Australian Government

Department of the Environment

Australia's Abatement Task and 2013 Emissions Projections

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OVERVIEW

These emissions projections are based on economic and emissions modelling conducted by the Treasury and the former Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE), now the Department of the Environment, for the Climate Change Authority's (CCA) *Targets and Progress Review.* The effect of the Direct Action Plan has not been included, as its final design is currently being developed through green and white paper processes.

The projections of Australia's abatement task presented here reflect these modelling results combined with a recently updated estimate of the surplus emission reductions from the first commitment period of the Kyoto Protocol (carry-over) published in the *Quarterly Update of Australia's National Greenhouse Gas Inventory June Quarter 2013.*

Australia's domestic emissions are projected to reach 685 Mt CO_2-e in 2020, taking into account pre-existing energy efficiency and legislated renewable energy measures.[1] To achieve Australia's emissions target of a five per cent reduction on 2000 levels by 2020, Australia faces a cumulative abatement task of 431 Mt CO_2-e and an abatement task of 131 Mt CO_2-e in 2020.[2]

The cumulative abatement task projection takes into account the ability to use surplus emission reductions achieved in the first commitment period of the Kyoto Protocol and projected abatement resulting from two years of the carbon tax and Carbon Farming Initiative. The abatement task before these factors are considered is presented in the modelling as 591 Mt CO_2-e.

This abatement task has fallen from the projection of 755 Mt CO_2-e published in *Australia's Emissions Projections 2012.* The reduction is mainly attributable to a revised outlook for activity in emissions-intensive sectors of the economy. In addition, the latest projections incorporate a number of important changes from the second commitment period of the Kyoto Protocol, including the adoption of revised global warming potentials (GWPs) and broadened coverage of the land sector, resulting in a net reduction in total emissions.

Despite the moderated emissions growth outlook from previous projections, underlying factors such as population and economic growth underpin a steady increase in emissions. This growth is bolstered by the continued strong demand for Australian energy exports, in particular, the expected significant expansion of the liquefied natural gas (LNG) industry and coal exports.

Growth in domestic emissions is projected to average two per cent per year over the period from 2012 to 2030. This is below the rate of growth projected for the economy, so that the emissions intensity per unit of production in the economy is projected to fall over the period.

[1] The projection does not include estimated abatement for the carbon tax, the Carbon Farming Initiative or new measures under the Direct Action Plan. Abatement from the carbon tax and the Carbon Farming Initiative is included in the cumulative abatement task projection of 431 Mt CO_2-e.
[2] Year references are to financial years ending with the year specified. For example, 2013 refers to 2012-13.

INTRODUCTION

Australia's Abatement Task and 2013 Emissions Projections (the Projections) presents projections and analysis of domestic greenhouse gas emissions out to 2030 prepared for the Climate Change Authority's (CCA's) *Target and Progress Review*. It provides an emissions projection scenario for domestic emissions along with analysis of key sectors including stationary energy (both electricity generation and direct combustion), transport, fugitive emissions from fuel production, industrial processes, agriculture, waste, and land use, land-use change and forestry (LULUCF).

The Projections do not take account of policy measures currently being finalised within the Government's Direct Action Plan. The emissions scenario incorporates updated data from the National Greenhouse Gas Inventory from 1990 to 2012, released in March 2013. More detail about the emissions scenario used in the Projections follows in the *Methodology* section of this report.

These projections use the GWPs from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) as agreed at the 2011 United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties in Durban. Further detail can be found in the *Changes from previous projections* section of this report.

Sectoral analysis and projection of emissions is inherently uncertain, involving judgements about the growth path of global and domestic economies, the implementation of policy actions, technological innovation and human behaviour. This uncertainty magnifies as the length of the projection period increases.

PROJECTIONS RESULTS

Australia's cumulative abatement task is 431 Mt CO_2-e

The Government is committed to reducing Australia's emissions to five per cent below 2000 levels by 2020. Over the period to 2020, the total emissions reduction required from projected baseline scenario emissions to achieve the minus five per cent emissions trajectory is 431 Mt CO_2-e inclusive of projected abatement from the carbon tax and Carbon Farming Initiative in 2013 and 2014 (Figure 1). In 2020, the minus five per cent target equates to an emissions reduction, or abatement task, of 131 Mt CO_2-e (Table 1).

Figure 1: Australia's abatement task to 2020

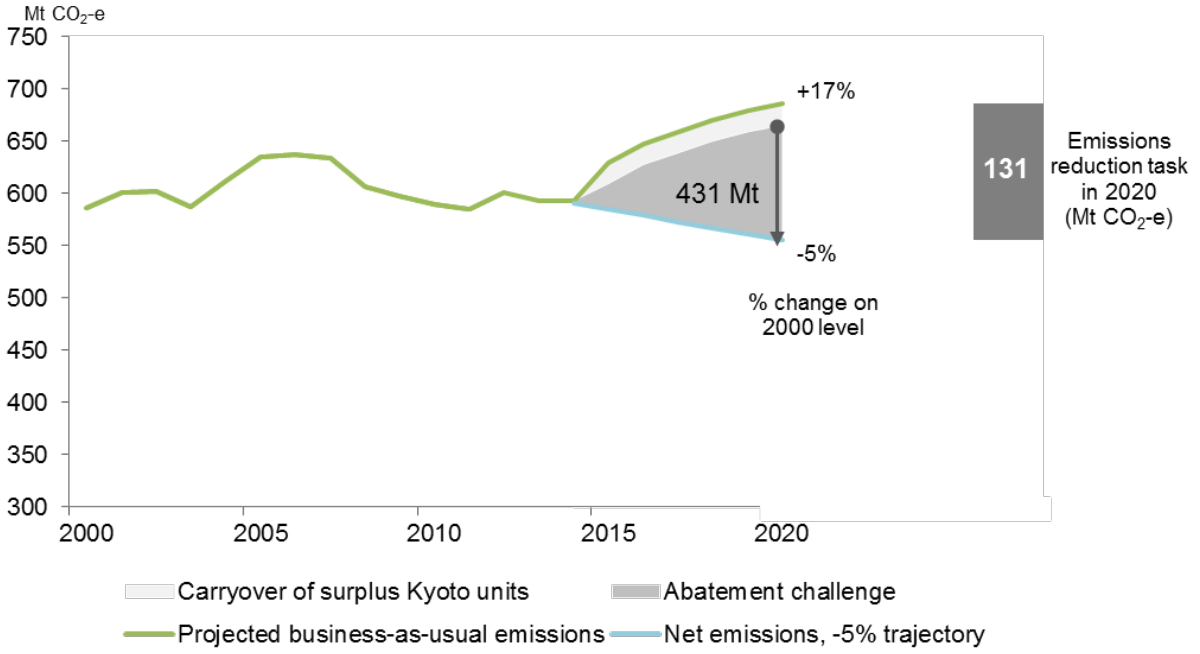


Table 1: Australia's abatement task

	2000[3] emissions	Kyoto period average 2008-12	2020 emissions	Abatement task in 2020	Cumulative abatement task
	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Baseline emissions	586	596	685		
-5% target			555[4]	131	431

[3] The 2000 emissions level is sourced from *Australian National Greenhouse Gas Accounts: National Inventory Report 2011*, April 2013.
[4] The minus five per cent target includes a 2 Mt CO_2-e adjustment in 2020 for voluntary action in the form of GreenPower purchases.

This cumulative abatement task has been revised downwards from previous estimates due to the following factors:

- a shift in the outlook for certain emissions-intensive industries and lower technology cost estimates especially for wind and solar technologies;
- changes from the Kyoto Protocol's second commitment period, including the adoption of revised GWPs from the IPCC's AR4 and broadened coverage of the land sector to include emissions from forest management and selected Article 3.4 activities;
- changes to the 2020 target associated with an updated inventory value for the 2000 base year;
- an adjustment for voluntary action in the period 2013 to 2020, which was not estimated in previous projections;
- the assumed use of 121 Mt CO_2-e of surplus units from the Kyoto Protocol first commitment period in the period to 2020; and
- projected abatement from the carbon tax and Carbon Farming Initiative in 2013 and 2014.

Table 2: Emissions reductions required to meet Australia's 2020 target 5 per cent below 2000 levels

Cumulative abatement task to 2020 (Mt CO_2-e)	
Initial cumulative abatement task to 2020	591
Less two years of abatement from the carbon tax and Carbon Farming Initiative (2013 and 2014)	552
Less estimated carry-over (121 Mt CO_2-e)[5]	431
Abatement task in 2020 (Mt CO_2-e)	
Task in 2020	131

[5] *Australian National Greenhouse Accounts: Quarterly Update of Australia's National Greenhouse Gas Inventory June Quarter 2013*. This has not been adjusted for voluntary cancellation of first commitment period units

Aggregate Emissions Projections

Projected 2020 emissions indicate how Australia is tracking against the 2020 abatement target and the level of the abatement task. Projected 2030 emissions provide an indication of long-term emissions trends.

Table 3: Projected emissions 1990 to 2030

	1990	2000	2020	2030
	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Energy	**294**	**367**	**498**	**584**
Electricity	*130*	*175*	*201*	*243*
Direct Combustion	*66*	*75*	*119*	*134*
Transport	*62*	*75*	*99*	*106*
Fugitives	*37*	*41*	*79*	*100*
Industrial processes	**26**	**26**	**37**	**45**
Agriculture	**99**	**105**	**106**	**123**
Waste	**21**	**17**	**15**	**15**
Land use, land-use change and forestry	**140**	**71**	**30**	**34**
Total domestic emissions	**580**	**586**	**685**	**801**

Note: Sub-totals may not sum due to rounding.

