

Responses to Feedback and Suggestions on Carbon Efficiency in the Power, Waste and Water Sectors (June 2015)

This document was prepared by the Energy Market Authority (EMA), National Environment Agency (NEA), National Climate Change Secretariat (NCCS), and PUB, Singapore's national water agency.

S/N	Suggestion	Response
Power		
1	<p>Deploy more solar power because Singapore gets a lot of sun.</p> <p>Several respondents commented that solar should be used as a 'sub-energy' source instead of a main source because of concerns over reliability and intermittency.</p>	<p>Solar energy remains the most promising renewable energy source for Singapore when it comes to electricity generation. While there are limitations due to the intermittent nature of solar energy and the constraint of available space, Singapore is facilitating the entry of solar. In 2014, Singapore announced plans to raise the adoption of solar power to 350 MWp by 2020. This would be about 5% of the projected peak electricity demand in 2020, which would be a significant increase from the present 33 MWp of installed capacity. EDB is working with key government agencies to aggregate demand for solar deployment across government buildings and spaces via the SolarNova programme.</p> <p>To facilitate the deployment of solar energy, EMA has raised the intermittent generation threshold for solar energy from 350MWac to 600MWac, and made it easier for solar owners to receive payment when they export electricity back to the grid. The Government is conducting technical studies and initiating R&D efforts on areas such as grid reliability and intermittency. EMA has embarked on a test-bed at the jetty area of Pulau Ubin to assess the impact of intermittent energy sources, such as solar, on grid operations.</p>
2	<p>Electric Vehicles (EVs) could provide decentralised energy storage for the grid</p>	<p>This concept is nascent, and its evolution will be dependent on the pervasiveness of EV adoption, the maturity of vehicle-to-grid technologies and the cost-effectiveness of substitutes such as grid-level energy storage systems (e.g. electro-chemical batteries; flywheels; redox flow systems). In Singapore, findings from test-bedding efforts revealed that EVs entail higher costs, and there are technical limitations to address (e.g. limited driving range; battery life; and charging time). These factors will likely affect the rate of EV adoption and the potential for them to provide decentralised storage for the grid.</p>
3	<p>Nuclear reactors could be installed underwater or in neighbouring countries to provide clean energy</p>	<p>The Government's pre-feasibility study concluded that nuclear energy technologies presently available are not yet suitable for deployment in Singapore. However, Singapore needs to continue to monitor the progress of nuclear energy technologies to keep our options open for the future.</p> <p>In order to assess the implications of evolving nuclear energy technologies and regional nuclear energy developments for Singapore, Singapore needs to strengthen our capabilities to understand nuclear science and technology. To support research in relevant areas of nuclear science and engineering, and to train a pool of scientists and experts, the National Research Foundation established the Nuclear Safety and Research Programme (NSREP) in April 2014. The NSREP includes the Singapore Nuclear Research and Safety Initiative (SNRSI) focusing on research and developing capabilities in nuclear safety, science and engineering; and the Nuclear Education and Training Fund (NETF) which will support education and training in these areas.</p>

4	Future energy solutions could include solar satellites to harness solar energy with wireless transmission, advanced biofuels from decay of plastics, wave energy, bioelectric generation from plants	EMA is open to energy options which are technologically feasible and commercially viable. The Government is supporting R&D in a number of advanced energy technologies, including some that have been identified as being particularly suitable for Singapore.
5	Solar thermal projects offer more yield than solar PV and less intermittency issues. Offshore solar projects could be viable in Singapore's relatively calm waters	EMA is open to energy options which are technologically feasible and commercially viable. Solar thermal technologies for electricity generation typically require concentration of solar irradiation, but most of our sunlight is diffused by cloud cover and there is a lack of large open spaces for sizeable concentrating solar power plants. Offshore solar projects can be challenging because our coastal waters are used intensively for port and coastal shipping activities.
6	Better meteorological data and predictive algorithms to match solar energy demand and supply	Government agencies recognise the benefits of better meteorological data and forecasting of output from solar PV systems, and are supporting R&D efforts to develop advanced systems that can help mitigate the effects of variability of solar energy in the tropics. It is also important to work on the use of other technologies and measures such as reserves and storage, and demand management, to ensure that larger scale deployment of solar PV will not compromise the reliability of electricity supply to consumers in Singapore.
7	Introduce subsidies/fines for cleaner/dirtier sources of power generation	Energy is a scarce resource. Singapore does not subsidise electricity generation regardless of its source. This is to ensure that consumers take into consideration the cost of energy, make efficient use of a scarce resource, and avoid wasteful consumption. All power generation plants are also required to adhere to strict environmental regulations for pollution and waste management.
Waste		
8	Change mind-sets to value used goods and to recycle. This could be done through better public education, e.g. targeting the young.	The 3Rs (Reduce, Reuse, Recycle) are a key component of Singapore's waste management system. Apart from conserving resources, it helps to reduce waste sent for final disposal and reduces the need for more waste-to-energy incineration plants and landfills. This is an important consideration in view of land constraints in Singapore. To promote the 3Rs, NEA has introduced various programmes such as the National Recycling Programme, School Recycling Corner Programme, etc. More information can be found at www.nea.gov.sg/energy-waste/3rs . With growing affluence, there may be a higher propensity to purchase new products and dispose of old ones that are still in working condition. Second hand shops and online platforms supporting goods exchange such as those listed at http://www.nea.gov.sg/energy-waste/3rs/collection-centres-for-used-goods offer an alternative for the reuse of consumer products.

