

Environmental Protection Department

Explanatory Booklet

for the

Proposed Integrated Waste Management Facilities

March 2011



Introduction

1. At present, about 13,300 tonnes of wastes are disposed of at landfills every day in Hong Kong, about 9,000 tonnes are unrecovered municipal solid waste (MSW); 900 tonnes are sludge generated from the Harbour Area Treatment Scheme or other sewage treatment processes; and 3,200 tonnes are construction waste.
2. The current recovery rate of MSW in the territory stands at 49% ¹. Except for those recovered for recycling, nearly all MSW are disposed of at three strategic landfills, namely the South East New Territories (SENT) Landfill, the North East New Territories (NENT) Landfill and the West New Territories (WENT) Landfill. For a densely-populated and small city like Hong Kong, the current practice of relying on landfills as the sole means of disposing wastes is not sustainable and needs to be changed. There is an **urgent need** to develop the integrated waste management facilities (IWMF) with incineration as the core technology and introduce **the most advanced, reliable and safe technology** for reducing significantly the volume of unavoidable wastes. The process will also generate electricity, thus turning wastes into resource.
3. On 4 January, 2011, the Government announced the overall waste management strategy and a specific action plan to tackle the imminent waste problem in Hong Kong in a comprehensive and timely manner. The action plan sets "**reduce, recycle and proper waste management**" as the objective, with three core strategies including:
 - (i) strengthening efforts in promoting waste reduction at source and recycling at source;
 - (ii) introducing modern facilities for waste treatment; and
 - (iii) extending the existing landfills in a timely manner.

¹ The recycling rates for Singapore, the UK, the USA, France, Tokyo and Germany are 43%, 35%, 33%, 33%, 23% and 63% respectively.

It should be emphasized that each of the three strategies plays an indispensable role in our waste management strategy.

4. In November 2008, we launched a detailed Engineering Investigation (EI) and Environmental Impact Assessment Studies (EIA Studies) for two potential sites (i.e. an artificial island near Shek Kwu Chau (SKC) and a site at Tsang Tsui Ash Lagoons (TTAL) in Tuen Mun) for the IWMF. The EI Study is near completion, while the EIA Study was completed in January 2011. The EIA Study was conducted in accordance with the requirements under the Environmental Impact Assessment Ordinance. The areas covered in the Study include air quality, noise, water quality, waste management, ecology (land and sea), fisheries, landscape and visual impact, cultural heritage and health risks. In February 2011, the Government announced the results of the EIA Study. The Government identified the artificial island near SKC as the preferred site for developing the first modern IWMF in Hong Kong after considering the factors analysed in paragraphs 20 and 21 below.

Part 1: Explanatory Notes on Technical Issues

The Most Commonly Used Application of Incineration Technology

5. After years of development, waste incineration technology has become very mature and widely adopted in cities all over the world. Currently about 2,000 incineration facilities with emission controls are in operation around the world, with the two largest in Singapore and the Netherlands, each having a capacity of about 4,000 tonnes per day. Apart from Singapore, Guangzhou and Macao which are close to Hong Kong and the major cities in Japan have long used incineration technology to address the serious problem of MSW. While incineration facilities are widely used, a set of international emission standards, with the European Union (EU) standards as the most stringent ones, have been developed to regulate emissions from the facilities to **ensure that they will not pose health risk to nearby residents during operation.**
6. The IWMF will be designed and operated to the most up-to-date international standards and practices. **We will adopt the moving grate incineration technology which has been recognised worldwide in respect of its safety and reliability and has been supported by ample proven track records.** The technology is in use in many advanced countries. The operators must be well trained to avoid accidental events and best practices of the industry will be implemented with reference to international standards and guidelines.

