CLIMATE CHANGE STRATEGY AND CARBON PRICING

Consultation paper

20 March 2017

The closing date for the submission of comments and feedback is 20 April 2017.

Contents

Aim

1 The National Climate Change Secretariat, Strategy Group (NCCS) is carrying out a public consultation on the proposed plan to introduce a carbon tax in Singapore from 2019. The consultation period will last 1 month from 20 March to 20 April 2017.

Background

2 Climate Change and Singapore

2.1 Climate change is the large-scale, long-term shift in the earth's weather patterns, and is caused by rising levels of greenhouse gases (GHG)[1] in the earth's atmosphere. This has led to higher temperatures, and changes in weather patterns globally. This is expected to worsen if GHG emissions from human activities are left unchecked. All countries will be affected, and Singapore, as a low-lying island state, is vulnerable. Temperatures are projected to rise in Singapore by 1.4 – 4.6°C towards the end of this century, alongside more extreme weather events and rising sea levels. This poses a threat to public health, as higher temperatures create prime conditions for mosquitoes to breed and viruses to replicate faster, encouraging the transmission of mosquito-borne diseases such as dengue. Higher temperatures also increase the risk of heat-induced illnesses, such as heat exhaustion or heat stroke.

3 International Commitments

3.1 Singapore ratified the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) on 21 September 2016 and was among the first 55 Parties to do so. The Agreement entered into force on 4 November 2016. As of 16 March 2017, 135 parties accounting for around 82% of global emissions have ratified the Paris Agreement. Singapore supports these efforts and has pledged to reduce our emissions intensity[2] by 36% from 2005 levels by 2030, and to stabilise our emissions with the aim of peaking around 2030.

Singapore's Efforts to Address Climate Change

4 Singapore's Mitigation Strategies

4.1 Due to our early actions, such as switching from fuel oil to natural gas – the cleanest form of fossil fuel – for 95.3%[3] of our electricity as of 2015[4], Singapore is

[1] Carbon dioxide accounts for the majority of GHG emissions globally and in Singapore. Other GHGs include methane, nitrous oxide, and fluorinated gases.
[2] Emissions Intensity refers to GHG Emissions per dollar of GDP
[3] Source: Singapore Energy Statistic 2016
[4] In 2000, natural gas accounted for around 19% of Singapore's fuel mix.

among the 20 least carbon-intensive countries[5]. Our small size, urban density, low wind speeds, relatively flat land, and lack of geothermal resources present serious difficulties in pursuing alternative energy options such as nuclear, hydro-electric, wind or geothermal power.

4.2 Given the challenges faced, Singapore's Climate Action Plan[6] sets out four strategies to achieve our pledge: (i) improving energy efficiency, (ii) reducing carbon emissions from power generation, (iii) developing and deploying cutting-edge low-carbon technologies, and (iv) encouraging collective action among government agencies, individuals, businesses, and the community.

Q1 How can we improve the strategies outlined in Singapore's Climate Action Plan to better achieve our 2030 pledge?

5 Energy Efficiency as a Key Strategy

5.1 Energy efficiency means using less energy to produce the same amount of output. It not only helps to reduce GHG emissions, but also lowers costs, increases business competitiveness, and enhances energy security. In particular, significant energy efficiency opportunities have been identified for the industry sector, which accounted for 59% of Singapore's emissions in 2012. Currently, Singapore's energy efficiency improvement rate in the industry sector is 0.6% annually[7]. The government plans to work with the manufacturing sector industries to achieve energy efficiency improvement rates similar to the 1% – 2% achieved in leading developed countries such as Belgium and the Netherlands. This will be done through a mix of regulation, incentives, capability development and carbon pricing.

Q2 What can be done to encourage greater energy efficiency?

Carbon Pricing Policy

6 Rationale to Price Carbon

6.1 Placing a price on carbon will complement Singapore's existing and planned efforts to reduce emissions and increase energy efficiency. It can also stimulate clean technology and market innovation.

[5] Source: IEA Key World Energy Statistics, 2015. Comparisons based on available carbon emissions per US$GDP data

[6] More information on Singapore's Climate Action Plan can be found at: https://www.nccs.gov.sg/resources/publications

[7] Based on data from the Energy Conservation Act, companies in Singapore only managed to achieve 0.6% energy efficiency improvement in 2015.