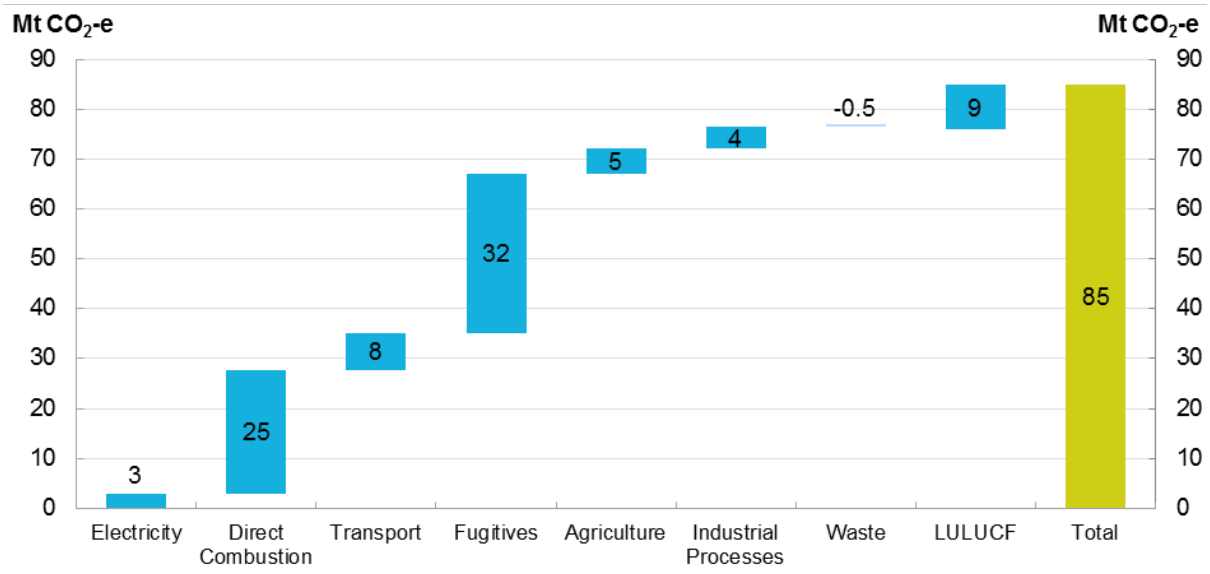
Source: The Treasury and DIICCSRTE, 2013

Projections to 2020

Australia's emissions are projected to reach 685 Mt CO_2-e in 2020, in the absence of further policy measures.

Projected emissions growth to 2020 is dominated by direct combustion and fugitive emissions associated with the production of energy resources, particularly export demand for Australian LNG and coal. Declining levels of carbon sequestration from reforestation are also projected to increase domestic emissions to 2020 (Figure 2).

Figure 2: Sectoral domestic emissions changes 2012 to 2020

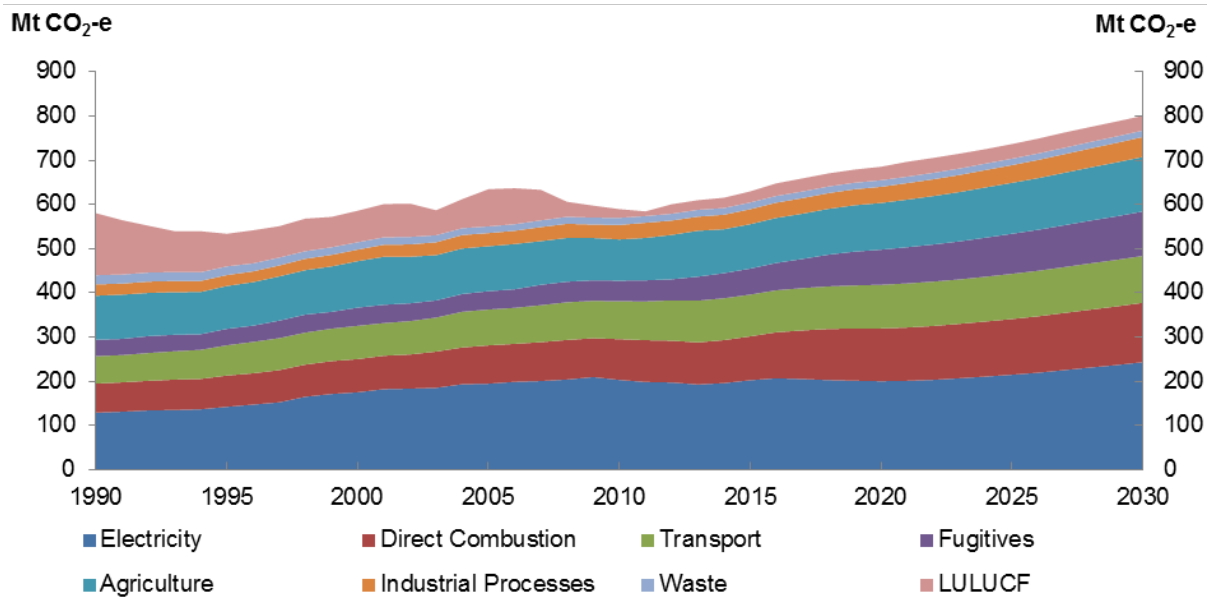


Source: The Treasury and DIICCSRTE, 2013

Projections to 2030

Australia's emissions are projected to reach 801 Mt CO_2-e in 2030, taking account of pre-existing energy efficiency and renewable energy measures.[6] Emissions growth in the decade to 2030 is dominated by emissions from electricity which are projected to increase by 43 Mt CO_2-e. Nearly all other sectors are projected to grow during the decade. Emissions from direct combustion and fugitives continue to grow, associated with continued demand for Australia's energy resources. The level of growth within the direct combustion and fugitives sectors is more moderate than the preceding decade. Agricultural emissions are projected to grow strongly in response to increased Asian demand for Australian agricultural exports, particularly grains and livestock (Figures 3, 4).

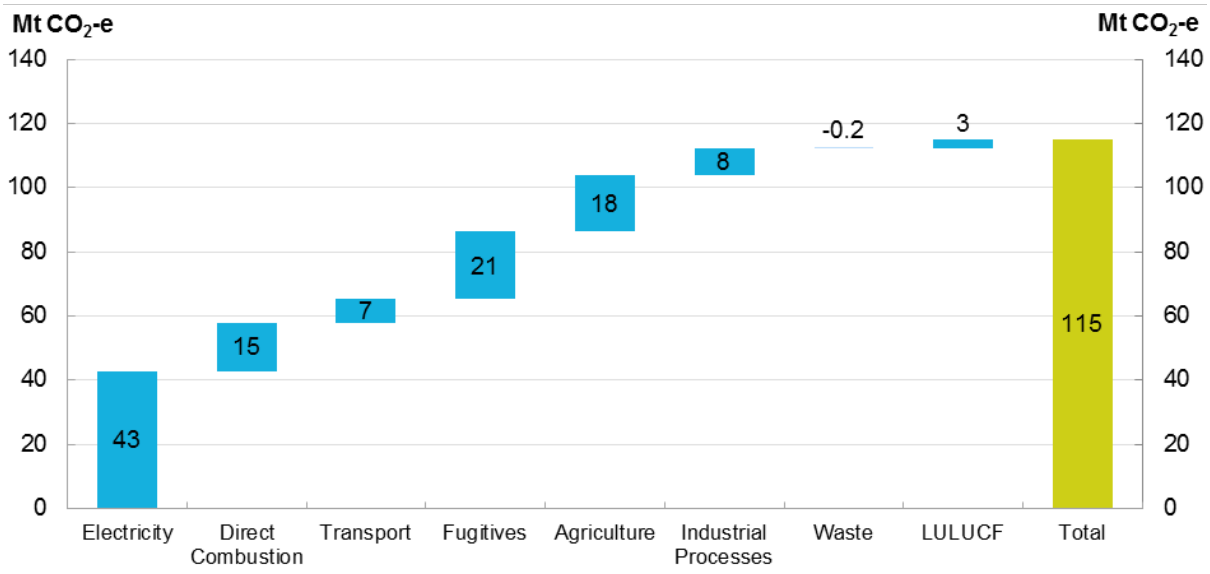
Figure 3: Australia's emissions 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

[6] The projection does not include estimated abatement for the carbon tax, the Carbon Farming Initiative or new measures under the Direct Action Plan

