ClearTheAir 爭氣行動
www.cleartheair.org.hk

Legco Public Works Subcommittee 10th April 2014

Dear Legco Members,
The Government will imminently seek initial funding approval to extend our landfills and for funding of a mega incinerator from the Finance Committee, represented by this Panel.

The DAB party has sided with the Government presumably as a tit-for-tat on another matter at the Panel on Environmental Affairs stage on this proposal, in the same way the DAB opposed the preventive health measure to try and stop youth smoking by increasing tobacco excise tax. It seems that DAB party does not care one iota for the health of Hong Kong people and even the health of their own children.

At no stage has the Government sought to disprove the overwhelming available peer reviewed evidence that proximity to incinerators, even modern ones, results in cancers and deaths the closer the inhabitants are to the incinerator. Neither it seems, have Legislators pressed them on this important life and death point. A simple Google search 'incinerator proximity dioxin cancer death' reveals abundant peer reviewed reports with numerous other links shown in those pages.

http://www.ncbi.nlm.nih.gov/pubmed/23160082	Europe
http://www.ncbi.nlm.nih.gov/pubmed/15242064	Japan
http://www.ncbi.nlm.nih.gov/pubmed/20581259	France
http://www.ncbi.nlm.nih.gov/pubmed/24076993	Italy
http://www.ncbi.nlm.nih.gov/pubmed/23727903	Taiwan

Similar reports are available on 'landfill proximity emissions – cancer – health - leachate'

http://www.ncbi.nlm.nih.gov/pubmed/12152892	Japan

The Government of Hong Kong for years has been a NATO proponent – that is **N**o **A**ction **T**alk **O**nly. Flashy Blueprints promised a lot and produced little, only hot polluted air and broken promises. More than 3,000 people a year die as a result of Hong Kong pollution.

The Government now seeks to start a waste charging scheme without first having provision of means for people to even voluntarily recycle their waste and for that recycled waste to be collected and utilised. Under this charging scheme even voluntary source separated waste would get dumped together in landfill and the volunteers charged, nil recycling would happen. This is manifestly wrong.

What the Govt should be doing is to approach Legco for **Source Separation of Waste legislation** first. Forcing people to recycle their domestic waste separates food waste and recyclables. The dry recyclables can create a whole new local recycling industry and increased employment. In tandem the Government needs to have a recyclable materials collection scheme in place for the whole of Hong Kong, not just Govt housing estates.

Once these are in place, by all means the Government can initiate a waste charging scheme for what is left after the food waste and recyclables are removed from the daily stream.

Contact : chair@cleartheair.org.hk Tel 26930136 Fax 26027153
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What should be happening in Hong Kong and is not:

1 Legislate source separation of waste , food waste and recyclables
2 Name a date to move to 'Zero Waste' like San Francisco http://www.sfenvironment.org/zero-waste
3 SAR- wide daily collection of recyclables to supply new local recycling industries and employment
4 Green Bin free collection of food waste like Santa Monica , UK, Australia, Europe
http://www.smgov.net/Departments/PublicWorks/ContentRecycling.aspx?id=16222
5 Utilisation of industrial garburation of food waste and use of the in situ sewerage system (CIWEM worldwide policy)
6 Reverse mine our landfills back to beneficial usage using plasma gasification
http://www.petcore-europe.org/content/belgian-company-leads-way-landfill-mining
7 Use plasma gasification plants to destroy end of life construction waste and convert into usable inert Plasmarok to replace imported road aggregate and construction sand

The Government's waste recycling figures are in disarray – the reason being they were exposed as fake after China erected **'Operation Green Fence'** http://earth911.com/general/operation-green-fence/ Container loads of overseas trash were passing through Hong Kong enroute to China and those statistics were being used to show a '48%' *local* recycling rate. Hong Kong's actual real local recycling rate is probably 20% below that figure and reliant on scavengers instead of Government policy.
Building an incinerator and extending landfills is not necessary if we have a capable source separation and recycling systems in place and this is where Hong Kong should be heading. If the myopic backroom staff of ENB that have served three different ministers so far had their blinkers removed we could have had the recycling system in place by now instead of their pet incinerator project concept which is already 1 ½ decades old. It is never too late to start and this is where they should be directed to use their blinkers – **RECYCLING.**
Approving the landfill /incinerator option is abject surrender and the definitive end of constructive recycling and recycling industry employment growth in Hong Kong. Incinerators are voracious demand-wise and issue more dioxins when they start up or shut down or burn wet feedstock. The proposed chimney stack height will deposit toxic pollutants to all parts of Hong Kong, Macau and PRD.
Mass burn incinerators reduce unsorted feed-stocks by up to 90% in volume but 30% by weight remains per day as toxic ash and fly ash especially since without sorting, chlorine, cadmium and lead batteries contaminate the ash – meanwhile 70% of what is burned goes into the air – baghouses and precipitators cannot catch PM1 and PM2.5 toxic particulates THAT KILL. This ash requires landfilling and will result in the Government coming cap in hand at a later stage to build man-made ash lagoons in the sea at the cost of billions of dollars. **This is a Bad, Bad, Bad idea.**