6.2 First, it will create a price signal to incentivise emitters to change their behaviour and reduce emissions. Currently, emitters in Singapore do not face a cost in releasing GHG emissions, which contribute to climate change and negatively impacts current and future generations. With a carbon price, emitters will have to factor in the cost of their GHG emissions in their business decisions. This will allow companies to reduce emissions and energy consumption in a manner that makes the most economic sense to them.

6.3 Second, a carbon price will help Singapore to reduce emissions in the most cost-efficient manner. In the absence of a carbon price, Singapore will need to rely more on regulations, amongst other measures, to reduce emissions. This is likely to be more costly and disruptive to companies than a carbon price.

6.4 Third, a carbon price will encourage demand for renewables and technological innovation in energy efficiency and clean energy. This will create more green growth opportunities in Singapore and abroad, as the global economy transitions towards becoming more resource-efficient and sustainable. Many jurisdictions with a carbon price have managed to reduce their emissions while maintaining economic growth, promoting green growth and reaping environmental benefits (details in Annex A).

Q3	**How can we harness green growth opportunities in Singapore and the region?**

7 Different Forms of Carbon Pricing

7.1 Broadly, carbon pricing can take on two forms: (i) a carbon tax, or (ii) a cap-and-trade.

(i) Under a carbon tax, the government sets the price that has to be paid for each unit of GHG emissions. This system has been implemented in the UK, British Columbia (Canada), Japan, South Africa, Sweden, Switzerland, etc.

(ii) In a cap-and-trade system, the government sets a cap on the total amount of GHG emissions allowed within the jurisdiction and issues an equivalent amount of permits. Covered emitters must obtain and surrender permits, equivalent to their GHG emitted, to the government. The market will determine the price for permits. This system has been implemented by the European Union, California (USA), 9 North-eastern states (USA), Ontario (Canada), Quebec (Canada), Tokyo (Japan), parts of China, and New Zealand.

For a small domestic market like Singapore, a carbon tax could be simpler to implement than a cap-and-trade. It provides greater price certainty and stability.

7.2 Singapore remains open to linking our proposed carbon tax framework to external carbon markets where feasible. We participate at the UNFCCC to discuss, amongst others, the development of international carbon market rules. The use of international carbon credits is one of the issues being studied. Discussions to further existing trading mechanisms are at a preliminary stage, and it is premature to determine how international carbon markets will evolve. We will monitor and make contributions to these international developments.

Q4	**How can a carbon pricing policy be designed to encourage greater energy efficiency in the industry sector?**
Q5	**How do you think international carbon markets will evolve and what can Singapore do to tap on opportunities in carbon trading?**

8 Enhancing Energy Efficiency for Businesses and Households

8.1 Singapore is looking at a carbon tax rate of $10-$20 per tonne of carbon dioxide-equivalent GHG emissions ($10-20/t$CO_2$e). The final tax rate to be decided needs to provide a sufficient price signal to incentivise behavioural change and energy efficiency improvement. At the same time, it has to maintain Singapore's international competitiveness.

8.2 The carbon tax will generally be applied upstream, for example, on power stations and other large[8] direct emitters.

Businesses

8.3 A carbon tax of $10-20/t$CO_2$e could increase operating costs equivalent to a 6.4% to 12.7% increase in current oil prices. This is within the historical quarterly oil price fluctuations which have ranged from -29% to +35% from 2011 to 2016. Companies are encouraged tap on existing initiatives to increase industrial energy efficiency. These include the Productivity Grant (Energy Efficiency), the Design for Efficiency scheme, the Energy Efficiency Improvement Assistance Scheme, and the Energy Efficiency Financing Pilot, which can help to support companies' energy efficiency plans (details in Annex B). The government will continue to enhance existing schemes, provide capability building, and study other modes of assistance to help businesses with the transition.

[8] For stationary emissions, government is looking at a proposed threshold of 25,000 tCO_2e of GHG emissions annually. This is equivalent to emissions produced by the annual electricity consumption of 12,500 HDB 4-room households. Based on current data, there are around 30 to 40 such large direct emitters.

