REPORT on
Pilot Project for the Separation and Treatment of Food Waste for Georgetown Heritage Area and Buffer Zone

DIVERSION OF FOOD WASTE FROM THE LANDFILL

(ACTIVITY 2- CCAC STAGE 3 FOR PENANG)

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for
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Supported by:
Section 1. METHODOLOGY AND LOGISTICS

1. Selection of participants or waste generator by Penang Island City Council (MBPP).
2. Briefing and information to selected waste generator by MBPP and Bio Regen.
3. Waste generator to purchase specially made plastic bags.
4. Waste generator to use plastic bags for disposal of food waste. Once the bag is full, the waste generator will seal and write name (or company name) and MBPP business registration number on the bag.
5. Bio Regen to arrange collection of filled up plastic bags and deliver to waste processing center.
6. At the waste processing center, Bio Regen staff to record name and MBPP business registration number and weight of plastic bag.
7. Bio Regen staff to open and inspect for waste contamination.
8. Bio Regen staff to process food waste if not contaminated.
9. If contaminated Bio Regen staff to remove contamination (if minor) and process. Bio Regen staff to return plastic bag to owner if there is major contamination. Bio Regen will issue warning letter to waste generator. After three (3) warnings, Bio Regen will no longer accept plastic bag from the waste generator.
10. Bio Regen staff to provide monthly report to MBPP.

SECTION 2. REPORT ON THE METHODOLOGY AND LOGISTICS

A. ENGAGEMENT WITH WASTE GENERATORS/PARTICIPANTS

1. Participants were categorized into two categories as follows:
   i. Within Chowrasta Market (WGCM) - 22 Waste generators (Participants)
   ii. Outside Chowrasta Market (WGCM) - 19 Waste generators (Participants)

2. Two briefings were held for waste generators within the Chowrasta Market and for the waste generators located outside the Chowrasta Market.
3. Ongoing engagement with participating and new waste generators

Participating waste generators are given stickers to put on their shop to indicate their participation.

Participating waste generators will be given specially designed aprons to further promote the need to recycle food waste.

A. 5-minute video promoting this pilot project as well as the virtues of food waste separation and recycling has been developed.
B. **WASTE PROCESSING CENTER**

The Waste Processing Center is located within Chowrasta Market along Penang Road in the heart of the city. It is one of the oldest markets in the Penang. The market recently underwent an RM1.5m renovation. Part of the renovation included relocating the toilets from a basement floor to the ground floor as the old toilets faced constant problems with the pumps pumping sewage from the basement floor.

As the Chowrasta market is located in the heart of the city, there are many commercial eateries and street stalls within the vicinity, which generate huge amounts of food waste. It made an ideal location for the Bio Regen process to process the food waste at its source. Its locality allowed for surrounding waste generators to deliver their food waste on foot thereby eliminating the need for motorized transport.

The waste is received at the center where it is weighed, inspected and processed by the Bio Regen Unit. The unit is located in a locale of the market that has been assigned for the project.

The product (processed food waste) of the Bio Regen unit is transferred to fermentation tanks. The tanks are located in the renovated basement of the Chowrasta market. The size of the basement is 10m by 10.5m, which allowed the installation of nine tanks. Each tank has a capacity to hold 62,371 liters. The nine tanks allow that there enough time for fermentation to take place before they are used to treat the grey water coming from the market drains.

The waste processing center is currently open daily from 11am to 7pm, including Saturdays and Sundays and public holidays.

Penang Island City Council owns and manages the Market and has allowed the use of the basement free of charge for this pilot project.
Signboard at the point of receipt of the food waste at the Waste Processing Center
The Bio Regen Machine Model XXJ

This Bio Regen Unit (model XXJ) is on loan by Bio Regen Photonics for the duration of the Pilot Project. The Unit comes with a 5hp 3-phase grinder. This process allows for all types of food waste including large bones and clamshells and very moist food waste, oily food. The unit is capable of handling up to 5kgs of waste a minute.
The Fermentation Tanks

The fermentation tanks are made of polyethylene with a capacity of 6,819 liters. The flow is from one tank to the next with piping designed to allow for “first in first out” flow.

