sludge treatment plant in the UK. The facility, located in Bristol, will be operated by Wessex Water subsidiary GENeco and will produce around 10 GWh of electricity per year - enough to power 3000 homes.

According to Monsal the plant will treat some 40,000 tonnes food waste collected from homes, supermarkets and businesses across the south west - preventing it from going to landfill.

Wessex Water has operated anaerobic digestion at Bristol sewage treatment works for a number of years and generates around 30 GWh of renewable energy from sewage sludge and produces 250,000 tonnes of high-nutrient fertiliser which is used by farmers instead of in-organic fertilisers.

He said: "Water companies using their expertise in treating sewage can provide a significant boost to the expansion of waste food anaerobic digestion in this country," explained Defra minister David Heath as he officially opened the plant. According to GENeco the amount of energy produced allows Bristol sewage treatment works - the largest in the south west - to be carbon neutral and self-sufficient from an energy perspective, which helps to drive down operating costs.

Wessex Water chairman Colin Skellett added: "We are building anaerobic digestion plants at other sites in our region due to the environmental benefits they offer and because they help tackle the problem of growing electricity and waste disposal costs. Monsal said that it completed installation of the new food waste plant in under a year.

WASTE & WATER: THE PERFECT PARTNERS?

http://www.waste-management-world.com/articles/print/volume-13/issue-1/features/waste-water-the-perfect-partners.html

Monsal's food waste digestion plant at Deerdykes in Scotland is one of only 3 plants in the UK to comply with PAS110 digestate specification

Following an Office of Fair Trade Market Study into Organic Waste Treatment Services, which highlights how to increase efficiency and competition in the market for sewage sludge and other organic waste treatment, exciting opportunities are emerging for waste companies. Charlotte Morton explains.

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The Office of Fair Trade (OFT) Market Study, commissioned by water services regulator Ofwat, identified that Ofwat regulations were inhibiting competition in sludge treatment between water companies, as well as reducing the likelihood of water companies and other waste companies becoming involved in wider organic waste treatment. The OFT has put forward recommendations for Ofwat to review economic regulations and design a framework which can deal with the issues that discourage competition and provide Water and Sewerage Companies (WaSCs) with a cost of capital advantage over other waste companies for treating organic wastes.

The volume of organic wastes that need to be treated in the UK is growing due to an increasing population and more stringent regulations designed to reduce organic wastes being sent to landfill. Consequently, it is important that growth in the organic waste treatment industry is promoted.

As in other areas, there is also increasing momentum behind making the best use of the resources we currently throw away. Defra's Waste Review (June 2011) identified that, for the treatment of food waste, Anaerobic Digestion (AD) offers the greatest environmental benefit of any treatment option. Making household and business waste available for digestion – by segregating the organic fraction at source – also increases the value of other recyclables in the waste stream by removing sources of contamination.

In addition to the 16 million tonnes of food we throw away each year, organic waste comes from two other sources. These are agricultural wastes, such as slurries and manures (around 90 million tonnes in the UK in 2008), and sewage sludge (around 1-2 million tonnes dry weight).

Most sludge (60% - 65%) is treated in sludge treatment centres located at wastewater treatment works, and governed by one of ten WaSCs. Other organic wastes tend to be treated by a large number of companies and farms of various sizes and structures. For the purpose of this article and in accordance with the OFT Market study these businesses will be referred to as 'waste businesses'.

Government incentives

Although **anaerobic digesters have been a feature of sewage treatment sites for decades**, there is a renewed level of energy and interest behind the sector. By utilising bacteria to break it down, AD is able to treat organic waste and produce a digested fertiliser as well as renewable energy, which allows WaSCs to gain access to Government incentives for renewable energy generation. In the financial year ending in 2011, 73% of sludge treatment was through AD and WaSCs obtained a total of £27million from incentives.

The OFT says that increased competition between industries could boost efficiency

The potential to gain access to Government incentives is also likely to increase with the recent introduction of the Renewable Heat Incentive (RHI) and the growing opportunities to develop gas-to-grid injections as pioneered in the water industry by Didcot Water Treatment plant. These gas-to-grid injections could be replicated at large facilities all over the country, resulting in hundreds of megawatts of power, in the form of gas, being pumped into the national grid. From the perspective of the UK's future energy mix, this is of huge significance. While renewable electricity generation has the greatest prominence, it is often forgotten that a third of the UK's final

energy consumption is of gas. Decarbonised energy therefore cannot be a reality without low carbon gas: even with their existing facilities, water and sewerage companies could be at the forefront of this energy revolution.

AD has been less commonly employed to treat other organic material (there are only 72 non-water AD plants in the UK), with slurries typically spread straight to land and food waste sent to landfill. However, recent policy developments have made the sending of organic waste to landfill more difficult, with escalating landfill tax creating a strong incentive for local authorities and businesses to find other treatment options. Consequently, waste companies now have to consider alternative ways of treating and recovering or disposing of organic waste.

Competition needed

To date AD plants designed to treat other organic wastes have typically been built either on farm or industrial sites. The sewage sludge treatment market, as a monopoly for local water and sewerage companies, exists in isolation from it. However, the OFT Market Study noted that "given the similarities in the technologies and systems used to treat, and recover or dispose of, sewage sludge and other organic waste, there is clear potential for competition between suppliers of treatment for each type of waste."

Competition within and between industries can be an inexpensive way to increase efficiency and innovation, providing significant benefits to consumers through lower prices and better quality of goods and services and/or greater choice. It could make use of existing assets and locations, and ensure that waste does not have to be transported long distances at great carbon and financial cost.

However, the Market Study observed that currently there is limited competition between WaSCs to treat sludge, and between WaSCs and waste companies to treat either sludge or other organic wastes. The study identified a number reasons for the lack of competition in the treatment of organic wastes, including differences in environmental regulation, there only being limited existing spare capacity (about 20%) for WaSCs to expand and there being a need for competition to exist locally as organic wastes can only be transported short distances (sludge can be transported at most around 50 km, while for other organic waste the distance which it can be transported economically depends on the energy potential of the waste). However, the main barrier the OFT identified as inhibiting competition in the treatment of organic waste are the economic regulations of Ofwat.

Regulations

Under the current regulations, if WaSCs are to carry out an unregulated activity (such as processing other organic wastes) but use their regulated business assets to carry out these activities, WaSCs are required to allocate some costs to the unregulated activities or to charge a 'transfer price'. Stakeholder engagement by the OFT demonstrated that this was perceived as complicated and time-consuming and thus very few WaSCs have undertaken the procedure.

Ofwat's economic regulations also discourage other waste companies from investing in facilities to treat waste other than sewage. Regulations enable WaSCs to borrow at a lower cost of capital than is available to waste companies, creating a potential market distortion. Capital costs for WaSCs building new facilities for other organic waste treatment at sewage treatment centres are also often lower, and planning permission and public agreement easier to obtain for WaSCs than for other waste companies as the infrastructure would be built on an already approved site and the public believes the treatment of sludge is necessary, whereas the treatment of other organic wastes is considered a business venture. It is therefore vital for Ofwat to create a balanced regulatory environment to ensure that competition between water and waste companies is fair.

The OFT Market Study identified changes to economic regulation as the "crux of any package of remedies", if the necessary competition within, and growth to, the organic waste treatment industry is to be realised. If Ofwat decides to follow the advice of the OFT and review economic regulations, WaSCs would be able to look into expanding their facilities to treat other organic wastes as well as sewage sludge (either separately or co-digested). This would not only aid the Government in reducing waste but would increase the incentives

brought in by the WaSCs **as other organic waste tends to have a higher energy content than sludge, so generates more biogas.**

The future

Ofwat is expected to announce its full response to the Market Study in April this year. This should include clarity on the future of the economic regulatory regime, and will clearly be of keen interest to both the water and waste industries. Defra's white paper on the future of the water industry, published in December 2011, suggested that the department would look carefully at elevating sustainability alongside economic regulation as a key directive for Ofwat. Many water companies have already started to act to unleash their potential in this area. GENeco, a subsidiary of Wessex Water, operates a biogas-powered VW beetle from gas generated at its Avonmouth plant and Northumbrian Water will commission its second advanced digestion plant in the summer, on the banks of the Tyne at Howdon. A change in Ofwat's economic regulation could lead to substantial growth in the renewable energy generated by water companies. It could cause a fundamental shift in the relationship between water and waste companies, and open up huge potential for novel projects and joint ventures. Organic waste is a hugely valuable resource, and the UK needs to get the most out of it. Expanding the use of anaerobic digestion both inside and outside the water industry is the only way to do this. Charlotte Morton, is chief executive of the UK's Anaerobic Digestions and Biogas Association. Web: www.adbiogas.co.uk

The Avonmouth Solution

A state of the art food waste processing facility that will have the capacity to receive up to 40,000 tonnes of food waste per year is now under construction at GENeco's 300 million litre per day **Bristol Sewage Treatment works** in Avonmouth. The plant will begin accepting food waste deliveries from autumn 2012. AD specialist, Monsal had previously upgraded the digestion plant for sewage sludge using an advanced pre-treatment technology that now generates 4 MWe from biogas. The process optimises the conditions for sewage sludge digestion in two separate vessels; thereby optimising gas production and making it one of the most efficient digestion plants in the country. GENeco has chosen to build on its digestion expertise by constructing a new food waste treatment facility.

The latest development will be the first large scale food waste treatment facility in the UK located at a sewage works. It will offer supermarkets and other local producers a cost effective and sustainable solution for treating their packaged and unpackaged food and catering waste. The GENeco food waste plant is based on the Monsal technology platform which is also operational at the Deerdykes plant for Horizons Environment. Key facts about the Avonmouth site

- Sewage sludge capacity PA 40,000 Tonnes Dry solids
- Food Waste capacity PA 40,000 Tonnes Wet solids
- Number of digesters 10
- Renewable power capacity 5.75 MWe Aidan Cumiskey is managing director of Monsal

Kind regards,

James Middleton

Chairman

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A FOOD WASTE & YARD WASTE PLAN FOR HONG KONG 2014-2022

Environment Bureau

February 2014

CONTENTS

Message from the Chief Executive

"Waste Not" is one of my deepest personal beliefs and I try to live by it. Reducing food waste is a subject I feel particularly strongly about. I frequently discuss topics such as avoiding food waste at source and separating out food waste from other waste for recycling. My family and I have considerable hands-on experience on a small scale at our home. This experience has deepened my passion for working with the people of Hong Kong to change our wasteful habits. If we all spend a bit more time and effort, we can significantly reduce food waste in Hong Kong.

My Election Manifesto includes a clear commitment to "promote food waste reduction, encourage the business and industrial sector to undertake sorting of their waste at source, build more organic waste recycling and treatment facilities, and encourage the full use of recycled resources such as compost".

I congratulate the Environment Bureau on publishing this blueprint on food and yard waste which articulates Hong Kong's stance with respect to organic waste and how the Government is tackling the issue. To succeed, we require everyone's support at each step along the way. The journey is complicated, as it involves many aspects and there are many details to be worked out. All this will take time, but there should be no doubting our commitment to reduce food and yard waste.

CY Leung

Chief Executive
Hong Kong Special Administrative Region

Special Messages from Principal Officials

"One of my responsibilities in this term of Government is to provide steer to the Environment Bureau in the overall mainstreaming of organic waste reduction and treatment. The Steering Committee to Promote Sustainable Development of the Recycling Industry that I chair, among other duties, provides an internal platform to align more effectively the work of Government departments in waste management, including the management of organic waste."