8.4 Companies will need to comply with the emissions measurement, reporting and verification (MRV) system. This is to ensure that the data collected is robust, to facilitate the implementation of the carbon tax. The government seeks to introduce an MRV system that provides a reasonable level of assurance whilst minimising compliance cost for companies. This will be done by leveraging on current systems, such as the Energy Conservation Act (ECA). The ECA requires energy intensive companies to measure and report energy use and GHG emissions annually. Most of these energy intensive companies are already complying with ECA regulations using international standards like the ISO, which will be used as a reference to develop the MRV system. The carbon tax would be implemented from 2019, to provide sufficient time for companies to understand the new carbon tax requirements, develop monitoring and reporting plans, and put in place systems, processes, and capabilities to comply with them.

Households

8.5 For households, the impact is likely to be modest. A carbon tax of \$10-20/tCO_2e is similar to an increase in current electricity prices of 2.1% to 4.3%[9]. For comparison, quarterly electricity prices have fluctuated up to 10% between 2010 and 2016. The impact is within historical electricity price fluctuations. For an average household living in a 4-room flat paying \$72 per month in electricity bills, the carbon tax translates to an increase of \$1.70 to \$3.30 per month. We hope that more households can adopt energy efficient practices. For example, purchasing a 3-tick instead of a 1-tick fridge and using a thermos flask instead of an electric air-pot is estimated to save \$5 and \$18 per month respectively.

Q6	**Is the price signal of \$10-20/tCO_2e adequate to achieve its intent of encouraging large emitters to lower its emissions?**
Q7	**What more can businesses do to drive improvements in energy efficiency and the adoption of clean energy? What prevents businesses from doing so on their own today?**
Q8	**What capabilities would companies need to build to adopt the MRV processes and manage their GHG emissions?**
Q9	**What can households do to be more energy efficient? What prevents them from doing so?**

[9] Singapore Power's Q1 2017 electricity tariffs for households is 20.20 cents per kWh.

Summary of Feedback Sought

9 Designing a carbon pricing policy will require guidance from all stakeholders. NCCS invites views and comments on the following:

Singapore's Mitigation Strategies

Q1 How can we improve the strategies outlined in Singapore's Climate Action Plan to better achieve our 2030 pledge?

Energy Efficiency as a Key Strategy

Q2 What can be done to encourage greater energy efficiency?

Rationale for Carbon Tax

Q3 How can we harness green growth opportunities in Singapore and the region?

Different Forms of Carbon Pricing

Q4 How can a carbon pricing policy be designed to encourage greater energy efficiency in the industry sector?

Q5 How do you think international carbon markets will evolve and what can Singapore do to tap on opportunities in carbon trading?

Enhancing Energy Efficiency for Businesses and Households

Q6 Is the price signal of $10-20/t$CO_2$e adequate to achieve its intent of encouraging large emitters to lower its emissions?

Q7 What more can businesses do to drive improvements in energy efficiency and the adoption of clean energy? What prevents businesses from doing so on their own today?

Q8 What capabilities would companies need to build to adopt the MRV processes and manage their GHG emissions?

Q9 What can households do to be more energy efficient? What prevents them from doing so?

Next Steps

10 Please send your submissions by:

(i) Email to: NCCS_Contact@nccs.gov.sg

(ii) Fax to: +65 6430 0601

(iii) Post to:

55 Newton Road, #13-04/05 Revenue House, Singapore 307987

11 Kindly note that submissions should be accompanied with a valid email address for NCCS to acknowledge receipt of submissions electronically. All submissions must reach us by 20 April 2017, 2359hrs.

12 NCCS reserves the right to make public all or parts of any written submissions made in response to this consultation paper, and to disclose the identity of the source. Any part of the submission, which is considered by respondents to be confidential, should be clearly marked and placed as an annex. NCCS will take this into account regarding disclosure of the information submitted.

Annex A

BENEFITS OF CARBON PRICING

A carbon price is one of the least costly ways to reduce emissions. According to several Organisation for Economic Co-operation and Development (OECD) studies[10], a carbon price achieves more emissions reduction per dollar spent than other measures such as regulations, based on experience in jurisdictions which have implemented carbon pricing. One OECD study[11] found that reducing carbon emissions in the electricity sector using carbon market mechanisms cost \$15-45/tCO_2e. If other policy instruments such as regulations or subsidies are used, the abatement cost would be much higher at between \$75-265/tCO_2e. This is because a carbon price incentivises emissions reduction when and where it makes economic sense.

Studies have shown that many jurisdictions with a carbon price have managed to reduce their emissions while maintaining economic growth, promote green growth, and reap environmental benefits (see table below).