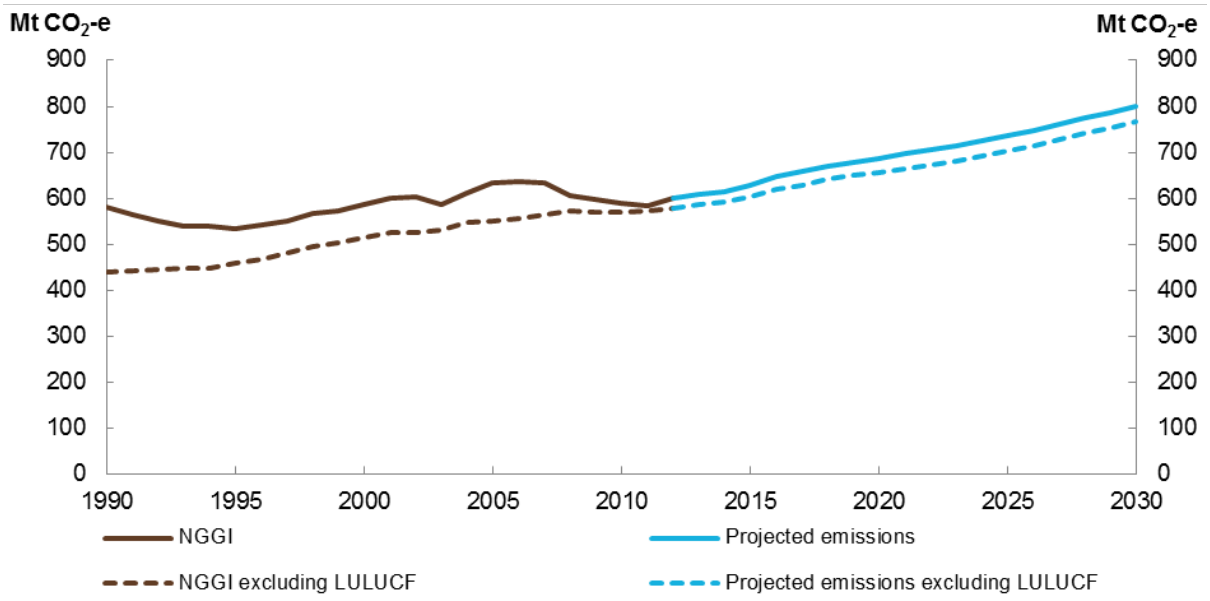
Figure 4: Sectoral domestic emissions changes 2020 to 2030



Source: The Treasury and DIICCSRTE, 2013

During the historical period, a decline in emissions from deforestation largely offset emissions growth in other sectors so that total emissions grew by an average of only 0.2 per cent per year. Excluding LULUCF emissions, average emissions growth over the historical and projections period was approximately 1.4 per cent per year (Figure 5). Emissions from LULUCF are projected to remain relatively stable over the projection period (2012 – 2030), no longer offsetting emissions growth in other sectors. Consequently, average annual emissions growth rates with and without LULUCF emissions are 1.6 per cent per year in both cases.

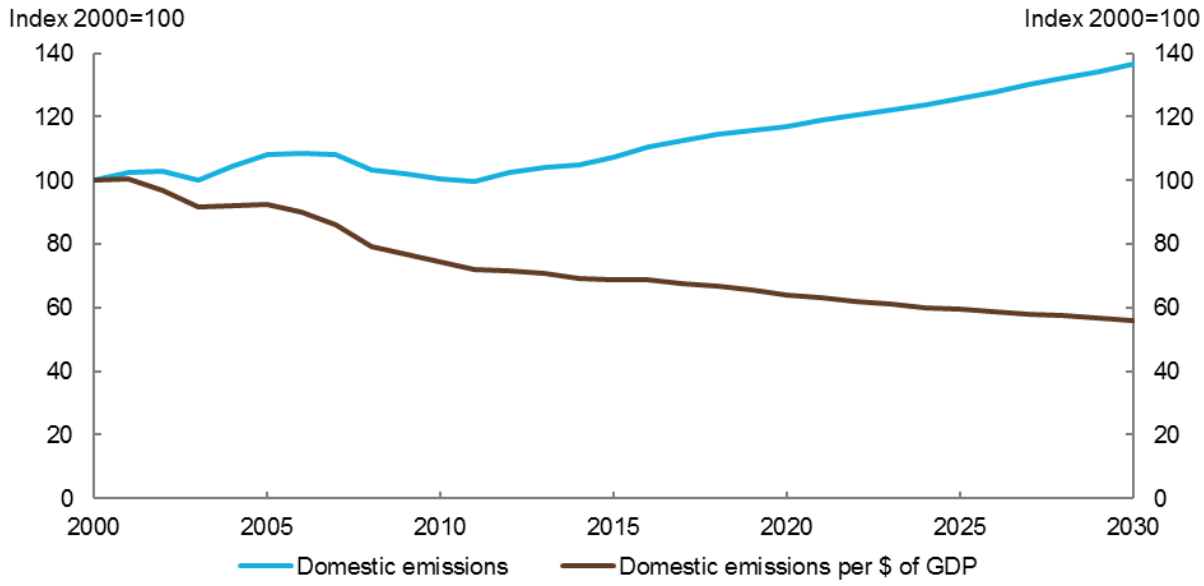
Figure 5: Comparison of emissions with and without emissions from deforestation and reforestation 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Australia's gross domestic product is projected to be 70 per cent larger in 2030 than it was in 2012, outpacing projected emissions growth over the same period. Indicators of the emissions intensity per unit of production in the economy continue to fall steadily over the period (Figure 6).

Figure 6: Economy wide trends in emissions intensity 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

SECTORAL EMISSIONS PROJECTIONS

Sectoral projections are derived from the 'no action' scenario modelled by the former DIICCSRTE and the Treasury for the CCA (The Treasury and DIICCSRTE, 2013).

Energy – Electricity

The electricity sector is the largest source of Australia's greenhouse gas emissions and incorporates the emissions from electricity generation. Emissions from the sector accounted for 198 Mt CO_2-e in 2012, or around 33 per cent of Australia's total domestic emissions.

Electricity sector emissions are projected to be relatively flat over the period to 2020 due to muted demand growth and the increasing penetration of renewables, both large and small scale (ACIL Allen Consulting, 2013). Emissions from the sector are projected to be 201 Mt CO_2-e in 2020 or 1.5 per cent above 2012 levels. Electricity emissions growth is expected to accelerate from 2020 to 2030, with emissions projected to be 243 Mt CO_2-e in 2030 or 23 per cent above 2012 levels. Higher emissions growth is due to increased demand for electricity that is largely met by fossil fuel generation.

Demand for Electricity

Population and income growth were largely responsible for the steady increase in electricity demand prior to 2006. In recent years, growth in electricity demand has moderated and electricity consumption has declined in every year since 2009-10 (Energy Supply Association of Australia, 2013).

One-off events can explain some of this decline, such as the Queensland floods in 2010 and 2011, milder weather in the eastern and south-eastern states during 2010 and 2011, and the closure of the Kurri Kurri aluminium smelter in 2012. Other longer term factors, such as increasing retail energy prices, underlying improvements in energy efficiency, and the uptake of small-scale distributed generation such as rooftop solar have contributed to the decline.

Projected electricity demand out to 2030 is expected to increase from around 2020 as demand returns to trend levels, and existing incentives for distributed generation are progressively phased down, such as under the Small-scale Renewable Energy Scheme.

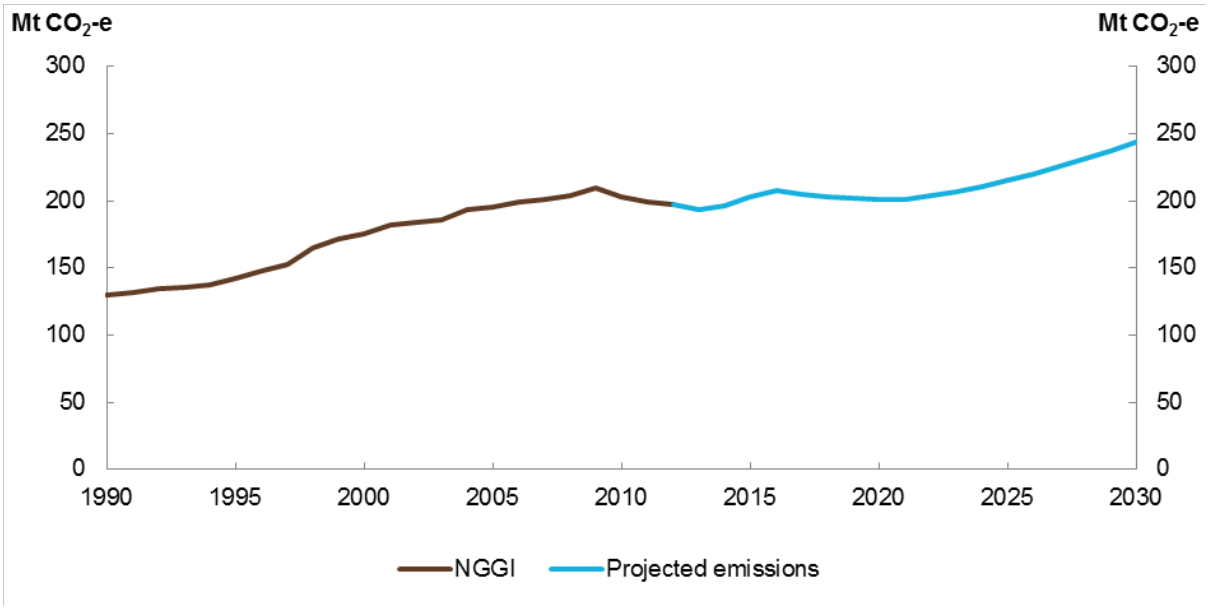
Generation Mix

Between 2000 and 2012, the share of coal fired electricity generation declined steadily to around 70 per cent of total electricity generation (BREE, 2013). This decrease was offset by an increasing share of gas generation. Although there has been strong growth in renewable generation in absolute terms, the share of renewables in electricity generation grew only slightly over the period, from around 8 per cent in 2000 to around 10 per cent in 2010.

The predominant trend in electricity generation after 2020 is that growth in electricity demand is primarily met from black coal and solar. Black coal generation increases as a share of generation by 2030, through higher utilisation of existing generation assets and the projected increase in installed capacity in the second half of the decade. Growth in black coal generation offsets a reduction in the share of brown coal by 2030.