Carrie Lam Chief Secretary for Administration

"Public money and food alike are scarce resources. Consistent with the principle of fiscal prudence, we should avoid and reduce food waste."

John C Tsang Financial Secretary

"Proper handling of waste is a challenging task, including enactment of new legislation and amendment of existing ones. We all share a responsibility to reduce food waste at source. I will give my full support and practise food waste reduction."

Rimsky Yuen, SC Secretary for Justice

"If Hong Kong is truly to deal with our large quantities of food waste, households will need to take on the responsibility to firstly avoid and reduce food waste, and when the food waste recycling system incrementally develops, separate their food waste. Colleagues responsible for public housing management will promote food waste reduction in the coming years to dovetail with the Government's overall food waste programme."

Professor Anthony Cheung Secretary for Transport and Housing

"As the Chinese saying goes, 'One should know that every single grain on the plate is the fruit of hard work'. Cherishing food is a traditional Chinese virtue. For urban dwellers living in densely populated cities nowadays, it is all the more necessary to reduce food waste. We support launching the environmental protection projects at district level to promote the 'Food Wise' culture and waste reduction."

Tsang Tak-sing Secretary for Home Affairs

"There are issues which we can talk about; yet food waste reduction is beyond negotiation. Let's work together to achieve our shared goal – to reduce food waste right from this meal!"

Raymond Tam Secretary for Constitutional and Mainland Affairs

"Hong Kong, as a bustling city, generates around 9 000 tonnes of municipal solid waste every day. Food waste accounts for about 40% (i.e. 3 900 tonnes) of them, equalling the weight of about 250 double-decker buses. The community has therefore put in large amount of land resources and public money to handle the waste. Let's join hands to find ways to reduce food waste and save social resources."

Professor KC Chan Secretary for Financial Services and the Treasury

Special Messages from Principal Officials

"I am particularly interested in making the fullest and best use of surplus edible food by redistributing and donating it to people in need. I understand from non-governmental organisations (NGOs) engaged in food donation and poverty alleviation that there should be huge potential in this respect if the supply and demand chains can be better coordinated. I look forward to wider tripartite collaboration involving NGOs, the business sector and the Government in unleashing this potential!"

Matthew Cheung Kin-chung Secretary for Labour and Welfare

"The catering and hospitality sector in Hong Kong is highly sophisticated and vibrant. Regardless of whether an establishment caters for budget or luxury customers, food wasteage is to be discouraged. Members of the sector participating in the Food Wise Hong Kong Campaign are to be commended for their efforts."

Gregory So Secretary for Commerce and Economic Development

"The disciplinary forces could be at the forefront of changing behaviour in how to deal with food waste. I am encouraged by the early success in one of our correctional institutions, which has the potential to be up-scaled."

TK Lai Secretary for Security

"I am pleased to collaborate with the Secretary for the Environment to see how schools can help further reduce food waste. I noticed that some schools' effort has borne fruit, and I am very proud of it."

Eddie Ng Secretary for Education

"I will call upon all civil servants to practice food avoidance and reduction. I believe civil servants and their families can play an important role in changing community behavior."

Paul Tang Secretary for Civil Service

"Promoting food donation is worthy of support from different sectors of the community. To facilitate the work of food donation agencies, the Centre for Food Safety has issued the 'Food Safety Guidelines for Food Recovery' for their reference."

Dr WM Ko Secretary for Food and Health

"I support the Environment Bureau's work in handling yard waste. The Development Bureau will assist relevant departments to implement yard waste reduction measures from planting design to maintenance stages."

Paul Chan Secretary for Development

Preface

We all know we need to change our habits so that we can live more sustainably. Treasuring our resources is essential to achieving environmental sustainability.

We have set a goal for Hong Kong that by 2022, we will reduce our per capita municipal solid waste disposal rate by 40% using 2011 as the base. This means each one of us must work hard to reduce our daily waste at home, at school, at work and even when we recreate.

One thing that we can all do is to become much more aware of the food we buy and eat, and to treasure our good fortune to have sufficient food to nourish us. By avoiding food waste, we will play our part for the environment to ease further pressure on the world's food system when so many individuals and families still face hunger all over the world, and even in affluent Hong Kong.

Our grandparents and parents were more careful in how they handled food. They did not over-buy or throw away leftovers when Hong Kong was a less wealthy society – now that we have wealth and also knowledge, we should be proud of adopting "Use Less, Waste Less" practices because we know better.

Our *Blueprint for Sustainable Use of Resources 2013-2022* published in May 2013 articulates our strategy on waste management to reduce, recycle, treat and dispose of waste. This document addresses Hong Kong's organic waste – namely food waste and yard waste. This is a companion document to the Blueprint, and articulates the specific strategy for tackling food and yard waste. I urge you to read both of them and join hands with us for this cause.

Just remember that when you leave food in your bowl; when you prepared or ordered too much food; when food is spoiled because you forgot to eat it – these all generally gets thrown away and end up in our landfills. So, take more care not to waste. Don't be a Big Waster.

KS Wong
Secretary for the Environment

February 2014

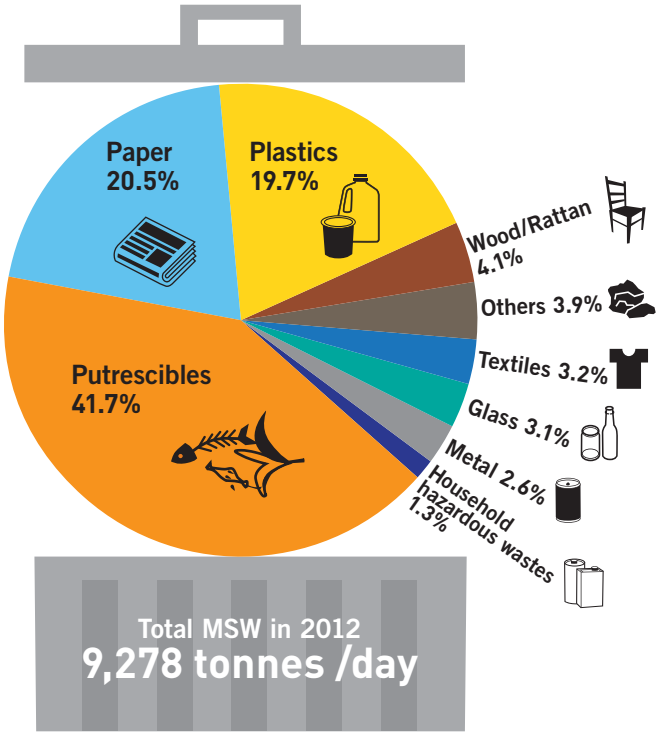
1 Our Vision for Reducing Food Waste

"Use Less, Waste Less"

Our overall vision is to "Use Less" and "Waste Less" of the earth's resources through instilling an environmentally-sustainable culture into Hong Kong people's daily lives.

Our *Blueprint for Sustainable Use of Resources 2013-2022* (the Blueprint) published in May 2013 provides a broad picture of our plan and strategy to deal with waste with a view to reducing impact on our environment. As stated in the Blueprint, the starting point of our new policy is to adopt a different attitude to waste in Hong Kong: our waste stream contains a treasure trove of useful resources, much of which can be reused, recycled and recovered.

Figure 1 **Composition of MSW in Hong Kong, 2012**



Overall Waste Reduction Target

Our target is to reduce the Municipal Solid Waste (MSW) disposal rate to landfill by 40% on a per capita basis by 2022 using 2011 as the base.

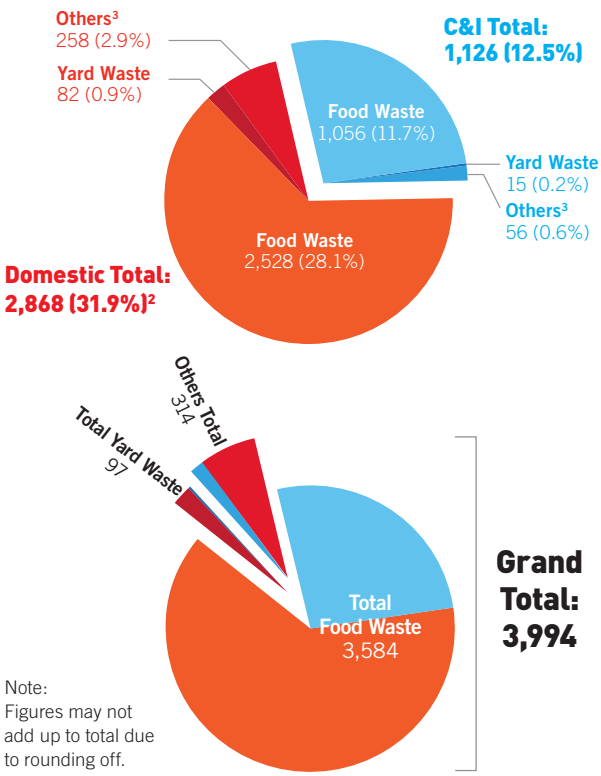
Of the approximately 9,000 tonnes of MSW that is thrown away at landfills everyday, some 40% are made up of "putrescibles",[1] which are various types of organic waste that decompose and create odour. It is mainly made up of food waste (around 90%) but includes some other waste, such as yard waste and personal care cotton products.

Food Waste

Among organic waste in Hong Kong, food waste constitutes the majority of putrescible waste. Food waste is any waste, whether raw, cooked, edible and associated with inedible parts generated during food production, distribution, storage, meal preparation or consumption of meals.

1. "Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2011", https://www.wastereduction.gov.hk/en/materials/info/msw2011.pdf.

Figure 2 **Breakdown of Putrescible Waste in 2011**
tonnes/day (% of MSW)[2]



Note:
Figures may not add up to total due to rounding off.

Hong Kong's food waste

In 2011, our base year, Hong Kong people threw away about 3,600 tonnes of food waste every day – two-thirds came from households (around 2,500 tonnes) and one-third from food-related commercial and industrial (C&I) sources (around 1,100 tonnes).

Our food waste disposal is equivalent to throwing away the weight of approximately 250 double-decker buses every 24 hours or nearly 100,000 double-decker buses every year. Reducing the quantity of food waste is critical to Hong Kong achieving our overall waste reduction target by 2022.

Hong Kong is not alone in producing large quantities of food waste. Figure 4 shows other cities with developed economies also generate significant quantities of food waste. Thankfully, there is a growing realization that food waste prevention and reduction should be high on the policy priorities of municipal authorities.

Everyone a Recycler

Everyone consumes food – at home, at work or dining out – so each one of us can play an active role to reduce food waste at source. Hong Kong also has many C&I enterprises involved in the food business, such as food factories, operators of restaurants, fast food outlets, cafes, canteens, hotels, supermarkets, food markets, bakeries, groceries, fruit stalls, butcheries and all types of food producers and retailers. Institutions that provide food, including hotels, restaurants, schools and colleges providing meals to students, hospitals providing meals to patients and airlines to passengers, as well as companies that provide staff meals, could play an active part to reduce food waste.

What is food waste?

