



MITIGATING METHANE AND BLACK CARBON FROM THE MUNICIPAL SOLID WASTE SECTOR

PENANG MALAYSIA

Penang is a densely populated state of approximately 1.8 million people in Malaysia. The state has two geographic regions: Seberang Perai, which is located on the mainland and governed by the Seberang Perai Municipal Council (MPSP); and the more densely populated Penang Island, which is governed by the Penang Island City Council (MBPP). Penang faces a number of solid waste management challenges, especially related to organic waste management. In 2013 the municipality began working with the Climate and Clean Air Coalition (the Coalition) Municipal Solid Waste Initiative (Waste Initiative) to address these challenges and improve solid waste management in general. Through this partnership the city is implementing several activities that will generate a range of environmental, economic, and public health benefits, including reduced emissions of short-lived climate pollutants (SLCPs), primarily methane and black carbon.

CHALLENGES AND OBJECTIVES

Approximately 2,200 tonnes of waste are generated each day in Penang. Nearly all of this waste is sent to a single sanitary landfill, Pulau Burung. This landfill is currently half full and is expected to be completely full by 2028. Moreover, because 40–60% of the waste generated is organic, the landfill generates large volumes of leachate and methane (approximately 11,100 tonnes/year). Leachate pollutes nearby land and waterways, and methane emissions contribute to air pollution and climate change. In addition, the state has had trouble changing people's behaviour and encouraging a shift away from a "throw away" mindset.

Through the Waste Initiative, Penang worked with the United Nations Environment Programme International Environmental Technology Centre (IETC) to develop a work plan for improving solid waste management and reducing SLCP emissions. As a part of this work plan, Penang decided to focus its efforts on an organic waste management plan. The plan, which was published in April 2015, aims primarily to divert organic waste from the Pulau Burung Sanitary Landfill and includes a goal of eventually banning disposal of organic waste in the landfill altogether.

Penang's [organic waste management plan](#) identifies specific implementation actions. First, the state intends to mandate source separation and treatment of organic waste, which has the additional

CITY FACTS

Population:
≈ 1.8 million
Waste Generation Rate:
≈ 1.3 kg waste/person/day
Waste Collection Rate:
≈ 100%

The **Climate and Clean Air Coalition Municipal Solid Waste Initiative** unites national and local governments, international organizations, and other partners to reduce emissions of short-lived climate pollutants, such as methane and black carbon, from the municipal solid waste sector.



benefit of lowering costs associated with the collection, transfer, and treatment of organic waste. Next, Penang plans to incentivize waste diversion at the source by developing various incentive systems, such as awards and reduction of fees, and using the savings from waste diversion to improve community facilities. In addition, the state is working toward future voluntary carbon offset schemes. Finally, the state aims to turn organic waste into byproducts that can be used in food and energy production processes (e.g., producing compost and liquid soil enhancers that can be used in farm applications).

ACHIEVEMENTS TO DATE

In June 2015, Penang developed a [Best Practices on Organic Waste Management](#) for organic waste management. This manual highlights some of the successes seen throughout the state thus far. It also provides information on best practices for composting different organic waste streams (e.g., kitchen waste), waste separation brochures, community posters, workshops, videos, and a [website](#) to share these best practice materials.

Penang Island has installed 22 Bio-Regen Photonics machines in several locations across the city, including in produce markets, school cafeterias, high-rise residential apartments, a hill resort food court, 2 factories, a nongovernmental office building, and a golf course canteen; further installations are planned. These compact machines turn organic waste into liquid fertilizer through a fermentation process that results in negligible methane emissions. In just 5 years, Bio-Regen machines installed across the state have diverted nearly 800 tons of organic waste, saving approximately \$23,000 USD from avoided tipping fees and preventing the emissions of just over 700 tons of carbon dioxide-equivalent emissions.

Seberang Perai, the mainland portion of the state, has established two centralized food waste composting facilities at the Bagan Ajam produce market and the AutoCity Commercial Centre. In addition, the municipality composts green waste at one of the major transfer stations in the state. Between 2015 and 2016, Seberang Perai composted approximately 6,100 metric tons of organic waste from its own projects, the transfer station, communities, commercial centers, and residential areas.

The state's efforts have not gone unnoticed. In November 2015, Penang Island won first place in the Composting Category at Malaysia's World Town Planning National Awards ceremony (Seberang Perai won second place).

The state also undertook a pilot project exploring the impacts of monetary incentives to encourage behavioural change. Under this program, the municipal government provides cash rewards to residents in select high-rise buildings who successfully separate organics from their household waste (based on quantity and quality).

ABOUT THE COALITION

The Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (Coalition) is a voluntary global partnership of governments, intergovernmental organizations, business, scientific institutions and civil society committed to catalysing concrete, substantial action to reduce SLCs (including methane, black carbon and many hydrofluorocarbons). The Coalition works through collaborative initiatives to raise awareness, mobilise resources, and lead transformative actions in key emitting sectors.



Top: Auto City food waste composting site.

Bottom: Bagan Ajam market composting demonstration project.



ONGOING ACTIVITIES

With continued support from the Waste Initiative, Penang is conducting a feasibility study for a project that would incorporate a biodigester and material recovery system. The biodigester would help divert organic waste from the landfill while also capturing methane for productive use (the state estimates that a 40-tonne per day system could avoid approximately 2,700 tons of carbon dioxide-equivalent emissions annually).

In addition, the state implemented a mandatory source segregation awareness program in June 2016. As a part of this program, Penang is developing a collection mechanism for food waste using the Chowrasta produce market as a central collection point for food vendors and outlets in the surrounding areas, such as coffee shops, restaurants, hotels, and roadside stalls.

MORE INFORMATION

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