Emissions are projected to reach 201 Mt CO_2-e in 2020 and 243 Mt CO_2-e in 2030.

Figure 5: Electricity projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Electricity Emissions

Emissions from the electricity sector are largely driven by changes in demand and emissions intensity. Historical emissions from the sector can be split into two distinct periods. Between 1990 and 2009, emissions grew by an average of 2.6 per cent year on year. Emissions declined significantly after 2009, as electricity consumption declined and the generation mix moved toward a lower emissions composition. One-off supply factors such as the closure of emission intensive plant and lower growth in economic activity also contributed to the decline in emissions.

In the medium term, emissions are expected to rise again to be 201 Mt CO_2-e in 2020. The main factors influencing projected electricity emissions are forecast increases in demand especially from LNG facilities on the east coast of Australia.

Energy – Direct Combustion

Direct combustion emissions occur when fuels are combusted for stationary energy purposes to generate heat, steam or pressure (excluding electricity generation). Direct combustion of fuels occurs across most sectors in the economy including mining, manufacturing, and construction, as well as domestically through heating and cooking. The manufacturing and mining industries produce around three-quarters of direct combustion emissions.
Direct combustion emissions were 95 Mt CO_2-e in 2012, accounting for 16 per cent of domestic emissions.

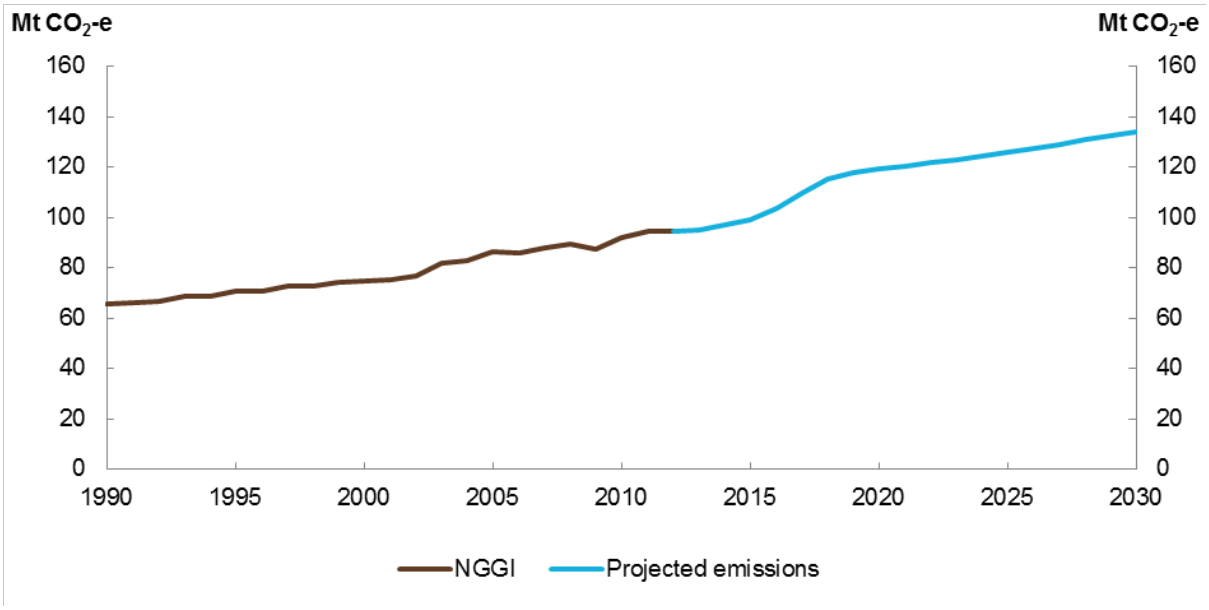
Emissions are projected to reach 119 Mt CO_2-e in 2020 and 134 Mt CO_2-e in 2030.

Direct combustion emissions are projected to increase by 26 per cent from 2012 to 2020 and by 42 per cent from 2012 to 2030, driven largely by strong export demand for Australia's energy and mineral resources. For example, LNG production is projected to quadruple by 2020 (BREE, 2011) as seven major new projects come online.

Direct combustion emissions from LNG production mainly arise through natural gas combustion to run stationary equipment, such as compression turbines. This dramatic increase in LNG production means that improvements in emissions intensity will be insufficient to offset the impact of higher production, which will result in higher emissions levels.

Direct combustion emissions from manufacturing are projected to decline to 2020 before gradually increasing out to 2030. This reflects the structural change currently occurring within the Australian economy as the high Australian dollar and falling commodity prices result in decreased domestic production in certain manufacturing industries such as petroleum refining and iron and steel. This decline is offset by the increase in direct combustion emissions from LNG production.

Figure 6: Direct combustion projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Energy – Transport

The transport sector covers emissions from the direct combustion (or end-use emissions) of fuels by road, rail, domestic aviation and domestic shipping. Transport emissions were 91 Mt CO_2-e in 2012, contributing 15 per cent of Australia's total domestic emissions. Within the transport sector, road transport is the largest subsector contributing 84 per cent of all transport emissions in 2012.

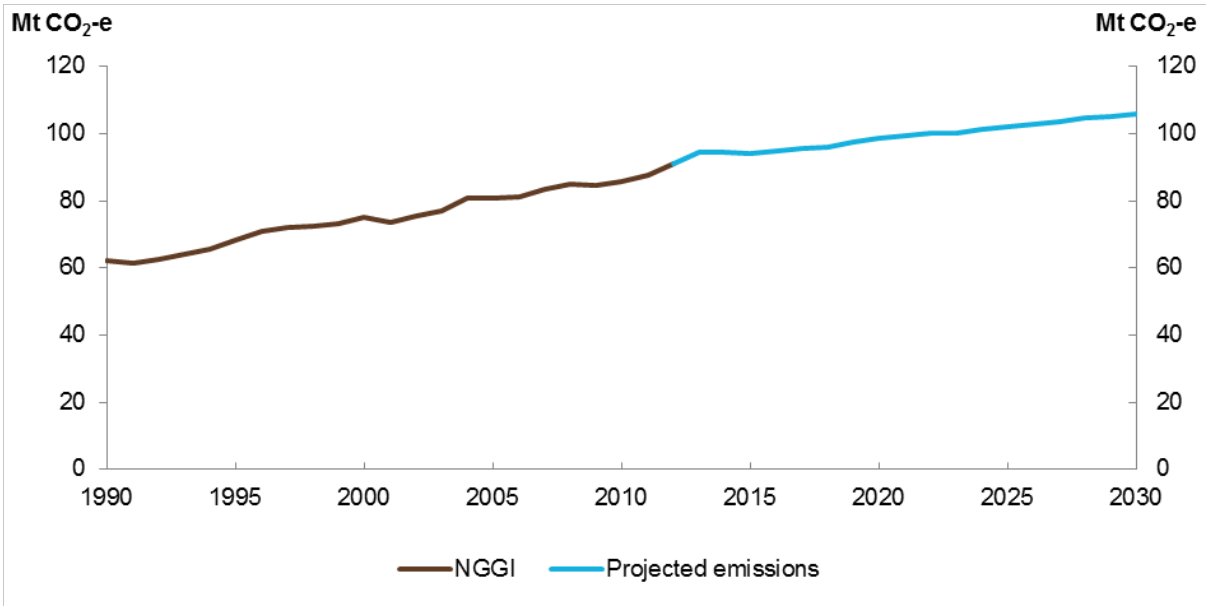
Transport sector emissions are primarily driven by economic activity, population growth and oil prices. Other important determinants of emissions growth include improved fuel efficiency, engine design standards, consumer preferences (resulting in changes to the fleet mix), and modal switching (for example between road and air transport).

Emissions are projected to reach 99 Mt CO_2-e in 2020 and 106 Mt CO_2-e in 2030.

The projected increase in transport emissions is attributable to strong activity growth in all transport subsectors. Activity growth is partially offset by future fuel and activity efficiency improvements and a modest uptake of alternative fuels and technologies beyond 2020. Road passenger transport accounts for a decreasing share of total transport emissions to 2030, due to changes to the fuel mix and an increasing preference for smaller vehicles.

Rail, domestic aviation and domestic shipping emissions grow in line with projected increases in freight and economic activity. Domestic aviation is projected to experience the fastest emissions growth within the sector, although growth is moderated by the availability of bioderived jet fuel in the late 2020s. Fewer emissions reduction opportunities are projected within the rail and shipping subsectors owing to long infrastructure turnover rates and limited fuel substitutability.

Figure 7: Transport emissions projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Energy – Fugitives

The fugitives sector covers emissions associated with the production, processing, transport, storage, transmission and distribution of fossil fuels such as coal, oil and natural gas. Emissions from decommissioned ('abandoned') underground coal mines are also included. The fugitives sector does not include the emissions arising from the combustion of these fuels; these emissions are accounted for under the stationary energy and transport sectors.

Fugitive emissions were 48 Mt CO_2-e in 2012, representing around 8 per cent of Australia's total greenhouse gas emissions. Within the fugitives sector, emissions associated with coal mining were 34 Mt CO_2-e in 2012, and emissions associated with oil and gas extraction were 14 Mt CO_2-e.

A key driver of fugitive emissions is growth in the production of coal, oil and natural gas, which is strongly influenced by both export demand, and conditions in major domestic energy intensive sectors. The emissions intensity of individual coal or gas reserves, together with operational practices, are other important drivers.

Fugitive emissions are projected to reach 79 Mt CO_2-e in 2020 and 100 Mt CO_2-e in 2030.