The center is kept dry and clean at all times with minimal or no foul odor.
The fermentation process produces minimal or no methane and carbon dioxide

C. COLLECTION PROCESS

1. Plastic Bags

Two sizes of plastic bags were issued to the waste generators as follows
   i. 20” x 10”  Hold up to 3kgs
   ii. 28” x 14”  Hold up to 10kgs

The plastic bags are currently provided free of charge to the participating waste generators. The waste generators are initially given a certain number of plastic bags and are given free replacements when they have sent their waste.

The plastic bags cost about USD 0.18 and USD 0.21 approximately, which can be substantially reduced if they are ordered in bulk.
2. Transport of food waste from waste generators to waste processing center

A motorcycle, on loan from Bio Regen, was used for the collection process. Collection time is between 11am to 6.30pm. Bio Regen makes private arrangement with the participants to collect their waste as most of them have different opening hours and amount of waste. Bio Regen helps the participants reduce storage time for food waste at their premises. This helps the participants to keep their place clean and free from any foul odor. Collection is also upon call (to a hotline) as all participants are within a 5km radius and the motorcycle moves easily between traffic. Turnaround time for collection can be as low as 10 minutes.

3. Separation of waste by participants
D. PROCESSING OF FOOD WASTE AT WASTE PROCESSING CENTER

1. Weighing of food waste and data entry

Data collection (sample of daily entries)
2. Inspecting for contamination

Common contaminants found are small plastic bags, plastic and metal fork and spoons, plastic straws, 5 and 10 Sen coins, strings.

3. Processing

4. Washing the plastic bags (to be sent for recycling)
E. TYPES OF WASTE

Different types of food waste from outside

Different types of food waste from inside
Section 3. DATA REPORTS

Collection over a 45-day period

(Note: 36th day, there was a power failure and part of the waste was processed on the next day)

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Collection</td>
<td>13,660.40 kg</td>
</tr>
<tr>
<td>Average</td>
<td>296.96 kg per day</td>
</tr>
<tr>
<td>Processed food (outside Chowrasta)</td>
<td>8,407.7 kg (61.55%)</td>
</tr>
<tr>
<td>Raw Food (within Chowrasta)</td>
<td>4,851.5 kg (35.52%)</td>
</tr>
<tr>
<td>Raw food (fruits)</td>
<td>401.20 kg (2.93%)</td>
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</tbody>
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Section 4. SUMMARY

1. Technology
   The Bio Regen process used for the conversion of the food waste has been consistent and easy to manage. There were no major odor issues which are generally associated with the handling of food waste and hence no complaints even though it is sited within the market surrounded by the stalls and public. The continuous process (as opposed to batch by batch processing) allows waste to be processed immediately and completely cleared at the end of every working day. It has also allowed for easy inspection and removal of contaminants.

2. Collection Process
   i. The size of the plastic bags allows for easy handling.
   ii. As the waste generators are all situated within a 5km radius of the waste processing center, collection can be done within minutes. The use of a motorcycle instead of a truck reduces both cost and time for collection as the motorcycles can maneuver around in narrow urban areas.

3. Waste Contamination
   The food waste collected has very low contamination. Most common contamination found are:
   i. Plastic bags
ii. Plastic fork or spoons although occasionally some metal ones were also found
iii. Small coins
iv. Metal wires

The low contamination rate can be attributed to the fact that the waste generator can be easily identified if his/her waste consistently has contaminants.

4. Others (co-benefits of the project)
i. The waste generators and consumers have seen a vast improvement in the market. The open waste bins in the market contain very small amounts of food waste, which mean no odors and flies. In addition, there are no leachate flows on to the floor.
ii. The drains in the market are also much cleaner and there are less rodents because there is no food waste lying around.
iii. Due to the location of the waste processing center, which is very visible within the market, it has attracted many visitors including many tourists as it is within the vicinity of the Georgetown Heritage Area. As such, many stakeholders have learned more about the need to recycle food waste.

5. Financial Implications
i. Capital Considerations
   a. Cost of premises
      A suitable premise needs to be located. Depending on the load, space will be required to house the holding tanks, which can be configured to meet space and height requirements.
   b. Tanks
      The cost of a PU tank can be relatively cheap (in this case approximately USD 1,000 per tank) but stainless steel tanks will cost up to 10 times that amount.
   c. Equipment
      The Bio Regen Model XXJ cost approximately USD 35,000 but comes with an inoculant pump/nozzles/control panel

ii. Operational costs
   a. Inoculants
      The Bio Regen Bio Digester (bokashi) costs approximately USD6.50 per liter and 20 liters are required for every 1 ton of food waste
   b. Water
      Approximately 1 liter of water is required for every 1kg of waste. Rainwater or ground water can be used. Current cost in Penang is USD 0.008 per liter
   c. Electricity
      The Bio Regen unit runs on 16amps, which is approximately 3.8KwH. Local cost of electricity is USD0.105 per KwH. Based on running time of approximately 1 hour per day for 300Kgs it comes to approximately 3.5 cents for every 100Kg of waste.
   d. Labor
Currently six temporary employees are retained to run the center. The cost of the six employees is approximately USD 480 per day. This can be substantially reduced if the employees are on permanent basis. The center can be run with four employees if running on a single shift.

