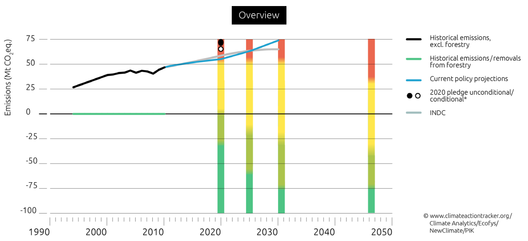
Singapore

Page last updated: 21st August 2015

Rating





Assessment

On 3 July 2015 Singapore submitted its Intended Nationally Determined Contribution (INDC), containing a target to reduce its greenhouse gas (GHG) emissions intensity (total GHG emissions per unit of GDP) by 36% below 2005 levels by 2030 and the aim of peaking its total GHG emissions around the same time. We rate this target "Inadequate," meaning it is not in line with any interpretations of a "fair" approach to hold warming below 2°C: if most other countries followed Singapore's approach, global warming would exceed 3–4°C.

According to our analysis, Singapore will not meet its INDC target under currently implemented policies, but only little more effort is need. The INDC target itself will result in an increase in emissions by 39% above 2010 levels in 2030 (equivalent to an increase of 142% above 1994 levels).

In 2009, Singapore had already pledged to unconditionally reduce its GHG emissions by 7 to 11% below business-as-usual (BAU) levels by 2020. Conditional on the conclusion of a universal legally-binding global agreement in 2015, Singapore would be willing to strengthen this target and reduce its GHG emissions by 16% below BAU by 2020. The BAU scenario assumed back then would have required emissions intensity to grow relative to 2005. This now seems unlikely, due to the changes in the fuel mix for power generation and general improvements in energy efficiency, which have led to a decrease of emissions intensity and the more recent target to reduce emissions intensity by 2030.

Singapore's currently implemented policies have focused on replacing oil and coal with natural gas in the electricity generation sector. However, this strategy has now reached its limits, with more that 95% of the electricity generation being provided by natural gas in 2014. There is no indication of any significant additional measures to reduce the carbon intensity of energy supply. Singapore's climate change strategy focuses on adaptation, as expected, due to its high vulnerability as a low-lying island state.

Singapore is one of the world's largest international navigation and aviation hubs. Emissions associated with these activities are nearly three times as high as domestic emissions and have been rising steeply over recent decades. If we were to include emissions from international navigation and aviation in this assessment, the mitigation measures would have little effect on Singapore's emissions growth.

Pledges and post-2020 contribution

Post-2020 contribution

On July 3, 2015 Singapore submitted its Intended Nationally Determined Contribution (INDC), with a target of reducingemissions intensity by 36% below 2005 levels by 2030 and stabilising emissions, aiming for them to peak around 2030.

We rate this target "Inadequate," meaning it is not in line with any interpretations of a "fair" approach to reach a 2°C pathway: if most other countries were to follow Singapore's approach, global warming would exceed 3–4°C.

Singapore intends to achieve the mitigation objectives under its INDC through domestic efforts, but states that it will continue to study the potential of international market mechanisms, signalling its probable intention to use them to meet its intended target.

The INDC also lists a significant number of actions that Singapore is planning - or already implementing - in relation to climate change adaptation. It is missing a similar listing of actions aiming to reduce GHG emissions.

Convention	
Copenhagen pledge	-7-11% below BAU by 2020 (unconditional) -16% below BAU by 2020 (conditional)
Conditions	Conditional to legally binding international agreement
INDCs	
2030 target	-36% of emissions intensity below 2005 by 2030
Coverage	Economy-wide, all gases covered
Emission peak target	2030
National goal(s)	
Long-term goal(s)	-45% of emissions intensity below 2005 by 2035 (Aspirational goal)

Copenhagen Pledge

Under the Copenhagen agreement, Singapore committed to reduce its emissions by 7-11% below BAU emissions in 2020 unilaterally and, in the event of a legally binding international agreement, by 16% below BAU.

The 7-11% reduction is "domestically funded and unilaterally implemented," and the 16% pledge is conditional on a legally binding international agreement. The National Climate Change Strategy (NCCS) includes several unconditional targets, e.g. 35% reduction in energy intensity (energy use per unit of GDP) from 2005 levels.

Of concern is that the BAU pathway - provided by the government to calculate 2020 emission levels - assumes the emissions intensity of the economy will go in the opposite direction from the historical trend and increase significantly at least until 2020. Emissions intensity between 2000 and 2010 dropped from 0.34 kg CO_2e to 0.23 kg CO_2e per USD (2012) of GDP, the business as usual pathway would signify an increase in emissions intensity to 0.27 kg CO_2e per USD (2012) in 2020.

Fair share

The "Inadequate" rating indicates that Singapore's commitment is not in line with interpretations of a "fair" approach to reach a 2°C pathway. This means it is not consistent with limiting warming to below 2°C unless other countries make much deeper reductions and comparably greater effort. Singapore could strengthen its reduction target to reflect its high capability.