Relative to 2000 levels, fugitive emissions are projected to rise by 93 per cent in 2020 and 144 per cent by 2030. The projected growth in fugitive emissions is driven by increasing demand for Australia's energy exports.

Coal

Production of black coal is projected to continue to grow strongly to 2020 in response to sustained high export demand. Growth in Australian thermal coal production is driven by export demand, primarily from China and India. Demand for metallurgical coal, used to produce steel, is expected to remain strong. Coal fugitive emissions are projected to grow to 57 Mt CO_2-e in 2020.

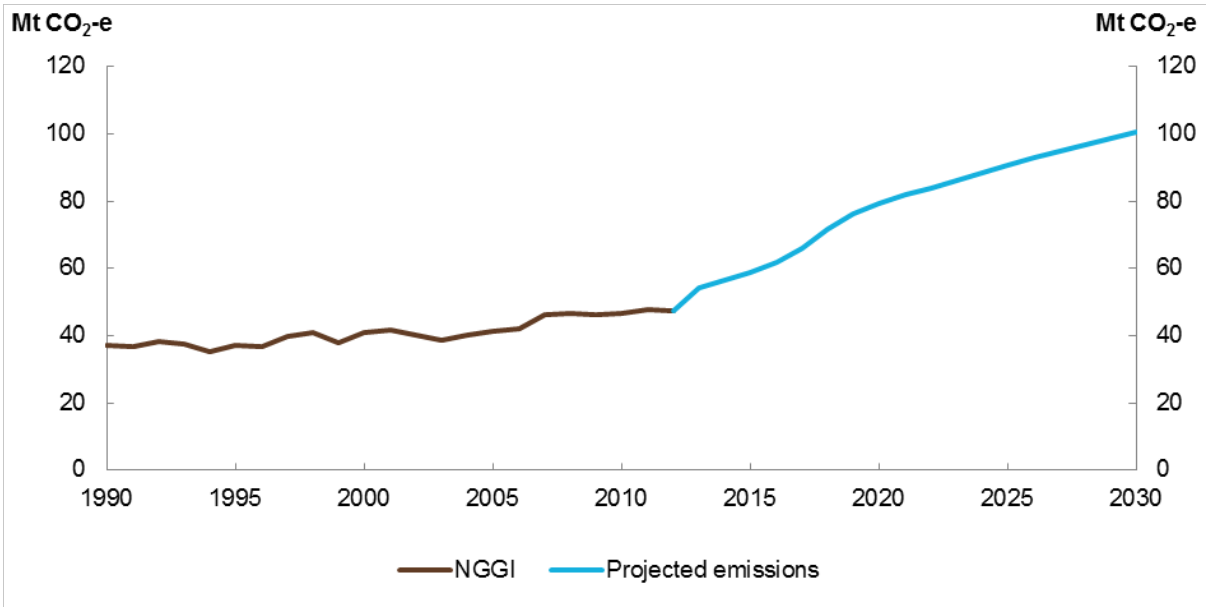
The most significant source of coal fugitive emissions is gassy underground mines which represent around 60 per cent of total coal fugitive emissions despite producing around a quarter of the black coal of surface mines. Coal fugitive emissions tend to fluctuate from year to year depending on the volume of coal mined and the share of production from underground mines of varying gas contents.

Liquefied natural gas (LNG)

The Australian LNG industry is forecast to undergo rapid expansion to 2020, when Australia is projected to become the world's largest LNG exporter. Production volumes between 2020 and 2030 are projected to see continued growth, though less strongly than to 2020. Fugitive emissions from the oil and gas subsector are projected to be 23 Mt CO_2-e in 2020.

The steep growth in LNG production to 2020 is accompanied by an associated ramp-up of emissions from 2015 to 2020. The largest source of fugitive emissions from LNG is emissions associated with venting during cooling processes in liquefaction. The emissions intensity of individual projects varies based on the carbon dioxide content of the reservoir gas. The overall emissions intensity of gas production is somewhat moderated by carbon dioxide reinjection attached to the Gorgon LNG project, commencing 2015.

Figure 8: Fugitive emissions projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Industrial Processes

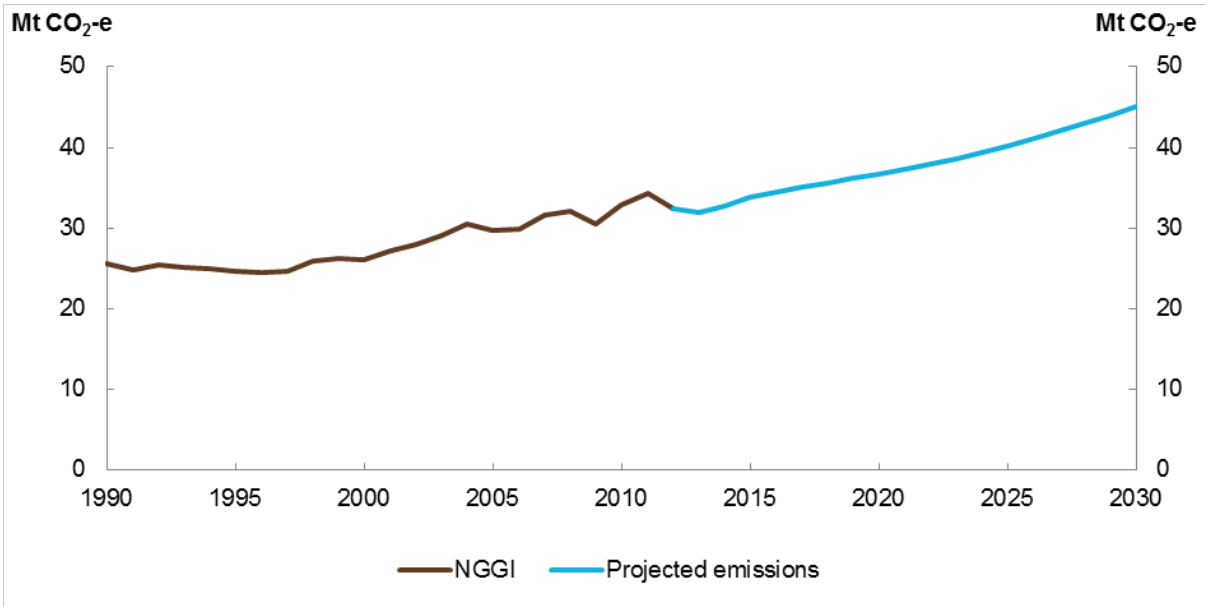
The industrial processes sector encompasses emissions generated from a range of production processes. This sector covers non-energy emissions arising from metal production, the chemical industry, mineral products, consumption of halocarbons and sulphur hexafluoride, and food and drink production. The emissions intensity of a given

process is dependent on both the technology used and the fundamental chemical reactions underlying the process. Industrial processes emissions in 2012 were 32 Mt CO_2-e.

Industrial processes emissions are projected to be 37 Mt CO_2-e in 2020 and 45 Mt CO_2-e in 2030.

Industrial processes emissions are driven primarily by strong production growth in the chemicals industry and increasing use of halocarbons and sulphur hexafluoride. Emissions growth in these subsectors is partially offset by a gradual decline in emissions from metal production.

Figure 9: Industrial Processes emissions projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Metal production

Emissions in the metal production sector declined relatively sharply between 2011 and 2013 due to the closure of one of BlueScope Steel's blast furnaces in late 2011 and the shutdown of the Hydro Kurri Kurri aluminium smelter in September 2012. Iron, steel and ferroalloy production is expected to remain stable from 2013 to 2030. Aluminium production is expected to gradually decline to 2020, after which it is expected to recover but remains within the existing smelting production capacity. Emissions are expected to decrease to 9 Mt CO_2-e in 2020 and then increase to 11 Mt CO_2-e in 2030.

Chemical industry

Emissions in the chemical industry are driven by the growth in production of ammonia and nitric acid to make ammonium nitrate. Five new ammonium nitrate plants or expansions are expected to come online in the next five years. The biggest technology change affecting future emissions in the sector is the introduction of nitrous oxide reduction catalysts in nitric acid production, which can achieve significant improvements in the emissions intensity of the process. Emissions in the chemical industry are projected to increase from 6 Mt CO_2-e in 2012 to 9 Mt CO_2-e in 2020 and 13 Mt CO_2-e in 2030 due to projected increases in production of ammonia and nitric acid to make ammonium nitrate.

Mineral production

Emissions from mineral production are projected to increase from 6 Mt CO_2-e in 2012 to 7 Mt CO_2-e in 2020. Between 2020 and 2030, emissions are projected to remain around 7 Mt CO_2-e.

Consumption of halocarbons and sulphur hexafluoride

Halocarbon and sulphur hexafluoride emissions are projected to increase to 11 Mt CO_2-e by 2020 and 14 Mt CO_2-e by 2030 from 9 Mt CO_2-e in 2012. Emissions in this sector are generated as the gases used in private and commercial refrigeration and air-conditioning, metered dose inhalers, foam blowing, fire extinguishers, solvents and other electric equipment escape over time. The use of these gases is projected to continue to increase as replacements for hydrochlorofluorocarbons, which are being phased out under the Montreal Protocol.

Other production – food and drink

Emissions from food and drink production are projected to gradually increase to reach 0.3 Mt CO_2-e in 2020 and 0.4 Mt CO_2-e in 2030.

Agriculture

The agriculture sector includes emissions from enteric fermentation, manure management, rice cultivation, agricultural soils, prescribed burning of savanna and field burning of agricultural residues. It does not include emissions from fuel combustion from operating equipment, which are included in the stationary energy sector.

