

Chapter 1: Context for the modelling

Key points

The evidence that the globe is warming is unequivocal.

There is clear scientific advice that the climate is changing, that greenhouse gas emissions from human activity are a major cause and that we can avoid the worst impacts by reducing emissions.

The Treasury has undertaken a comprehensive modelling exercise using a suite of models comparable to that undertaken in the Government's *Australia's low pollution future: the economics of climate change mitigation* report released in October 2008. The impacts of carbon pricing have been assessed at the international, national, state, industry and household levels.

The analysis provides information on only one element necessary for evaluating climate change policy: the costs of taking action. To form policy judgements, this modelling analysis needs to be evaluated alongside the detailed analysis of the economic and social impacts of climate change itself and the benefits of reducing global emissions.

This report examines different scenarios in which Australia and the world take action to reduce emissions so greenhouse gas concentrations are stabilised at levels that avoid the worst impacts of climate change.

Two international action scenarios, assuming the world takes action to stabilise greenhouse gas concentration levels at around either 550 or 450 parts per million (ppm) by around 2100, provide a credible and realistic backdrop to examine the impact of a domestic carbon price in Australia.

The core and high price Australian policy scenarios assume Australian emissions will face different prices (A\$20 and A\$30) from 1 July 2012, which rise at a fixed rate each year, before the introduction of a flexible price cap-and-trade scheme on 1 July 2015. Australia's emission reduction targets of between 5 and 25 per cent below 2000 levels by 2020 and 80 per cent below 2000 levels by 2050 have been modelled.

This report adds to the large body of analysis that shows the economic cost of taking action to reduce emissions is modest, if action starts sooner rather than later. Delayed action only raises the eventual economic costs.

1.1 The climate change issue

Economic activity is the key driver of global greenhouse gas emissions. Modern industrial society depends heavily on fossil fuels for economic development. As the global economy expands and developing countries grow rapidly, global emissions continue to rise.

As global emissions rise, the stock of emissions in the atmosphere grows. Since the industrial revolution, when fossil fuel combustion began driving economic growth, global atmospheric concentrations of greenhouse gases have increased markedly. Current concentrations of carbon dioxide, the most significant anthropogenic greenhouse gas, are estimated to be around 390 ppm, far exceeding the range estimated over the past 800,000 years (Garnaut, 2011a).

Changes in atmospheric concentrations of greenhouse gases change the global climate system's energy balance. Recent observations of changes in the climate system strengthen the conclusions of the IPCC (Intergovernmental Panel on Climate Change) Fourth Assessment Report (2007a) and the Garnaut Review (2008) that contemporary climate change is indeed real, and is occurring at a rapid rate compared with geological time scales. Climate change is evident from recent observations confirming an increase in average air temperature at the Earth's surface, increase in ocean temperatures, widespread melting of snow and ice, and rising global average sea levels (Climate Commission, 2011).

Emissions of greenhouse gases induced by human activity are the primary factor triggering observed climate change since at least the mid 20th century. The IPCC Fourth Assessment Report attached 90 per cent certainty to that statement; research over the past few years has strengthened the confidence in this statement even more (Climate Commission, 2011).

Climate science projects that warming is likely to drive changes in wind patterns, rainfall, snow and ice cover, extreme weather events (for example, heat waves, floods and intense storms) and increasing acidification of the ocean (IPCC, 2007a).

For Australia, climate change could severely affect agriculture, infrastructure, biodiversity and ecosystems (Garnaut, 2008). Australia's hot and dry climate and economic structure make it particularly vulnerable to climate change and give it a stronger reason to effect a global agreement to mitigate climate change than other developed countries (Pearman, 2008; Garnaut, 2008; and Garnaut, 2011a). For example, more than \$226 billion in commercial, industrial, road and rail, and residential assets is potentially exposed to inundation and erosion hazards at a sea level rise of 1.1 metres (DCCEE, 2011c).

If emissions are left unabated, the global atmospheric concentration of greenhouse gases could reach 1500 ppm, which would result in a 7 or more degree increase in global average temperatures from preindustrial levels. A greenhouse gas concentration of 450 ppm carbon dioxide equivalent (CO₂-e) generally is associated with a 50 per cent chance of limiting the increase in global average temperature to 2 degrees Celsius above preindustrial levels, while 550 ppm CO₂-e is associated with a 50 per cent chance of limiting the temperature increase to 3 degrees Celsius (IPCC, 2007a). With higher levels come increasing risk of greater temperature change and greater impacts on the climate system.

1.2 The policy context

The world is taking action on climate change. Governments in Australia and around the world have implemented a range of climate change mitigation policies (Productivity Commission, 2011). Many others are being considered and developed.

