Singapore’s Resource Sustainability Bill: Tackling the Food-Water-Energy Nexus
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SYNOPSIS
A new Resource Sustainability Bill was introduced in Parliament on 5 August 2019. The Bill should be understood as part of the Singapore government’s Zero Waste Masterplan to encourage circularity and to promote resource sustainability. This brief will examine new obligations under the Resource Sustainability Bill relating to the collection and treatment of food waste and assesses how this will help inch us towards closing the food-water-energy nexus loop.

KEY POINTS
• The introduction of the Resource Sustainability Bill comes as Singapore declared 2019 as the Year Towards Zero Waste.
• The Bill is part of the government’s Zero Waste Masterplan, which comes into effect on 30 August 2019, to encourage circularity and to promote resource sustainability.
• Food waste has increased by 30 per cent over the last decade and is projected to increase with Singapore’s growing population and economic activity. At the current rate, Semakau Landfill is expected to reach capacity by 2035.
• In 2018, waste-to-energy (WTE) generated 1.9 per cent of Singapore’s total electricity generation capacity, amounting to 256.8MW out of a total of 13.6GW. If food waste is dehydrated or segregated for bio-digestion for compost, coupled with recycling efforts, it is unclear if total contribution of WTE to Singapore’s energy consumption mix will fall.
• Key areas of improvement to this Bill would be to enhance guidelines for the proper handling and re-distribution of unsold and excess food to food distributors instead of being discarded.

INTRODUCTION
Economic growth over the last five decades have resulted in an exponential increase in solid waste disposed on our island city-state. Although Singapore has developed a solid waste disposal infrastructure comprising of four waste-to-energy (WTE) plants as well as the Semakau Landfill, space is running out.

The Resource Sustainability Bill (hereafter “the Bill”) was read for the first time on 5 August 2019 in Singapore’s Parliament. The Bill was designed and introduced as part of the government’s Zero Waste Masterplan to encourage circularity and to promote resource sustainability. The Bill intends to impose obligations relating to the collection and treatment of electrical and electronic waste and food waste, to require reporting of packaging imported into or used in Singapore, to regulate persons operating producer responsibility schemes, and to promote resource sustainability. The Bill targets electrical or electronic products and e-waste, food waste and packaging. This policy brief, will focus on the food waste section of the Bill.

Key to this effort to reduce waste is addressing the food-water-energy nexus loop. Singapore aims to become partially self-sufficient in both food and water, with an aim to produce 30 per cent of Singapore’s nutritional needs domestically by 2030 (branded the “30-by-30” target). This was announced by Mr Masagos
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Zulkifli, Minister for the Environment and Water Resources on 7 March 2019. The 30-by-30 target will be under the remit of the newly established Singapore Food Agency (SFA).

With effect from 1 April 2019, the SFA took over food-related work done by the Agri-Food and Veterinary Authority of Singapore (AVA), the National Environment Agency (NEA) and the Health Sciences Authority (HSA).

Food production in Singapore currently stands at 10 per cent. To achieve the 30-by-30 target in the same time period, Singapore also aims to produce 80 per cent of its water supply; up from 65 per cent today. Both processes are expected to increase Singapore's energy demand substantially due to energy-intensive agro-technology. This would include vertical fish farming and indoor hydroponic vegetable farms, NEWater and desalination, which in turn feeds back into Singapore's climate policy. Furthermore, food waste forms part of solid waste, which is currently incinerated. WTE currently generates 1.9 per cent of Singapore’s total electricity generation capacity.

ANALYSIS

Preventing Food Waste at Source

The reduction of food waste will be crucial if Singapore is to accelerate food self-sufficiency, especially in the face of a rising population. By reducing the amount of food which reaches the waste bin, Singapore can ensure that more of the existing food produced and imported will feed a larger population. However, it remains unclear how much the Bill will affect WTE’s contribution to Singapore’s total energy mix.