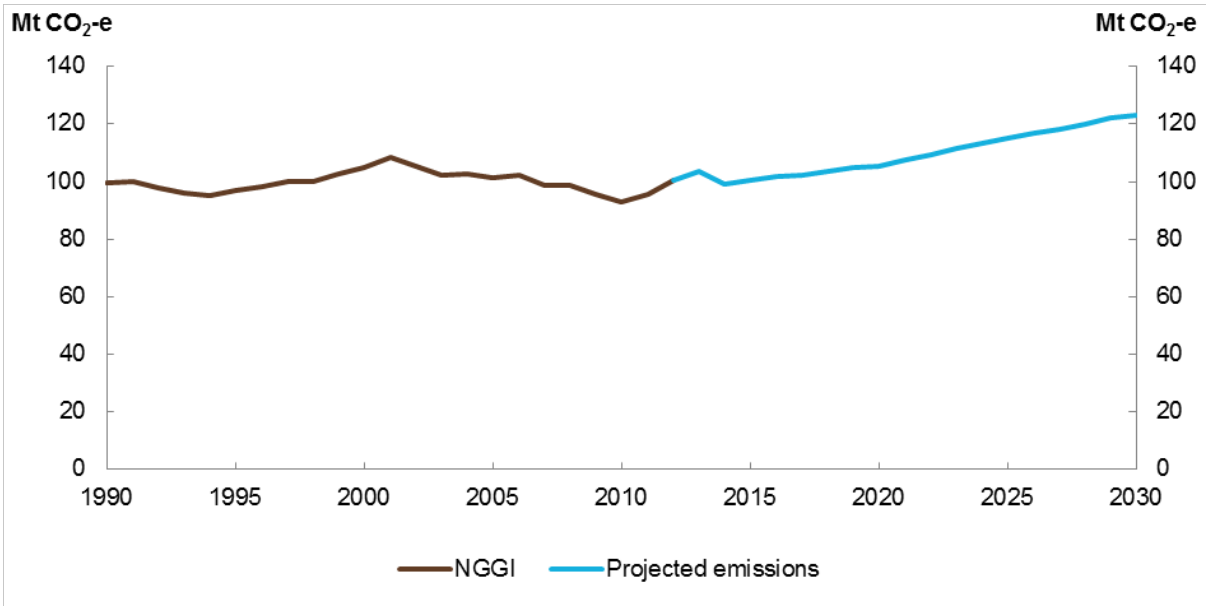
Emissions in the agriculture sector consist of methane and nitrous oxide, which are generated by biological processes. Carbon dioxide emissions from agriculture are considered part of the natural carbon cycle and are not counted in Australia's greenhouse gas emissions. With emissions from enteric fermentation accounting for over 60 per cent of agriculture emissions, growth in demand for agricultural commodities, particularly beef and lamb, has a significant impact on emissions growth in the sector. Agriculture emissions were 100 Mt CO_2-e in 2012.

Agriculture emissions are projected to be 106 Mt CO_2-e in 2020 and 123 Mt CO_2-e in 2030.

With the continued improvement in seasonal conditions since 2010, slaughter rates for sheep and cattle have decreased as farmers rebuild their flocks and herds. This recovery in livestock populations has caused an increase in emissions from 2010 to 2012, but is projected to stabilise from 2012 to 2020. Production from other animals and crops is also expected to remain stable to 2020 after emerging from the drought.

Agriculture emissions are expected to increase after 2020, as production is projected to expand across all major agricultural commodities. Global income growth, particularly in South-East Asia, leads to increased demand for Australian agriculture exports. Australian agricultural production is projected to increase in order to meet this demand. Sheep and cattle numbers are expected to increase to meet greater demand for exports, while expected increases in agriculture productivity growth maintains Australia's high export position in the face of a projected decline in the farmers' terms of trade.

Figure 10: Agriculture emissions projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Waste

The waste sector covers emissions from the disposal of organic materials to landfill and wastewater emissions from domestic, commercial and industrial sources. Emissions are predominantly methane, generated from anaerobic decomposition of organic matter.

In 2012, the waste sector accounted for 3 per cent of Australia's total greenhouse gas emissions or 15 Mt CO_2-e. Waste emissions have generally declined since 1990 due to improved diversion of waste from landfill to recycling and increasing methane capture in all subsectors.

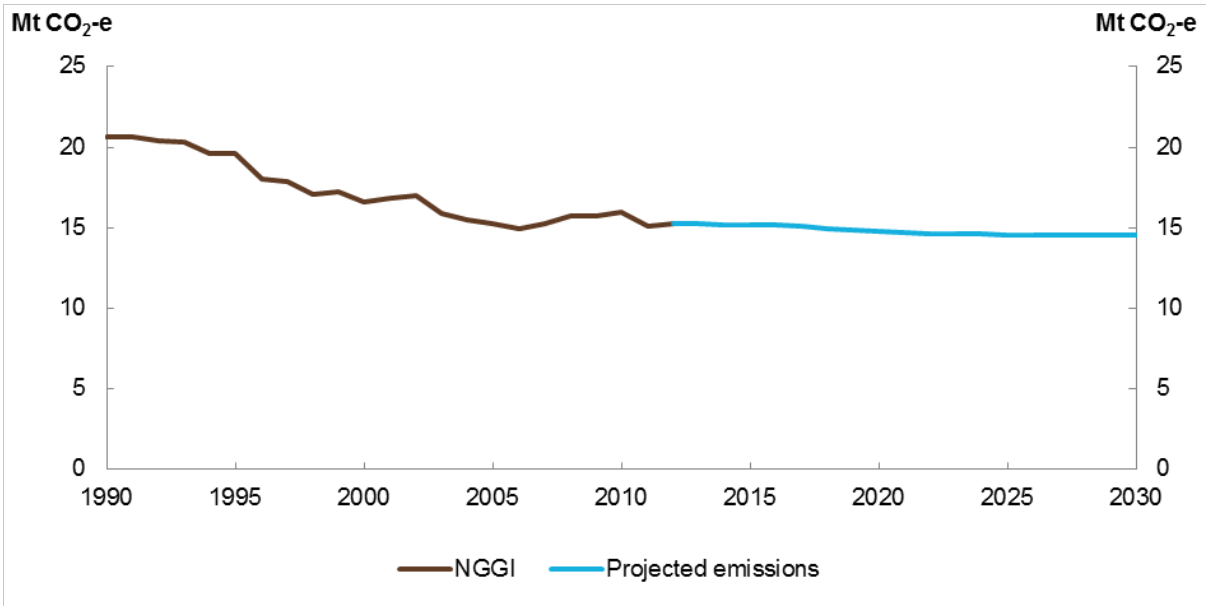
Key drivers of solid waste emissions are waste deposited in landfill, which is affected by population, per-capita waste generation, waste diversion and methane capture rates. In the wastewater subsector key drivers are population growth, growth in industrial production and methane capture rates.

Emissions are projected to remain relatively stable at 15 Mt CO_2-e in 2020 and 15 Mt CO_2-e in 2030.

Waste generation is expected to grow across the projections period due to population growth. However, these increases are counteracted by improvements in methane capture and the diversion of waste from landfill to alternative treatment facilities.

The uptake of methane capture for electricity generation is expected to increase due to incentives under the Renewable Energy Target scheme and declining technology costs. Jurisdictional waste diversion policies and improvements in recycling technologies are also expected to significantly reduce the amount of waste to landfill per capita across the projections period.

Figure 11: Waste projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Land use, Land-use change and Forestry (LULUCF)

The LULUCF sector includes emissions and removals from deforestation, afforestation and reforestation activities. From 2013, emissions and removals from forest management, cropland management, grazing land management and revegetation are also reflected in the LULUCF sector. These new subsectors have been added to reflect the broadened coverage of Australia's emissions in the second commitment period of the Kyoto Protocol.

In 2012, the LULUCF sector is expected to account for 4 per cent of Australia's total greenhouse gas emissions, and at 21 Mt CO_2-e, emissions are estimated to be 85 per cent below 1990 emissions of 140 Mt CO_2-e.

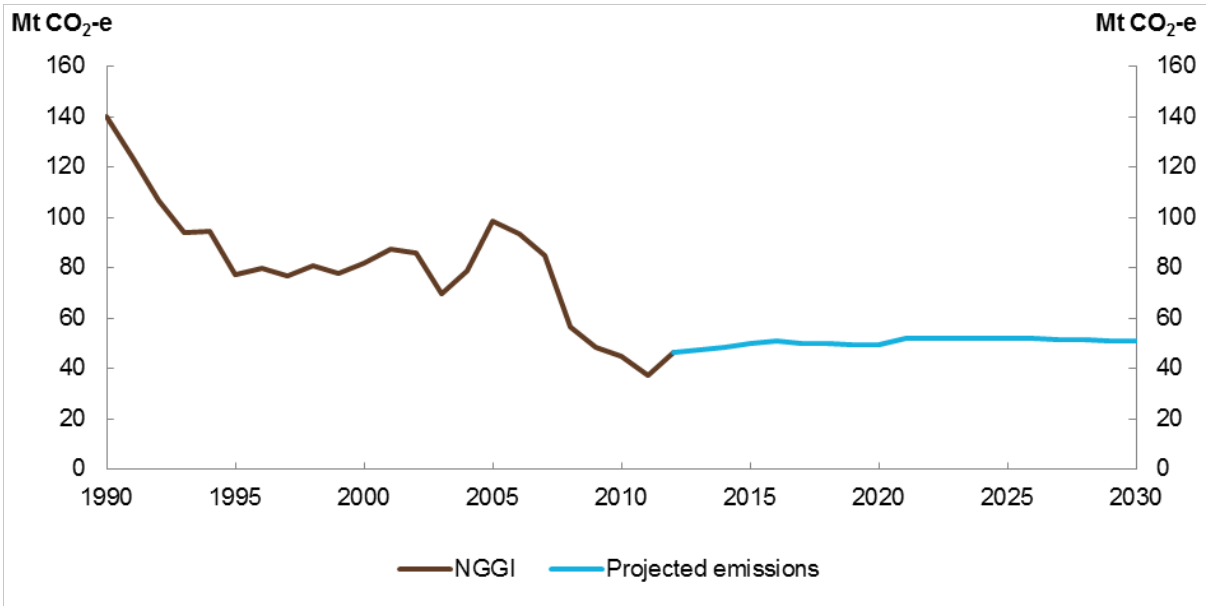
LULUCF emissions are projected to reach 30 Mt CO_2-e in 2020 and 34 Mt CO_2-e in 2030.