Air Quality Management

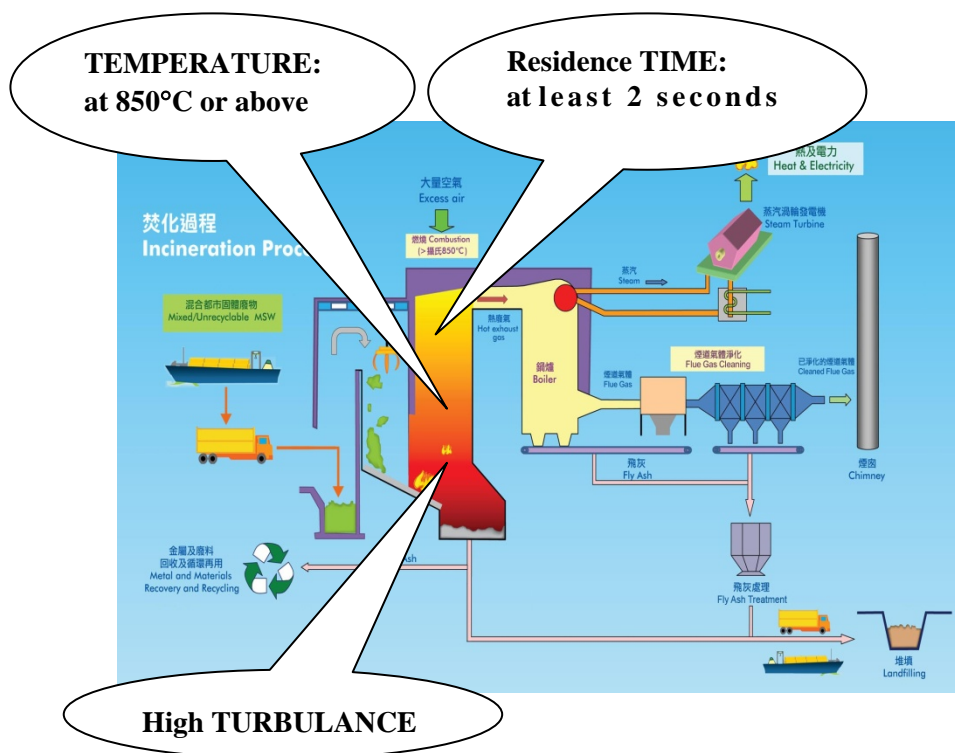
Modern 3T Technology

7. The proposed IWMF in Hong Kong will comprise an advanced incineration plant equipped with waste-to-energy facilities, a mechanical sorting and recycling plant, and ancillary facilities (including community facilities). The incineration plant is the core of the IWMF. **The Environmental Protection Department (EPD) has decided to adopt the modern 3T technology to ensure that emissions from the**

facilities will meet the EU Standards which is the most stringent international standards available. The 3T technology employed in the incineration process comprises the following three requirements:

- i. **Temperature** at 850°C. A strict process control of incineration at a temperature of at least 850 °C to completely decompose organic matters and dioxin.
- ii. High **Turbulence**. Incineration under highly turbulent conditions to achieve complete combustion.
- iii. Residence **Time** of at least 2 seconds. Maintaining flue gas at a temperature of 850 °C or above for a residence time of at least 2 seconds to achieve complete combustion and further reduce pollution.

8. The illustration below shows how the strict process control of 3T technology for incineration to be adopted in the future IWMF can ensure complete combustion of wastes, thus substantially reducing pollution.



Multiple air cleansing system

9. In addition to the 3T technology, an advanced air cleansing system, including selective catalytic reduction for nitrogen oxides (NO_x) removal, activated carbon for dioxins removal and continuous emission monitoring system, will be installed in the IWMF to ensure emission from the IWMF will comply with the EU standards, the most stringent international standards available.

Highly transparent operation and all-weather monitoring

10. On completion of the IWMF, we will also set up an open and highly transparent monitoring system. The public and Cheung Chau residents can have **24-hour access to real-time data from the continuous emission monitoring system** so as to be assured that the IWMF will operate effectively and within emission standards.

“Through the introduction of advanced technologies, the future IWMF will be in full compliance with the environmental requirements. It will not have any adverse impact nor will it affect residents’ health.”

Odour Management

Fully enclosed waste delivery

11. Design of the waste delivery process is critical to reduce odour effectively. Among the three existing strategic landfills in the territory, wastes collected from Hong Kong Island and Kowloon are transported by sea in enclosed containers to the WENT Lanfill in Nim Wan. We have about 20 years of experience in proper delivery of waste by sea. In future, all MSW from the refuse transfer stations (RTSs) on Hong Kong Island and in Kowloon will be delivered to the IWMF on the artificial island in **enclosed containers** on vessels **so as to ensure that no odour nuisance will arise during delivery.**

Enclosed design for individual components of the IWMF

12. For installations within the IWMF that may give rise to odour nuisance, such as sewage treatment plant, waste reception hall, waste storage area and mechanical treatment plant, the EPD will stipulate that the contractor must adopt a fully enclosed design. Furthermore, **a deodorizing system** will be installed in the IWMF and the facility will be **operated under negative pressure** to prevent odour emitting to the outdoor environment. According to the EIA Study, the cumulative odour concentrations will comply with the required standard in the Technical Memorandum to Environment Impact Assessment and will not cause odour nuisance to the nearby neighbourhood of the preferred site or Cheung Chau.