Rotten fruit and vegetables
Fish and poultry organs and intestine, meat trimmings and residues
Fruit and vegetable peelings, cores, pips, garnishes
Meat, fish, shellfish shells, bones
Food fats, sauces, condiments
Soup pulp, Chinese medicinal pulp
Egg shells, cheeses, ice cream, yogurts
Tea leaves, teabags, coffee grounds
Bread, cakes, biscuits, desserts, jam
Cereals of all types e.g. rice, noodles, oats
Plate scrapings and leftover of cooked food
BBQ raw or cooked leftovers
Food past its use-by-date
Pet food

2. Average MSW disposed of in 2011 was 8,996 tonnes per day.
3. Other putrescible waste includes personal care cotton products, such as diapers.

Figure 3 Average daily disposal quantity of food waste in Hong Kong (2003-2012)

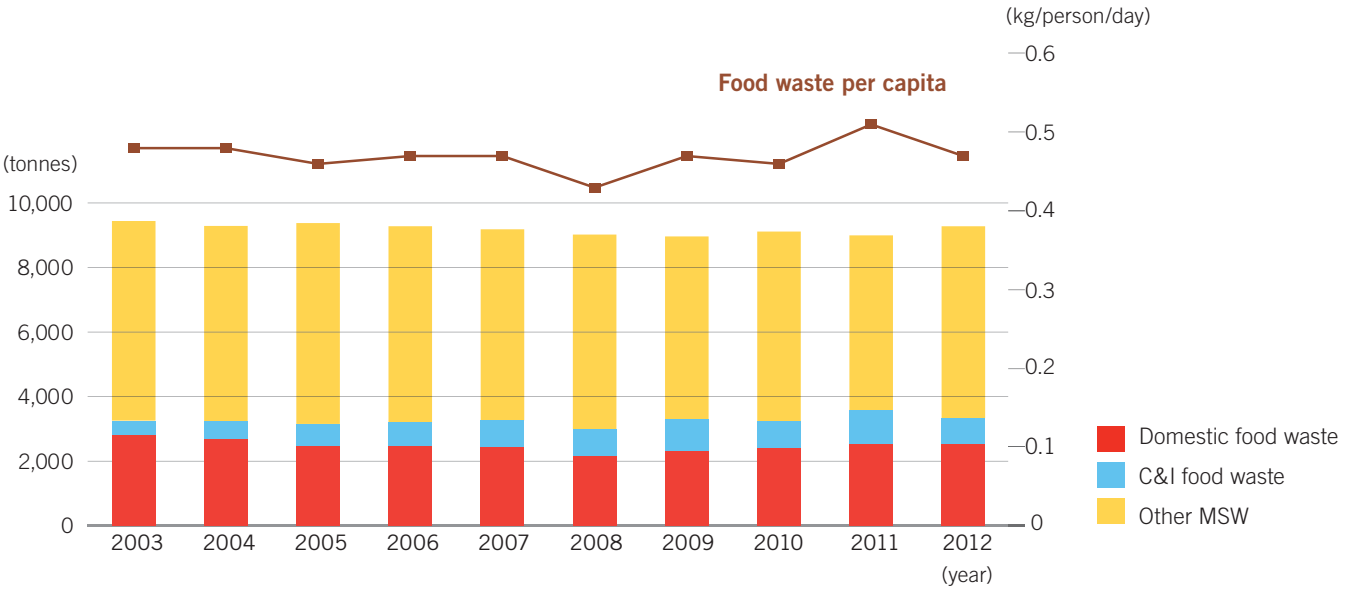
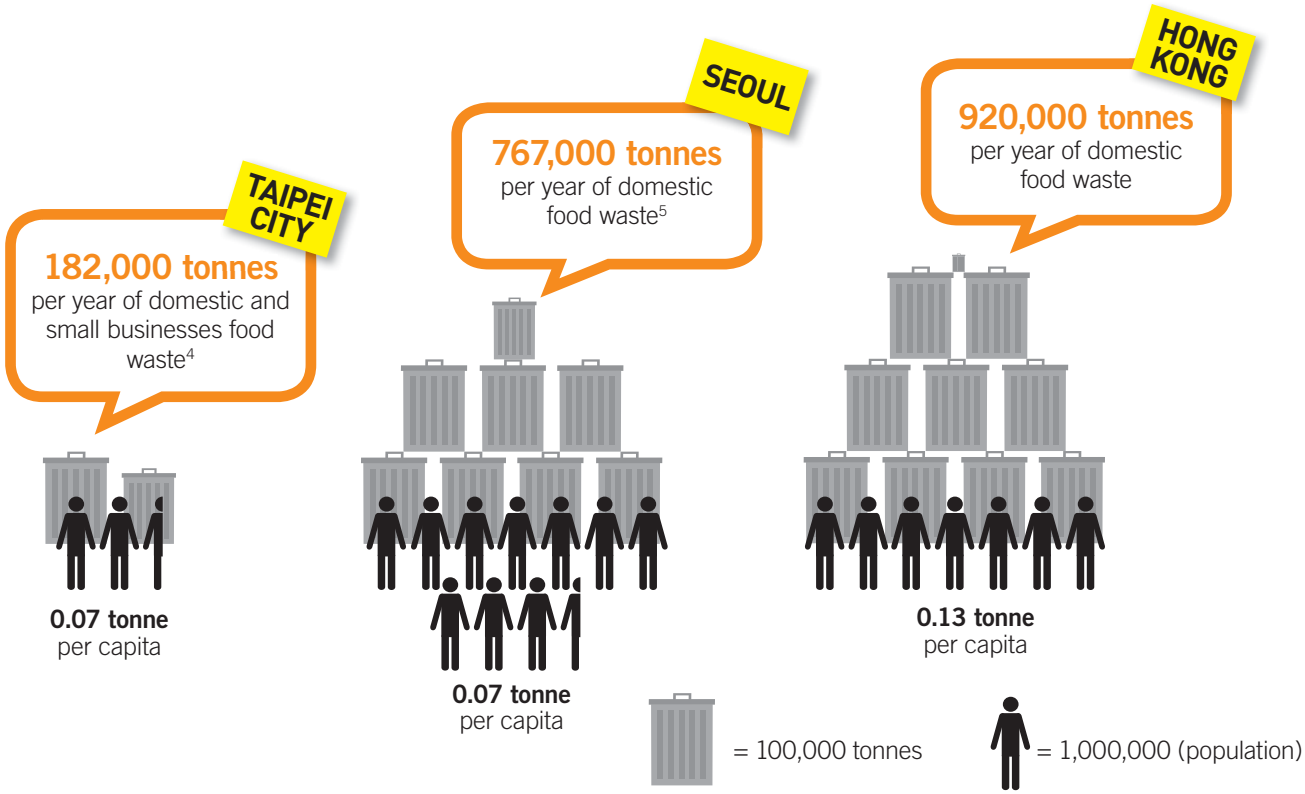


Figure 4 Food waste of Hong Kong and other cities from domestic sources (per year)



4. Taiwan environmental authority, 2011; the tonnages includes food waste from small businesses. The population in Taipei is about 2.6 million.

5. Ministry of Environment, South Korea, 2011. The population in Seoul is about 10.5 million.

2 Our Target and Strategy for Food Waste

Diverting food waste from landfills

Our target is to cut down the amount of food waste that goes to landfills by at least 40% by 2022. This means our goal is to reduce our food waste to landfills from around 3,600 tonnes a day to around 2,160 tonnes a day (a reduction of about 500,000 tonnes per year) over the course of about eight years. This is an ambitious goal and it can only be achieved with public support and active participation.

The prevention and reduction of food waste to landfill has multiple direct and indirect benefits. It will help to reduce various resource use associated with food production, cut greenhouse gas (GHG) emissions, recover useful resources from food waste, reduce the social cost of handling and treating food waste, and better utilize the capacity of landfill and waste-to-energy facilities.

Strategy to achieve our target

Our strategy for food waste has FOUR main components:

- **Mobilize the community**
  - Prevent and reduce food waste at source (i.e. before food become waste)
  - Donate surplus food to people

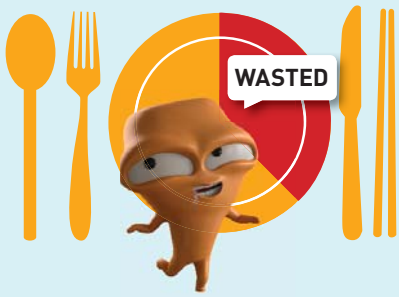
- **Promote food waste separation**
  - Incentivize separation

- **Recycle and treat separated food waste**
  - Turn food waste into renewable energy
  - Convert food waste residue to compost to create a soil supplement

- **Treat non-separated food waste and final disposal**
  - Provide MSW waste-to-energy treatment that includes non-separated food waste for recovery of energy
  - Disposal as last resort at landfills

Direct and indirect benefits of food waste prevention and reduction

Preventing and reducing food waste saves resources and cut environmental impacts. According to UNEP, roughly a third of the food produced in the world for human consumption is wasted or lost every year, amount to 1.3 billion tonnes annually. This amounts to a major squandering of resources, including land, water, energy, labour and capital that had gone into producing the food, and needlessly produced GHG, expediting climate change.[6]



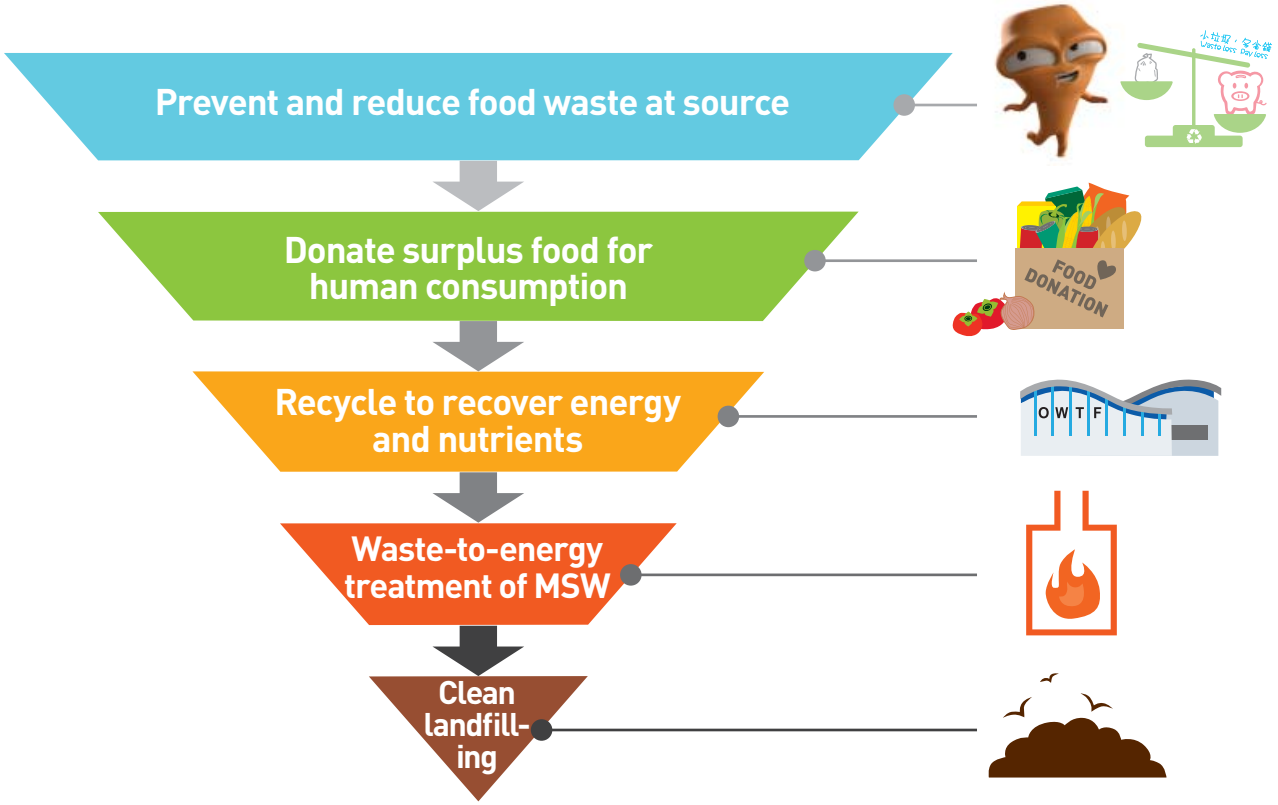
6. UNEP, "Food Waste Facts", http://www.unep.org/wed/quickfacts/.

