25th Anniversary BUSINESS ENVIRONMENT COUNCIL 商界環保協會

ENVIROSERIES

BEC ENVIROSERIES CONFERENCE SUMMARY REPORT

Circular Economy: Towards a Resource Efficient Hong Kong - Managing Waste, Driving Growth

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Managing Waste, Driving Growth
16 May 2017

I) INTRODUCTION

BEC organised this conference on the circular economy because of the waste management issue in Hong Kong. A great challenge has been created as this issue would add considerable pressure on the territory's limited land space. In parallel, it may also be a valuable opportunity to use waste as a resource. This conference brought the Government, business leaders, academics and environmental groups together to discuss the related problems, challenges and solutions on the subject.

The facts in brief are:

- The disposal rate of municipal solid waste[1] (MSW) of Hong Kong was 1.39 kg per person per day in 2015[2]. Hong Kong's waste load is comparatively large when compared with Asian cities at a similar level of development[3].

- The Government set a target in 2013 to reduce MSW disposal rate by 40% by 2022.

- In 2015, the total amount of solid waste disposed of at the strategic landfills was 5.51 million tonnes, which has increased by 1.6% as compared to 2014.

- Despite various Government waste management initiatives, the amount of total solid waste disposed of at the strategic landfills was 15,102 tonnes per day (tpd) in 2015, which was higher than those of 2014 (14,859 tpd) and 2013 (14,311 tpd).

- The composition of the total solid waste in 2015 comprised -:
    - Municipal solid waste: 10,159 tpd
    - Overall construction waste: 4,200 tpd
    - Special waste: 743 tpd.

- The amount of MSW recyclables recovered in 2015 was 2.03 million tonnes and the overall MSW recovery rate was 35%. The four major types of recyclables were (i) metals, (ii) waste electrical and electronic equipment, (iii) papers and (iv) plastics. Their recovery rates were:
    - Metals: 92%
    - Waste electrical and electronic equipment: 79%
    - Papers: 52%
    - Plastics: 11%.

  Most of the recovered recyclables (98%) were exported. In terms of export value, the recyclable materials recovered in 2015 amounted to $4.6 billion in 2015, as compared to $5.5 billion in 2014.

[1] Municipal solid waste (MSW) comprises domestic waste, commercial waste and industrial waste.
[2] EPD 2016, Monitoring of Solid Waste in Hong Kong: Waste Statistics for 2015
[3] Environment Bureau 2013, Hong Kong Blueprint for Sustainable Use of Resources: 2013-2022.

Around the world, a new approach to resource management is emerging. This involves minimising the impact of waste on the environment and capturing opportunities by turning waste materials into resources akin to a natural cradle to cradle cycle. This is driven by:

1. Expected increase in scarcity of resources with a growing global population – expected to be 8.5 billion in 2030[4] in comparison with 7.5 billion in 2017[5]
2. Efficiency and benefits of being able to use resources through recycling
3. High carbon cost associated with raw material extraction and manufacturing processes.

This report is a summary of proceedings of the conference. Key messages emerged from the discussion are as follows:

- As the global population and affluence grows, a circular cradle to cradle approach becomes even more important.

- To support the circular economy we need to encourage the right design of products to make it easier to recycle products/materials.

- Technically, it is possible to do a lot with the materials that we consider "waste", but the right designs and development of appropriate reprocessing methods are required for this to work.

- Buyers/Procurers need to be more innovative in what they purchase and make use of.

- The purchase of services rather than only products themselves is a way of reducing waste by encouraging longevity and upgrading. A "sharing economy" is a means of providing a service –access to products– which is also aligned with "circularity".

- A holistic waste policy that takes on board the waste hierarchy of reduce, reuse, recycle, recover energy, and then disposal needs to be developed. Some policies are in place but they need to be reviewed with the ultimate goal of establishing a circular economy. The waste hierarchy is a useful reminder of the steps that should be prioritised.

- Regulations can sometimes hamper change and need to be kept under review to ensure they are not unnecessarily deterring positive innovation.

- MSW charging rate is on the low side considering the relative costs of collection/transportation and recycling. But it is an important first step in terms of kick-starting recycling.

- Tendering systems to allow for more flexibility in proposals are recommended when it comes to developing waste management and other related facilities. For example, it may be better to have 5 small waste to energy facilities instead of one large facility.

[4] http://www.un.org/sustainabledevelopment/blog/2015/07/un-projects-world-population-to-reach-8-5-billion-by-2030-driven-by-growth-in-developing-countries/
[5] http://www.worldometers.info/world-population/

- Government has an important role to play in terms of creating a level playing field to enable businesses to come up with the best technologies. It also has an important proactive role to make things happen and ensure that projects are realised within a reasonable time period.

- Collecting, recycling and managing waste is a business, and the right policy framework can ensure that businesses can capture the many opportunities available.

- It is equally important for the government, business sector and organisations like BEC to make a concerted effort to institute one or more pilot projects aimed at developing a circular economy in Hong Kong.

II) EVENT SUMMARY

Keynote Speakers

KS Wong, Secretary for the Environment, Hong Kong SAR Government

KS Wong spoke about the Government's approach to making the circular economy work as well as initiatives to date.

1. The ABC's of achieving circular economy are authorities (A), businesses (B), and consumers (C). Private-public partnership –in other words, getting all stakeholders involved– is essential for a circular economy to be realised.

2. Key Government circular economy-related initiatives in its published blueprints are:

    - Smarter Design/Production: lower resource consumption – "less is more"

    - More Conscious Use: Optimizing Product Life
        - e.g. EMSD HQ where adaptive reuse principle was applied to transform an existing building to become a Government headquarters building and a green building with BEAM Plus NB and EB certifications.

    - Increase Reusability: Waste as Resources
        - A good example of this is T-Park. Creative designers were engaged to reuse timber from the old pier to create furniture for a café. T-Park also turns waste into energy, making it a resource.
        - At the community level, Hong Kong is building up a network of Community Green Stations, one for each district. Old containers are reused and transformed as structures for the stations, an example of upcycling, and the green stations foster an understanding at a community level of the circular economy.

    - Food for Thought: the Government is encouraging consumers to be more "food wise". Currently 30-40% of municipal solid waste going into landfill is food-related.
        - Influencing consumer behaviour
        - Working with business - established a Food Wise Eateries initiative. Even when ENB organises dining, priority is given to Food Wise Eateries.
        - Building a network of organic resources recovery centres, which will transform food waste to energy.

3. Other key initiatives on a waste stream level are:

    - The Producer Responsibility Scheme (PRS) on plastic bags has been quite successful. It has managed to reduce 80-90% of plastic shopping bag generation at source during its first phase implementation.

- The upcoming PRS programs for glass bottles and waste electrical and electronic equipment (WEEE) hopes to build on this success. An E-Waste Hotline is available: 26768888, and free e-waste collection (in particular air-conditioners, refrigerators, washing machines, televisions, computers, printers, scanners and monitors) is provided.

- A further PRS in planning is a program for plastic containers (mainly those carrying beverages or personal care products).

4. Hong Kong will also implement waste charging, which will promote reduction, reuse and recycling of waste. The waste bags to be used in the waste charging scheme are degradable and made of 50% recycled content, and preferably made in Hong Kong as an example of circular economy.

5. Progress made towards achieving circular economy will also help Hong Kong get closer to its climate targets, a 65-70% intensity reduction (or 26-36% absolute reduction) by 2030.