1.2.1 International policy context

The global community has recognised the risks associated with climate change and the need for a coordinated global response. The United Nations Framework Convention on Climate Change established in 1992 has almost global membership, with 192 parties. Since its establishment, steady gains have been made towards the overall objective to stabilise atmospheric concentration of greenhouse gases at a level needed to prevent dangerous climate change.

These negotiations are ongoing and evolving. At Copenhagen in 2009, it was agreed any temperature increase needed to be held to below 2 degrees Celsius above preindustrial levels to prevent dangerous climate change. At Cancun in 2010, developed countries and, for the first time, developing countries pledged to reduce national emissions. Now 89 countries have pledged action, covering over 80 per cent of global emissions and over 90 per cent of the global economy (WRI CAIT, 2011; IMF, 2010; UNFCCC, 2011a and 2011b). These pledges suggest more countries have committed to action earlier than Treasury modelled in the CPRS scenarios in 2008.

To achieve these pledges, many of the world's key economies are introducing or planning emission trading schemes or carbon taxes. Australia's top five trading partners — China, Japan, the United States, the Republic of Korea and India — among others (New Zealand, the United Kingdom, Germany, Italy, France and the Netherlands) have implemented or are piloting emissions trading schemes or carbon taxes at the national, state or city level.

1.2.2 Australian policy context

Australian Government policy on climate change has progressed over many years. As part of considerations around the implementation of the Kyoto Protocol, the government of the day commissioned the Australian Greenhouse Office to do a series of discussion papers from 1999 onwards examining design aspects of a possible emission trading scheme. In 2003, the government considered an emissions trading scheme proposal and in 2007, set up the Prime Ministerial Task Group on Emissions Trading and adopted a policy to introduce an emission trading scheme no later than 2012.

In 2004, state and territory governments initiated the National Emission Trading Taskforce which released a series of discussion papers canvassing scheme design issues between 2005 and 2008.

The Rudd government commissioned The Garnaut Climate Change Review, Treasury modelling and presented the Carbon Pollution Reduction Scheme Green and White Papers through 2008.

The current Government established a number of processes to update and provide additional information to inform climate change mitigation policy. These include the Multi-Party Climate

Change Committee, the Business Roundtable on Climate Change and its working groups, the Non-Government Organisation Roundtable on Climate Change and its working groups, the independent Climate Commission, the Garnaut Climate Change Review update 2011, the Productivity Commission's *Carbon emission policies in key economies* research report; and updated Treasury economic modelling.

In February 2011, the Multi-Party Committee on Climate Change released a proposed architecture for a carbon price mechanism. It outlined the high level design features of the proposed carbon price mechanism, such as the start date, flexibility mechanisms to move between fixed-price and emission trading, sectoral coverage and international linking arrangements.

1.3 Purpose

The purpose of the report is to provide input into the policy-making process and help inform the Australian people of the economic implications of pricing carbon.

This report examines different scenarios in which Australia and the world take action to reduce emissions, so greenhouse gas concentrations are stabilised at levels that avoid the worst impacts of climate change. It updates and expands on the analysis undertaken for the Government's *Australia's low pollution future: the economics of climate change mitigation*, released in October 2008.

While there are many existing studies on the impact of pricing carbon, they usually consider only parts of the Australian economy or results at a high level of aggregation. This report provides a comprehensive and interconnected analysis of the international economy, Australian macroeconomy, industries, sectors and households under different carbon prices.

The analysis provides information on only one element necessary for evaluating climate change policy: the costs of taking action. To form policy judgements, this modelling analysis needs to be evaluated alongside the detailed analysis of the economic and social impacts of climate change itself and the benefits of reducing global emissions; analysis that has been provided elsewhere (Garnaut, 2008; Pearman, 2008; Stern, 2007; OECD 2009; various CCSP studies, 2007). Benefits include the reduced risks of climate change impacts and the lower costs of adapting to the climate change that does occur.

1.4 The structure of this report

The rest of this report has the following structure:

Chapter 2 sets out the report's analytical framework, describing the models and how to interpret the results.

Chapter 3 describes the global action scenarios. They project how the world could evolve, given global action to reduce the impacts of climate change. They provide a plausible back-drop, a starting point for the analysis of carbon pricing in Australia.

Chapter 4 explores the path of the Australian economy without a domestic carbon price. It includes the impact on Australia of the world moving to stabilise greenhouse gas concentrations.

Chapter 5 outlines the impact of different Australian carbon prices. It shows the implications for Australia in terms of the macroeconomic, sectoral and household response to different Australian carbon prices.

Reports commissioned from external consultants are available on the Treasury website at www.treasury.gov.au/carbonpricemodelling.