FOOD WASTE

More than 40% of our daily domestic waste is ultra-wet 90% water food waste that is mixed with, taints and renders useful recyclables unusable – **since we have no Source Separation legislation**.
We have previously copied this panel and the panel on Environmental Affairs the **CIWEM** worldwide recommended solution for the treatment of food waste. Self-explanatory information is attached for ease of reference. The Government's Mr Elvis Au, himself a CIWEM member has seen fit to pooh-pooh the idea, saying it would not work here. ***Should the Public Works Committee Panel believe Elvis Au on his unproven unsubstantiated word, or rather the wealth of engineering knowledge of CIWEM that normally advises Governments in 98 countries of the world through their local branches, including Hong Kong?*** **We posed the current situation to CIWEM Head Office in UK and here is their reply:**

From: Laura Grant [_____]
Sent: Tuesday, April 01, 2014 6:11 PM
To: _____
Subject: RE: Legislative Council Panel on Environmental Affairs: Special meeting on 22 March 2014 Shek Kwu Chau Incinerator
Dear James,
Thank you for your email. Based on the information you have provided I cannot see a problem with the proposal and it is in-line with CIWEM's position, although it may depend on the capacity of the sewer system.
In CIWEM's experience there hasn't been an increase in sewer blockages associated with FWDs provided that fats, oil and grease are not entered into the sewer system. FOGs shouldn't be entered under any circumstances, whether there the use of FWDs or not.
I would imagine your proposal should be subject to trials first and this may help make your case to the government.
Kind regards,
Laura
Laura Grant BSc MSc MCIWEM
Policy Adviser, CIWEM
T: +44 (0)20 7831 3110

From: James Middleton [_____]
Sent: 26 March 2014 06:32
To: Dr. Simon Festing
Subject: Legislative Council Panel on Environmental Affairs: Special meeting on 22 March 2014 Shek Kwu Chau Incinerator
Chartered Institution of Water and Environmental Management (CIWEM)
106-109 Saffron Hill, London, EC1N 8QS Tel: 020 7831 3110 Fax: 020 7405 4967
Dr Simon Festing Chief Executive simon@ciwem.org
http://www.ciwem.org/policy-and-international/policy-position-statements/food-waste-disposers.aspx
CIWEM Policy Statement on Food Waste disposers
http://www.ciwem.org/knowledge-networks/branches/hong-kong.aspx

Dear Dr Festing, 26/3/2014
We are an NGO Charity in Hong Kong run by volunteers.
Our website is www.cleartheair.org.hk
We have read and totally agree with CIWEM's policy statement on the use of food disposers for the treatment of food waste.
See our report 'Some Food for Thought' attached.
Our adviser is a technical director /engineer from a locally based international engineering and environmental consultancy, who is completely in agreement with CIWEM's stance.
I attach self-explanatory information for you showing how Hong Kong Government thinks that use of the sewerage system is not appropriate for Hong Kong. 40% of daily household domestic waste is food waste.
The food waste moisture content is 90% for local wet market food waste and 78% for Mall food waste (Government data) versus only 30% water content in Europe.
Hong Kong has many high (30 storey +) rise buildings and estates rather than houses; the Government's position is that if every household had a sink disposer the building drains might get clogged.
We consider this would not happen, would immediately remove 40% of daily load on our landfills and necessary trucking etc.
Our counter to this Government point is that there is currently no Green Bin collection system here which should be instigated asap. Food waste from estates, houses and rural houses could be deposited in Green Bins , collected by Government and delivered to transfer stations where industrial garburators would puree the ultra wet food waste that would be then fed into the existing sewerage system.
There are 11 waste water treatment plants in Hong Kong and an existing massive sewerage system (Hong Kong always overbuilds everything) . The largest CEPT tanks operation is at Stonecutters island which has 75% of HKG's waste water capacity.
By 2016 the capacity of Stonecutters waste water reception will be a maximum 2.75 million cubic meters per day. The current daily top load of Stonecutters is only 1.3 million cubic meters per day. Our point being that adding 3,500 cubic meters (Hong Kong's current daily food waste amount) of ultra wet pureed food waste to the system would be inconsequential and our consultant agrees. Can you see any drawbacks to our suggestion which is in line with CIWEM policy position ?