Alexander Verbeek, Former Strategic Policy Adviser on Global Issues, The Ministry of Foreign Affairs of the Netherlands

European approach in circular economy to drive green growth: a focus on Dutch initiatives

Explained the process of transformation and change as to managing resources that is taking place in Europe, explaining key aspects such as shifting to sell products as part of a service, retrieving materials for re-use in different innovative ways, and redesigning materials to enable reuse. He also explained what EU countries aim to achieve from this new approach, including competitiveness and jobs.

1. We are witnessing change and innovation across the world:

    - Schiphol Airport in Amsterdam strives to be the most sustainable airport in the world. A notable aspect is use of new business models with lighting as a service rather than a set of products: the airport buys a light service from Philips, rather than buying lights itself as a product. Philips provides energy efficient, long lasting lights for the airport. The lighting system is modular, so parts can be replaced easily.

    - Businesses are making ambitious commitments: Unilever aims to have all the plastic they use to be reusable and biodegradable by 2025.

    - Boyan Slat, a Dutch young man invented a way to clean up plastics in the ocean. He is the founder of The Ocean Cleanup, as plastics in the ocean cause huge ecological problems.

- Plastics retrieved from the ocean are used to build roads. Not only is this utilizing recycled material, but there are other benefits as well. The material is much lighter, and it allows roads to be built in days rather than months. Hollow roads allow more room to integrate pipes and electrical wirings beneath the road. It is also efficient in absorbing water runoff. Plastic roads can be 3 times more durable than conventional roads, which means there is less need to repair roads, hence less congestion. They are also 100% recyclable: at the end of life stage, the plastic material can be melted down and reused.

2. The concept of circular economy is drawn from nature, as shown in the life cycle of a tree (from seed to tree, etc.) The current approach is to produce, use, and waste. Resources are being depleted; this system is “out of balance”. Resource extraction has been increasing significantly. By-products of this extraction and consumption include GHG emissions, resulting in climate change and rising sea levels.

3. As there are less resources to go round, countries are becoming more dependent on other countries. And this may increase tensions between countries due to the competition for resources. The estimates of sea level rise are being updated, with the expected the levels getting higher each year.

4. The current system is not logical. We are all already using 1.6 planet’s worth of resources. By the mid-2030s, we would need 2 planets. The USA is even consuming resources at a rate that is using 5 planet’s worth. We are putting too much on our “ecological credit cards”.

5. As the world population is growing, this is even more unsustainable. Furthermore, the worldwide middle class is growing a lot, which means overall consumption is increasing as well. We see lots of hockey stick graphs, with exponential change. For example resource extraction has gone up from 5bn tonnes in 1900 a year to 90bn tonnes in 2005. These graphs are a sign of something being very wrong.

6. Humans are the only species producing waste that does not become a resource for new life and growth. All other species are part of a circular economy.

7. Circular economy isn’t just about looking at waste, or buying end-of-life of products. But it’s about transforming our economic system. It’s about job creation, resource conservation, and reducing environmental impact.

8. Within the EU circular economy package, achieving a circular economy will help promote sustainability, create new jobs, preserve resources, reduce environmental impacts, and transform Europe’s economy. It is estimated that a shift towards a circular economy in Europe will create close to 200,000 jobs, reduce net resource spending in the EU by 600 billion euros, bringing total benefits of 1.8 trillion euros per year.

9. The European Commission welcomes the 2030 United Nations Agenda for Sustainable Development, which includes shifting from a linear to circular economy.

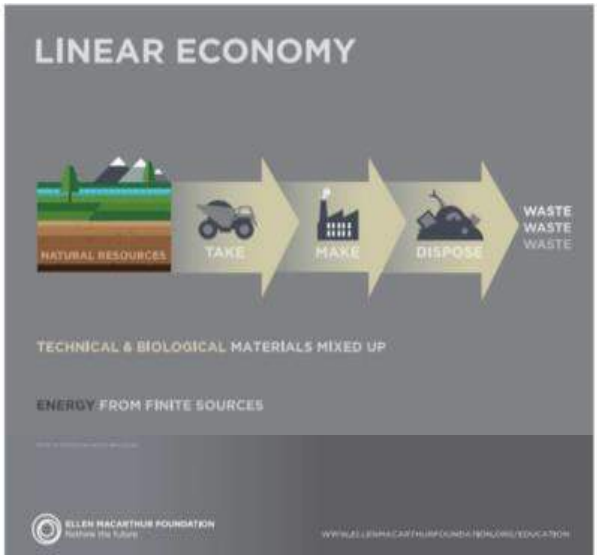
10. As for Netherlands' circular economy program,

    - Netherlands committed to a 50% reduction in using primary raw materials by 2030, and aiming to achieve circular economy by 2050. This will future-proof, and achieve a sustainable economy

    - Raw materials will be used and reused efficiently with minimal emissions, and be obtained in a sustainable manner without damage to the environment or social/physical living environments. Products and materials will be designed to be reused with minimal loss of value and harmful emissions.

    - The expected outcomes are:
        - Creation of over 50 thousand jobs
        - 10% decrease in CO2 emissions
        - 7 billion euros in benefits for the Dutch economy

11. Netherlands and HK can learn from each other. Netherlands has "green deals" programs, which encourage all parties to work together towards sustainability. An example of a green deal is to aim to achieve clean/zero emission bus transport by 2025. It starts with the government setting a goal, and then all stakeholders (including those who don't traditionally work together) being encouraged to work towards this common goal.



Plenary I: Rethinking waste and discovering the value of waste in the circular economy

Ir Dr Bruce Chong, Ove Arup & Partners, Hong Kong
The Circular Economy from Planning to Implementation

Explained the importance of a planned holistic approach that involves going back to the design of materials for the circular economy to work effectively, as well as key components of a circular economy from a "sharing economy", design & materials, and management of food waste. Set out the "enablers" of a circular economy.

1. Planning is key to implementation. Many products aren't designed to be recycled. This is a characteristics of linear economy: take →make→use→dispose. This is a cradle to grave model. So for example, a coffee cup has plastic coating which makes it expensive and complicated to recycle. The cost of recycling some products are often times greater than the cost of production from virgin material.

2. Products are generally of a technical nature or a biological nature. Hard to separate them if mixed. Many technical and biological materials/nutrients are mixed together, making items difficult to recycle.

3. The characteristics of a circular economy are regenerate, share, optimise: cradle to cradle model. It requires a change of thinking. From "waste strategy" → "resource strategy" → "economic strategy". The key principles are:
    - Preserve and enhance natural capital
    - Optimise resource yields
    - Foster system effectiveness

4. A holistic consideration of the economy and the various processes is necessary to achieve this. Various EU countries have published strategies. Finland published a white paper on primary, secondary, tertiary industry. It includes co-operation across sectoral boundaries, consideration of product lifecycles, and implementation of pilot projects. The Netherlands has also published a paper with a hard target re reducing primary raw material use.

5. The benefits sought include: GDP growth, Household income, CO2 emission and primary material consumption reduction.

6. A shared economy is an important component to achieving a circular economy.
    - Cars are parked 80% of time, so there is an opportunity to develop a carpool economy. Bike sharing as well. All about seeing mobility as a service.
    - Buildings and office spaces can be shared as well. Offices are unused 50-65% of time. Space can be provided as a service where users have access to space when needed – "space on demand" and mixed use. This intensifies the use of the building.
    - Digital infrastructure supports a shared economy, and helps make processes smarter.

7. Design and materials also important: modular design in cars helps make upgrading easy. Biodegradable natural materials also offer opportunity.

8. Food Waste Management can be 95% circular:
    - Food waste collection at source. This can be aided by an optic bag system (different bag colours to differentiate between waste types), or a sewage network to transport the waste.
    - Biological treatment with co-digestion
    - Material recovery (MRF) and biological treatment
    - Thermal treatment to recover

All of these processes combined can achieve up to 90% waste diversion from landfill. If the ash from incineration is also treated, then we can achieve almost 95% waste diversion.

