

Singapore's Drive towards Energy Efficiency: Policies for a Low Carbon Future

Melissa Low and Su Bin

SYNOPSIS

Singapore has attained economic success and along with it the enhancement of its living environment. The country's success was and will continue to be underpinned by economic growth. The policies and measures Singapore has adopted are forward-looking, and aim to guide how the country views and conserves precious energy resources. New policies such as a carbon tax and enhancements to the Energy Conservation Act continue to shape positive choices in the industry, transport, and household sectors as well as catalyse demand for efficient and clean energy services. This policy brief provides an overview of Singapore's energy efficiency policies that are targeted at incentivising companies to be more efficient and to pursue green growth opportunities.

KEY POINTS

- Given Singapore's lack of access to alternative energy, energy efficiency is its primary strategy to reducing emissions.
- For Singapore to achieve its 2030 mitigation target while sustaining economic growth, it should do so in a cost-effective way by investing in energy efficiency technologies and fuel switching in demand technologies.
- Energy-related incentives and grant schemes were recently consolidated under a single fund known as the Energy Efficiency Fund to support companies in identifying and undertaking energy efficiency retrofits.
- A series of measures targeting the industry and power sectors, including the tightening of energy monitoring and reporting requirements for large industrial energy users, and plans for a carbon tax starting in 2019, signal a shift away from business as usual.

INTRODUCTION

Singapore is a 719km² low-lying island state that lacks conventional energy resources. With a population of 5.54 million in 2015, it currently contributes around 49 million tonnes (Mt) CO₂-equivalent, or 0.11 per cent of global greenhouse gas (GHG) emissions. In its Climate Action Plan released in July 2016, the government devised four strategies to achieve a sustainable and vibrant low carbon economy: improving energy efficiency, reducing carbon emissions from power generation, developing and demonstrating cutting-edge low-carbon technologies, and through the collective action of the government, individuals and businesses.

Singapore has participated actively in international climate change negotiations to

discuss and develop a universal agreement on GHG mitigation to prevent further anthropogenic interference with the climate system. In 2015, building on its earlier commitment announced in 2009 to reduce emissions by 16 per cent from business-as-usual (BAU) levels, Singapore pledged to reduce its Emissions Intensity (EI, or GHG emissions per unit of GDP) by 36 per cent from 2005 levels by 2030, and stabilise emissions with the aim of peaking around 2030. Meeting these ambitious targets require combined efforts by the government, businesses, households, and individuals in improving energy and carbon efficiency across all sectors. Early policies to improve energy efficiency include switching from fuel oil to natural gas – the cleanest form of fossil fuel – for power

generation. Studies suggest that around 7.6 Mt-CO₂ emissions abatement in the past decade can be attributed to this switch. Today, about 95 per cent of Singapore's electricity is generated from natural gas. Singapore also prices energy at market cost without subsidies to encourage households and businesses to judiciously use energy. With these policies in place in the last decade (2000-2010), Singapore's GDP increased by 76 per cent, but its carbon emissions increased by only 18 per cent. This translates to a reduction in the emission intensity of 33 per cent from 2000 to 2010.

ANALYSIS

Government Incentives and Funding Support

By incentivising companies to pursue green growth opportunities, the country is in fact raising its workforce's productivity levels and enabling a more efficient use of resources and at the same time decoupling economic growth with GHG emissions. Energy-related incentives and grant schemes introduced since 2009 include the Design for Efficiency (DfE) Scheme; Energy Efficiency Improvement Assistance Scheme (EASE); Grant for Energy Efficient Technologies (GREET); Singapore Certified Energy Manager (SCEM) Training Grant; and Energy Efficiency Financing (EEF) Scheme. These schemes help defray company costs in integrating resource efficiency plans, honing energy management skills, and investments in infrastructural or technical improvements.

In July 2013; mindful of potentially harmful impact on smaller corporations, a National Small and Medium-Sized Enterprise Energy Efficiency (SME-EE) Initiative was announced, with S\$17 million set aside to help some 300 SMEs achieve at least 10 per cent savings in energy costs over three years by covering costs associated with the initial energy audit, setting up of an Energy Monitoring System, implementation of efficiency projects, and leadership training.

From 3 April 2017, these schemes and initiatives have been consolidated under a single fund known as the Energy Efficiency Fund (E2F) to better support companies (SMEs included) in identifying and undertaking energy efficiency retrofits.