“With proper design and careful management, we will ensure that the future IWMF will not cause odour nuisance in the vicinity of the preferred site or Cheung Chau.”

Monitoring Ecological Environment and Water Quality

Conservation of the habitat of Finless Porpoises

13. The artificial island near SKC is not located within the statutory or proposed ecological protection areas. The EIA Study reveals that while the waters around SKC are not frequented by the Chinese white dolphins, the waters to the south of Lantau Island and Lamma Island, including the area around SKC, are an important habitat for Finless Porpoises (*Neophocaena phocaenoides*). The construction of the proposed artificial island may result in a permanent loss of 31 hectares (ha) of the habitat for Finless Porpoises. In fact, Finless Porpoises can be found across a vast area of waters. They frequent the vicinity of Po Toi Island in summer and autumn, and the waters to the south of Lantau Island (around the Soko Islands, SKC, Cheung Chau, Lantau Island) and Lamma Island in winter and spring. Nevertheless, to mitigate the loss of the 31 ha of habitat, it is proposed in the EIA Study that **a marine park of approximately 700 ha should be designated in a**

suitable area in the waters between SKC and the Soko Islands. In this connection, a marine park study will be conducted to identify the suitable location and area for the proposed marine park and the marine ecological enhancement measures that should be implemented in the proposed marine park, such as deployment of artificial reef and release of fish fry.

14. Furthermore, a number of measures have been proposed in the EIA Study to mitigate the potential indirect impacts on Finless Porpoises during construction and operation of the IWMP. The measures include avoidance of noisy works during peak Finless Porpoise season, monitoring of exclusion zone, adoption of regular traffic route, and limitation of vessel speed to 10 knots in areas with high Finless Porpoise sighting density. With the implementation of the proposed mitigation measures, **the adverse impacts on Finless Porpoises of the IWMP would be mitigated to an acceptable level.**

Impact on fisheries

15. Reclamation of an area of about 16 ha is required to create the artificial island near SKC for the development of the IWMP. In order to minimise dredging and filling works and its environmental impacts, the area to be reclaimed has been reduced by about 40% as compared with the original proposal. The EIA Study also proposes to use cellular cofferdam rather than sloping seawall for reclamation. Cellular cofferdam is a way of reclamation whereby cellular metal cofferdams are used to enclose an area to be reclaimed before fill materials are poured onto the enclosed waters. By doing so, **there will be no need to carry out large-scale sediment dredging works during breakwater construction on the artificial island.** In addition, a number of mitigation measures including silt curtain system, control over dredging and filling rates and so on, will be taken during construction to reduce impact of the works on marine resources. More importantly, **the future operation of the IWMP will achieve the target of zero wastewater discharge in the long term and all the wastewater generated during the waste treatment process will be reused after treatment.**

16. On this basis the EIA Study made a quantitative evaluation of the impact on water quality. The results show that with the implementation of mitigation measures, the impact of the works on water quality will be localised and minimal, and its indirect impact on fisheries in the immediate waters will be insignificant and temporary. Given that the fish culture zone in Cheung Sha Wan, Lantau Island is more than 9 km from the artificial island, it is expected that the reclamation for the proposed artificial island will not adversely affect the water quality and the operation in the fish culture zone. The water quality will be subject to close monitoring during construction and operation of the IWMF. The results will be published on the Internet so as to maintain high transparency.
17. There will be a permanent loss of 31 ha of fishing area on the southern waters of Hong Kong subsequent to the construction of the artificial island for the IWMF. According to the EIA Study, the area supports low to moderate fisheries production of about 100-200 kg/ha. In addition, the 31 ha to be permanently lost accounts for just a very small part of Hong Kong's fishing area as a whole. Therefore, the IWMF should not have any significant impact on Hong Kong's overall fisheries production. Its impact on fisheries will be acceptable. The ecological mitigation measures mentioned in paragraph 13 will also help enhance fisheries resources.

“We will introduce a series of improvement and mitigation measures to ensure that the adverse impact of the IWMF on Finless Porpoise will be mitigated to an acceptable level, and that the impact on fisheries will be maintained at an acceptable level.”