9. Circular economy is a new way to plan and manage the economy that is more sustainable and delivers economic value. It focuses on "material flows": materials, products and components are designed to be reused (take, make, use, remake) and recycled purposely for as long as possible and at the highest level of value.

10. New business models in a circular economy
    - products supplied as a service (access not ownership – digital);
    - renewable inputs are preferred (reuse);
    - material recovery is enabled through design;
    - products are designed and maintained to last longer;
    - products are shared (cars, rooms, appliances).

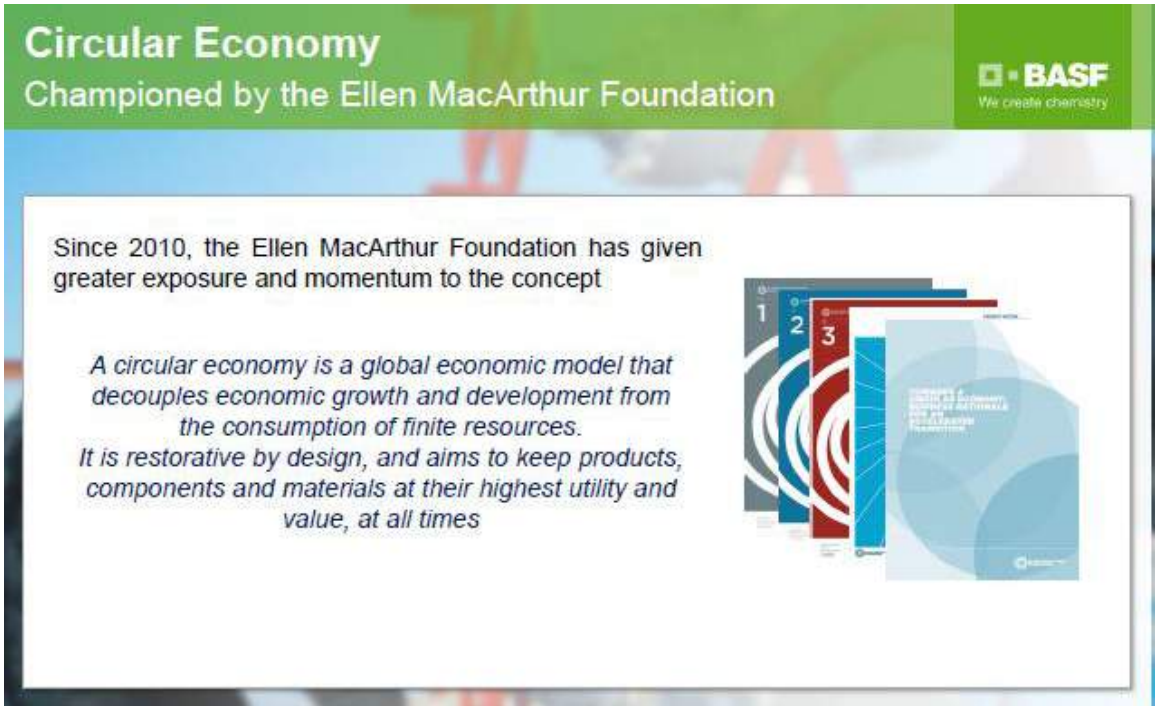
11. Enablers for transition to circular economy:
    - New business models
    - Innovation
    - Collaboration
    - Digital tools

Rachel Fleishman, Head, Advocacy and Sustainability Communications, Corporate Affairs, Asia Pacific, BASF East Asia Regional Headquarters Limited

Recalibrating the economy: design, materials and business models for a circular economy

Explained the background to circular economy thinking including the contribution of the Ellen MacArthur Foundation. Highlighted the new set of parameters in which companies had to innovate within this new system. Explained the new business models emerging that reflect this change, and BASF progress to "create more value" from products.

1. Background: Ellen MacArthur sailed solo around the world. During her journey she realised the similarity between the global society and living on a boat. Both need to survive on their own with only the available resources available.



2. The circular economy is restorative by design, just like nature. It is not just about taking waste and doing something with it, but is about creating loops (returning material into practical use instead of discarding it as waste) all along the value chain. The elements of a circular economy are:
    - Keep resources in use as long as possible
    - Minimise disposed residual waste
    - Extract maximum value from products
    - Recover and regenerate product at end of service life

3. New business models within the framework of circular economy

4. Examples of circular economy approaches within BASF operations:
    - Optimise: creating thinner diapers that take up less space and are more absorbent.
    - Regenerate: ecovio® is biodegradable and prevents soil degradation.
    - Exchange: Eopotal® coating for food packaging delivers better functionality (barrier to grease and moisture) and that can recycled.
    - Share: CathoGuard 800® protects cars from erosion and obviates the need for a primer coat.
    - Virtualise: the Materials Marketplace in the US is an online platform for companies to offer or search for excess products from other companies that can serve as inputs for their own operations.
    - Loop: re-deploy materials after use: using recycled materials in Green Sense® concrete.

5. To make the circular economy happen, we need to:
    - Stop: undervaluing ecosystems, presuming unlimited resources, and be driven by the growth imperative. Not valuing, or putting a price on environmental materials, leads to pollution and overuse. The result is an unlimited demand for limited resources.
    - Start: design to allow for longer, shared, regenerative use; work as partners along the value chain, consumers need to demand transparency and quality; government needs to set stretch goals and then support and allow businesses work to achieve them.

6. Circular economy is much more than waste management. It's a recalibration of the entire global economy, one sector at a time. It brings opportunities, reduces risk, and involves collaboration with partners in value chain.

Professor Jonathan Wong, Department of Biology, Hong Kong Baptist University
Food waste Recycling – a realisation of the circular economy in Hong Kong

Spoke on how food waste can be made use of as a resource in Hong Kong, with a focus on biofertilisers, biopolymers and energy. Set out the key policy changes he considers need to be introduced for a circular economy to work.

1. The problem: 1/3 of the food we buy, we throw away. Food disposal contributes about 8-9% of global GHG emissions. There is significant deforestation and water consumption attributed to wastage of food.

2. HK driven by necessity to address this challenge as we are close to reaching landfill capacity – estimated to be reached in 2018/19 - and scarce land resources available.

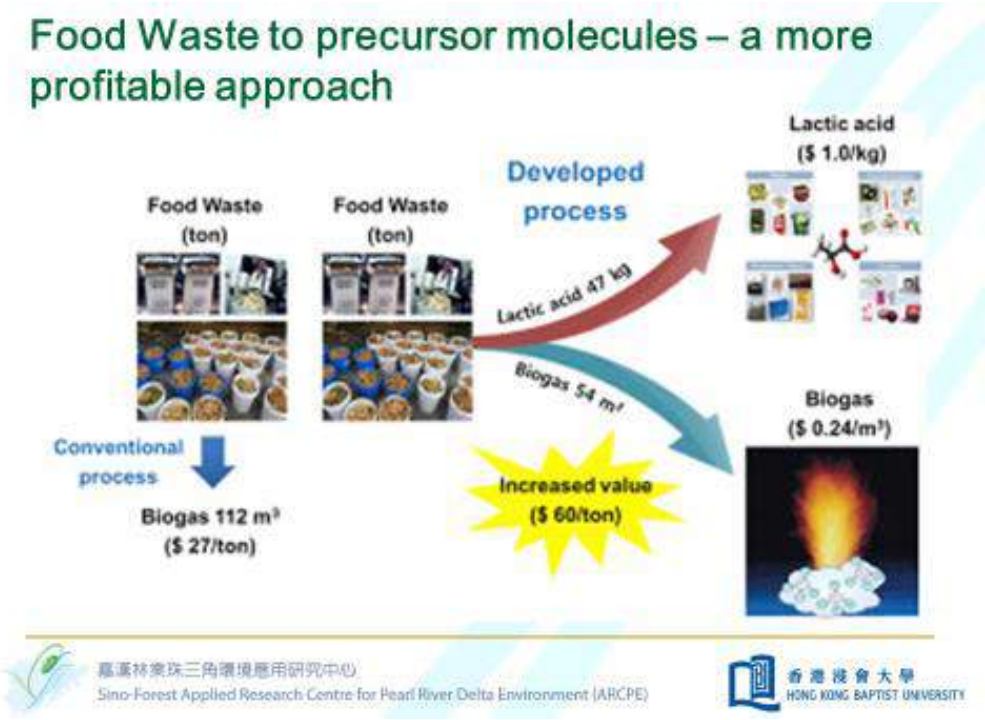
3. We need to rethink our concept of waste "management/treatment", and start viewing waste as resources not as something that needs to be disposed of but as a resource which needs to optimised.