Singapore’s only landfill, Semakau Landfill, opened 20 years ago by enclosing 350 hectares of sea space enclosing two offshore islands. Despite limited landfill space, a total of 7.7 million tonnes of solid waste was generated in 2018 according to NEA waste statistics. Of this figure, 10 per cent or 763,000 tonnes was food waste. This averages out to more than 2,000 tonnes of food waste per day. Half of all food waste generated comes from food manufacturers, hotels, shopping malls and hawker centres. The remainder comes from residential households. Although incineration reduces the volume of waste to as little as 10 per cent of its original volume, Semakau Landfill received an average of 2,189 tonnes of WTE plant ash and non-incinerable waste daily in 2016. At the current rate, Semakau Landfill is expected to reach capacity by 2035.

Preventing Food Waste at Source

The government has been making an effort to reduce food waste. Since 2015, food waste minimisation guidebooks have been distributed to food retail establishments, supermarkets and food manufacturing establishments. The aim is to guide owners and operators of food and beverage businesses to implement measures to reduce food waste across the supply chain. Consumers are also encouraged to buy and order just enough.

Redistribution of Unsold or Excess Food

Yet in 2018, Singaporeans wasted a total of 763,100 tonnes of food, according to the NEA. This is a notable increase of around 30 per cent over the past decade. Singapore currently does not have an active national level strategy in redistributing unsold or excess food. At present, NEA mainly works with interest groups and NGOs such as Food Bank Singapore and Food from the Heart to increase awareness and drive action in the community.

Part of the problem stems from regulations which lacks clarity in defining terms used in the sale of food, such as “best before”, “consume by”, “sell by”, “use by” and “expiry” dates. This means that businesses are not legally allowed to sell food items beyond the indicated date when in fact the dates usually denote the food manufacturer's recommended period of consumption for the food items sold. Some Members of Parliament have called for regulations to extend the shelf life of, for instance, processed foods on the condition that the food is donated to charities. This allows for food to be redistributed instead of being discarded. Others have suggested a form of Good Samaritan Law, keeping in mind the need to ensure than any food donated is fit for consumption while trying to reduce food waste. While the Government continues to study the possibility of such laws and regulations, initiatives such as online apps and chat groups have been developed by the private and individual advocates to match businesses with unsold or excess food with consumers.

A data collection loophole noted by Mr Masagos Zulkifli in response to a
parliamentary question in 2016 is that MEWR does not track the specific amount of food waste generated from food industries, food and beverage outlets, markets and supermarkets. It is unclear if such data collection has continued since. Regardless, the Bill does not include such data collection. It also does not address food sold in food vending machines. Currently, licensees are required by the SFA to ensure that expired, damaged food, and food waste are properly disposed but says nothing about aiming to reduce the amount. Perhaps further guidelines requiring licensees to place food items in vending machines according the closest date of expiry to the latest such that consumers have access to the former first will bridge this gap.

**Mandatory Food Waste Segregation**

Under the Bill, food waste segregation will become mandatory for commercial and industrial premises that generate large amounts of food waste from 2024. These will include large hotels, shopping malls and industrial facilities. From 2021, developers of new developments where large amounts of food waste are expected to be generated will also be required to allocate space for on-site food waste treatment in their building plans. This means that occupiers of a prescribed building or part of a prescribed building must segregate food waste. They are also prohibited from disposing any food waste generated in the building in any other place other than the food waste segregation facility provided or dispose any food waste together with any other type of waste. Occupiers who do not comply shall be liable on conviction to a fine not exceeding S$5,000.

In addition, building managers must provide food waste segregation facilities to enable occupiers of the prescribed building to separate and dispose food waste or risk conviction, which carries a fine not exceeding S$10,000 or to imprisonment for a term not exceeding 3 months or to both. In the case of a continuing offence, building managers will be liable to a further fine not exceeding S$1,000 for every day or part of a day during which the offence continues after conviction. The Bill will require all food waste disposed in the food waste segregation facility to be treated in the building. However, it is unclear what the output of treatment will be used for and if there are off-takers for such by-products. For all other prescribed buildings, the food waste can be treated in the building or on its premises. Another option is for the building manager to engage a licensed waste collector to send the food waste for treatment at a licensed waste disposal facility.