Deforestation

Deforestation is the direct, human-induced removal of forest cover and replacement with pasture, crops or other uses on land that was forest on 1 January 1990. Emissions result from the burning of removed forest cover, decay of unburnt cleared vegetation, and emissions from soil disturbed in the process of land clearing.

Australia's deforestation emissions, as defined under Article 3.3 of the Kyoto Protocol, declined from 140 Mt CO_2-e in 1990 to 38 Mt CO_2-e in 2011. Over the projection period, deforestation emissions are expected to increase and then stabilise at around 50 Mt CO_2-e per year (53 Mt CO_2-e in 2020 and 52 Mt CO_2-e in 2030). This increase is primarily driven by increased land clearing in response to improved terms of trade for farmers. These projections also take into account the easing of Queensland land clearing laws and assume no further significant changes to land clearing regulations.

Figure 13: Deforestation projection 1990 to 2030[7]



Source: The Treasury and DIICCSRTE, 2013

Afforestation and reforestation

Under the Kyoto Protocol accounting rules, afforestation and reforestation covers new forests established by direct human action on land not forested in 1990. No forestry sinks are included in the 1990 baseline, and only afforestation and reforestation occurring since 1 January 1990 is credited. Removals result when carbon is sequestered by growing forest plantations.

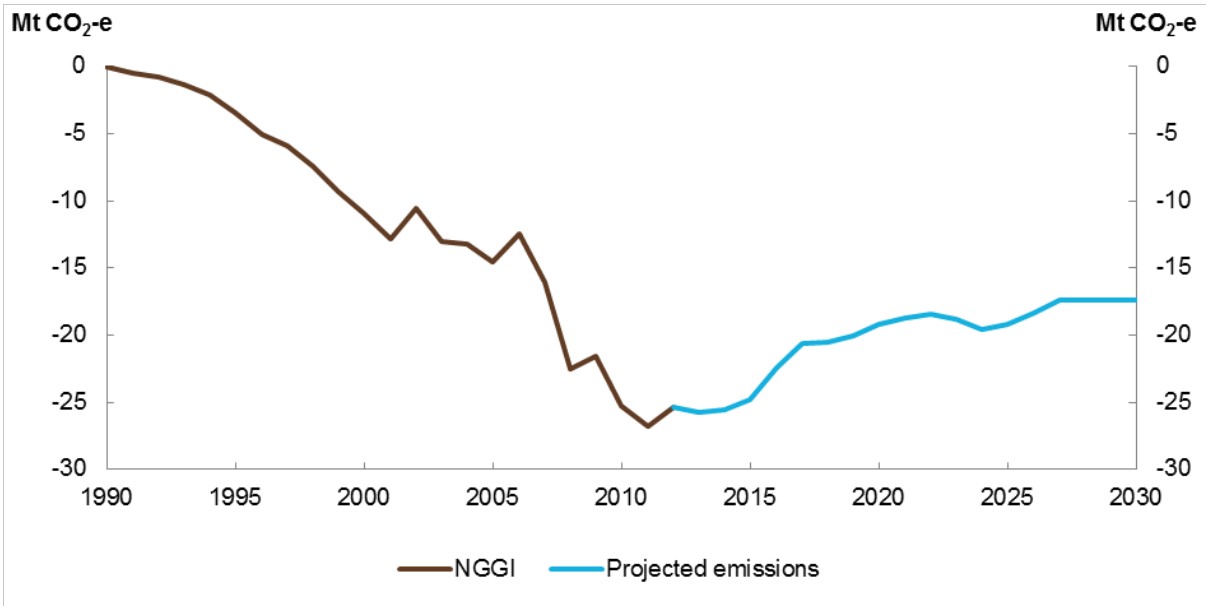
In 2012, Australia's removals from reforestation and afforestation are expected to be 25 Mt CO_2-e. Removals are projected to be 10 Mt CO_2-e in 2020 and 8 Mt CO_2-e in 2030. The projections assume slow growth in the total area of forest plantations to 2030. The high exchange rate has made exporting plantation products more challenging in recent years and economic conditions are projected to remain subdued. New plantation establishment is projected to continue at historically low rates, while in some cases plantation land will be converted to agricultural use following final harvest.

Forest management

Forest management emissions and removals arise as a result of the management activities and practices related to the production of wood and wood products. In 2013, the first year of reporting for forest management, Australia's forest management emissions are expected to be 7 Mt CO_2-e lower than Australia's internationally agreed reference level.[8] The reduction in emissions from forest management is associated with declining harvest rates in native forest due to increasing supply from plantations, changes in the international price of harvested wood products, and a high Australian dollar. Emissions are projected to be 9 Mt CO_2-e lower than the reference level in 2020 and 2030.

[7] The projections in Figure 13 also incorporate emissions and removals from the Article 3.4 activities grazing land management and cropland management.
[8] Australia's internationally agreed reference level for forest management is a projection of emissions from forest management activities policies as at December 2009.

Figure 14: Afforestation and reforestation and forest management projection 1990 to 2030



Source: The Treasury and DIICCSRTE, 2013

Electable Article 3.4 Activities

Under Article 3.4 of the Kyoto Protocol, Australia has elected to include cropland management, grazing land management and revegetation when accounting for Australia's greenhouse gas emissions for the second commitment period (2013 – 2020). In the projections provided to the CCA, removals from revegetation are incorporated into the afforestation and reforestation subsector.

Cropland management

Cropland management is the system of practices on land on which agricultural crops are grown, and on land that is set aside or temporarily not being used for crop production. Emissions and removals from cropland management are primarily the result of changes in the quality of organic carbon stored in soils and in the biomass of woody crops including orchards and vineyards. Changes in management practices affect soil carbon stocks over a long period (assumed by the IPCC to be 20 years).

In 2013, cropland management is expected to generate net removals of 2 Mt CO_2-e in comparison to the 1990 base year. This decline in emissions since 1990 is associated with the widespread adoption of farming practices that maintain soil carbon. Emissions are projected to be 2 Mt CO_2-e lower than the base year in 2020 and equal to the base year in 2030. Removals decline to 2030 based on the assumption that there have been no additional changes in policy or cropland management practices after 2010.

Grazing land management

Grazing land management is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced. Fire and pasture improvement can influence emissions and removals from grazing land management through altering the amount of carbon stored in live biomass and dead organic matter as well as the amount of residue, root and manure inputs to soil carbon.

Between 2013 and 2030, grazing land management is expected to generate 1 Mt CO_2-e of removals per year relative to the 1990 base year. Over time, grazing land management varies from a small net source of emissions to a modest sink, as net fire emissions approximate a steady state over the long term, and pasture improvement since the 1980s is reflected in the 1990 base year (DIICCSRTE, 2013).

METHODOLOGY

Australia's Abatement Task and 2013 Emissions Projections (the Projections) provides a projection of Australia's cumulative abatement task to 2020 and greenhouse gas emissions to 2030.

The Australian Government is required to submit projections to the United Nations as part of Australia's National Communication on Climate Change and Biennial Report under UNFCCC at least every two years. *Australia's Emissions Projections 2012* were submitted to the United Nations in August 2013 as part of Australia's *Sixth National Communication on Climate Change.*

The Projections are prepared in accordance with the emissions accounting rules (applicable to Australia) for the second commitment period of the Kyoto Protocol (2013 – 2020):

- The Projections are prepared at a sectoral level for the group of six Kyoto Protocol greenhouse gases.[9]
- The scope of the LULUCF sector has been broadened to include emissions and removals from forest management, cropland management, grazing land management and revegetation.[10]
- Results are expressed in terms of carbon dioxide equivalent (CO_2-e), using the GWPs published in the IPCC's AR4. [11]

The impact of the coverage changes to LULUCF and the use of AR4 GWPs are discussed in the following section on *Changes from previous projections*.

Emissions reduction target, 2020

The abatement task is derived from economy-wide modelling and emissions analysis completed by the former DIICCSRTE (now the Department of the Environment) and the Department of the Treasury for the CCA in September 2013 (The Treasury and DIICCSRTE, 2013).

The modelling was completed using a suite of computable general equilibrium (CGE) models and complemented by detailed sectoral inputs. The results from the CGE and sectoral modelling were integrated into a consistent set of projections. For further information on the modelling approach, refer to the *Climate Change Mitigation Scenarios: modelling report provided to the Climate Change Authority in support of its Caps and Target review* (The Treasury and DIICCSRTE, 2013).