4. Food waste has many opportunities for utilization:

- <u>Biofertilisers</u>**:** fertiliser consumption and demand is rising. By 2020, the biofertiliser market is expected to reach $1.88 billion. Phosphate is estimated to run out after 50-100 years, and in China, the discussion is turning to circular agriculture because fertiliser resources are getting depleted. Nutrients from waste which can even be used for anti-pathogenic compost is the way forward.

- <u>Biofuel and energy:</u> The bioenergy sector is expected to grow 10 fold by 2050. HK is building Organic Waste Treatment Facilities to convert waste to energy. Phase 1 Siu Ho Wan (200tonnes per day) expected to generate electricity for 3000 homes. A 2-stage system is however more efficient in capturing methane, but Hong Kong only building a 1-stage facility now. A 2-stage approach could lead to the generation of 0.2-0.5 kWh/kg of food waste.

- <u>Biopolymers:</u> Food waste can be converted to precursor molecules, which is a fairly profitable market. This can be done by controlling the fermentation process to produce lactic acid as well as biogas. There are many applications for these materials: fibres, diapers, bio-lipids, etc.



- Animal feed: Potential to turn 100t of organic waste into 40t of fertiliser. Need not be complicated. In Hangzhou, 82.5% of food waste fed to pigs without processing.

5. Government policy measures are needed to make the recycling and regeneration of waste preferred/competitive with production of products from virgin products. At the moment, the policy measures in the form of market mechanisms that could work are not in place. So those investing in circular economy facilities are losing money.

6. The following key policy changes are required:

    - Waste charging scheme to increase economic incentive to use it as a resource
    - Mandatory waste separation
    - A food waste collection system
    - Changing models from Design-Build-Operate (DBO) to Build-Operate-Transfer (BOT) from treatment to utilization, to increase efficiency and profitability
    - Government's financial model/assistance on waste management projects
    - Research and development: though the challenge is in commercialization

Panel Discussion 1

Moderator: Professor Daniel M. Cheng, MH, JP, BEC Board Director and Managing Director of Dunwell Enviro-Tech (Holdings) Limited

Prof Cheng kicked off the discussion saying that for any operation to be sustainable, it needs to make business sense. A series of questions were asked by the audience: on importing waste, plastics, level of MSW charging.

Q: HK is an import economy. Lots of material that goes into our landfill comes from the ports, imported from outside the territory. What is the challenge and opportunity for HK to close this loop? What are the challenges and opportunities of being an import economy?

- Dutch economy is similar to HK, lots of import and trade. In terms of managing resources well, a good start is a charge on waste and improving waste treatment methods which increased efficiency in using resources - only 1% of waste in the Netherlands goes to landfill. When you become efficient in using waste and looking at waste as a resource, you start to import waste because there's money in it. Sweden is also importing waste, and treating it as a resource.

- A different view - export of waste shouldn't be encouraged because it will decrease what people do domestically. Moreover, MSW charging is not enough. It's just one tool. Need tools to ensure waste separation at source and incineration, and seek to recover all the materials from our imports. Eventually, nothing should go to landfill and waste should be fully utilised.

- Waste separation will allow us to make more high quality products. Thermal treatment must be built on other forms of treatment.

Moderator's conclusion: Waste charging is a catalyst to make people rethink before they dispose of their waste. This creates an incentive which will eventually change the practice and culture around waste. Technology will be developed. Charging for waste is a good start, and hopefully even larger scale change will follow.

Q: Plastic to BASF is a material. To oil companies, it can be a resource. HK dumps a lot of plastic every day. What can the Government do to avoid this waste, to encourage using of these resource?

- This isn't a question of science, it is a question of business models and policy. Containers can be broken down, and made into different products. But there is a need for the infrastructure to collect, clean, and reuse these materials, which we don't have as yet. The government also needs to introduce policies to give businesses and consumers an incentive to separate and collect plastic and set a clear goal of no more plastic in landfills.

- The circular economy is complicated because you need to get so many stakeholders on board. Government, consumers, NGOs, producers, etc. At times, businesses don't move forward because to make the jump they have to go through a phase which is not profitable. If the government legislates or provides some sort of subsidy to encourage them to make that first step, everyone will be on a level playing field and encouraged to make the move towards a circular economy. A further idea is to offer a prize for the best solution to get people coming up with ideas to move forward.

- The current business model is not working in Hong Kong. The economics just don't work. Government is subsidizing dumping into the landfill (through operating waste collection and transfer, etc.). But the Government is not subsidizing the business of recyclers. People are cleaning up waste for the government, but don't receive money for it. Recyclers have to invest by themselves, but often times there is little profit. We need some money going to the recyclers. Money from waste charging should be used to support the recycling sector, strengthening the incentives.

Moderator's summary: It's not a technical issue. It's a matter of commitment on the part of Government to introduce the necessary incentive structure.

Q: Is $365-395 per tonne of waste in the MSW charging scheme a sensible number? What is the logic there?

- The number is not representative of the waste situation. It's not a scientific figure. It's just a political figure.

- It's a first step. People need to get used to the idea that you have to pay for your waste. As people get used to this idea, the government can slowly raise prices. However, even though the price is low, it is not a bad policy. The government should give lessons as to what can be done with waste. There are other ways to promote this and to get buy-in. An idea is to get an artist in Hong Kong to fill a public square with waste as a demonstration to citizens. The government needs to find a way to create a convincing story about why it is better for all of us to move to a circular economy.

- A food waste collection service/facility will be helpful in this context. Also, the MSW charging will need to be paired with strong enforcement of illegal dumping.

Moderator summary: Hong Kong is far behind its peers. We need a multi-pronged approach, and have to start somewhere. Everyone now has a reusable bag to bring to the supermarket motivated by a 50c levy, so don't underestimate a small amount of money having the ability to kick-start something larger. Money talks, including awards and competitions. Federation of HK Industries has a 1-1-1 program. One year, one factory, to do one environmental project. The Bank of China provides monetary prize to the winner.

Q: How can we encourage and make it easier for people to recycle and separate their waste? Do you believe there needs to be a change in building code/waste management space throughout the building?

- Since 2008, buildings in HK have a material recovery room with 3 colour bins for recycling and separating waste on every floor. There is also a material recovery chamber on the ground floor. Maybe the functions of these places can be enhanced, and more functions can be performed there. Such as volume reduction, or some phases of more advanced waste treatment. A lot of the material produced during the construction and demolition stages can be used as resources as well.