		<p>The overall recycling rate in Singapore has increased from 40% in 2000 to 60% in 2014. NEA will continue to promote the 3Rs and has set a target of a 70% recycling rate by 2030. For instance, more recycling bins with more frequent collection have been deployed in all HDB estates and cash-for-trash incentive schemes to encourage recycling are available around Singapore. Centralised chutes for recycling will also be provided in all new HDB developments launched from 2014. All landed homes are provided with recycling bins with weekly instead of fortnightly collection, and weekly garden waste collection for recycling has also been introduced.</p>
9	<p>Make it more inconvenient to use plastic bags, such as through taxation</p>	<p>NEA promotes the practice of the 3Rs (Reduce, Reuse and Recycle). Minimising waste and recovering resources from waste would help to minimise land needed for waste disposal facilities. This means using less disposables, avoiding wastage and practising recycling as much as possible.</p> <p>NEA encourages the use of reusable bags to reduce waste. Therefore, while households may use plastic bags to contain their waste, shoppers are encouraged to decline plastic bags that they do not need and use reusable shopping bags as often as possible. NEA welcomes the efforts of retailers and environmental groups who promote reusable bags to reduce avoidable plastic-bag waste.</p>
10	<p>Provide incentives for recycling (e.g. coupons), or penalties for excessive waste (e.g. charge for waste collection based on weight)</p>	<p>Industrial and commercial premises pay licensed general waste collectors for the collection and disposal of the waste generated, which includes a haulage cost and the disposal fee of \$77 per tonne at the waste-to-energy incineration plants and Semakau Landfill. As such, these premises would be motivated to reduce and/or recycle waste in order to reduce disposal costs.</p> <p>There are also incentive schemes such as Cash for Trash, where residents served by Public Waste Collectors can exchange their recyclables for cash. In addition, NEA is conducting a Save-As-You-Reduce (SAYR) pilot to assess if a usage-based pricing system for waste disposal could encourage residents to reduce waste.</p>
11	<p>Introduce mandatory segregation of waste and recyclables</p>	<p>As some condominiums were not part of recycling collection services provided under the Public Waste Collection scheme, provision of recycling receptacles by condominium management was made mandatory on 1 Nov 2008 to ensure residents in all housing types can recycle their waste.</p> <p>On 1 Apr 2014, mandatory reporting of waste data and waste reduction plans by all large hotels (with more than 200 rooms) and shopping malls (with more than 50,000 sq ft) took effect. This helps build greater awareness among building managers of the potential for improving their waste management systems.</p>
12	<p>Introduce central dishwashing in hawker centres to reduce use of disposables (e.g. chopsticks, plates)</p>	<p>NEA will be implementing central dishwashing in new hawker centres, which have the necessary space available. For existing hawker centres, this will be implemented depending on site considerations.</p>

13	Introduce composting stations or anaerobic digestors to generate biogas from food waste in hawker centres and estates. Composting at home would also reduce household waste	<p>In 2015, NEA will pilot onsite food waste recycling in two hawker centres. A district-level pilot will also be conducted at Clementi, where food waste collected from multiple premises will be sent to an off-site test facility located at the Ulu Pandan Water Reclamation Plant for anaerobic co-digestion with used water sludge.</p> <p>NEA also provides the 3R Fund, a co-funding scheme, to encourage organisations to undertake waste minimisation and recycling projects, including food waste recycling projects.</p>
14	Collect waste cooking oil and convert it into useful products like automobile fuel	There are currently several companies that collect used cooking oil from large generators of used cooking oil for recycling. The used cooking oil is processed at local recycling facilities into biodiesel fuel or exported to overseas recycling facilities.
15	Reduce paper waste through increased technology use (e.g. e-book)	NEA encourages the public to reduce paper waste through the practice of the 3Rs of Reduce, Reuse and Recycle. More corporations have moved towards e-billing and the use of paperless technology has gained wider acceptance as shown by the increased subscription to digital newspapers.
16	More waste disposal locations for electronic products	NEA has been working closely with industry partners and communities to increase public awareness and encourage the recycling of e-waste through voluntary programmes led by industry partners. To provide more convenient e-waste recycling avenues for the community, NEA is launching a national voluntary e-waste recycling partnership programme to bring together stakeholders from the entire e-waste value chain.
17	Increase business-to-business recycling	A gate fee of \$77 per tonne is charged for the disposal of waste at the waste-to-energy incineration plants and Semakau Landfill. The fee encourages businesses to reduce and/or recycle waste to reduce disposal costs and possibly generate revenue from the sale of recyclable material that can be processed into raw material for the manufacture of other products.
18	Reduce food waste through methods such as taxation	<p>The Government is exploring ways to reduce food waste along the food chain. The Agri-Food & Veterinary Authority of Singapore (AVA) collaborates with industry and research institutions to develop technological innovations for post-harvest processing and packaging to reduce post-harvest losses. AVA also promotes testbedding and adoption of innovative technology for food waste reduction and recycling. In September 2014, NEA and AVA commissioned a survey on consumer attitudes and behaviour regarding food waste to formulate strategies to cut food waste. NEA and AVA are also working with the industry to develop good practice guides for food manufacturing and food and beverage (F&B) retail establishments to reduce food waste.</p> <p>In addition, NEA provides support for corporate and ground-up initiatives in food waste reduction by linking up food distribution NGOs with retailers, importers and food manufacturers at various platforms, including the 13th Singapore Packaging Agreement CEOs' Luncheon, and the 3R Awards and Seminar for Hotels.</p>