Countries achieving environmental benefits while maintaining economic growth with carbon pricing

Benefit	Jurisdictions	Evidence
Reduces emissions while maintaining economic growth	EU	• Between 2005 and 2014, the sectors covered by emissions trading have reduced their emissions by 13%.[12,13] • In particular, UK, Belgium and the Netherlands reduced their overall emissions by 8-28% while maintaining GDP growth of around 10-16% over the same period.[14] • Despite having one of the highest carbon price, Sweden's economy grew by almost 30% between 2000 and 2012 while emissions fell by 16%. Renewable energy

[10] OECD (2013). *Effective Carbon Prices*. http://www.oecd.org/env/tools-evaluation/effective-carbon-prices-9789264196964-en.htm
[11] Climate and Carbon: Aligning prices and policies, OECD, October 2013.
[12] World Resources Institute (2016). *Putting a Price on Carbon: Reducing Emissions*. https://www.wri.org/sites/default/files/Putting_a_Price_on_Carbon_Emissions.pdf
[13] European Commission (2016). *Implementation of the Effort Sharing Decision*. https://ec.europa.eu/clima/policies/effort/implementation_en
[14] European Commission (2016). *EDGAR database*. CO_2 time series 1990-2015 per region/country. http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2015

Benefit	Jurisdictions	Evidence
		reached 52% of electricity production in 2014 compared to 39% in 2004.[15]
	US Regional Greenhouse Gas Initiative (RGGI)	• Between 2005 and 2013, the RGGI states reduced CO_2 emissions from the power sector by more than 40%, while the regional economy grew by 8%.[16]
	British Columbia (Canada)	• Fuel consumption per capita in British Columbia declined 17% in 2016 compared to 2007, the year prior to implementation. Correspondingly, the GDP grew by 26% between 2011 and 2015.[17] • Between 2008 and 2013, GHG emissions reduced by 6.1%, while the rest of Canada's emissions increase by 3.5%.[18]
	California	• During the first year of operation (2013), emissions from covered companies decreased by 3.8% while the state's GDP grew by more than 2%. In 2013 and 2014, California's job growth of 5.4% (900,000 new jobs) outpaces the national average of 1.8%.[19,20]
	Tokyo	• Achieved a 23% reduction below baseline emissions for 2013, 4 years after the introduction of the Tokyo Cap-and-Trade program. In the same period, Tokyo's GDP grew around 7.4%.[21,22]

[15] World Bank (September 18, 2014). *What Does Carbon Pricing Success Look Like? Ask These Leaders*. http://www.worldbank.org/en/news/feature/2014/09/18/what-does-carbon-pricing-success-look-like-ask-the-leaders
[16] International Carbon Action Partnership (2016). *Emissions Trading Worldwide: ICAP Status Report 2016*. https://icapcarbonaction.com/en/status-report-2016
[17] British Columbia government (2016). *The British Columbia Economic Accounts*: http://www.bcstats.gov.bc.ca/StatisticsBySubject/Economy/EconomicAccounts.aspx
[18] Clean Energy Canada (2015). *How to Adopt a Winning Carbon Price*. http://cleanenergycanada.org/work/adopt-winning-carbon-price/
[19] Environmental Defense Fund (2016). *California's carbon markets is a big success. Here are the facts* [blog post]. https://www.edf.org/blog/2016/08/26/californias-carbon-market-big-success-here-are-facts
[20] Environmental Defense Fund (2014). *Carbon Market California*. https://www.edf.org/sites/default/files/content/carbon_market_california_year_two_executive_summary.pdf
[21] International Emissions Trading Association (IETA) (2015). *Tokyo: An Emissions Trading Case Study*. http://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/tokyo_case_study_may2015.pdf
[22] Tokyo Cabinet Office (2017). *Annual Report on National Accounts for 2015*. http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2015/pdf/point20161222e.pdf