- We need to think of ideas of how to optimise at the design and production stage. I'd like to see government policies demanding it, where they set the bar and then take a step back, and then have industry work on it. BASF does designing, but there is not a high demand for sustainable designs at this moment.

- We need to be more innovative. There is a view that the government is not being sufficiently forward looking. There are many restrictions from regulations on innovative material use (glass in bricks). Rules need to be forward looking, so not to deter innovative ideas from businesses.

Moderator summary: Design is crucial to minimizing waste. Architects are doing a lot of work on this when they are designing buildings.

Plenary II: A sectoral analysis: from textiles to electronic and building materials - from waste prevention to extending lifespan of the resources used

Edwin Keh, CEO, The Hong Kong Research Institute of Textiles and Apparel
Reduce Reuse Recycle

Explained the shift in the apparel industry taking on board the impacts of fast fashion, including action by a new generation of companies. Also the projects being undertaken by HKRITA that will support this shift – from green materials to recycling technologies.

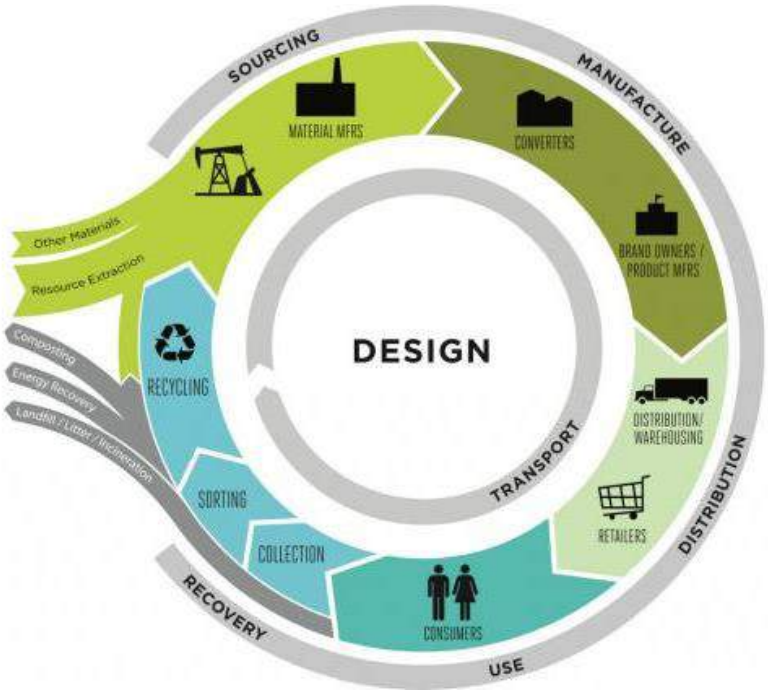
1. Traditional cycles are no longer relevant. Fast fashion not sustainable. There is seasonal apparel, but in some cases, there are as many as 12 fashion seasons.

2. It takes a lot of energy and water to produce apparel, and the dyeing process uses toxic chemicals adding to water pollution. Factory disasters have also injured or killed workers as many as 1,129 in Dhaka, 2013.

3. Traditional retail is not doing well financially. Clothing prices have actually gone down not up.

4. A new fashion business model is in transition. Intentionality from the industry is important – need to design good product which takes on board water and energy consumption.

5. From a linear to circular model: Closing the loop in this industry requires a production process where no longer wanted textiles are collected, recycled and used to make new products. Moving on from ownership, we need to foster stewardship of products, just like how people take care of their watches.



6. Many successful companies have a social mission, in addition to other conventional business missions, such as aesthetics and good design, etc. Examples include Patagonia, Toms, Warby Parker, etc. Recognition that Millennials want something different. Interested in repairing products, amongst other things.

7. HKRITA supported by the Government – the Innovation and Technology Fund - and established in 2006, working with universities and researchers on R & D. The following are the main topics within HKRITA's sustainability projects:
    - Waterless Technologies
    - Energy Efficiency
    - Green materials
    - Recycling technologies
    - Zero Discharge

8. Vision of Industry:

    Efficient, effective, disruptive → Sustainable: Less bad, more good
    → Better Society: competitive and healthy

9. A sample of HKRITA projects:
    - Created an innovative spinning system for chitosan yarn; found a way to make it so cheaply that is able to be used for apparel. Hypoallergenic, self-disinfecting fabric to save water. It will be used in children's clothing.
    - Waterless dyeing to reduce water pollution. It essentially involves using less water.
    - Created a fibre from food waste collected from companies such as Starbucks and Café de Coral. A fashion show was held at PMQ

10. Work with industry – a large piece of work funded by H&M: researching into innovative ways to recycle textiles. The technical aspect of recycling isn't complicated. It's the business model that is challenging. A demonstration plant in HK for post-consumer apparel recycling is planned.

11. Conclusion: "Innovate or die trying" – If you don't innovate around sustainability, we will die.

Nigel Mattravers, Director & General Manager. ALBA Integrated Waste Solutions (Hong Kong) Limited

Hong Kong's first integrated e-waste transformation facility – how will it contribute to the circular economy

Explained the problems arising from e-waste and the HKSAR Government's approach to addressing the problem. The WEEE facility is part of the solution, not the whole solution and more is needed to ensure circularity. Explains the challenges and solutions in relation to closing the loop.

1. Large amount of E-waste in HK (70,000 tonnes per year) – the highest per capita in Asia at 21.7kg per person. 85% of this material can be recovered for reuse. Most (80%) WEEE is exported from HK to developing countries where the waste is handled in a poor fashion and materials aren't being utilised, and 20% goes to landfill.

2. Waste Electrical and Electronic Equipment law (Promotion of Recycling and Proper Disposal (Electrical and Electronic Equipment) plus the Amendment Ordinance of Producer Responsibility Scheme 2016 was introduced to address this problem. It applies to "regulated electronic equipment".

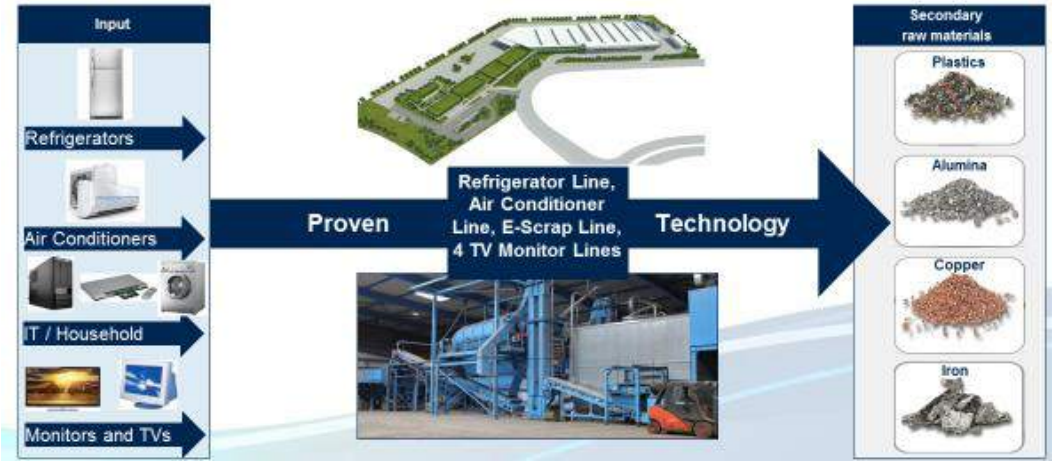
3. The WEEE facility in Eco Park to operate from summer 2017. It is an integrated project—responsible for design and build of a plant, but also need to put in a collection network, refurbishment arm, and education component.

4. Collection System: this is the most important component. Working with NGOs, retailers, and households to collect material, which is then sorted into categories before going to the treatment facility.