Enhanced Monitoring through the Energy Conservation Act

In 2012, Singapore introduced the Energy Conservation Act to consolidate laws on energy efficiency under one Act. The Act, which came into effect on 22 April 2013, requires industrial companies that use 54 or more Terajoules (TJ) of energy per year to appoint an energy manager; monitor and report energy use and GHG emissions; and submit energy efficiency improvement plans annually. This is part of the Government's plan to introduce minimum energy management standards for the industry sector, and is a step towards setting a baseline for Singapore's energy consumption. Overall, this move to conserve energy in the industry sector has provided impetus for large industrial consumers of energy to increase energy efficiency through the implementation of more rigorous energy management practices.

Under its Climate Action Plan, Singapore boldly set out to achieve improvements in energy efficiency in the manufacturing sector by one to two per cent a year between 2020 and 2030. Singapore's industry sector accounted for 59 per cent of the country's GHG emissions in 2012; the petroleum refining, chemicals, and semiconductor sectors formed the majority of these emissions. An energy efficiency study in 2014 commissioned by the National Climate Change Secretariat (NCCS), together with the Ministry of Trade and Industry and Ministry of Environment and Water Resources, and conducted by ICF International with the Economic Development Board and National Environment Agency as lead agencies, found potential for further energy savings of about 20 per cent by 2030 within the industry sector.

As a result, amendments to the Energy Conservation Act (the Bill was introduced on 9 March 2017 and passed on 3 April 2017), will include tightening of energy monitoring and reporting requirements for large industrial users of energy, as it looked into areas where carbon emissions can be further reduced. It is expected that with more accurate data, companies will be able to incorporate energy and fuel efficiency considerations early in their decision-making processes. This will help lower electricity and fuel usage, and ultimately provide companies with cost savings.

Energy Efficiency Roadmaps and R&D Studies

To address Singapore's energy and climate change challenges, the government places importance on accelerating research for deployment of energy efficient and low carbon technologies. To this end, Technology Roadmaps were commissioned by the NCCS and the National Research Foundation, and was published between July 2014 and June 2016.

For the power sector, as the bulk of electricity is produced by natural gas, carbon intensity for electricity, i.e. the average emissions per kWh of electricity produced, has already reached a level where there is little opportunity for further reduction in the short-term. The Solar Photovoltaic (PV) Roadmap identified solar PV as the most feasible source of alternative energy to be introduced into Singapore's energy mix. In 2014, Singapore announced plans to raise the adoption of solar power to 350 MWp by 2020, equivalent to about five per cent of the projected peak electricity demand. Since the announcement was made, solar PV installed capacity increased from 19MWp to 125MWp, over 1.5 per cent of Singapore's total electricity needs. However, the main challenge for a large-scale deployment of PV energy conversion in Singapore is to master the reliable integration of solar PV into the grid, despite its high variability and limited spatial distribution of system installations.

For the manufacturing industry, the Industry Energy Efficiency Roadmap identified Singapore's manufacturing sector as an important part of the economy, contributing to around 20 per cent of its GDP, and employing a fifth of its workforce. It also has strong linkages with the service sector. The manufacturing sector is also expected to account for about 60 per cent of Singapore's projected 2020 GHG emissions. Given the lack of access to alternative energy, energy efficiency is the primary strategy to reducing emissions. A total of 30 emerging and next generation technologies were identified to have technical potential energy savings of 5.7 per cent in 2030. This is in addition to a technical potential energy savings of 13.1 per cent from best available technologies (BAT) currently not utilised in industry. The corresponding potential 2030 emissions reduction from

emerging and next generation technologies is estimated to be 6.2 per cent, and 14.2 per cent from BAT.

In the transport roadmap, electrification of Singapore's vehicle fleet was identified as the best measure to reduce energy and carbon intensity. Electro-mobility deployment, which refers to the introduction of greener modes of transport such as electric vehicles (EVs), is underway in Singapore, as the country lays the infrastructure to become a green-car and car-lite society. The government in collaboration with the Bolloré Group, recently announced plans to launch an EV car-sharing programme by mid-2017, with the deployment of EVs in every Housing & Development Board estate by 2020, to allow as many residents as possible to enjoy car-sharing facilities.