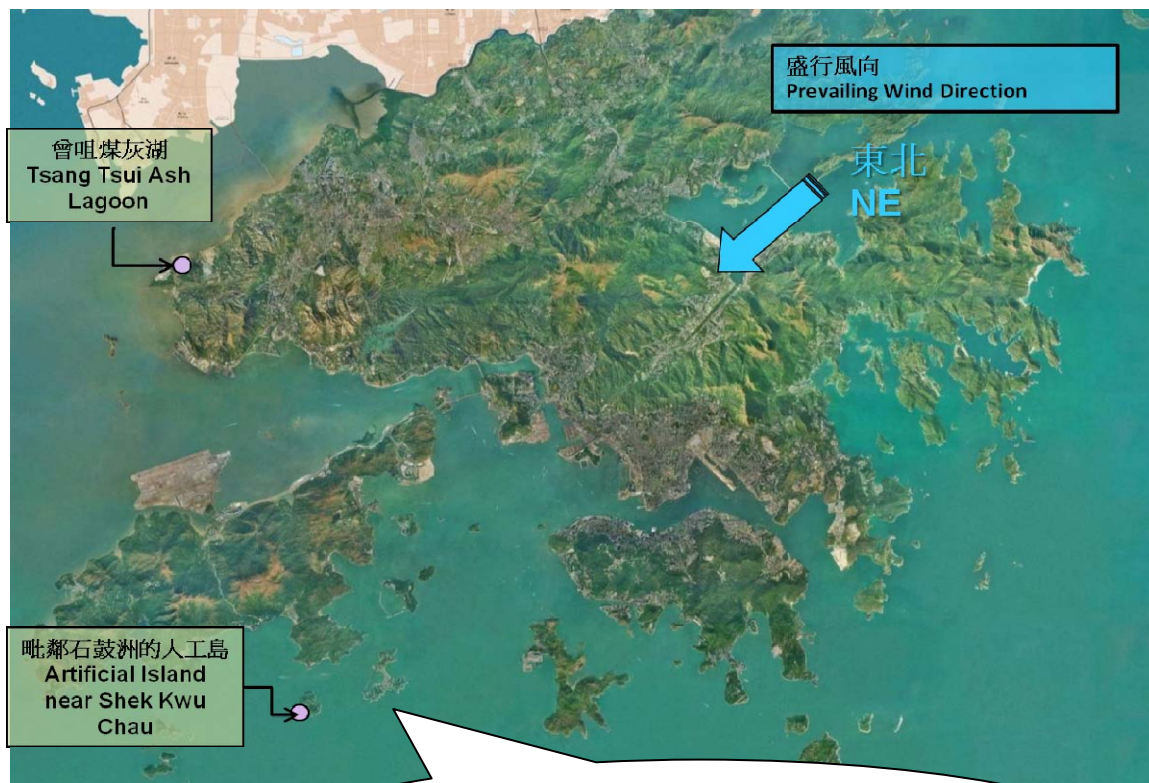
Part 2: Considerations on Site Selection

Site Selection Process

18. We conducted a detailed territory-wide site selection study in 2007-08 to identify potential sites for developing the IWMF. Based on the recommendations by the Advisory Group on Waste Management Facilities, whose members were drawn from professional bodies, green groups, academia and business sectors, 23 types of areas were excluded from the preliminary site selection. They included country parks, marine parks and marine reserves, conservation areas, as well as residential and commercial areas etc. After taking into account the environmental, ecological, planning, transport, technology/engineering, economic and social considerations and out of the government sites considered, eight potential sites for developing the IWMF were shortlisted for further assessment. Tsang Tsui Ash Lagoons (TTAL) site in Tuen Mun and an artificial island adjacent to Shek Kwu Chau (SKC) were identified in 2008 as two potential sites for further consideration. In the same year, the Environmental Protection Department (EPD) briefed the Legislative Council, Tuen Mun District Council, Islands District Council and Advisory Council on the Environment on the outcome of the site selection study.