5. Refurbishment & Donation: technicians repair/refurbish items in good condition, the items are ultimately donated to people in need (more than 700 items/month).

6. Education: workshops are held to teach people how to repair their own electrical items, so to reduce waste generation, as well as the benefit of proper e-waste recycling.

7. The WEEE transformer uses proven technology to produce usable secondary materials. All processes are enclosed, have strict monitoring systems, and strict extraction systems to protect the local environment and workers. Some hazardous substances will be extracted and sent to the chemical waste facility.



8. In summary, this project helps to close the loop in the electronics chain:
    - Education, so items aren't wasted in the first place
    - Refurbishment, items are being brought back into the community
    - Dismantled and recycling to create a new product for material manufacture

- Saving 33,000 tons of carbon/year through this; and refurbishment lowers the total resources extracted.

9. Challenges to e-waste circularity:
    - Low level treatment of E-waste causes pollution and produces poor quality materials – but it is cheap!
    - Informal recyclers focus on valuable materials only - other resources lost
    - Lack of control over transshipment – not just Hong Kong
    - Strict legislation and enforcement are vital to make the Circular Economy work. There is no clear definition to what really is e-waste.
    - Recognition that there is a cost to delivering a Circular Economy – Hong Kong Government has done this with their investment in the WEEE project

10. Role of the Government
    - Develop and enforce strict environmental regulation
    - Recognise that quality material is not waste but a resource
    - Look at opportunities for re-processing in Hong Kong
    - Look at opportunities for the development of resource parks – industrial symbiosis – to support smaller business
    - Work with governments across the Greater Bay Area to remove barriers to material movement and develop the Circular Economy for the Region

11. Governments should recognise that there is a cost – but an opportunity to develop business

Mr SK Wu, Risk Manager, Alliance Construction Materials Limited

Sustainable construction materials and the circular economy

1. Concrete production doesn't require scarce materials because limestone and aggregate are abundantly available. It is also durable. However, concrete is 100% recyclable, even the steel bars embedded inside as well.

2. Construction waste was 28% of overall waste in 2015 to landfill. Concrete was only 1% of construction waste.

3. The quarry and concrete industry can achieve little emission and waste through sustainable production.
    - Fully utilise all extracted materials
    - Reuse surplus rocks, turn them into materials
    - Quarry restoration – these areas can provides safe and usable land
    - Concrete can be made into materials for reuse

4. Sustainable concrete solutions, strategies to reduce waste:
    - Highly durable concrete – longer lifespan, minimizing consumed materials
    - Ultra-high strength concrete can reduce volume and material needed
    - Waterproof concrete improves durability

- Reclaim waste water from truck washout
- Long pumpable concrete – can be pumped long distances

5. There are barriers to reuse such as specifications in government projects that require use of virgin materials.

6. Collaboration is key (industry, government, standard setters, developers & contractors, communities, academic)

Panel Discussion 2

Moderator: Wilson Kwong, BEC Board Director and Chief Executive of the Jardine Engineering Corporation Limited

Questions from the audience:

Q: These are 3 good examples of circular economy approaches in 3 sectors. But what is the business case for these projects, or are they wholly funded by the Government?

- The operational funding for textiles comes from the government, while research funding comes from both the government and the industry. This enables HK RITA to work with the government and business to commercialise innovative approaches. Often Government works from the intellectual challenge but in textiles work the opposite way. Start with what is needed by industry, and then work backwards to academia to find solutions. Hence, the distance from research to market is very short, and able to get things done quickly and help industry compete globally.

- The construction materials sector does not need government financial support, though works with the Government because quarries are owned by them.

- E-Waste is a government project. They realised the problem is so big that they needed to do something about it. Hopefully this approach can be expanded to other waste materials as well such as plastic and wood. Right now, tyres are still go whole into landfills when this is was banned in Europe 20 years ago.

Q: How far is demolition waste used in aggregate concrete?

- Recycled aggregate can be made from demolition waste, but this is possible for low-grade buildings only. There is difficulty in using demolition aggregate, because a separate production line needs to be set up, in addition to the raw aggregate production line. Also, there really isn't a market/demand for demolition aggregate because developers demand virgin aggregate concrete.

- We need a change in construction specifications to encourage the use of secondary aggregates. Secondary aggregates are used in construction in Europe. The HK Government is the biggest user of concrete here. They should lead in creating demand for this.

Q: Concrete construction produce ~5% of GHG. But recycled concrete has less carbon footprint. Can this be used as a selling point to get the Government to use recycled concrete?

- Cement manufacturing is carbon intensive, hence concrete has lots of embodied carbon. But we shouldn't look at concrete just from a carbon footprint perspective. We need to consider the lifetime of material and their lifecycle impacts.

Q: Zara invented fast fashion, demonstrated how their clothes produced. How to make the apparel recycling model attractive to Zara? How do you make the recycling business model desirable to companies that aren't environmentally or socially minded?

- Fast fashion doesn't work because it's built on an infinite growth model. But we have finite resources and a finite market of growth opportunities. We need to encourage a 0 sum gain model – otherwise resource consumption goes up. Patagonia is a good example as it has been growing but at the expense of other less sustainable brands. It communicates its sustainability performance and has a desirable social message for consumers.

- Building a business case is the key challenge. But once we know there is market demand, then we can consult the science. For profit companies won't be sustainable out of the goodness of their hearts. This raises the question of how we create business cases for companies to do the right thing.

Q: You have the government's support to build e-waste facilities, but the challenge is collection, transportation, and all this "stuff" to dismantle. What do you think both the government and other businesses can do to ensure that you have sufficient input/materials to process?

- For consumers, there is a free takeaway service. In terms of retailers, they should have a removal service plan, where they remove the old machine when a new one is purchased. The majority of material comes from consumers and will effectively come through that system. Equally, businesses are consumers and are pleased with that support. They recognise they must have a CSR component, and what we're doing helps them do so.

Plenary III: The final step – waste to energy in the circular economy and implications for Hong Kong

Mr Victor Kwong, BEC Board Director and Head of Corporate Health, Safety & Environment and Chairman of Environmental Working Committee of Towngas

Waste-to-energy from a carbon perspective

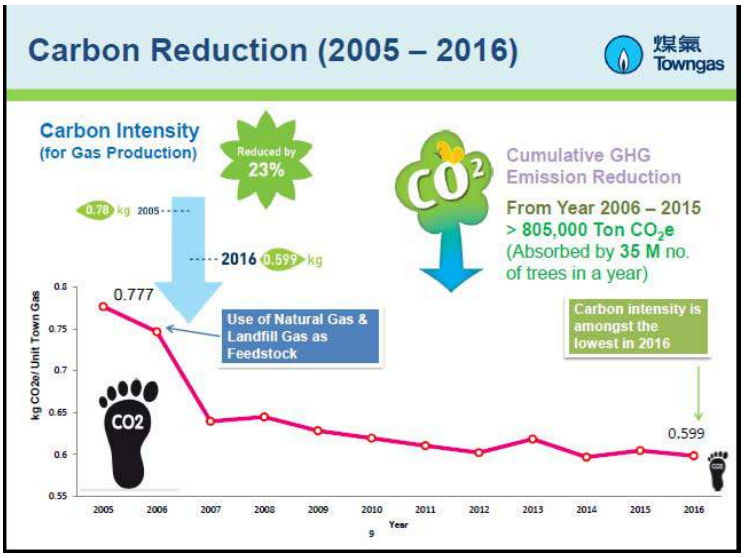
1. Towngas have been using landfill gas for some time. This began in 1999, when started to capture Shuen Wan Landfill gas. It was the first commercial project to utilise landfill gas in HK. In 2007, the North East New Territories landfill gas capture and utilisation project began, reducing carbon emissions by 135,000 tonnes per annum (Hong Kong's total greenhouse gas emissions are approximately 45,000,000 tonnes CO_2-e per annum[6]), and reducing naphtha consumption by 43,000 tonnes annually (2-3% of our total output)

2. From 2017, Towngas will start to capture SENT gas as well. Raw landfill gas is treated into synthetic natural gas (SNG), which will be used in TKO industrial estate. This is a sizeable project.