Water		
19	Heavy water users should submit pinch-analyses of water usage	<p>Since January 2015, it has been mandatory for large water users with water consumption of at least 60,000 cubic meters to install private water meters at various water usage areas within their premises. They will also be required to do an annual submission to PUB on their Water Efficiency Management Plans (WEMPs) for the next 3 years. (http://www.pub.gov.sg/consERVE/WEMP/Pages/default.aspx)</p> <p>Under the WEMP, heavy water users will develop a water balance chart to understand the breakdown of water usage, to help identify areas to reduce consumption and raise efficiency. More advanced approaches such as water pinch analysis could potentially contribute to further improvements in water efficiency management.</p>
20	Introduce new technologies such as distillation of grey water at office or industrial complexes	<p>Technologies for grey water recycling, such as membrane filtration and disinfection, are already available. PUB has also published relevant guidelines “Guidelines for Treated Greywater Quality” (http://www.pub.gov.sg/consERVE/CommercialOperatorsAndOther/Documents/greywaterRequirements.pdf) and “Technical Guide for Greywater Recycling System” (http://www.pub.gov.sg/consERVE/CommercialOperatorsAndOther/Documents/greywaterTech.pdf) to facilitate implementation of grey water recycling.</p>
21	Introduce rain water collection for toilet flushing, watering plants, washing cars, etc	<p>Rainwater harvesting is already allowed. At the national level, PUB carries out rainwater harvesting by channelling the rain that falls on two thirds of the island into our 17 reservoirs.</p> <p>At the local level, PUB allows developers to build rainwater collection systems to collect rainwater for non-potable uses such as toilet flushing, general washing and irrigation of plants, provided that NEA’s guidelines on mosquito prevention are adhered to. For residential estates, rainwater harvesting has been implemented since 2011 in all new BTO public housing blocks in Punggol to encourage the use of non-potable water for the washing of common areas. (http://www.pub.gov.sg/consERVE/CommercialOperatorsAndOther/Pages/AlternateSourceofWater.aspx)</p>
22	A higher water conservation tax, or a tiered tax, would reduce water use	<p>The price of water in Singapore is set to reflect its scarcity value – the cost of producing clean water from the next available source after rainwater collection. Currently, the domestic water tariff has a two-tier structure, with the threshold between the two tiers set at 40 cubic meters per month. A higher price is charged for the second tier to discourage excessive use. Customers will enjoy savings from a lower water bill if they can reduce their water consumption. (http://www.pub.gov.sg/general/Pages/WaterTariff.aspx)</p>
23	Subsidies for below-average water use, benchmarked against other households in the block.	
24	Better education to instil water conservation values	<p>PUB works with all stakeholders to instil water conservation values. For example, PUB works with MOE to incorporate water-related issues (e.g. Singapore’s water supply strategy, water conservation, stormwater management, ABC Waters programme, etc.) into the school syllabus. Water conservation is one of the topics covered in the Secondary 1 Humanities and Primary 3 Social Studies syllabi. Students in Primary 5 – 6 learn about topics like the water cycle, pollution & conservation in their Science syllabus.</p>

		<p>At the wider community level, PUB has extensive outreach efforts on water conservation. Under the umbrella programmes of the 10-Litre and 10% Challenge (for the domestic and non-domestic sector respectively), outreach efforts are used to raise awareness and enhance the capability of water users to improve their water efficiency. These include initiatives that leverage on mass media and social media platforms (e.g. TV commercials and radio jingles; tips, teasers and contests on popular platforms like Facebook and Instagram) as well as roadshows in malls and educational institutions, and events such as Singapore World Water Day to spread the water conservation message.</p> <p>Initiatives such as the Water Efficiency Management Plan, Water Efficient Building Programme, Water Efficiency Manager course and regular water-saving advisories also help various industries to be water efficient in their operations.</p> <p>http://www.pub.gov.sg/conserve</p>
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