Accordingly this Panel should be guided by CIWEM's advice and delve further into this solution, (through CIWEM or independent consultants) a solution which has the necessary infrastructure already in place other than to install industrial garburators at Green Bin collection stations.

Applying common sense, working towards a Zero Waste programme , recycling and use of the existing infrastructure for our food waste would drastically reduce the amount of daily waste to landfill – and the Government must know this – but hypocritically the truth does not suit their outdated policy.

Hence they seek the alternative, to extend landfills and to mass-burn non source-separated recyclables and food waste which at 2 MJ/kg calorific value is non-combustible (combustion requires 7 MJ/kg) – hence more energy would be needed to destroy the food waste by burning than any resultant energy that could be recovered. Does that make any sense ?
What quality of compost or fish food can be recovered from expensive anaerobic digestion food waste that is 78% water (Mall waste) and 90% water (Wet market waste)?

http://www.bmj.com/content/348/bmj.g2351 IPCC report
Incinerators create massive amounts of CO2 in addition to toxic pollutants. It is for this reason that Denmark is making a paradigm shift away from incineration and towards recycling.
http://cphpost.dk/news/denmarks-carbon-bomb.1181.html *Denmark's carbon bomb*

whereas Hong Kong seeks to revert to the stone ages. 

The Government should be sent back to set **Source Separation** laws in place, to setup the Green Bin recycling scheme and to pursue recycling of the remaining dry usable waste before taking the easy and retrograde landfill/incineration caveman option.
Moreover the Govt wanted to use EU incinerator standards instead of the stricter US EPA.
US EPA: Commercial and Industrial Solid Waste Incineration Units: Reconsideration and Final Amendments; Non-Hazardous Secondary Materials That Are Solid Waste; Final Rule
http://www.gpo.gov/fdsys/pkg/FR-2013-02-07/pdf/2012-31632.pdf

Stand up for the health of Hong Kong people and deny the funding request – otherwise your conscience, yours and your children's health will suffer.

Yours sincerely,

James Middleton
Chairman
www.cleartheair.org.hk

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 [_____]
Sent: Wednesday, February 12, 2014 6:06 PM
To: _____
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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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.

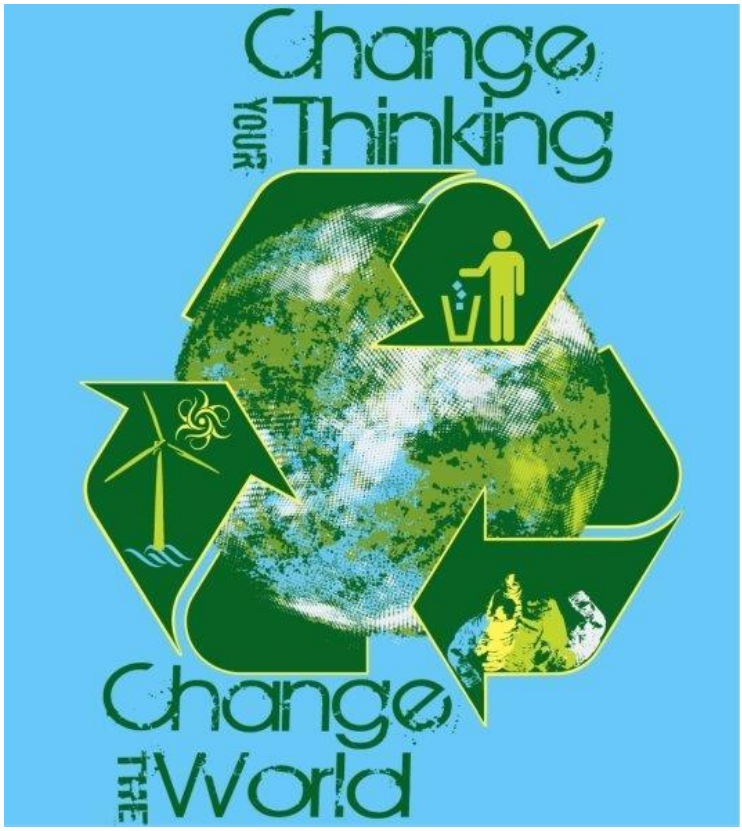
This will give Hong Kong breathing space to commission enhanced landfill mining at its landfills using plasma gasification technology that can produce bio diesel and bio fuels for airlines and Ocean Going Vessels (OGV's our biggest source of pollution).

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

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.

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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.