3. NENT gas directly used in Tai Po Nethersole Hospital for Combined Heat & Power, producing electricity, steam, and hot water. Overall energy efficiency can reach to 87%.

4. Towngas is also conducting a number of projects in China, aiming to utilise biomass/organic waste from food waste processing and agricultural/forestry waste too – for energy production as well.

5. This use of biogas is connected with Towngas' carbon reduction strategy. This is to shift away from Naphtha to natural gas and landfill gas. It is intended that landfill gas, currently at 1.5% of the fuel mix will become 5%. This will lead to a low carbon intensity of gas. By 2016, this had fallen by 23% and at 0.599, was amongst the lowest in HK.



[6] https://www.climateready.gov.hk/files/pdf/HKGHG_CarbonIntensity_201612.pdf

Mr Mike Kilburn, Acting General Manager, Sustainability, Airport Authority, Hong Kong
Waste-to-energy: opportunities and challenges for Hong Kong International Airport

1. HKAA's target is to recycle/recover 50% total waste generated by the airport by 2021. A consultancy study found that the best achievable recycling rate would be 35% and an on-site waste to energy plant of less than 50t per day could help to achieve 68% recycling/recovery.

2. Drivers to implement recycling and waste to energy plant:
    - Avoid MSW and associated charges
    - Contribute to 2020 airport-wide carbon reduction target
    - Stewardship/reputation – demonstrates feasibility of small-scale incineration in HK.

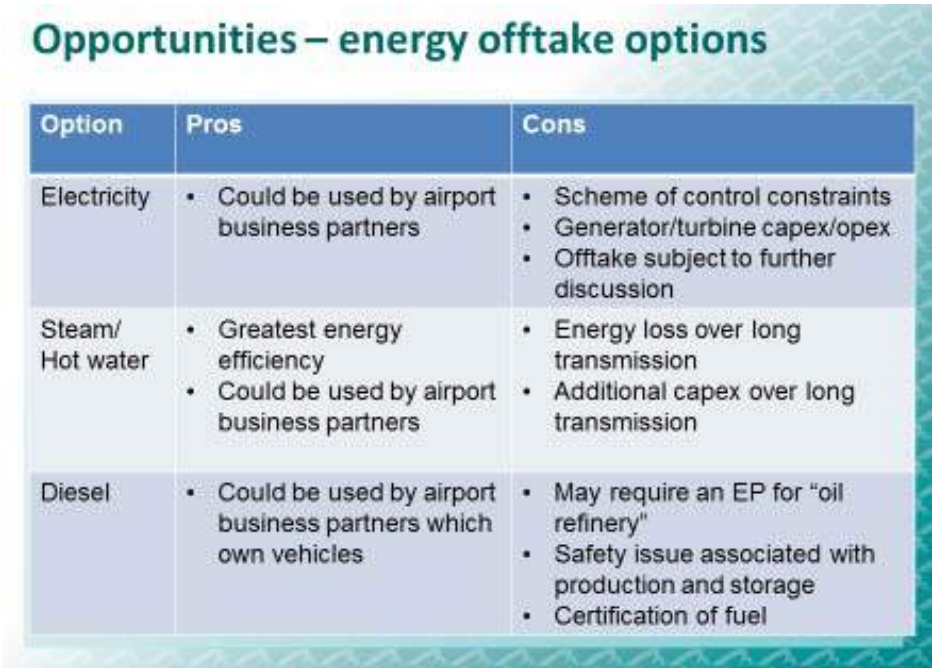
3. Considerations in deciding on nature of the waste to energy plant:
    - Avoid impact on the airport's 3RS Environmental Permit
    - Manage cost
    - Manage stakeholders concerns, such as odour and emissions considerations and, NIMBY mindsets. Airport's distance from community, especially Tung Chung town, makes operation easier because it may help to reduce resistance/opposition.
    - Stewardship/reputation. Mike sees HKIA as a gateway to HK, and should be an exemplar

4. Constraints:
    - Under SCA, electricity generated has to go into the grid. AA can't resell it.
    - Consideration of waste emissions near food production facilities
    - Limited land space

5. Assessment of alternatives:

    <u>Incineration:</u>
    - Moving grate system: accepts mixed waste, commonly-used technology. Electricity and hot water production but there is heat/energy loss depending on distance
    - Gasification/pyrolysis: requires sorting

    <u>Non-incineration</u>
    - Generate biofuel/diesel with waste – but will legally become an "oil refinery" and will need a lot of permits and raise other operational considerations e.g. safety.



6. AA will commence a feasibility study this month (May). There are 2 stages of the project. First is to identify the suitable technology type and the required business models/procurement option. The second is to conduct further engineering investigations.

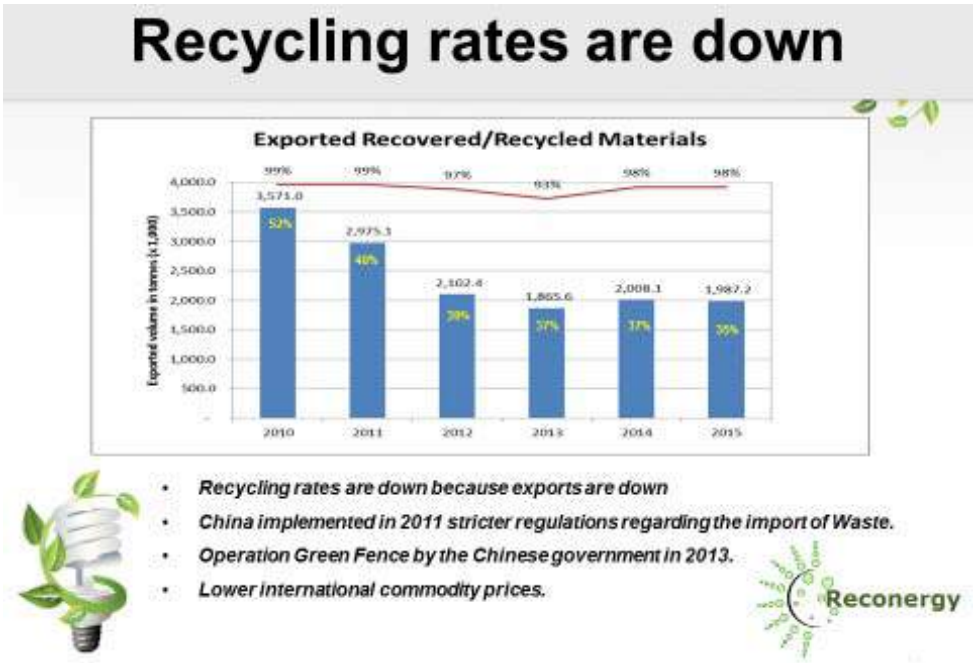
Tom Uiterwaal, Chairman of the Environment and Energy Business Council, European Chamber of Commerce in Hong Kong, Founder and CEO of Reconergy (Hong Kong) Limited

How small scale waste-to-energy technology can help reduce landfilling in Hong Kong

1. Managing waste is a business. Technically most MSW can be recycled. Economics not science is the determining factor.

2. 2,032,800 tonnes of materials are recovered/recycled (2015) out of over 5 million tonnes. 98% of recovered/recycled materials are exported, 2% are recycled locally. The total value of exported materials is HKD $4.6 billion. Waste is serious business.