Emphasis on food waste-to-energy

Our plan is to recycle food waste mainly into renewable energy because Hong Kong can use large quantities of energy either in the form of biogas or electricity. Food waste could also be treated to recover nutrients in the form of compost as side product for landscaping or agricultural applications but Hong Kong has limited capacity for such uses.

Figure 5 provides a picture of food waste management options according to a hierarchy of their importance. Chapter 3 deals with the prevention and reduction of food waste, as well as donation of surplus food; Chapter 4 deals with separation and collection of food waste; Chapter 5 addresses recycling of food waste; and Chapter 6 deals with the treatment and disposal of MSW where food waste has not been separated, collected and recycled. Chapter 7 deals with yard waste.

Figure 5 Food waste management hierarchy



3 Food Waste Avoidance

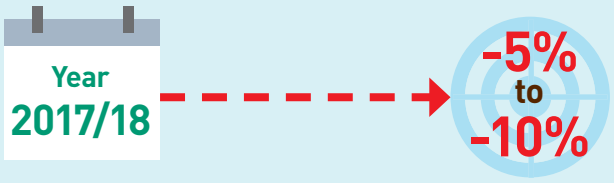
The most important step in reducing food waste is to avoid creating it in the first place.

Rethink and Community Mobilization

Hong Kong people need to rethink our relationship with food. By focusing on our real need for nutrition, we can choose to avoid over-buying, over-ordering and over-preparing food that is then dumped because we cannot use or consume it all. Once we rethink our habits as individuals, households and businesses, we can change and not waste precious food.

Our main social mobilization campaign is the Food Wise Hong Kong Campaign. It is designed to galvanise the community, from individuals to households to C&I operators, to avoid and reduce food waste at source. Using overseas experience as a guide, we anticipate this campaign may help Hong Kong to avoid about 5% to 10% of food waste by 2017/18.[7]

Food Wise Hong Kong Campaign



On 3 December 2012, we set up the Food Wise Hong Kong Steering Committee to drive leadership in food waste avoidance and reduction through working with leaders in this field in order to formulate and oversee the implementation of the Food Wise Hong Kong Campaign. The campaign was formally launched on 18 May 2013.

The campaign has a variety of activities, ranging from articulating and disseminating best practices in the C&I sector to working with government departments, schools and non-governmental organisations (NGOs) in order to expand participation. The campaign is also facilitating food donation for dual purposes of caring for the disadvantaged and waste reduction.

Food Wise Ambassadors from the community and organization have been recruited since the launch of the Campaign. Training will be provided to help Ambassadors to spread the key messages and practical tips about food waste reduction across the community. By end 2013, over 450 Ambassadors have been recruited. A Food Wise Charter has also been established. By end 2013, over 320 organisations, including various trades, non-governmental organisations and government departments have signed the Charter to show their support for the Campaign and to commit to reducing food waste.

Based on the actual effect of the campaign, we would keep in view the need for any further policy measures to incentivize the reduction of food waste generation.

7. The estimate of 5% to 10% from avoidance is derived from the British experience, where the national average reduction achieved after a period of intense public education was 2% but in the best districts 14% was achieved. We are using 5% to10% as a possible estimated outcome.

Disney/Foodlink event

Ma On Shan Ling Liang Primary School

Sing Yin Secondary School

Food waste reduction successes

The Environment Bureau and **Education Bureau** jointly launched the Green Lunch Charter in February 2010 to encourage schools to reduce food waste and the use of disposable lunch boxes. The Environment and Conservation Fund (ECF) has also reserved $150 million to support existing schools to retrofit facilities in order to portion meals on site, while new school premises will be designed to enable on-site meal portioning as a standard feature.

A good example is **Ma On Shan Ling Liang Primary School**, which involves daily volunteer parent helpers. About 720 participating students join the programme, while 170 students bring their own packed lunch. The school has also set up a small on-site composter to convert food waste into fertilizer which is used for their own school organic farming. The programme results in substantial reduction in disposable lunch boxes and utensils, with 90% waste reduction from lunch. After the implementation of the scheme, the school generates about 4.5 – 6 kg of food waste per day, or about 0.006 – 0.008 kg per student.

Sing Yin Secondary School set up its own environmental policy and introduced knowledge and skills for practising a wide range of measures by students and staff. As regards food waste reduction, the school has set up food waste recycling facility and other green initiatives, such as working with the school's food kiosk operator to avoid and reduce food waste. In the past, the operator would prepare extra lunch boxes every day to meet contingent needs but that often resulted in a surplus that ended-up having to be dumped. The new practice offers soup noodles and other snacks to meet extra demands as they arose, thus avoiding food waste.

In September 2013, **The Chinese University of Hong Kong** launched a two-year "Love Food Hate Waste @CUHK", which is a food waste education campaign. The university envisages the campus becoming a 'living laboratory' for food waste reduction and recycling. The campaign takes a multi-pronged approach and initiatives included the operation of food waste composters and other food waste recycling methods, micro film production and distribution of food and beverage coupons to students who have finished all their food.

The Lo Wu Correctional Institution has an average of 75% of its inmates participating in the Waste No Food Scheme since April 2013. The project enhanced environmental awareness and encouraged the reduction of leftover food. Upon enrolment to the scheme, the persons in custody volunteer to receive a reduced portion of their staple food (rice, chapatti or potatoes). The scheme has avoided 500 bowls of rice having to be dumped every day (i.e. around 100 kg). The institution also installed an on-site food waste composting system with a daily capacity of 100 kg which turns fruit peels, vegetable leaves and meal leftover into organic compost for greening purposes.

Since September 2011, **the Health Care Food Service Team at the Pamela Youde Nethersole Eastern Hospital** has reduced patients' meal portions by 20% and prepare meals according to actual demand. This initiative has resulted in 42 tonnes of food waste reduction (i.e. around 115 kg per day) and a saving of several hundred thousands per year. This team won the Hospital Authority's Outstanding Team Award in 2013.

The MTR Corporation Limited has launched an incentive scheme that is expected to achieve a 15% reduction in food waste by participating food and beverage tenants in 18 months' time.

A New Core Value

Early results show there is sympathy within the community to avoid food waste. With strong and sustained public communication, and with the commitment of the C&I sector, we can make food waste avoidance a core Hong Kong value – that is, it becomes a fundamental aspect of our lifestyle and a value we are proud to practise and display. It is not too hard to imagine that by encouraging a new "Food Matters" culture that it can help Hong Kong's catering and hospitality C&I sector, as well as the community as a whole, to innovate.

Food Donation

Surplus edible food could be redistributed for human consumption. Throwing food away deprives someone else from being nourished by it and is a sheer waste of resources. Momentum of food donation is building up in Hong Kong. NGOs operate food banks, redistribute dry foodstuffs, as well as take cooked food from eateries to community centres. There are also NGOs that use surplus produce from fresh food markets either for distribution or for preparing hot meals in community kitchens for the needy.

Hong Kong's food donation NGOs are becoming increasingly adept at observing good hygiene practices. Furthermore, in August 2013, the Government's Centre of Food Safety issued a set of food safety guidelines for food recovery, where it sets out food safety principles that should be applied to food donated to charity, regardless of the types and sources of food. Some NGOs have also entered into food donation agreements with their donors to deal with food safety liability issues.

We wish to strengthen our support of the work of NGOs to increase the collection of surplus food from the C&I sector, such as supermarkets, fresh food markets, restaurants, clubs and hotels. NGOs may consider applying for the ECF to support food donation projects that could help reduce waste to landfill.

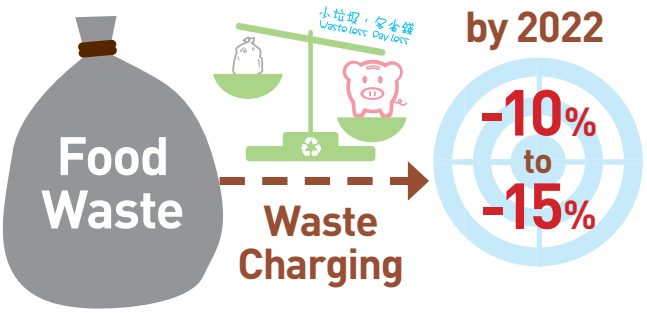
4 Separation and Collection of Food Waste

In the long run, food waste that cannot be avoided should be recycled as far as possible. Successful food waste recycling requires the waste to first be separated from other types of MSW and then collected for delivery to recycling facilities. Food waste that has been mixed with other types of waste is contaminated and cannot be recycled. The separation and collection of food waste is therefore a critical aspect of any food waste recycling system.

Waste Charging

Our intention is to implement a quantity-based MSW charging scheme by 2016/17. With quantity-based waste charging, people will seriously rethink their consumption and disposal behaviour and become much more conscious about the environmental consequences. We can pay less by throwing away less. Experience from other parts of the world, including Taipei City and Seoul, shows that implementation of quantity-based waste charging provide powerful economic incentive for people and various trades to reduce avoidable waste and to separate recyclables from the waste stream.

With waste charging, Hong Kong's overall MSW should drop by a good margin over the course of several years.[8] We estimate that MSW charging could further reduce the quantity of food waste by a further estimated 10% to 15% between 2017 and 2022. Together with reduction at source by the Food Wise Hong Kong Campaign, as well as the establishment of Organic Waste Treatment Facilities (OWTFs – see Chapter 5), we expect Hong Kong could achieve some 40% food waste reduction by 2022.



Public consultation in 2012 showed Hong Kong people support the concept of quantity-based MSW charging. On 24 January 2014, the Council for Sustainable Development (SDC) completed a four-month public engagement and will draw up recommendations on how quantity-based MSW charging may be implemented in Hong Kong, which will help us to take the initiative forward. We will carefully consider the SDC's recommendations and draft the necessary legislative proposals as soon as possible for the Legislative Council's scrutiny.

Source separation of food waste

There are TWO categories of food waste in general:

Pre-consumer food waste
Waste from industrial food processing (vegetative and animal food waste)
Vegetative food waste (vegetable and fruit trimmings, spoiled produce)
Animal food waste (fish, meat, diary)

Post-consumer food waste
Served food that has been left uneaten (plate scraping, uneaten buffet/salad bar food etc.)

The food manufacturing and cooking process often requires the use of cooking oils. This is a separate form of waste derived from food but it is not counted as part of our food waste statistics (see below).