Current policy projections

CAT assessment of Singapore's current policy projections relies on CO_2 emissions projections of the Asia Pacific Energy Research Centre (APERC, 2013), including all the measures in place up to 2012 and on non-CO2 emissions projections from the United States Environment Protection Agency (EPA). We assess Singapore's current policy projections are lower than its 2020 targets but exceed the 2030 target proposed in their INDC. This means that Singapore can achieve its 2020 goal with no additional measures but will require new mitigation policies in order to achieve its 2030 target.

Due to its small contribution to the global emissions but its high vulnerability to the adverse effects of climate change, most of Singapore's climate policies focus on adaptation. In the area of mitigation, Singapore's climate policy is based on three pillars: increasing energy efficiency, fuel switching, and development of renewables.

Increasing Energy Efficiency

Improvement of the energy efficiency across the different sectors of the economy is the backbone of Singapore's mitigation strategy. In its 2012 National Climate Change Strategy (NCCS-2012), the government listed a number of barriers to increase energy efficiency, such as limited availability of capital, lack of information or unwillingness to replace "tried and tested" products.

To deal with these issues the government has introduced grants and tax incentives for energy efficiency investments via the Grant for Energy Efficiency Technologies (GREET). This scheme covers up to 20% of the qualifying costs of an investment, capped at SGD 4 million per project. In 2008 the government introduced environmental sustainability standards for new or retrofitted buildings to further increase energy efficiency. It has also introduced a number of instruments to increase the level of awareness about energy consumption in the residential sector (i.e. Green Mark Scheme) and improve energy management in industry (ISO 500001).

These instruments should have a positive impact on emissions reduction, which is difficult to quantify. However, according to Singapore's third National Communication, the abatement potential of all the energy efficiency measures taken together is expected to be only 1.15 MtCO2e by 2020, and other measures like the ones related to the buildings sector and domestic transport demand are expected to abate 1.21 MtCO2e and 1.16 MtCO2e compared to BAU by 2020 respectively.

Fuel switching

The major trend of Singapore's energy development was to replace oil with natural gas in the power sector. As a result, the consumption of gas has increased six-fold since of the early 2000's. By 2014, more than 95% of Singapore's electricity was provided by gas-fired power plants, an increase from below 70% a decade earlier. The construction of a liquefied natural gas (LNG) terminal clearly signals that Singapore plans to continue using natural gas as its main source of power generation. However, even if the emissions from natural gas are lower than these from oil, the gas liquefaction, transportation and regasification significantly increases the carbon footprint of gas and thus reduces its emissions reduction potential. This needs to be kept in mind, especially since a large share of these emissions will not be counted as originating in Singapore.

Apart from electricity, a large part of Singapore's final energy consumption comes from industrial processes, especially those related to petroleum refinement, where the consumption of oil is closely related to the process itself and cannot be substituted with different forms of final energy, e.g. electricity provided by high-efficiency natural gas-fired power plants.

Development of Renewables

Notably, Singapore's INDC pays little attention to renewable sources of energy. This can be understood by the lack of potential to develop energy sources as there are no suitable sites for hydropower or geothermal installations, wind speeds are low and the small size of the country means limited potential for photovoltaic installations.

However, a further limitation has come with the government's 600 MW cap on solar energy capacity, which is being reviewed by the Energy Market Authority. Solar energy can be beneficial for grid stability by generating electricity on sunny days, when the demand from air conditioning is at its highest. With the decreasing costs and effectiveness of building integrated PV systems, available space should become less of a limitation. Singapore is currently on track to achieve its goal of increasing renewable contribution to cover up to 8% of peak power in 2030 (as stated in the INDC).

Singapore is one of the largest oil refining and oil products trading hubs in the world. About 60% of its final energy consumption is directly related to the petroleum sector. Petroleum refining and trading contributes a large share to Singapore's GDP and the sector is likely to grow over the coming decades, along with the associated GHG emissions. Increases in the overall efficiency of this sector are limited since the associated processes are well known and already highly optimised.

Assumptions

Singapore provided a national greenhouse gas inventory for 1994, 2000 and 2010 and emission projections for 2020 for a business as usual (BAU) scenario. Data for emissions in between 1994 and 2000 was calculated using linear interpolation and emissions between 2000 and 2010 were taken from the figures presented in the Biennial Update Report of the country.

The INDC emissions pathway between 2010 and 2030 was obtained by levelling off emissions (through adjusting the underlying growth rates) to peak in 2030 at levels stated in the INDC (around 65 $MtCO_2e$ in 2030). If GDP projections from state-of-the-art sources (e.g. IMF World Economic Outlook GDP projections until 2020 and an annual GDP growth of 3% until 2030—at the lower bound of the growth between 2014-2020) were used to model 2030 emissions levels resulting from the emissions intensity targets, we estimate that emissions levels in 2030 would be higher (at around 70$MtCO_2e$) than the levels anticipated in the INDC.

Singapore is a city-state with one of the highest population densities in the world and is nearly completely dependent on imports for food. Most of the remaining natural areas are sanctuaries and excluded from agricultural use. We did not consider emissions related to LULUCF as they are negligible.

We excluded emissions from marine and aviation bunkers when calculating the comparability range which determines the rating. These emissions are nearly three times higher than the rest of Singapore's emissions – with the great majority being related to Singapore's role as a hub in international navigation.

Sources

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