3. In recent years, HK's recycling rates are going down because exports are going down. HK's recycling rates are very much tied to the export rate of recyclables. Recycling rates are down partly because China has been implementing stricter regulations to the import of wastes and lower international commodity prices. A key challenge for increasing recycling is that recycled materials have to compete with virgin materials.



4. On average 3.5 tonnes of waste is collected per day through source separated MSW collections, of which only 2t goes to recycling. To be contrasted with the 10,000tonnes per day which goes to landfill. The cost of collection is HKD 15,000 per tonne, which needs to be contrasted with the proposed MSW charge of HKD 365-395 per tonne. Source separation of MSW is essential but a long term solution for the waste problem in Hong Kong.

5. The Government is putting in place mega-projects such as the Organic Waste Treatment Facility. Securing the feedstock (steady input of organic waste) is essential (pilot plant of 4 tonne a day was running at 22% capacity). Need to have an inclusive strategy to obtain this, which involves including all stakeholders in the waste process. A possible option moving forward to address this is to conduct waste sorting at landfills to create more recyclables available. Value is created when waste is separated… there is no value for mixed waste. The cost of the OWTF is HKD 1.589bn per day – 200t capacity. There is already a 100t private initiative running. Query whether the government step into a business area which already has a private initiative.

6. A possible option moving forward to address this is to conduct waste sorting at landfills to create more recyclables available. Value is created when waste is separated… there is no value for mixed waste.

7. Another approach is to utilise small scale waste incinerators within the city. The cost of these are HKD 50mn a day for 200t capacity. They take up the space of a 40ft container. Low risk and fast to implement.

8. Many people are willing to invest in waste infrastructure, but what's needed is:
    - A level playing field: as at present the large scale facility is Government funded
    - An inclusive strategy
    - Support for the local recycling industry

9. When businesses determine what happens, things can be much cheaper and more efficient. To achieve this, Government needs to get the tendering system right

10. The Circular Economy is where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste is minimised (EU). Initiatives to reduce waste at source such as MSW charging, PRS are vital to a sustainable waste environment.

Panel Discussion 3
Moderator: Ms Maya de Souza, Senior Manager – Policy Research, Business Environment Council Limited

Summed up discussions. Have heard about the reasons for transitioning to a circular economy as well as to how this is beginning to take shape in key sectors. Some discussion of waste to energy in session 1 too – on food waste.

Questions from audience and moderator

Q: Regarding the small scale incinerator. Where else has these small scale incinerator been used? In the HK context, how can these facilities fit into the dense urban fabric of HK?

- Small scale incinerators are used in 140+ countries. It's modular, so it can be repaired and replaced easily. More containers can be attached to create more capacity. It doesn't take a lot of space, and can be used in HK. It can be installed quickly, in a matter of months.

- HKAA's situation is an example of how to fit a similar facility into a small space. Lots of considerations – piping, turning radius for trucks, etc. But it probably can be done.

Q: Does HK need a holistic waste management policy, rather than small scale activities here and there?

- Yes, the first step is to focus on reducing waste through waste charging, producer responsibility schemes, etc. The second step is waste separation before being sent to the landfill, especially at home. Mechanical waste separation is happening all over the world and has shown to be effective. This is a business. By separating waste, you are creating value that can then be exported, and which the recycling industry can benefit from it. But there is waste that cannot be exported and that needs to be other solutions. This is where small scale incinerators fit in. This is a comprehensive waste strategy for Hong Kong, where there will be fast results. Waste management is a business and needs an inclusive strategy to be the most effective/efficient.

- Agree with needing a holistic waste management strategy that ensures the right set of policies are in place to enable business to make things happen. With the landfill gas project, it took many years of discussions with the Government for the project to commence. A holistic approach to the problem which results in policies in place that can streamline/make easier for local organizations to create a circular economy and take advantage of opportunities would be beneficial.

Q: As to the relative performance of large scale facilities, and the organic waste treatment pilot plant operating at 22% capacity, can you elaborate on this figure? And how safe are the emissions from small scale waste to energy plants?

- The 22% comes from the Audit Commission for Hong Kong, which looked at a pilot plant for Hong Kong and how it was running. It has a capacity of 4tpd, but the audit commission reported it's only running at 22%. The experience of the waste oil industry shows that the collection/transportation process of waste is a challenge.

- In terms of emissions, these plants meet European standards. The equivalent is being run in the United Kingdom, so we know that it meets standards. These machines are available with 24 hours monitoring of emissions. People are critical about these technologies, so transparency is very important.

- One firework display generates more dioxins than in the emissions of a city-sized incinerator operating for a year. Very often, a problem gets highly emotionalised when the reality is that emissions aren't significant, especially when you look at the gains and benefits. The Danes and Japanese among others have built incinerators right within cities. If European regulators are willing to permit them, then we should be able to do so in Hong Kong.

Q: What is the Government's reaction to the idea of the small scale incinerator system?

- The government has an open ear for what's going on and what is available in the market, and is welcoming to new technology. We need to have a lot more private initiative in Hong Kong in the waste area, and the government should support this with policy measures. There are many who are willing to invest in waste processing in Hong Kong, but at the moment, the business case is a difficult one.

- EPD has shown interest in the small scale distributed waste treatment. HKAA's interest to take forward a study to determine feasibility is supported by the Government, because once a scheme in place it would provide a useful precedent. However there is much to be learned including how to integrate such a system into a densely populated area, for example.

Q: Is there a role for large companies to set up small scale waste to energy plants?

- HKPC had a project on this recently, which was about small scale anaerobic digestion of food waste. In HK it is difficult to have small scale biogas facility, because of the problem identifying sites considering the cost of land and NIMBY attitude.

Q: HKAA's waste target of 50%. Are there any plans to work with airlines? Airlines is quite resource intensive as well.

- About 45% of HKAA's waste is from aircraft, of which 77% is paper (magazines and newspaper). It is essential to separate at source, and if this is done a good amount can be captured. The problem is that a lot of aircraft waste is considered contaminated. In light of MSW charging, HKAA is working with airlines and their cleaning contractors to see how the capture/recovery rate can be further increased. A simple solution is to hand out fewer magazines, newspaper, etc., and instead just put the subscriptions on seatback entertainment systems.

Q: A waste hierarchy is recognised in Europe - first avoid, then reuse, then recycle, and then energy). In HK, is the waste treatment hierarchy recognised and embedded in the Government's preferred system? And if not, should it be?

- Application of the waste hierarchy is important. We should focus on separation at source. Then, each type/source of waste has a best/most suitable approach. In some cases incineration will be appropriate. For animal waste, for example, incineration is perfect.

- The type of waste management method depends on what kind of waste it is. An example is that whenever Towngas install an appliance, it collects the old appliance as well supporting reuse and recycling.

- Yes. Waste to energy is to recover the thermal value of the waste, and it should be used as the last resort.

Q: In terms of improving the tendering or procurement process, how can this be improved? Should the technology should be left open so that the best technology can be identified?

- The best technology tomorrow, may not be the best today. The Government should let business decide the best technology to treat waste. The role of the Government is to get everyone playing their part and avoid the Government's actions in effect being in competition with the private sector, and without a level playing field.[large scale facilities in effect subsidised, with small scale ones having to pay full costs]

- Eco Park was a smart move, in providing land for the recycling industry. It provides a platform, but doesn't prescribe the type of recycling operations. That is a good model.

- Government support and commitment to waste to energy work is important, it will help to quicken the pace of projects that can be realised.

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