Often found among food waste are soiled food packaging and food service ware (e.g. plastic eating utensils, plastic containers and wooden chopsticks). Removing them first would be most helpful.

To recycle food waste requires a THREE-step strategy – **separation, collection and recycling**. Each step is a major operation in itself and then each of the steps needs to be properly aligned for good results. This chapter deals with the first two steps and the next chapter with the third step.

8. In Taipei City and Seoul, about 20% reduction in waste generation was achieved after several years of imposing quantity-based MSW charging and publicity. We are assuming a similar level of reduction could be achieved in Hong Kong through the Food Wise Hong Kong campaign and quantity-based MSW charging.

Food waste source separation

Source separation is the pre-requisite for effective recycling of waste into useful resources.

Waste generators should be responsible for separating their food waste. Thus, a food processing business, such as a factory making cakes or food sauces should put in place a system whereby the pre-consumer food waste arising from its business is separated out for subsequent collection. Likewise, a restaurant can have a system whereby its pre-consumer and post-consumer food waste is also separated from other waste for collection.

Both the food processing factory and the restaurant can also separate out the oils and fats it produces.

C&I food waste

In preparation for recycling food waste on a large scale, we have gained experience on food waste source separation with the C&I sector over the past few years through the operation of the Kowloon Bay Pilot Food Waste Composting Plant and the Food Waste Recycling Partnership Scheme. The plant was initially used in 2008 to treat food waste from the venues hosting the Olympic and Paralympic Equestrian Games, after which EPD started the Partnership Scheme with C&I participants to collect source-separated food waste for delivery to the Kowloon Bay plant. Today, the scheme has over 120 participants. From 40 tonnes in 2008, the plant treated 283 tonnes in 2012. While this is a useful pilot scheme to help us gain knowledge, it is recycling less than 0.1% of Hong Kong's total C&I food waste.

The compost produced from the plant is being used by the Leisure and Cultural Services Department (LCSD) for the many community gardens it cares for. So far, 24 tonnes of compost has been provided for its use.

Household food waste

The Housing Authority has conducted food waste recycling trial schemes at 14 public housing estates by phases since 2011, involving nearly 1,000 families to encourage the cultivation of food waste separation habits and food waste recycling.

In addition, in 2011, EPD launched the Food Waste Recycling Projects in Housing Estates to raise awareness on food waste reduction and to install composters. As of December 2013, 37 of them have received funding under the ECF to install composters at the estates. Education programmes organised by these estates would cover about 81,500 households, of which about 4,100 would participate in food waste source separation and recycling. It is expected that a total of 1,300 tonnes of food waste (i.e. 3-4 tonnes per day) would be recycled each year and 260 tonnes of compost would be produced annually, which can be used as fertilizers by the estates for their plants and gardens. From data collected, the Project has created an impact on changing behaviour, as reflected by the notable reduction in food waste generation by participating households.

District food waste schemes

We also have district-based programmes at Kwun Tong, Tsuen Wan, Tuen Mun and Wong Tai Sin. In the first case, we started the Food Waste Reduction Programme in 2011 in collaboration with the Kwun Tong District Council and the property management of a shopping mall, whereby customers at eateries are encouraged to minimize and separate food waste, which is then recycled at an on-site composter.

As at June 2013, about 108 tonnes of food waste (i.e. over 0.1 tonne per day on average) has been recycled, and about 20 tonnes of compost produced for gardens in the district.

In March 2012, the Islands Food Waste Recycling Scheme was launched on Cheung Chau and at Yung Shue Wan on Lamma Island. It aims to educate and motivate restaurants, food premises and hostels for the elderly to reduce, separate and recycle food waste by means of composting. Up to the end of 2013, about 194 tonnes of food waste (i.e. about 0.3 tonne per day on average) had been recycled, and about 21 tonnes of compost produced for local use.

Up-scaling on quantity

We are gathering data and reflecting on experience from all the C&I participants, housing estates and districts so as to assess the effectiveness of all the abovementioned schemes. This will help us identify how to broaden the implementation of food waste separation in Hong Kong. In addition, we would initiate a study on the appropriate means of organic waste collection and delivery in Hong Kong in 2015.

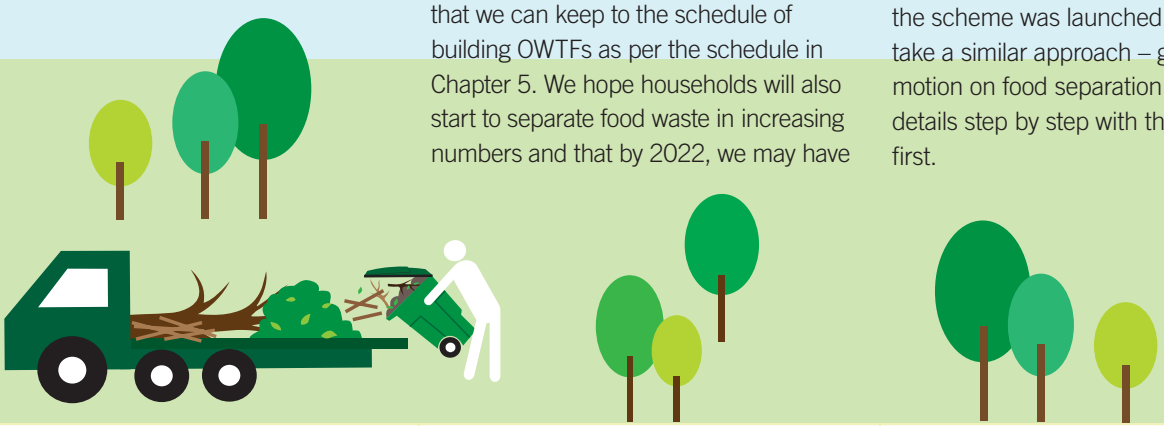
By 2018-19, our aim is for about 50% of our C&I food waste to be recycled, rising to 60% by 2022 for the C&I sector, assuming that we can keep to the schedule of building OWTFs as per the schedule in Chapter 5. We hope households will also start to separate food waste in increasing numbers and that by 2022, we may have 250,000 households (i.e. around 11% of all households in Hong Kong) participating.

To achieve this magnitude of increase from where we are today requires massive social mobilization, as well as collaboration with food-related businesses and estate managers. *The Food Wise Hong Kong Campaign* will work hard to mobilize all stakeholders and the public. We are ready to support more programmes and we expect food separation to increase progressively in scale when MSW charging is in place.

Needless to say, Hong Kong must make long term plans to involve the community to reduce and separate food waste so that a very large number of households will be involved beyond 2022.

Voluntary or mandatory separation?

Examples from overseas show there are successful cases in adopting the voluntary and mandatory approach. Some jurisdictions, such as South Korea, first adopted the voluntary approach to get society used to a new way to deal with food waste and to learn from the process before mandating food waste separation. After all, to be able to draft the appropriate legislation, it is necessary to articulate how it is to be done. In the case of South Korea, legislation only came about 7 years after the scheme was launched. Our view is to take a similar approach – get the wheel in motion on food separation and iron out the details step by step with the community first.



Collection and delivery of food waste

Transporting food waste requires special attention. Food waste collection vehicles are needed to ensure there is no leakage or odour. In future the vehicles will likely be different from the ones operating in Hong Kong today transporting MSW. Thus, a new fleet of food waste vehicles will need to be used or the existing fleet will need to be upgraded.

Once food waste has been separated from other MSW, it can be collected and delivered to the food waste recycling facilities. Our plan is for C&I establishments to be responsible for separating their food waste from their other MSW and deliver the separated food waste to the recycling facilities discussed below.[9]

The collection of food waste from domestic sources is more challenging than for C&I establishments because there are many types of residential dwellings. We will initiate a study on the food waste collection and delivery to consider the different types of circumstances in Hong Kong, including dwellings with/without storage space for separated food waste and C&I establishments, the collection and delivery arrangement, the suitable types of vehicles, appropriate ancillary and supporting facilities for any on-site interim storage, the appropriate arrangement for prioritization in the collection and delivery of food waste as well as the social, institutional and resource implications.

Separation and Collection of Used Cooking Oil and Grease Trap Waste

Separation and collection of used cooking oil (UCO) and grease trap waste (GTW) has become an established practice in the C&I sector as there is value in the UCO itself and the GTW is required to meet the effluent discharge standards under the Water Pollution Control Ordinance[10] and also because of the growth of Hong Kong's burgeoning biodiesel industry. Hong Kong's 20,000 plus eateries and food businesses generate an estimated 20,000 tonnes of UCO each year and about 175,000 tons of GTW. These quantities of waste are not counted as part of our food waste, so they are in addition to it.

In the case of UCO, many restaurants separate it from other forms of kitchen waste and sell it to collectors. The collectors range in size from traditional small waste collectors covering a small geographical area, to large collectors, which collects from more than 10,000 outlets every month. The waste oil is aggregated for use as a raw material for local biodiesel production or export for production overseas.

In the case of GTW (oil and grease in wastewater), it is collected by specialised collectors from the grease traps which all commercial kitchens are required to install. Before GTW can be used as a raw material, it must first be treated in one of Hong Kong's two GTW separation facilities where the oil is extracted for use as a raw material for biodiesel production and the residual wastewater treated to the required environmental standards. The first separation facility was built by the Government at the West Kowloon Transfer Station in 2006, and the second facility is built by one of the biodiesel producers. Together, Hong Kong has the capacity to treat about 1,000 tonnes of GTW a day.

9. Currently, C&I establishments are responsible for delivering their waste either to reduce transfer stations (RTS) or landfills.
10. Grease and oil that is allowed to enter the sewer system causes problems by separating from the wastewater and accumulating on the inside of sewer pipes. Over time, these deposits get larger as more grease and other solid material builds up. Grease deposits reduce the capacity of sewer pipes and cause sewage overflows, offensive odour and an unhealthy environment. The cleaning of grease deposits from sewers is difficult and can be dangerous and is carried out at considerable cost. Therefore, in many areas of Hong Kong there are limits set by the Water Pollution Control Ordinance on the amount of grease and oil that can be allowed to pass to sewer.

5 | Treatment and Recycling of Food Waste

OWTF Network

In light of the fact that Hong Kong generates a very large amount of food waste each day, and that food waste in general decomposes quickly and is unsuited to compaction at RTS for long-haul transport, the most suitable method to recycle food waste is to create a network of recycling plants. This approach enables food waste to be transported quickly from population centres to the facilities that are not too far away thereby reducing potential nuisance.

Preferred technology

We have reviewed many types of technology for treating food waste to assess their suitability for Hong Kong (see Annex). As Hong Kong has a large need for energy, our policy is to treat the city's collected food waste to produce energy using anaerobic digestion as the core technology. This process also produces residue that could be processed to become compost or fertilizer as side-products but our goal is to turn waste into energy and maximize energy production since Hong Kong has limited use for compost and fertilizer but can use large amounts of energy.

Social mobilization

Hong Kong people are becoming more and more conscious about reducing food waste. We expect this trend to gather strength with the spread of awareness raising programmes promoted by us and also by community groups in the coming two years, as well as after MSW charging is in place. The key is to get food-related C&I operators and householders to separate their food waste from other MSW.