Specific location of the preferred site at SKC

19. The map below shows the location of the artificial island near SKC. SKC lies on southern Hong Kong waters and is **about 3.5 to 5 km from its nearest island** (i.e. Cheung Chau), **which is three to five times the ferry distance between the Star Ferry Piers at Central and Tsim Sha Tsui**. Another point worth noting is that the planned artificial island will lie behind a ridge of high hill on SKC. **The 150 m hill ridge will serve as a natural barrier between the IWMF and Cheung Chau.**



Cheung Chau, about 3.5 to 5 km away from SKC, i.e. three to five times the ferry distance between the Star Ferry Piers at Central and Tsim Sha Tsui.

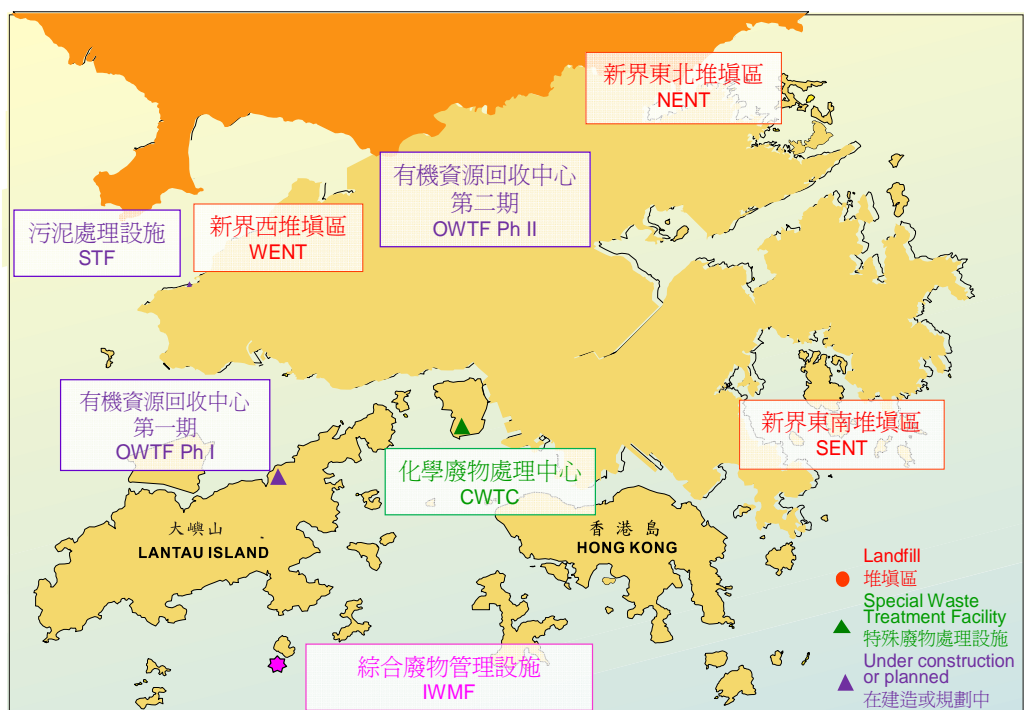
Reasons for Selecting SKC

20. Taking into account the EIA results and Hong Kong's overall waste management strategy, we have identified the artificial island near SKC as the preferred site for developing the first modern IWMF in Hong Kong, subject to the final approval of the EIA report. The major considerations are:
 - i. SKC is in a relatively central location in relation to the refuse transfer stations (RTSs) on Hong Kong Island and in Kowloon. The aggregate distance of refuse delivery from RTSs by sea will be shortened by about one fourth compared with that to West New Territories. In terms of distance of marine transport, **the operation of the IWMF on the artificial island near SKC will be more environmental and cost effective. It will also help reduce greenhouse gas emission. In addition, it will create no significant impact on marine traffic in the area and help reduce marine traffic near Ma Wan.**

Residue generated by incineration process will be transported by sea directly to the landfill at Nim Wan, minimising the required land transport for delivery of the residues from TTAL to the landfill at Nim Wan.

