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## **Making Waste Work for Us**

What is waste? It is unusable or unwanted material generated from our daily activities. Waste can, however, be a valuable resource — it can be converted to electricity to power our needs! At present, Singapore's garbage goes into incineration plants, which are also waste-to-energy plants. The heat that comes from burning refuse is used to generate superheated steam that drives turbo generators to produce electricity.

Rubbish is not the only resource we can use for energy production. Here are three unconventional alternatives that are powering four home-grown initiatives.

### *From Bird Poo to Biogas Power*

Making waves by using innovative technologies to make their operations more sustainable and eco-friendly, two of Singapore's egg farms, Chew's Agriculture and Seng Choon Farm are setting up biogas plants to turn bird poo into electricity.



Conveyor belts whisk away chicken poo for later treatment.

Chew's rears about 750,000 chickens that produce 60 tons of droppings a day while Seng Choon collects about 70 to 80 tons of chicken waste per day. Currently, these

birds' manure is treated to be sold as fertiliser, a process that requires much money, space, energy and manpower. Looking to save resources, as well as the environment, Seng Choon and Chew's decided to adopt biogas technology provided by Anaergia Pte Ltd as an environmentally sustainable solution.

The biogas plants work by breaking down the manure in a digester vessel using bacteria in an oxygen-free environment (known as anaerobic digestion) to produce biogas. Biogas (made up of 60 per cent methane and 40 per cent carbon dioxide) can then be combusted for energy generation in a gas engine.

Seng Choon's biogas plant is expected to be up and running by October 2014, while Chew's Group is constructing theirs in two phases, with the first phase to be completed by June 2014. When the plants are fully operational, the electricity produced will be able to meet the farms' total energy needs, which is projected to save the farm's operating cost and provide a return on their investment within 5 to 6 years. The surplus can even be sold to the power grid. So how's that for poo power?

### *From Twigs to Turbines*

A flourishing green paradise in the city, the Gardens by the Bay plays host to the Cloud Forest and Flower Dome conservatories, which house plants and flowers from the cool-moist tropical montane and cool-dry Mediterranean regions.



The Flower Dome is kept cool by chillers that are powered by the Gardens by the Bay's biomass co-generation system.

To keep the plants growing well, pruning and clearing dead leaves are a daily affair, resulting in a growing pile of plant matter. And what about maintaining the cool environment they live in? To meet these two needs, the Gardens by the Bay uses horticultural waste to power the chillers that cool the conservatories.

The horticultural waste comprises plant cuttings from maintenance work in the Gardens and other parks around Singapore. These cuttings are processed off-site before being used in a biomass co-generation system in the Gardens to produce energy.

About 2,000 tons of mixed horticultural and organic waste are burnt each month to run a steam turbine, generating enough electricity to cool both conservatories! The resulting ash acts as fertiliser in the Gardens while waste heat is captured to regenerate a liquid desiccant for removing moisture from the air, as less energy is needed to cool dry air.

The Gardens also adopts other cutting-edge cooling technologies, which saves at least 30 per cent on energy consumption compared to conventional cooling technologies, making the Gardens a sterling example of reusing and reducing waste.

### *From Cooking Food to Moving Cars*

Deep-frying food always requires a lot of vegetable oil, and it's a shame to let the used oil go down the drain after cooking. Thankfully, it can be given a new lease of life as biodiesel — a clean fuel for cars, motorcycles and trucks.

Since 2004, local company Alpha Biofuels has championed the use of biodiesel, which produces lower carbon emissions than petroleum diesel. The company collects waste cooking oil from restaurants, schools and events to produce around 60 to 100 tons of biodiesel per month. IKEA, for one, has recycled its restaurants' used cooking oil through Alpha Biofuels since December 2010.



Alpha Biofuels also sets up micro-refineries for clients to convert waste cooking oil into biodiesel within their premises, such as this one at Asia Square Tower 2.

The conversion process is straightforward: The oil is transformed through transesterification, followed by demethylation and further purification. Ordinary diesel-engine vehicles can then use the resulting biofuel.

About 200 organisations have joined Alpha Biofuel's "Waste oil for fuel" programme, providing waste oil and/or using its biodiesel. The Westin Singapore is the first to complete the "waste oil-to-energy loop" — not only does the hotel contribute used cooking oil from its kitchens, it uses the biodiesel for its fleet of luxury limousines.

*Article adapted from:*

<https://www.nccs.gov.sg/climatechallenge/issue08/Waste-To-Energy-Initiatives.html>