As noted in the previous chapter, we have been promoting food waste separation for some time, where the collected food waste has been recycled into compost. Apart from the Kowloon Bay Pilot Food Waste Composting Plant and collaborating with the C&I sector, we also launched a number of schemes for households and other sectors. In the case of our household schemes for on-site composting, the daily capacity for individual estates is in the range of around 50 kg to 100 kg. Schools and some institutions have also installed small on-site composters, most of which have daily capacities of 5 kg to 100 kg. While the pilot plant and on-site composters handle very small quantities, the goal is to get people used to separating food waste. More organizations, schools and residential establishments are interested to start their own on-site programmes.

Expectation and Capacity Mismatch

Going forward, our challenge is to continue to promote food waste reduction at source as our priority, while increasing the social momentum to separate waste as we start to build the network of OWTFs, although the first one will only be ready in 2016. Indeed, it will take some years before Hong Kong has the recycling capability to deal with approximately 50% of the city's food waste. There could well be a mismatch between public expectation to participate in food waste separation schemes and the availability of treatment capacity, especially for households.

Anaerobic digestion technology

Anaerobic digestion is a process where micro-organisms are used to breakdown organic matter in the absence of oxygen.[11] Recycling food waste using this method is low carbon and produces biogas (a source of renewable energy similar to natural gas) as well as a residue that can be processed for use as compost or fertilizer. The energy produced can be used to run the facility and for the surplus energy to be exported. For example, we estimate OWTF1 can produce up to 14 million kWh of surplus electricity, which is equivalent to the electricity used by some 3,000 households.

This technology is now mature and the optimal capacity for an OWTF is in the range of 100 to 300 tonnes per day.

11. There are other technologies to treat food waste, such as composting, waste decomposing into waste water, dehydration and the Bokashi method, but they cannot compare with the advantages of large-scale anaerobic digestion facilities.

Network of Organic Waste Treatment Facilities (OWTFs)

We envisage Hong Kong needs to build a network of around five to six OWTFs between 2014 and 2024 with a total recycling capacity of about 1,300-1,500 tonnes per day. The first facility (OWTF1) at Siu Ho Wan (North Lantau) is already under tender and will cater for 200 tonnes of food waste per day. It is a government-funded Design-Build-Operate (DBO) project and is expected to become operational in 2016.[12]

There are currently two other possible sites for OWTFs to be built. The Environmental Impact Assessment (EIA) for OWTF2 has been done and it needs to be taken forward expeditiously using the established DBO arrangement.

The EIA for OWTF3 will also be taken forward as quickly as possible. As for further facilities, suitable locations still need to be identified.

We welcome the private sector to participate in the development of further OWTFs. We are open to options and proposals from the private sector either on sites identified by the Government or other sites proposed by the private sector.

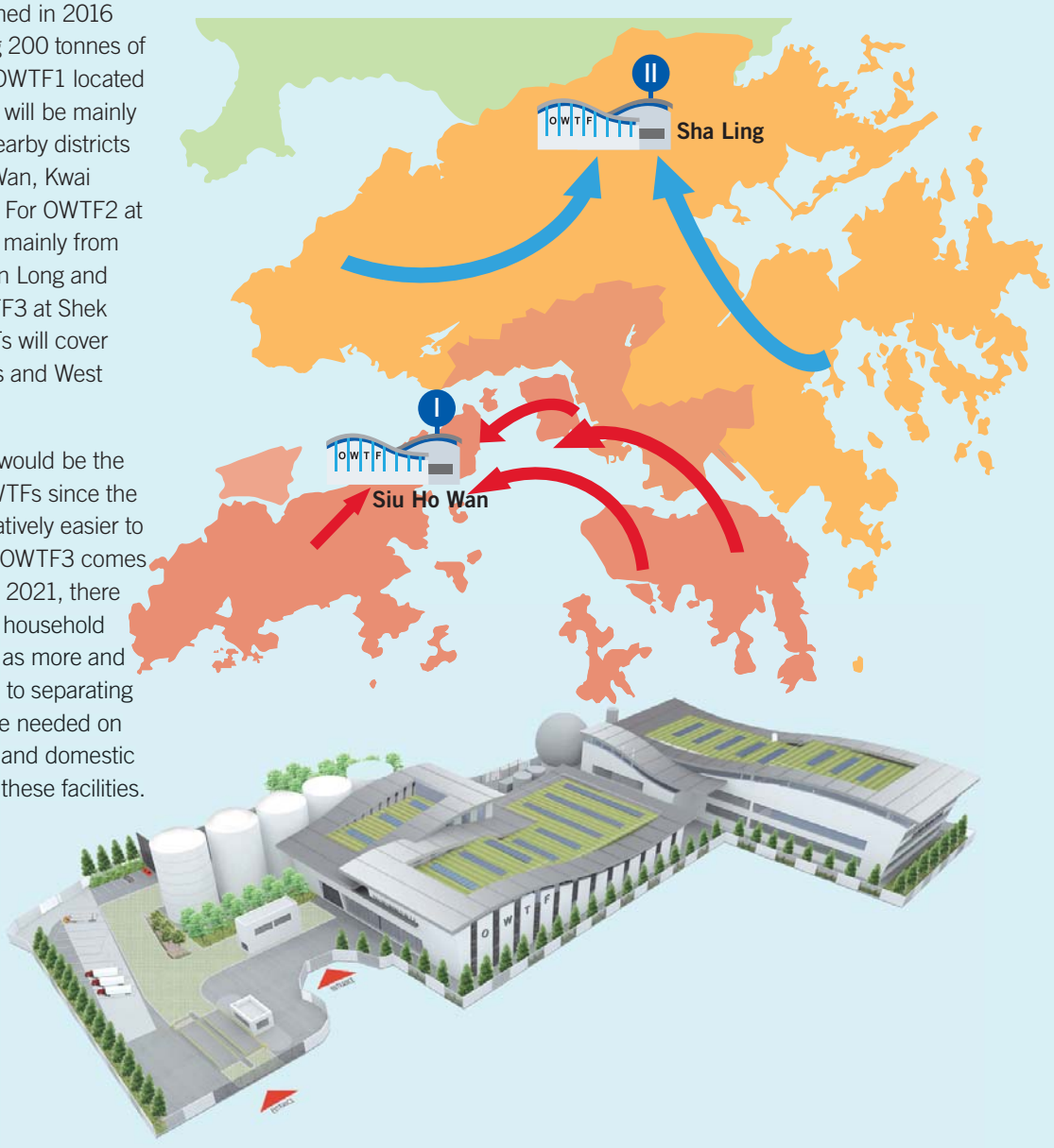
12. The contractor is engaged through open tender to conduct detailed design, carry out the construction works and operate the facility upon completion for 15 years.

One possible measure is to continue to encourage, facilitate and subsidise households to do small scale on-site or off-site composting (or other off-site treatment) so that residents continue food waste separation practices. As for on-site composting, since most estates have limited space, such an arrangement will have limited potentials however. Off-site composting may have better potentials, such as for the collected food waste to be taken to sites like the Kowloon Bay pilot plant as a stop-gap arrangement. While it is not easy to find suitable sites for this purpose, we are open to ideas from the community. What we need is for the network of OWTFs to be built as quickly as possible. It is often not appreciated that weight for weight, on-site composting is much more expensive than OWTFs.

C&I sector before households?

OWTF1 will be commissioned in 2016 with a capability of treating 200 tonnes of food waste a day. For the OWTF1 located in North Lantau, the users will be mainly from Lantau Island, and nearby districts including Tsing Yi, Tsuen Wan, Kwai Chung and West Kowloon. For OWTF2 at Sha Ling, the users will be mainly from Sheung Shui, Fanling, Yuen Long and Shatin. Together with OWTF3 at Shek Kong, the first three OWTFs will cover most of the New Territories and West Kowloon.

We expect the C&I sector would be the first to use the first two OWTFs since the food waste from C&I is relatively easier to be separated. By the time OWTF3 comes on stream possibly around 2021, there will be greater demand for household food waste to be recycled, as more and more households get used to separating waste. Adjustments may be needed on how best to distribute C&I and domestic food waste for recycling at these facilities.



Participation by Private Sector and Universities

Hong Kong needs to build urgently a network of OWTFs with due speed in order to meet our disposal at landfill reduction target by 2022. Moreover, we also wish to ensure that the public would not become discouraged if in future their separated food waste could not be recycled due to a lack of OWTF capacity.

In order to build up Hong Kong's ability to separate and recycle food waste, we welcome private sector participation. OWTF1 and 2 will be taken forward using the established DBO arrangement. We are open to adopting different types of private sector participation mode for future OWTFs with a view to building them as soon as practicable while maintaining high technological and operational standards. For future OWTFs, we are open to proposals from the private sector either on sites identified by the Government or on sites proposed by the private sector.

On-site composting – several challenges

Doing on-site recycling of food waste into compost is not the most suitable solution in Hong Kong because of our dense urban environment and operational challenges.

Space constraint

Not every housing estate has the space to put one or more composter on-site (see below on scale). In terms of treatment capacity, on-site composting is not the best solution for Hong Kong.

Expertise and quality

Proper operational expertise is required to keep the composter working optimally, and professional managers may be necessary. The lack of expertise will affect the quality of the compost output, which will in turn affect whether users will be willing to use the compost.

Potential nuisance

Potential hygiene and odour issues may create nuisance and complaints, especially if the food waste handling process is not up to scratch. The composting operation should better be carried out away from residents.

Cost efficiency

The operating cost per tonne of treating food waste by on-site composters is far from cheap. Indeed, it could be ten times more than operating an OWTF due to scale and the constant need to sustain good management. It can cost from around HK$10,000 to even HK$20,000 to treat one tonne of food waste taking a small 100 kg composter as example. The cost comparisons on page 21 are derived from local measures experimenting with composters.