- ii. TTAL and SKC are both remote locations, and SKC is even farther from major population clusters than TTAL. There is a residential population of about 300 on the island. The island is about 3.5 km to 5 km from Cheung Chau and the 150m-high hill on SKC may serve as a natural barrier. Furthermore, Cheung Chau is not in the prevailing downwind direction of the proposed artificial island. According to the Hong Kong Observatory's information, the main wind direction around the year is from northeast blowing southwestwards to the sea. Therefore, emissions from the proposed IWMP will be blown southwestwards over the sea most of the time. Moreover, the advanced technology employed by the modern incineration plant in the IWMP will fully comply with the European Union emission standards for MSW incinerators, which are the most stringent international standards available. Through the use of scientific mathematical models, the EIA Study predicts that even when the southwesterly wind prevails in summer, emission from the IWMP will have insignificant impact on the air quality of Cheung Chau, which is about 3.5 km to 5 km (i.e. 1.9 to 2.7 nautical miles) from the artificial island near Skeh Kwu Chau. The air quality will be in full compliance with the environmental requirements, and will cause no adverse effect or risk to residents' health.
- iii. The selection of the artificial island for developing the IWMP and its education and community facilities can generate in the long run **positive economic synergy** with nearby islands, particularly Cheung Chau, during construction and operation, in terms of **an increase in employment opportunities, ferry service and other economic activities and benefits from people who work at or visit the facilities.**
- iv. With regard to the medium to long term planning strategy for waste management facilities, the selection of the IWMP site at the artificial island near SKC will achieve **a well-balanced spatial distribution for waste management facilities for Hong Kong as a whole.**

A Balanced Spatial Distribution of Waste Management Facilities



21. On the economic benefits to be brought about during the construction and operation of the IWMF, we estimate that **about 1,000 engineering staff will be engaged in various project-related jobs on the island and the immediate waters at its peak of construction** (from 2013 to 2018), with **about 200 staff to be engaged at the daily operation of the IWMF** upon its commissioning. Given its considerable distance from the urban area, Cheung Chau will be the major project supporting base for the IWMF during its construction and operation. This will greatly boost the economic activities related to accommodation, retail and catering on Cheung Chau. Moreover, **a planned education centre and related visitor facilities within the IWMF are expected to attract up to several hundred students and other visitors daily.** Cheung Chau, which is in close proximity to the IWMF, will benefit from the economic and related activities during its construction and operation.

Part 3: IWMF-Generated Development Potential

Landmark designs

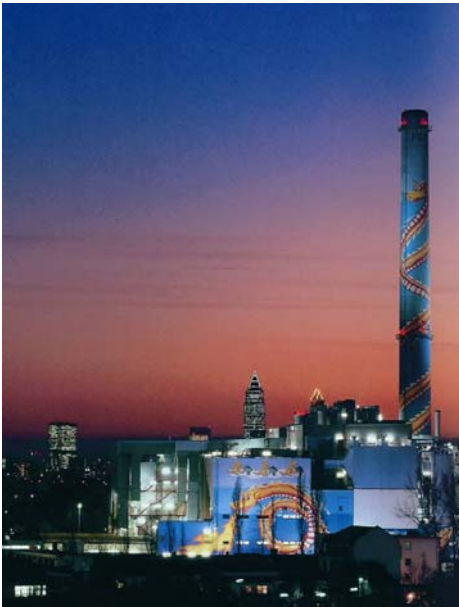
22. Apart from state-of-the-art technologies, many advanced incinerating facilities around the world have adopted new or innovative designs. Some have even become local landmarks. The following are some overseas examples:



Example 1: Spittelau incineration plant in Vienna, Austria, designed by famous painter and designer Friedensreich Hundertwasser.



Example 2: Maishima Waste-to-Energy Plant in Maishima, Osaka, Japan, with the Spittelau incineration plant in Vienna as its design blueprint.



Example 3: Incinerator in Frankfurt, Germany, decorated with cartoon flying dragons on its external walls.



Example 4: Incinerator in Beitou, Taipei, with a revolving restaurant at the top of the chimney.



Example 5: A new incineration plant in Roskilde, Denmark, designed by famous architect Erick van Egeraat in 2008 under commission from Kara/Noveren, to be open for operation in 2013

23. In fact, the proposed IWMF will also adopt innovative design. The EPD will put forward the specific design concept for discussion at district level in due course. The Sludge Treatment Facilities currently under construction, in Tuen Mun is a very good example. The EPD adopted the design concept of flowing seawater having regard to the advice of the Tuen Mun District Council at the planning stage. The following drawings show the exterior design of the sludge incineration facility and its ancillary installations. The facility is expected to commence operation in 2013.