Benefit	Jurisdictions	Evidence
Promotes green growth	EU	• The EU-ETS increased low carbon patenting of regulated firms by 10% compared to otherwise similar firms.[23]
	US Regional Greenhouse Gas Initiative (RGGI)	• During the first three years of operation (2009-2011), the RGGI program was generating net economic benefits of US$1.6 billion, fueled by US$1.3 billion in consumer energy savings, and led to over 16,000 new job years.[24,25]
	California	• The state boasts about 500,000 green jobs, including more than 50,000 in the solar energy sector, and there has been a steady growth over the past decade with clean energy jobs doing well through the recovery. About 24% of California's green jobs are in manufacturing, jobs that are generally recognised as better-paid work.[26]
	Sweden	• Carbon pricing (since 1990s) and other fuel taxes have made renewables cost-competitive. Sweden now derives 86% of its electricity from hydroelectric power and nuclear plants.[27]
Creates co-benefits from reduction in hazardous air pollutants	US Regional Greenhouse Gas Initiative (RGGI)[28]	• Between 2009 and 2013, the reduction in sulphur dioxide, nitrogen oxide and mercury in RGGI states has led to an estimated US$10.4 billion in health savings from avoided illness, hospital visits, lost work days and premature deaths.[29]

[23] European Commission (2015), *Study on the Impacts on Low Carbon Actions and Investments of the Installations Falling Under the EU Emissions Trading System*, p. 174.
https://ec.europa.eu/clima/sites/clima/files/ets/allowances/docs/report_low_carbon_actions20150623_en.pdf
[24] IETA (2015). *Tokyo: An Emissions Trading Case Study*.
[25] Regional Greenhouse Gas Initiative (RGGI) (2015). *Investment of RGGI Proceeds through 2013*.
http://www.rggi.org/docs/ProceedsReport/Investment-RGGI-Proceeds-Through-2013.pdf
[26] US Energy Innovation (2015). *The California Climate and Clean Energy Policy Story*. http://energyinnovation.org/wp-content/uploads/2016/11/CA_LowCarbonStory.pdf
[27] IEA statistics (n.d.). *Sweden: Electricity and Heat for 2012*.
http://www.iea.org/statistics/statisticssearch/report/?year=2012&country=sweden&product=ElectricityandHeat
[28] International Carbon Action Partnership (ICAP) (2016). *Benefits of Emissions Trading*.
https://icapcarbonaction.com/en/?option=com _attach&task=download&id=389
[29] Arcadia Centre (2014). *The Regional Greenhouse Gas Initiative: Performance To-Date and the Path Ahead*.
http://acadiacenter.org/wp-content/uploads/2014/05/AcadiaCenter_RGGI_Report_140523_Final3.pdf

Annex B

SCHEMES TO SUPPPORT INDUSTRY ENERGY EFFICIENCY[30]

	Schemes	Description
1	Productivity Grant (Energy Efficiency) *Previously known as Grant for Energy Efficient Technologies (GREET)*.	• Funds up to 30% of qualifying costs for eligible projects by companies in the manufacturing sector. • The grant aims to encourage owners and operators of new and existing industrial facilities to invest in energy efficient equipment or technologies, and achieve measurable and verifiable energy/carbon savings.
2	Energy Efficiency Financing Pilot	• Third party financing scheme to provide up to 100% upfront capital investment to finance energy efficiency projects in the manufacturing sector. • The appointed financing partner to administer up to S$200mil under the pilot is Sustainable Development Capital (Asia) Limited.
3	Design for Efficiency*	• Funds up to 50% of the qualifying cost of the design process, or $600,000, whichever is lower. • Encourages companies to integrate energy and resource efficiency improvements into manufacturing development plans early in the design stage.

[30] Accurate as of 16 March 2017.

	Schemes	Description
4	Energy Efficiency Improvement Assistance Scheme*	• Funds up to 50% of the qualifying cost, at a cap of $200,000 over 5 years. • Encourages companies to carry our detailed studies on their energy consumption and identify potential areas for energy efficiency improvement, through engaging the services of an expert consultant or Energy Services Company (ESCO).
5	One-Year Accelerated Depreciation Allowance for Energy Efficient Equipment and Technology	• Tax incentive to encourage companies to replace old, energy-consuming equipment with more energy efficient ones, and to invest in energy saving equipment. • The capital expenditure on the qualifying equipment can be written off or depreciated in one year instead of three, resulting in less tax paid in the first year.

**These schemes will be consolidated under the Energy Efficiency Fund (E2F) in the future. NEA will be consolidating their existing energy efficiency incentive schemes into a single fund called the E2F. NEA will redesign the E2F to better support companies, including SMEs, to identify and undertake energy efficiency retrofits.*