Damage of paddles and composting chamber

Leachate from odour removal device

Compost not suitable for planting

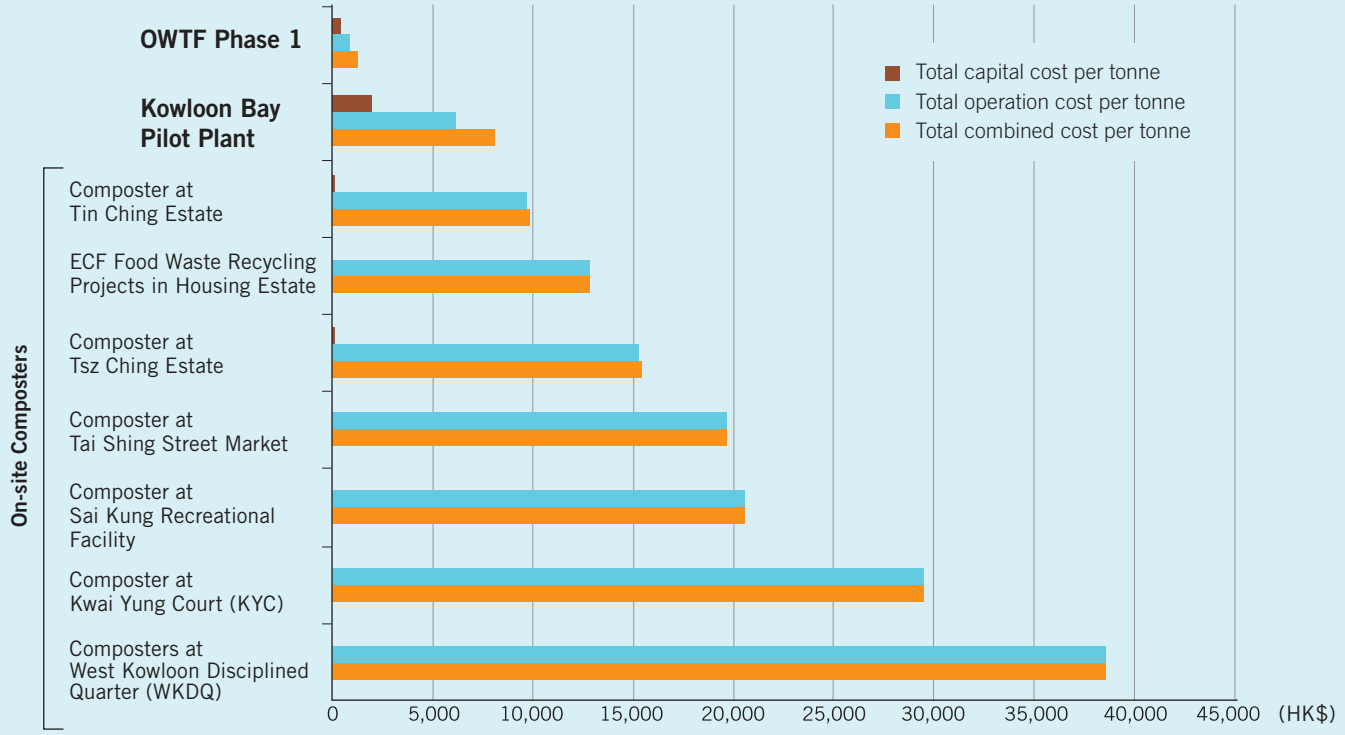
Issue of scale

Buildings and estates

A typical Hong Kong household produces just over 1 kg of food waste per day. Thus, a typical residential block of 50 floors with 8 households per floor produces about 400 kg of food waste per day. Let's say 50% of the households separate their waste, including food waste, which means there is 200 kg of food waste to recycle each day. Approximately 15 sq m will be needed for one composter with a capacity of 100 kg that also allows room for operation. Many standalone buildings will not have sufficient space to do on-site composting. Even large estates may not be able to find sufficient or suitable space. That said, for new building, efforts are being made to encourage a more facilitating design for food waste recycling (e.g. through BEAM Plus).

Outlying Islands and remote communities

Take Cheung Chau as an example. Its residence produces about 6 tonnes of food waste per day. There are currently two composting facilities there capable of handling 200 kg and 100 kg each day per day. Assuming a 50% recycling rate, there is a need to find suitable space for 15 to 30 composters on the island, which is difficult. As Cheung Chau is now served by an outlying island RTS, food waste generated in Cheung Chau can be transported to one of the future OWTFs nearby for recycling and treatment. Thus, for outlying islands with RTS or remote areas with road access, food waste could still be transferred to one of the OWTFs for recycling and treatment.



Biodiesel

an encouraging example of private sector-led food waste recycling

Biodiesel made from UCO is known as a second-generation biofuel. In the past several years, Hong Kong has seen the establishment of three factories to convert UCO or GTW to biodiesel. This represents private-sector led capital investment totalling about HK$1.5 billion. Their combined production capacity is about 150,000 tons per annum of biodiesel. This end product can be exported and also used in Hong Kong. Biodiesel can be blended with diesel to reduce pollutant emissions from vehicles, ships and machinery.

Local Technology

innovation in biological treatment of food wastes

We are paying close attention to local research and experimentation with food waste treatment technologies, some of which are supported by ECF funding. For example, university researchers are looking at how to increase the energy potential of food waste using anaerobic digestion, as well as developing composting techniques to reduce odour and nitrogen loss that can also improve the quality of the end product. Experiments are also on-going on how to reduce composting time. We will keep in view the progress of local research and consider incorporating successful experience into our food waste management projects.

6 The "Leftovers" for Disposal

Despite everyone's efforts, there will still be a considerable amount of food waste that are not separated and mixed with other waste that will be treated with other MSW. Using overseas experience as a guide, even with sustained efforts, there will likely still be over 50% of our food waste that will be mixed in with the city's MSW.[13] By 2022, about 3,000 tonnes of our MSW will be treated at a new Integrated Waste Management Facility (IWMF) each day, assuming it can be built in time. The rest will still have to be landfilled.

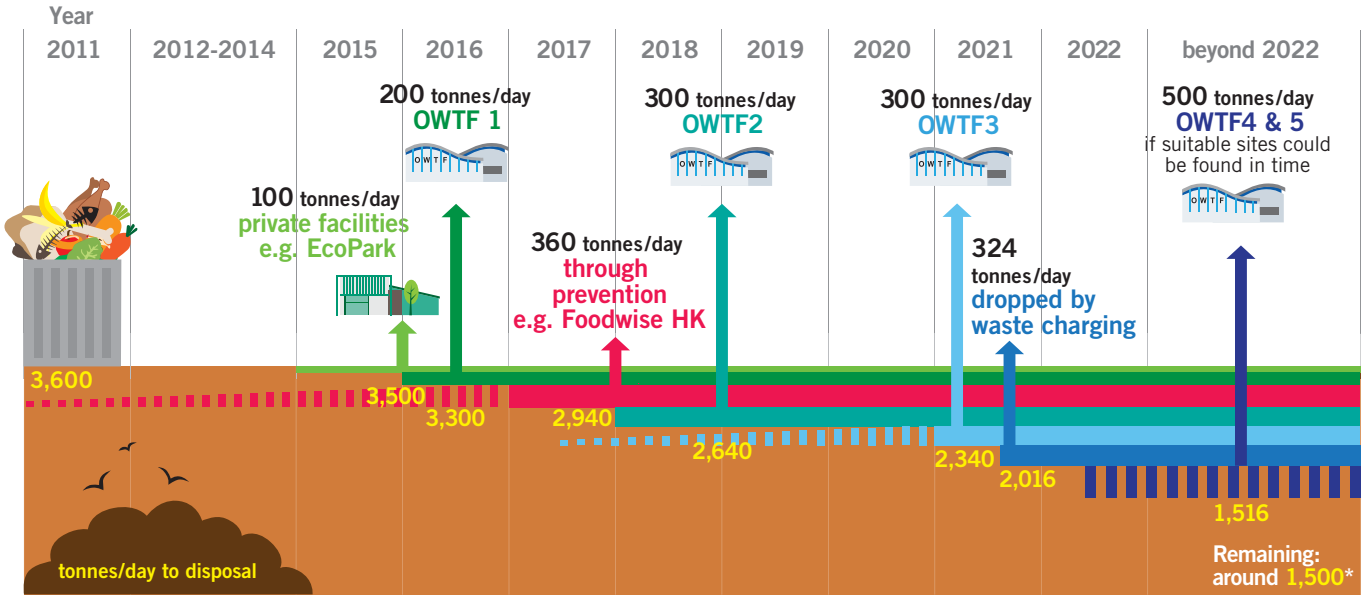
Assuming a relatively constant local population and keeping the same food waste disposal rate, even if we can achieve roughly 5% to 10% reduction through food waste prevention, and another 10% to 15% reduction from waste charging, plus having a network of several OWTFs with the capacity to recycle about 1,300 tonnes of food waste, Hong Kong will still have about 1,500 tonnes of food waste mixed in with the city MSW to deal with.[14] This remaining portion represents un-separated, contaminated food waste.

The assumptions in Figure 6 are ambitious and optimistic but highly dependent on the successful mobilization of the community to separate waste, implementation of quantity-based MSW charging by 2016/17, development of an effective collection and delivery system for source-separated food waste, and the continuous adding of OWTFs. Any change will increase the quantity of "leftover".

Achieving Our Food Waste Reduction Target

The above presents a reasonable plan to achieve the target of at least 40% reduction of food waste to landfills by 2022 using 2011 as the base. However, community support of the programme of action is as important as our commitment to the target. The success of achieving the target hinges upon the measures highlighted in Chapters 3, 4 and 5 so that citizens, organisations and the Government can each play their part to reduce, separate and recycle food waste.

Figure 6 Projected Reduction in Food Waste Volume



* About 2,000 tonnes of food waste still to be dealt with if OWTF4 and 5 cannot be built in time.

13. In Taipei, even with pay per bag system implemented since early 2000, food waste recycling programme and having pig feed as an outlet for food waste, the food waste recovery rate achieved is about 44%, less than 50%. Other cities in Taiwan have achieved much less than that, with some cities only achieved less than 20% food waste recovery rate.
14. As can be seen in other countries, any further reduction of the "leftover" food waste would require much stronger policy measures such as a sufficiently high level of waste charge to incentivize further behaviour changes or a total ban of food waste at landfills. Implementation of such measures in Hong Kong would need much longer time for the community to discuss and achieve consensus and would also depend on the initial operational experience of the waste charging scheme.

7 Dealing with Yard Waste

Our Yard Waste Strategy

Yard waste is also known as green waste or garden waste, which consists of all types of vegetation waste matters. This type of waste decomposes gradually in nature. Woody material is also combustible.

Hong Kong has not focused on yard waste up until recently. While we are designing an overall waste-to-resources programme for all types of waste, in the area of yard waste, we still have information gaps although we are already working on filling them.

Our strategy to deal with yard waste is to collect data, promote reduction at source, encourage separation and collection, and find the best ways to treat the unavoidable portion.

We are taking a coordinated approach within the Government to collect data and promote best practices through an inter-departmental working committee led by Environment Bureau. We will introduce best practices to the public sector and major generators of yard waste in the C&I sector in due course. We will provide periodic updates on progress.

Types of yard waste

Amount Going to Landfills

About 127 tonnes[15] of yard waste is disposed of at our landfills each day, which make up about 1.5% of Hong Kong's total MSW going to landfills.

The major generators of yard waste are various government departments and commercial establishments with extensive plantings and landscaping. These government departments include Leisure and Cultural Services Department, which manages public parks and gardens as well as maintains roadside trees and landscaped areas along non-expressway public roads outside country parks; Housing Department (HD), which manages public areas in housing estates; Highways Department (HyD), which is involved in road construction, improvement and maintenance works, as well as the associated vegetation maintenance within the boundary of expressways and roadside slopes under its purview; and Architectural Services Department (ArchSD), which is involved in building projects and vegetation maintenance on slopes under its purview.

The Agriculture, Fisheries and Conservation Department's (AFCD) total annual yard waste tonnage is 1,400 tonnes of which only 80 tonnes (i.e. 5%) have to end up in landfills since much of the yard waste can be dealt with within the country parks it manages.

Yard waste reduction

We are calling upon government departments to contribute to yard waste reduction at source through two key measures:

- Minimizing using plants that are just displayed during festivals (e.g. Christmas and Chinese New Year). Replanting plants are also encouraged. For example, the Food and Environmental Hygiene Department (FEHD) has been doing so with unsold flowers and plants from the Lunar New Year Fair; and

- When designing landscaping areas to consider how to minimize yard waste generation, such as through reducing the use of annuals. We will publish Practice Notes on Yard Waste Reduction to help improve how Hong Kong deals with this type of waste.

Yard waste separation and collection

Separation of yard waste is straight forward. We need to develop the habit of doing it, and collection needs to be organized systematically so that the waste can be properly treated. The practice of separate collection of yard waste should of course be promoted in tandem with the development of facilities capable of treating yard waste properly (see below).