For the building sector, the Building Energy Efficiency Roadmap highlighted that buildings (including residential and non-residential) are responsible for around half of Singapore's electricity consumption. Under the Building Control Act of 2013, all new and existing post-retrofit buildings are required to undergo Green Mark certification, a benchmarking scheme administered by the Building and Construction Authority which incorporates internationally recognised best practices in environmental design and performance. Buildings are required to undergo auditing of their cooling systems every three years, and to submit energy consumption and related data regularly. However, the potential for improving building energy efficiency has not been fully realised due to a lack of systematic evaluation of the different motivations towards adoption of technologies.

To complement the Technology Roadmaps, an energy modelling study undertaken by the Energy Studies Institute last year found the most cost effective way for Singapore to achieve its 2030 mitigation target is to invest in energy efficiency technologies, and fuel switch in demand technologies; where fuel oil is directly combusted to meet heating needs, e.g. in boilers. It is expected that a switch to cleaner fuels such as natural gas can decrease carbon emissions from heating processes by about 25 per cent. The study also found that the largest abatement potentials come from the industry and power sectors.

Implementing Market Mechanisms

Besides energy efficiency measures, the government plans to use market mechanisms to push through its energy efficiency objectives. In his Budget speech in Parliament on 20 February 2017, Singapore's Finance Minister, Mr. Heng Swee Keat announced plans to introduce a carbon tax on large direct emitters of GHGs such as power stations, and the refining and petrochemical industry from 2019. The tax will cost between S\$10 and S\$20 per tonne of emissions, which is in the range of similar carbon tax rates around the world and is expected to affect around 40 emitters that are currently operating in Singapore.

A carbon tax will enhance Singapore's existing and planned mitigation efforts under the Climate Action Plan, and stimulate clean technology and market innovation. As the carbon tax is targeted at large GHG emitters, it is hoped that the price signal will incentivise companies to consider the cost of their emissions in business decisions, and improve their energy efficiency and innovation. The government is also examining the potential implications of the carbon tax that's being passed on to consumers, so as to avoid adversely impacting lower-income consumers and widening the inequality gap.

CONCLUSION

A robust and vibrant economy is dependent on a reliable and constant supply of energy. Singapore has strived to improve energy efficiency all sectors. In the last decade, energy efficiency improvement, especially in the manufacturing industry, helped reduce around 19.1 Mt-CO₂ in emissions. To achieve the 2030 mitigation target, more than 50 per cent of the abatement will have to come from energy efficiency improvements across various sectors. Most measures in place today are expected to reduce energy costs for businesses and households. But like all countries, Singapore's physical, economic, and social environment will continue to evolve, and it will need to address new challenges that arise, including dealing with climate change, while ensuring economic growth, environmental sustainability, and energy security.

In order to tap on substantial opportunities for green growth, the government must continue to work with research and business

communities, invest in R&D, and carry out extensive test beds in order to develop and deploy clean and innovative technologies aimed at addressing climate change.

WHAT TO LOOK OUT FOR

- Findings from the industry and public consultations on the newly introduced carbon tax held from 20 March to 20 April 2017.
- Full Retail Competition (FRC) in the retail electricity market by end 2018, allowing 1.3 million households to choose if they want to remain on the regulated tariff or switch to buy electricity from retailers.
- Further integration of solar PV into the main grid through the management of intermittency into the main grid, which could help reduce Singapore's reliance on natural gas for power generation.

Melissa Low is a Research Fellow at the Energy Studies Institute, National University of Singapore.

Su Bin, PhD is a Senior Research Fellow at the Energy Studies Institute, National University of Singapore.

Key words: Singapore, Energy Efficiency, Low Carbon, Energy Conservation Act

This is a revised and abridged version of a book chapter published in Khasru, S. M. (ed) *Energy Efficiency: Prevalent Practices & Policy Perspectives*, 1st ed. Vol. 1, The Institute for Policy, Advocacy, and Governance (IPAG), Dhaka, March 2017.

The views and opinions expressed in the *ESI Policy Briefs* are those of the authors and do not necessarily represent or reflect the views of the Energy Studies Institute, NUS.

Copyright © 2017 Energy Studies Institute. *ESI Policy Briefs* can be reproduced, provided prior written permission is obtained from ESI, the content is not modified without permission from the author(s), and due credit is given to the author(s) and ESI. Contact: Ms Jan Lui <esilyyj@nus.edu.sg>