iii. Average Cost to handle 1kg of waste (excluding labour)

Given the above, the cost to process about 1,000 kg of waste will be

- Plastic bags 0.20 USD x 100 pcs = USD 200
- Electricity 0.035 USD x 10 = USD 0.35
- Water 0.0008 USD x 1000 liters = USD 7.89
- Transport fuel (petrol) (approx. 0.26USD /day) = USD 0.80

Total = USD 209.24

Approximately 20.9 USD cents per kg

Section 5. CONCLUSION AND RECOMMENDATIONS

The purpose of this pilot project was to test the system of a small centralized system (covering a radius of not more than 5km from the waste processing center) using the Bio Regen Process as well as to test the collection mechanism using plastic bags. The pilot project also included testing the financial model of “Waste Generator pays” and whether it can be financially viable for the private enterprise to partake such a venture.

The Bio Regen process, the collection, and the participation has been proven to be viable. The financial model can only be fully determined when the State Government fully implements the waste separation law and implements the law that private sectors will have to pay for the disposal of their waste.

It is envisaged that this project can economically viable in countries or cities where private/commercial outlets have to pay private contractors to handle their waste and/or the authorities either pay or subsidize for the operations.

On the other hand, the Penang State Government has embarked on a very ambitious move to introduce the “Waste Generator Pays Principle” for the commercial sector. This pilot project is instrumental in introducing this principle on a small-scale before this approach is replicated to other areas.

Lessons learnt from this very important pilot project include:

1. Developing a standardized policy and regulations by the Penang State government for both local authorities. This will mean that the commercial sector (hotels, restaurants, food outlets, shops, etc.) will have to pay for transport and dispose of their garbage. Currently some engage their own contractors for disposal and others depend on the local authority for such services.

2. Developing an approach to incentivize the system; either in terms of monetary or non-monetary (in kind) so as to ensure sustainability of the projects and to further encourage waste minimization and diversion of the various wastes.

3. Developing a systematic approach for further awareness raising and public education on waste separation at source and of the “waste generator pays principle”.

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(4) Providing sufficient staff to implement and monitor the replication process.

(5) Documenting valuable ground experience especially of the stakeholder engagement activities.

(6) Liaising with and updating the State administration on the progress of the project.

(7) Preparing an annual budget for such activity in terms of incentives, publicity materials and continual stakeholder engagement.

Penang aspires to be one of the green hubs in the region that will proudly showcase its best practices, infrastructure, facilities, layout and operations that addresses issues such as:

- Reduction or avoidance of greenhouse gas emissions and other pollutants in the air,
- Energy management for sustainable energy consumption,
- Water management for sustainable water consumption, and
- Pollution control of waterways

In heeding the international call to reduce our carbon footprint as well as to avoid short-lived climate pollutants, Penang has created and used various technologies successfully and believes that the only way to deal with municipal organic waste streams is to boldly introduce and implement waste minimization and diversion policies for the State.

Successful solid waste management strategies and programmes are dependent on three main factors:

- Willingness of the public and stakeholders to participate in such programmes
- Sustained public education and awareness campaigns to change public attitudes and
- Strong and bold political will to implement programmes which may not be popular but is good for the environment.

The community and local authorities play very important roles in the project. Interest must come from the community so that ownership of the project by the community will ensure continual project sustainability.

Public education and awareness to achieve mindset change continues to play an important and vital part in waste minimization and resource recovery.

Penang is very thankful and grateful for being selected by CCAC to implement this pilot project, which will bring the modernization of its solid waste management into its next chapter.

The project will continue to develop and evolve into a sustainable effort that benefit all citizens, be a showcase to others locally as well as become a very important player regionally and internationally turning Penang into a Low Carbon City and in the broader context towards GREEN ECONOMY & GREEN GROWTH.