Collection and Replanting of Potted New Year Citrus Plants To Reduce Domestic Waste

To boost environmental awareness of reducing and recycling domestic waste at source among the public rental housing (PRH) tenants, the Hong Kong Housing Authority (HA) launched a pilot scheme to collect and replant disposed citrus plants after Chinese New Year. The pilot scheme was well received by over 30 participating estates and more than 1,000 pots of citrus plants were collected. To keep up the momentum in reducing waste, the scheme would be extended to all some 160 PRH estates.

15. The figure is based on the relevant data in the "Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2011" plus further estimated amounts from various government departments.

Households: As most households do not have gardens in Hong Kong, the amount of yard waste generated by individual households is very small. A typical household may occasionally dispose of cut flowers and leaves from indoor potted plants. As we will have major programmes to urge householders to separate food waste, their yard waste can be separated with the food waste for collection. The larger quantities of yard waste may arise from landscaping and gardens of private housing estates.

C&I: Since there are relatively few privately managed commercial establishments with extensive gardens, plantings and landscaping (such as Ocean Park, Hong Kong Jockey Club and Disneyland), source separation and collection for them should not present a major problem. For general commercial buildings, they can also better source separate their yard waste and organize for its collection. As the job in commercial buildings is normally carried out by cleansing or gardening contractors, commercial property management may introduce relevant requirements in their contracts with them. It just needs to be organized and the Government will help raise public awareness.

Public sector: Government departments will lead the way in developing best practices in yard waste separation and collection. The best practices can then be shared with the community.

Yard waste treatment

There are various treatment methods for treating yard waste, some of which are more suitable for Hong Kong than others:

Natural degradation: Space permitting, yard waste can be left in situ or taken to a place where it can be left to degrade over time. While a natural decomposition process is appropriate for yard waste arising from country parks to degrade within country parks, it is much more difficult to do this elsewhere as the decomposition process takes considerable time.[16] However, government departments are looking at where there may be space for natural degradation but we expect only limited capacities to be available. Where there is space, we support natural degradation in situ.

Peach Blossom Tree Recycling Campaign

In 2014, the Environmental Protection Department (EPD) and the Hong Kong Environmental Protection Association have jointly organised the Peach Blossom Tree Recycling Campaign. The EPD and Food and Environmental Hygiene Department set up a network of 50 collection points in all the districts of the territory to expand the Campaign to cover individuals and households. All the peach blossom trees collected were delivered to the waste wood recycler in the EcoPark, Tuen Mun for recycling into wood fuel pellets (a useful type of renewable energy) and composting materials with a view to raising the public's awareness in waste reduction and relieving the pressure on landfill disposal.

16. AFCD is unlikely to be able to accommodate more yard waste apart from its own in country parks. There are also concerns on the likely impact on biodiversity and invasion of unwanted species and disease if yard waste came from other sources.
17. Care should be exercised for excluding diseased plants for reusing as mulch or compost. In particular for plants affected by Brown Root Rot disease, they should be properly treated according to the guidelines promulgated by the Tree Management Office of the Development Bureau, which are available from the Trees website (www.trees.gov.hk).

Composting: Space permitting, composting is also a viable means to treat yard waste. It is environmentally friendly and cost effective if composters can be located near larger sources of yard waste, such as some of the bigger sites managed by LCSD, large housing estates, and the large commercial establishments. Where the waste has to be collected and transported, the Government currently has two sites with limited composting capacities – EPD's Kowloon Bay Pilot Composting Plant noted in Chapter 4 and EPD's Animal Waste Composting Plant at Ngau Tam Mei (with a maximum design capacity of 40 tonnes/day). There may be a possibility to increase capacities, which we will examine. The capacities of these plants may be combined with that for the OWTFs (see below). Yet, it should be noted that this method takes time and it becomes inefficient for large volumes of yard waste especially where land space is a major constraint.

Anaerobic digestion: The OWTFs noted in Chapter 5 can also have some capacity dedicated to deal with yard waste. We will assess whether and how this may be done as part of our overall plan for building the OWTF network. Together with the two composting plants noted above, it should be possible for about 35 tonnes of yard waste to be treated per day.

Reuse and Recycling: Wood waste and plants displayed during festive seasons (e.g. Christmas trees and peach blossom trees) may be sorted and recycled as a fuel material, such as being turned into wood pellets or wood fuel. Wood waste may also be reused as mulch after proper treatment.[17] A tenant at the EcoPark is able to operate such a process with a capacity of 2 tonnes per day currently, which may be increased to about 10 tonnes in the future.

8 Conclusion

Together, the Government, the people and businesses of Hong Kong has the opportunity to significantly reduce the amount of food we waste each day. Our success will mitigate the environmental and economic impacts of the MSW management system. To be successful, however, we all need to change our daily behaviour by reducing food waste at source. Through committed and sustained individual and corporate actions, and through complementary government policies and programmes to incentivize food waste reduction, and in time separation and collection, as well as to provide the necessary infrastructure for recycling and treatment, we believe Hong Kong can achieve the target of reducing food waste to landfill by 40% by 2022.

We cannot emphasize enough the very tight timetable we have set for dealing with a large variety of actions that needs to be successfully accomplished in order to achieve our target. Any changes will set us all back in our timeline. The journey will not be easy because success depends on public acceptance and large-scale community mobilization to participate in waste separation. Studies and trials are necessary to examine what will work in Hong Kong. There will no doubt be many views and suggestions about how to do it well and debates over the institutionalisation of methods and systems for different types of circumstances, such as low-rise and high-rise households, urban and rural areas, as well as factors relevant to the C&I sector. Beyond everyone's effort to reduce waste, we need the community to work through many challenges with us in the spirit of collaboration if Hong Kong is to be successful in transforming how we deal with food waste.

Furthermore, a critical step is the implementation of MSW charging in 2016/17, as well as the speedy construction of the OWTF network. We recognize we still need to present the public with Hong Kong's MSW charging plan and that the political process to bring it to fruition must be gone through, where there could well be a diversity of views. At this stage, we are heartened by the public's acceptance of the concept of waste charging. As for creating the OWTF network, we have tendered OWTF1 and will make a decision on selecting the operator soon. In order to stay with our timetable, we need to move ahead expeditiously with OWTF2. To proceed with the other ones, we re-emphasize our desire to work with the private sector to explore how we may be able to speed-up the construction of more plants, and also to find available sites for them.

"Through committed and sustained individual and corporate actions, and through complementary government policies and programmes to incentivize food waste reduction, separation and collection, as well as to provide the necessary infrastructure for recycling and treatment, we believe Hong Kong can achieve the target of reducing food waste to landfill by 40% by 2022."

This document represents the start of a new journey for Hong Kong. At Environment Bureau, we wish to see Hong Kong people taking pride in "Everyone being a Recycler" and in adopting a "Food Matters" culture that will spread through our society and become one of our core values. Hong Kong is famous for our good food. Yes, we can eat well but we must not waste. Let us all adopt these practices as a part of how we wish to live. Hong Kong's catering sector can be well-known for not only providing good food but also how they minimize and recycle food waste. With infrastructure established and the culture of Food Wise taking root in the community, the coming 10 years will lay a solid foundation for us to plan ahead for the future.

Annex

Evaluation of Food Waste Treatment Methods

Option	Strengths	Weaknesses	Remarks
Anaerobic Digestion	• Highly suitable for wet biodegradable organic waste • Possible energy recovery in the form of biogas • Useful end product in the form of compost	• Longer start-up time to develop high biomass inventory • Relatively slow process rate • Only limited to biodegradable waste	• A promising biological treatment technologies with wide applications worldwide • Great demand in HK for the biogas or energy as product of the treatment
Aerobic Composting	• Suitable for various types of biodegradable organic waste • Useful end product in the form of compost	• Longer start-up time to develop high biomass inventory • Relatively slow process rate • Limited to biodegradable waste • Relatively large area requirement • Difficult in odour control	• Biological treatment technologies with wide applications worldwide • Likely limited demand in HK for the compost product
Conversion to solid biofuel	• Energy and resource recovery • Can be employed as a supplementary fuel in conventional boilers	• High operation cost • Not cost effective for source separated biodegradable organic waste • No markets identified for Refuse Derived Fuel	• Treatment by mechanical sorting and drying • Excessive drying required as organic waste has a high moisture content • Demand for the solid biofuel in HK is uncertain
Conversion to liquid biofuel	• Sustainable use of resources • Replacement for fossil transport fuels or used to generate heat and power on site	• High operation cost • Not cost effective for mixed food waste • Advanced / complex technologies required, some of which are still experimental	• Thermochemical/ Biochemical/Mechanical process • Production of liquid biofuel is largely concentrated on the agricultural industry, with ongoing research using waste biomass as feedstock • While there are existing facilities producing biofuel from pre-segregated oil in Hong Kong, the technology for mixed food waste is potentially complicated and unproven
Conversion to Fish Feed	• Useful end product in the form of fish feed	• Nutritional needs vary between fish species • Inconsistent feedstock and difficulty in managing quality control • Limited market in HK	• Involve sorting and sterilization treatments • Offensive Trade License might be required • Not a prevalent practice in other countries

Option	Strengths	Weaknesses	Remarks
Conversion to Animal Feed	• Useful end product in the form of animal feed	• Potential spreading of infectious animal diseases • Inconsistent feedstock and difficulty in managing quality control • May contain excessive amounts of trace minerals or substances which may be harmful to animal health e.g. excessive amounts of preservatives and salt • Only limited to food waste with known sources and compositions • Limited and declining market in HK	• Involve sorting and sterilization treatment • All feed provided to the animals must fulfill the Public Health (Animals ad Birds)(Chemical Residues) Regulation, Cap.139(N) • In Europe, the Animal By-product Regulations (ABR, EC 1774/2002) identified catering waste as potential risk materials that is not suitable for processing animal feed. Some other countries such as Canada and Australia also ban recycling food waste to feed farmed animal
Miscellaneous methods	• Some volume reduction; • Some useful end products if treatment is completed	• Usually for small scale operation • Usually require second stage treatment or involve high operational cost	Including the following : • **Bokashi:** fermented food waste required to be buried within soil for second stage fermentation • **Dehydration:** dehydrated food waste still need to go through decomposition before usage as compost. High energy demand for dehydration • **Biological (e.g. earthworm, black soldier fly, etc.):** under trial or relatively small scale operation. Potential ecological concerns if foreign species are introduced • **Grinding up food waste and disposing of it via the sewerage system:** it would have adverse impact on the sewers and sewage treatment works. Large scale practical experience especially for multi-storey buildings is lacking and inconclusive internationally. Some cities have banned such practice

Abbreviations

AFCD	Agriculture, Fisheries and Conservation Department
ArchSD	Architectural Services Department
BDO	Build Design and Operate
C&I	commercial and industrial
ECF	Environmental and Conservation Fund
EIA	environmental impact assessment
EPD	Environmental Protection Department
FEHD	Food and Environmental Hygiene Department
GHG	greenhouse gases
GTW	grease trap waste
HyD	Highways Department
HD	Housing Department
IWMF	Integrated Waste Management Facility
LCSD	Leisure and Cultural Services Department
MSW	municipal solid waste
NGOs	non-government organizations
OWTFs	Organic Waste Treatment Facilities
UCO	used cooking oil
SDC	Council for Sustainable Development