Building managers that have to install food waste segregation facility are likely eligible to apply for the NEA's 3R Fund, a co-funding scheme to encourage organisations to reduce waste disposed of at NEA's incineration plants and disposal facilities. This is as long as projects result in an increase in the quantity of solid waste (excluding toxic and chemical wastes) recycled or a reduction in the quantity of solid waste generated. The minimum tonnage eligibility is 100 tonnes reduced, reused or recycled over the whole project duration. The 3R Fund will co-fund up to 80 per cent of qualifying costs, subject to a cap of S$1 million per project or applicant. However, funding level will depend on the actual quantity and type of waste reduced or recycled.

The government is also investing heavily in research. In December 2017, the NEA set aside S$45 million under the Closing the Waste Loop R&D Initiative along with the Environmental Services Industry Transformation Map to fund innovative projects that address the circular economy. So far, 4 projects have been awarded to the Nanyang Technological University (NTU), Republic Polytechnic, Institute of Chemical & Engineering Sciences, A*STAR and Temasek Polytechnic to study landfill conservation through the utilisation of incineration ash, as well as the sustainable design of, and value recovery from, plastics.

**Closing the Food-Water-Energy Loop**

Food, energy and water are intricately connected, especially in Singapore. For instance, combustion of food waste is inefficient due to high water content leading to thermal losses. Dehydration of food waste may increase efficiency during the incineration process, but this inevitably results in an energy penalty. The Energy Market Authority (EMA) reported that in 2018, WTE generated 1.9 per cent of Singapore's total electricity generation capacity, amounting to 256.8MW out of a total of 13.6GW. This comes from three WTE plants, run by the NEA, Keppel Seghers and Senoko.
The fourth plant, which houses a research facility, was launched in May this year at Tuas South by NTU and the NEA. It can treat 11.5 tonnes of waste daily, with an average of eight tonnes contributed by municipal waste from the NTU campus.

The Public Utilities Board (PUB), Singapore’s water agency, set a target in 2018 to meet future demand by doubling the amount of clean water it produces today by 2060 without using more energy. PUB aims to do this with R&D, and by testing out new technologies such as electro-deionisation which requires less energy than the current method of reverse osmosis. Since 2002 till last year, PUB, its research partners and the National Research Foundation have pumped in S$453 million in 613 water R&D projects, more than three-quarters of which have moved towards full-scale deployment. The government has also posed a goal to water scientists to produce desalinated water with energy use of 1 kilo Watt hour per metre cube (kWh/m$^3$). Overall, the government plans to further spend nearly S$400 million under the Research, Innovation and Enterprise 2020 (RIE2020) Plan towards research and innovation in water, circular economy and climate change and food. Such investments are expected to help Singapore explore greater possibilities across the food-water-energy-waste nexus, achieve new results, and scale up.

The Integrated Waste Management Facility (IWMF) co-located with the Tuas Water Reclamation Plant (TWRP), jointly known as Tuas Nexus aims to close the energy-water loop. Tuas Nexus, which will be completed by 2025 builds on the results of a trial project started in 2016 at the Ulu Pandan Water Reclamation Plant. If current technologies continue to be used, PUB expects this will result in twice as much used water sludge by 2060. Tuas Nexus will combine food waste slurry and used water sludge to be co-digested to produce biogas. The synergistic effects in the co-digestion has been shown to potentially triple biogas production, compared to separate digestion of the two inputs. Biogas could become not only a way to offset around 25 per cent of PUB’s water reclamation plants’ energy requirements with a view to complete energy self-sufficiency, but can potentially also be a larger part of Singapore’s energy mix in the future. Another way to close the food-energy-water loop is to develop cost-effective agro-technologies. This would help increase food production through efficient utilisation of space and water while minimising energy demand and reliance on synthetic chemical and fertiliser inputs. Presently, total of 600 hectares of land in Lim Chu Kang, Murai, Sungei Tengah, Nee Soon, Mandai and Loyang towns are allocated to some 200 farms.

CONCLUSION

Gaps in the food-water-energy nexus have to be bridged through a mix of effective legislation, enhanced infrastructure and changing mindsets. Plugging these gaps will also enhance Singapore’s self-sufficiency and economic security as well.

WHAT TO LOOK OUT FOR

- Upcoming sitting of Parliament which will commence on 2 September when the Resource Sustainability Bill will likely be discussed.
- Subsidiary legislation by the National Environment Agency or Singapore Food Agency that would list prescribed buildings affected by the Resource Sustainability Bill, after it is passed.

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