The modelling incorporated historical emissions data for 1990 to 2012 from *Australia's National Greenhouse Accounts: National Greenhouse Gas Inventory*, released April 2013 and estimates from *Quarterly Update of Australia's National Greenhouse Gas Inventory,*

[9] Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
[10] From 2013, forest management is a mandatory inclusion in Kyoto Protocol accounting. Australia has voluntarily elected to include emissions and removals from cropland management, grazing and land management and revegetation under Article 3.4 of the Kyoto Protocol.
[11] Translation into CO_2-e aggregates the global warming effect of the six Kyoto Protocol greenhouse gases. The use of AR4 GWPs is consistent with the outcomes of the 2011 UNFCCC Conference of the Parties in Durban.

March Quarter 2013, released in October 2013. A base year of 2012 applies to all sectors other than waste and LULUCF, where a base year of 2011 is used.

Australia's abatement task in 2020 is the difference between the baseline emissions projection and Australia's 2020 emissions reduction target. The baseline projection was constructed from the 'no action scenario' to 2030 modelled by the Treasury and DIICCSRTE (The Treasury and DIICCSRTE, 2013).

The cumulative abatement task is the total level of emissions reductions required to 2020 to achieve the 2020 emissions reduction target. For the purposes of calculating the cumulative abatement task, the emissions trajectory is a straight-line trajectory from Australia's annual average assigned amount in the mid-point of the first commitment period of the Kyoto Protocol (616 Mt CO_2-e in 2010), to the minus 5 per cent of 2000 level target in 2020 (555 Mt CO_2-e) (Figure 1).

The cumulative abatement task estimate takes into account the ability to use surplus reductions achieved in the first commitment period of the Kyoto Protocol and abatement from two years of the carbon tax and Carbon Farming Initiative (CFI).

Abatement from the carbon tax and CFI in 2013[12] and 2014 is calculated as the cumulative difference between the baseline projection and the 'central policy' scenario projected by the Treasury and DIICCSRTE in those two years.

The latest estimate of carry-over of surplus emission reductions is from the first commitment period of the Kyoto Protocol reported in the *Quarterly Update of Australia's National Greenhouse Gas Inventory June Quarter 2013* is 121 Mt CO_2-e.

Key assumptions

The Projections are based on the modelling completed by DIICCSRTE and the Treasury for the CCA. Consequently, the Projections have been compiled against an outlook for the Australian economy broadly consistent with the macroeconomic parameters in the 2013–14 Budget.[13] Detailed outlooks have been drawn from a range of experts for the agriculture, mining and manufacturing sub-sectors, and updated to incorporate some of the more recent movements in commodity price projections.

Key assumptions include:

- In electricity policy, Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRES) targets in line with those published on the Clean Energy Regulator's website;
- National population, employment and gross domestic product growth parameters consistent with the 2013-14 Budget and the 2010 Intergenerational Report;
- International prices for oil and gas based on projections from the International Energy Agency's *2012 World Energy Outlook*. Coal prices based on Treasury's medium-term projections, informed by stakeholders and domestic and international experts; and

[12] All years referred to are financial years ending in that year (that is 2013 relates to 2012-13).
[13] These parameters have not been updated for the *Mid-Year Economic and Fiscal Outlook*, December 2013.

- Updated projections by the Australian Government Bureau of Resources and Energy Economics, Wood Mackenzie and IBISWorld for mining and emissions-intensive segments of industrial processes.

The Projections includes historical and ongoing abatement from a range of pre-existing policy measures other than the carbon tax and CFI. Other policies in the Projections include:

- the LRET and the SRES;
- the NSW and ACT Greenhouse Gas Abatement Scheme (GGAS);
- the voluntary market program GreenPower;
- the Queensland Gas Scheme;
- fuel excise rates, the NSW Biofuels Act and the Liquefied Petroleum Gas Vehicle scheme; and
- Queensland and New South Wales land clearing legislation.

For further detail on assumptions used in the modelling, refer to *Climate Change Mitigation Scenarios: modelling report provided to the Climate Change Authority in support of its Caps and Target review* (The Treasury and DIICCSRTE, 2013).

CHANGES FROM PREVIOUS PROJECTIONS

In November 2012, the former Department of Climate Change and Energy Efficiency released *Australia's Emissions Projections 2012* (the 2012 Projections). Since the release of the 2012 Projections, the CCA released their *Targets and Progress Review Draft Report* which included projections of Australia's emissions to 2030. The CCA's report drew on economic and emissions modelling conducted by the Treasury and the former DIICCSRTE. This section summarises differences between the 2012 Projections and the modelling provided for the CCA's *Targets and Progress Review Draft Report* that are drawn upon in this publication.

Changes from 2012 Projections

The report provided to the CCA included updated data, revised accounting protocols, a broadened coverage of the land sector and changes to the emissions outlook when compared to the 2012 Projections.

Changes to the National Greenhouse Gas Inventory

Since the release of the 2012 Projections, the Quarterly Update of the National Greenhouse Gas Inventory (NGGI) has been updated to include complete data for 2012, and the projections provided to the CCA incorporate this updated data. The estimate of the NGGI for the year to December 2012 was 564 Mt CO_2-e. This was 6 Mt CO_2-e lower than estimates prepared one year earlier (around 1.1 per cent lower). While most sectors were higher than the previous year's estimate, emissions from LULUCF were 12 Mt CO_2-e lower.

Changes to accounting and coverage

Changes in accounting and coverage protocols contribute 5 Mt CO_2-e to the reduction in the abatement challenge in 2020 in comparison to the 2012 Projections.

Australia currently uses UNFCCC national inventory reporting guidelines which prescribe GWPs published in the 1995 IPCC Second Assessment Report (AR2) for national inventory reporting. At the UNFCCC meeting in November-December 2011 in Durban, South Africa, countries agreed to adopt the updated GWPs published in the IPCC's AR4 in inventory submissions from 2015 onwards and for commitments under a second commitment period of the Kyoto Protocol (2013-20). The projections provided to the CCA are in AR4 GWPs and this has contributed a 7 Mt CO_2-e increase to the abatement challenge in 2020.

The projected net emissions for LULUCF covers a broadened set of land activities compared with previous projections reflecting the Government's implementation of changes to accounting rules agreed internationally to apply for the second commitment period of the Kyoto Protocol. This has resulted in the inclusion of emissions from forest management, grazing land management and cropland management in Australia's emissions accounting and has led to a 12 Mt CO_2-e decrease in 2020 emissions.

Key changes to the emissions outlook

In 2020, domestic emissions are projected to be 23 Mt CO_2-e lower than the 2012 Projections, accounted on an AR4 basis. The majority of the difference can be attributed to the electricity, direct combustion and LULUCF sectors.

Projected 2020 emissions in the electricity sector are 6 Mt CO_2-e lower compared to the 2012 Projections due to a reduction in electricity demand. Over the short term, key drivers of this reduction are increasing energy prices, energy efficiency programs, the uptake of small-scale distributed energy and high levels of hydro generation. To 2020, this trend is carried through in structural changes in the economy away from manufacturing to services resulting in decreased demand from aluminium, alumina, zinc and steel industries.[14]

In comparison to the 2012 Projections, 2020 emissions from direct combustion are projected to be 15 Mt CO_2-e lower. The recent high Australian dollar and global economic conditions have led to lower levels of industrial production in emissions-intensive industries, reducing projected emissions from direct combustion in 2013 and into the future. New coal seam gas plants are now expected to source more of their energy needs from on-grid electricity rather than from direct combustion, contributing to the decrease in projected emissions.

Projected emissions from LULUCF in 2020 are 5 Mt CO_2-e lower compared to the 2012 Projections. This is partially due to improvements in remote sensing technology resulting in an increase in the area of land known to be under reforestation, and due to changes to the scope of reforestation activity to include removals from the regeneration of vegetation as the result of deliberate land management activity.

In the projections provided to the CCA, emissions in 2030 are 17 Mt CO_2-e lower than the 2012 projection. This is predominantly due to lower projected emissions from direct combustion and LULUCF that outweigh upwards revisions to transport, agriculture and electricity generation.

[14] The net decrease in emissions from the electricity sector would have been greater if not for increased electricity demand from new coal seam gas to LNG plants, which are now assumed to use grid electricity for some processes.

Table 4: Changes from the 2012 Projections (AR4 GWPs)

	2020	**2020** (2012 Projections)	**2030**	**2030** (2012 Projections)
	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e	Mt CO_2-e
Electricity	201	207	243	241
Direct combustion	119	134	134	149
Transport	99	97	106	102
Fugitive	79	77	100	100
Agriculture	106	106	123	116
Industrial processes	37	37	45	46
Waste	15	15	15	15
LULUCF	30	47	34	49
Total	**685**	**720**	**801**	**818**

FURTHER INFORMATION

Supplementary modelling reports that informed the Projections can be sourced from the Department of the Environment website www.environment.gov.au/cleaner-environment/abatement-task-projections.html

- *Climate Change Mitigation Scenarios: Modelling report provided to the Climate Change Authority in support of its Caps and Target review*
- *Electricity Sector Emissions: modelling of the Australian electricity generation sector*
- *Transport greenhouse gas emissions projections 2013-2050*
- *Australian agriculture emission projections to 2050*
- *Australian land use, land use change and forestry emissions projections to 2030*
- *Analysis of electricity consumption, electricity generation emissions intensity and economy-wide emissions*
- *Consultation on assumptions*

Copies of related National Greenhouse Gas Inventory and National Carbon Accounting System documents can be obtained from the Department of the Environment's website.

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