Tuen Mun Sludge Treatment Facility



Wave-form Exterior Design



Waterfront Amenities



Education Centre



Wetland Succession Garden

Community facilities benefitting the neighbourhood

24. The aforesaid incineration facilities usually include community facilities to serve the neighbourhood. The more common ones are the use of electricity generated by incinerators to heat water for swimming pools and education centres for the public, in particular students. Taking the Sludge Treatment Facilities currently under construction in Tuen Mun as example, after consultation with the District Council, we have incorporated into the design an environmental education centre, a permanent interactive exhibition room, a children's corner, and a public sunset viewing terrace at waterfront. On public facilities, there will be an indoor spa, an outdoor foot bath, a waterbird habitat pool, a wetland park, fountains, a promenade and a woodland garden in the sludge treatment facility.
25. To enhance the connectivity of the facility with Tuen Mun Town Centre, the contractor is required to provide dedicated electric shuttle bus service for visitors between the town centre and the facility.
26. The IWMF under planning will have an environmental education centre that will provide information on and demonstration of waste management and the most advanced waste-to-energy technology. There will also be information on the ecology of the area around SKC to promote education on environmental protection. Drawing on experience from the Sludge Treatment Facilities, the IWMF may also provide recreational and leisure facilities for visitors, such as a viewing terrace, and ferry services between Cheung Chau and SKC for visitors. It is anticipated that the facilities can attract several hundred visitors a day. As visitors will have to stop over in Cheung Chau, this will help boost the local tourism and catering business.

Annex 1: Basic Information of the IWMF Phase 1

1. The IWMF Phase 1 will have a capacity of about 3,000 tonnes per day. The preferred site is an artificial island to be formed by reclamation at the southwestern coast of SKC. The IWMF will be built on a piece of reclaimed land measuring about 11.8 hectares (ha) with a berth area and a storage area for waste containers. Due to occasionally rough sea condition in the vicinity, the project will include constructing a breakwater of about 4.1 ha to ensure that loading/ unloading activities can be safely carried out in the berth, and that the safety of facilities can be guaranteed. The area enclosed by the breakwater (including the area of the breakwater) will be about 31 ha. To conserve the natural coastline of SKC, the reclamation area will not be connected to SKC. Instead, the coast of SKC and the reclamation area will be separated by a water channel.
2. The infrastructure of the IWMF will comprise an advanced incineration plant, a mechanical sorting and recycling plant, as well as ancillary and supporting facilities. The major facilities are:
 - **the incineration plant** (including moving grate incineration units, a waste heat recovery and power generation system, a flue gas treatment system, a stack, an ash storage and handling system and an odour control system, etc.);
 - **the mechanical treatment plant** (including mechanical shredding and sorting facilities and an odour control system, etc.); and
 - **the ancillary and supporting facilities** (including an administration building/visitors and environmental education centre, a desalination plant, a wastewater treatment plant, an electricity supply and export system, etc.).
3. An on-site desalination plant will be provided for supplying fresh water to the IWMF. An on-site wastewater treatment plant will also be installed and the treated effluent will be reused in the incineration plant or the mechanical treatment plant or for washing and landscape irrigation within the IWMF. No effluent will be discharged into the nearby water body.

4. The IWMF will operate 24 hours daily throughout the year, but MSW will be received only from 8 am to 8 pm.
5. MSW in sealed containers will be delivered daily by marine vessels from the existing RTSs (including the Island East RTS, Island West RTS and West Kowloon RTS) to the berth on the artificial island by sea.
6. At the reception hall of the incineration plant, MSW in the containers will be discharged to a waste bunker. It will then be fed into incineration furnaces for combustion. The heat energy released will be recovered to generate electricity through the waste heat boilers and steam turbine generators for daily operation of the facilities within the IWMF. Surplus electricity will be exported via newly laid cables to a substation for connection into the power grid. It is estimated that the first phase can supply about 480 million kilowatt-hours (kWh) of surplus electricity to the power grid per year, which is sufficient to serve about 100,000 households and can save about 0.44 million tonnes of carbon dioxide emission per year.
7. Flue gas generated from the incineration furnaces will be carefully treated before discharging to the atmosphere.
8. Bottom ash, fly ash and air pollution control residues produced from the incineration process will be collected, fly ash and air pollution control residues will be pretreated and then disposed of at the WENT Landfill or its extension if they have met the disposal requirements.
9. During the construction and operation of the IWMF, employment and economic opportunities will be created. The artificial island near SKC will generate demand for economic activities for SKC and the neighbouring islands, such as Cheung Chau.
10. The ferry services set up between the IWMF and Cheung Chau during the construction and operation of the IWMF, together with the education centre and recreational and leisure facilities within the IWMF site will serve residents in Cheung Chau and other outlying islands.